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in Sub-Saharan Africa: A Quasi-Experimental Evidence from
Tanzania's Rural Economy**



Employment and Income Effects of Sunflower Oil Processing SMEs in Sub-Saharan Africa: A Quasi-Experimental Evidence from Tanzania's Rural Economy



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Abstract

Purpose: Small and Medium Enterprises (SMEs) are globally recognized as engines of inclusive economic growth, yet limited rigorous empirical evidence exists on the employment and income effects of agro-processing SMEs in Sub-Saharan Africa, where rural transformation remains a critical policy priority. Drawing from Resource Based View (RBV) theory, this study assesses the causal contribution of sunflower oil processing SMEs to employment creation and income generation in Singida Region, Tanzania, one of East Africa's leading sunflower production hubs.

Methodology: Employing explanatory sequential mixed methods design, the study combined quantitative data from 384 enterprise owners, managers, and employees with qualitative insights from four Focus Group Discussions and ten Key Informant Interviews. To address selection bias inherent in enterprise-level comparisons, Propensity Score Matching (PSM) with nearest-neighbor matching (1:1 ratio) was applied, matching sunflower oil processing SMEs (treatment) with observationally similar rice processing SMEs (control) based on owner age, sex, marital status, education, enterprise ownership type, and enterprise age. Robust covariate-adjusted regression models estimated Average Treatment Effects on the Treated (ATT).

Findings: Results reveal that sunflower oil processing SMEs generate, on average, 7.86 additional jobs per enterprise compared to matched rice processing counterparts (ATT = 7.86, $p < 0.001$), with effects robust to hidden bias up to $\Gamma = 1.35$ in Rosenbaum sensitivity analysis. Employment effects were particularly pronounced among better-educated entrepreneurs ($\beta = 17.45$, $p < 0.001$), although profitability effects were not statistically significant ($p > 0.05$), indicating that employment gains do not automatically translate into superior income outcomes.

Unique Contribution to Theory, Practice and Policy: These findings contribute to the empirical literature on SME-led rural transformation by demonstrating that agro-processing enterprises serve as effective employment catalysts, while simultaneously revealing structural constraints; limited certification, weak branding, and competition from imports; that suppress profitability. Strategic policy interventions targeting technological upgrading, market linkages and entrepreneurial capacity are essential to unlock the full employment and income potential of sunflower oil processing SMEs. Practically, the study proposes expanding affordable finance, strengthening value chain coordination and promoting business development services to enhance SME sustainability and maximize contributions to poverty reduction in Tanzania and similar Sub-Saharan African contexts.

Keywords: *Agro-processing SMEs, Employment Generation, Propensity Score Matching, Rural Transformation, Sub-Saharan Africa*

1.0 INTRODUCTION

Small and Medium Enterprises (SMEs) are globally recognized as fundamental drivers of inclusive economic growth, employment creation, poverty reduction, and income generation in both developed and developing economies (World Bank, 2024; ILO, 2024). In Sub-Saharan Africa, SMEs account for approximately 95 percent of registered businesses and contribute around 80 percent of employment, making them indispensable to the region's economic fabric. The agricultural processing sector, particularly agro-processing SMEs, has emerged as a critical avenue for value addition, rural transformation and livelihood improvement across the continent (FAO, 2024). In Tanzania, MSMEs contribute approximately 35 percent to gross domestic product (GDP) and employ an estimated 5.2 million people, accounting for about 40 percent of the total workforce. The small agro-processing sub-sector alone represents a significant portion of all firms, underscoring its centrality to the national economy (Nkwabi et al., 2019).

The sunflower oil processing subsector has gained particular strategic importance in Tanzania due to escalating domestic demand for edible oil and concerted government efforts to promote import substitution and domestic industrialization (URT, 2024). Tanzania ranks among the leading sunflower producers in East Africa, with the Singida Region serving as one of the country's premier production hubs, hosting numerous sunflower oil processing enterprises. The expansion of sunflower cultivation has catalyzed the growth of sunflower oil processing SMEs, which transform raw sunflower seeds into edible oil and by-products, thereby enhancing value addition and stimulating local economic development. Recent evidence demonstrates significant employment potential, as exemplified by one youth-led enterprise that works with over 1,000 smallholder farmers, produces nearly 400,000 liters of sunflower oil annually, and employs permanent staff. However, the sector's full employment and income-generating potential remain constrained by structural challenges that limit enterprise performance and sustainability.

Existing literature has extensively documented the importance of SMEs for employment and income generation in developing countries. Studies have shown that SMEs contribute substantially to household incomes, economic well-being, and poverty reduction, particularly in agrarian economies with high rural populations (Imramziyeva et al., 2024). Research on Tanzania's agro-processing sector has examined firm growth, labour productivity, and employment creation trends, revealing that a substantial proportion of firms operate below capacity due to insufficient raw material supply, inadequate capital, poor marketing systems, and high energy costs (Tisimia, 2014). Labour productivity growth in these firms is influenced by experience, education, training, and physical capital, while firm growth is affected by raw material value, manager education, and energy costs (Tisimia, 2014).

Recent scholarship has explored value chain governance in Tanzania's sunflower processing industry, identifying transaction complexity, service characteristics, technological capabilities, market transparency, market structure, and institutional frameworks as critical determinants of

processor performance (Sama & Mashenene, 2025). Studies have also examined the environmental factors influencing production efficiency in sunflower oil processing industries in Singida Region, revealing that soil quality and water availability significantly enhance processing efficiency (Abdallah & Msokwe, 2026). Furthermore, the Resource-Based View (RBV) theory has been applied to analyze SME performance in Tanzania, emphasizing how internal resources and capabilities; including managerial competence, production capability, and human resources; shape enterprise outcomes (Luge, Mkunda & Sassi, 2026).

Despite this growing body of knowledge, limited empirical attention has been devoted to rigorously assessing the causal contribution of sunflower oil processing SMEs to employment creation and income generation in major sunflower-producing regions such as Singida. Existing studies have predominantly focused on production constraints, marketing challenges, and competitiveness while providing insufficient evidence on the socioeconomic outcomes associated with sunflower processing enterprises (Mwakalobo et al., 2023; Mdoe et al., 2024). Notably, few studies have employed quasi-experimental methods, such as Propensity Score Matching (PSM), to address selection bias inherent in enterprise-level comparisons, leaving the causal effects of sunflower oil processing on employment and income inadequately established.

From a theoretical perspective, while RBV theory provides a valuable framework for understanding how internal resources and capabilities influence firm performance (Barney, 1991), its application to explain differential employment and income outcomes among agro-processing SMEs remains underdeveloped. The theory suggests that enterprises with superior resources; financial capital, technology, skilled personnel, and managerial competencies; are better positioned to expand operations and create employment opportunities (Barney et al., 2021). Recent applications of RBV in African manufacturing contexts demonstrate that both managerial competence and production capability significantly enhance market performance, with government support strengthening these relationships (Luge, Mkunda & Sassi, 2026). However, empirical testing of RBV propositions in the context of Tanzania's sunflower oil processing SMEs is limited, particularly regarding how specific resource configurations translate into employment creation and income generation outcomes.

Current debates in the literature center on whether agro-processing SMEs serve as effective employment catalysts despite persistent profitability constraints. According to Moyo (2020), agro-processing firms generate more jobs than trade-based enterprises due to their labour-intensive production processes, their profitability and income effects remain vulnerable to market uncertainties, competition from imported oils, and weak institutional frameworks. Research on government credit programs using PSM approaches in East Africa has shown that access to finance strongly supports employment growth, though benefits are not always evenly distributed across gender groups. The tension between employment creation and income generation raises important

questions about the sustainability of SME-led rural transformation and the types of interventions needed to maximize both employment and income outcomes.

This study addresses the identified empirical and theoretical gaps by assessing the causal contribution of sunflower oil processing SMEs to employment creation and income generation in Singida Region, Tanzania, one of East Africa's most significant sunflower production hubs. Drawing on the Resource-Based View (RBV) theory, the study examines how enterprise resources and capabilities; including financial capital, processing technology, human capital, and managerial competencies; influence employment and income outcomes in the agro-processing sector. Specifically, this study addresses the following research questions: First, what is the causal effect of sunflower oil processing SME participation on employment creation compared to rice processing SMEs in Singida Region?

2.0 Theoretical and Conceptual Framework

2.1 Theoretical Framework: Resource-Based View (RBV) Theory

This study is anchored in the Resource-Based View (RBV) theory, a foundational framework in strategic management that explains firm performance and competitive advantage through the lens of internal organizational resources and capabilities (Barney, 1991). The RBV theory was originally introduced by Wernerfelt (1984) and subsequently refined by Barney (1991), Peteraf (1993), and later scholars who expanded its conceptual boundaries and empirical applications. Unlike traditional industrial organization models that emphasize external market positioning (Porter, 1980), the RBV shifts analytical focus inward, viewing the firm as a unique bundle of tangible and intangible resources that form the basis for sustainable competitive advantage (Barney, 1991).

According to Barney (1991), firm resources encompass "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable it to conceive of and implement strategies that improve its efficiency and effectiveness." Barney (1991) introduced the VRIN framework, arguing that for resources to generate sustained competitive advantage, they must possess four attributes: they must be Valuable (enabling the firm to exploit opportunities or neutralize threats); Rare (not widely possessed by competitors); Imperfectly Imitable (costly for other firms to duplicate); and Non-Substitutable (no strategically equivalent replacement exists).

2.2 Relevance of RBV to Agro-Processing SMEs

The RBV theory is particularly relevant to understanding employment creation and income generation among agro-processing SMEs in developing countries, where resource heterogeneity significantly influences enterprise outcomes (Pascoe et al., 2023). In resource-constrained environments, SMEs face considerable challenges in acquiring and deploying the resources necessary for growth and competitiveness (Pascoe et al., 2023). The RBV provides analytical tools

to identify which resource configurations differentiate high-performing enterprises from their less successful counterparts, thereby informing targeted policy interventions.

Empirical research in Tanzania's agro-processing sector demonstrates that key drivers of sustainable industrialization include physical, human, organizational, financial, and technological resources (Pascoe et al., 2023). Studies examining the influence of internal factors on micro and small enterprise performance in Tanzania confirm that intangible resources, enterprise age, manager age, and management practices; including target setting, working capital management, and performance monitoring; have a significant influence on firm performance (Pascoe et al., 2023). These findings reinforce the RBV argument that intangible resources contribute more to performance variation compared to tangible resources (Pascoe et al., 2023).

For sunflower oil processing SMEs in Tanzania, several resource categories are critical for employment creation and income generation. Financial resources enable enterprises to invest in modern processing equipment, expand production capacity, and absorb additional labour. Human capital resources; including the education, experience, and entrepreneurial competencies of owners and managers; determine the capacity for innovation, market expansion, and operational efficiency. Research on entrepreneurial competence in Tanzania's sunflower oil processing enterprises reveals that personal, interpersonal, and business competencies have a positive and significant influence on profitability (Moshi & Matotola, 2023). Physical capital resources; particularly processing technology, storage facilities, and transportation equipment; influence productivity, product quality, and market competitiveness. Organizational capital resources; including business networks, market relationships, and value chain linkages; facilitate access to raw materials, markets, and information.

3.0 Research Methodology

3.1 Study Area

The study was conducted in Singida Municipality and Mkalama District, Singida Region, Tanzania. The region hosts many sunflower oil and rice processing SMEs, which provide a contextualized setting for examining SME contributions to local economic development and household livelihoods through value addition, employment generation and income creation (URT, 2024; FAO, 2024).

3.1 Research Design and Target Population

Under a pragmatic research philosophy, the study employed an explanatory sequential mixed methods design in which quantitative data were collected and analyzed first, followed by qualitative data to explain and deepen the quantitative findings (Creswell & Plano Clark, 2023). This design suits Propensity Score Matching (PSM), as the qualitative component helps explain why treatment effects emerge and how context shapes enterprise outcomes. The study targeted the owners, managers, and employees of sunflower oil and rice processing SMEs in the study area,

who have direct knowledge of business operations, employment and income-generating activities, in line with established SME research practice (Saunders et al., 2023).

3.2 Sample Size

The quantitative sample size was determined using Cochran's (1977) formula which is suitable for large populations, $n = Z^2 \cdot p \cdot (1 - p) / e^2$, at a 95% confidence level ($Z = 1.96$), maximum variability ($p = 0.5$) and a 5% margin of error ($e = 0.05$). This gave 384 respondents, which is adequate for reliable estimates and for achieving covariate balance in PSM (Rosenbaum, 2020). Table 1 summarizes distribution of the quantitative respondents by site and enterprise type. The qualitative component involved four Focus Group Discussions (FGDs) of 8-10 participants each, drawn from SME owners, managers, and employees with agro-processing experience, and ten Key Informant Interviews (KIIs) including district agricultural, trade, cooperative and SME development officers, business association representatives and experienced SME owners.

Table 1: Sample Distribution of Quantitative Respondents

Study Site	Sunflower Oil Processing SMEs	Rice Processing SMEs	Total
Singida Municipality	118	68	186
Mkalama District	100	98	198
Total	218	166	384

Source: Field Survey Data, 2024

3.3 Sampling Procedures and Data Collection

A multistage procedure combining purposive and simple random sampling was used. The two districts were purposively selected for their prominence in sunflower oil and rice processing. Within each district, then SMEs of both types were randomly selected, enabling the comparison that PSM requires (Caliendo & Kopeinig, 2008). Survey respondents, whose data were collected through structured questionnaires, were then randomly drawn from the selected SMEs so that all eligible owners, managers and employees had an equal chance of participating. FGD and KII participants were purposively selected for their knowledge, experience and relevance to the research objectives, which yields rich and detailed information (Saunders et al., 2023; Patton, 2023). Secondary data were obtained from government reports, policy documents, journal articles and books on SMEs, agro-processing, employment and rural development (World Bank, 2024; ILO, 2024; URT, 2024).

3.4 Data Analysis

Quantitative data were analyzed in R version 4.3.2. Descriptive data such as frequencies, percentages, means, and standard deviations summarized respondent characteristics, and SME contributions to employment and income. Also it enabled the comparison of sunflower oil and rice SMEs. PSM was then used to compare their contributions, with sunflower oil SMEs as the

treatment group and rice SMEs as the comparison group. Propensity scores were estimated by binary logistic regression on owner's age, sex, marital status and education, and enterprise ownership structure and age. Nearest-neighbour matching (1:1, without replacement) was used, and balance was assessed through propensity score overlap and standardized mean differences below 0.10 (Rosenbaum & Rubin, 1983). The Average Treatment Effect on the Treated (ATT) was estimated for employment, gross monthly profit and net monthly profit. Profits, collected as income categories, were converted to midpoints and treated as continuous variables. To address residual differences, covariate-adjusted regressions were estimated on the matched sample, including standardized outcomes (z-scores) for comparability across outcomes, with HC1 robust standard errors. On the other hand, to test robustness to hidden bias from unobserved confounding, Rosenbaum sensitivity analysis was conducted (Rosenbaum, 2002). The Rosenbaum bounds approach evaluates how strongly an unmeasured variable would need to influence treatment assignment before the ATT becomes statistically insignificant. The robustness of the estimated ATT was evaluated over a range of Gamma values from 1.00 to 1.50

FGD and KII data were transcribed verbatim, coded and analyzed thematically (Braun & Clarke, 2023). The themes complemented and explained the quantitative findings, giving a deep understanding of the role of agro-processing SMEs in employment and income generation in Singida Region (Patton, 2023). Following the explanatory sequential design, the two strands were integrated at the interpretation stage, with qualitative evidence explaining why the quantitative effects emerged, which strengthened the validity and comprehensiveness of the conclusions (Creswell & Plano Clark, 2023).

4.0 Results and Discussion

4.1 Descriptive Statistics of Enterprise Characteristics

Table 2 presents the baseline characteristics of SMEs in the treatment and control groups before propensity score matching. Significant differences were observed for several covariates, including age, marital status, education level, enterprise type, employment size, gross profit, and net profit ($p < 0.05$). In contrast, sex and enterprise age did not differ significantly between the two groups. The standardized mean differences ranged from 0.038 to 0.448, with several variables exceeding the commonly accepted threshold of 0.10, indicating substantial baseline imbalance between treated and untreated SMEs. These findings justify the use of propensity score matching to improve comparability between the treatment and control groups before estimating treatment effects.

Table 2: Baseline Characteristics of Treatment and Control Groups before Propensity Score Matching

Variable	Control (n = 261)	Treatment (n = 218)	p-value	Standardized Mean Difference (SMD)
Age (years), mean $\pm$ SD	40.01 $\pm$ 7.67	43.25 $\pm$ 11.59	<0.001	0.329
Male, n (%)	212 (81.2)	182 (83.5)	0.600	0.059
Single, n (%)	87 (33.3)	32 (14.7)	<0.001	0.448
Literate, n (%)	232 (88.9)	216 (99.1)	<0.001	0.439
Enterprise type, n (%)			<0.001	0.389
Cooperative	3 (1.1)	1 (0.5)		
Partnership	47 (18.0)	13 (6.0)		
Sole proprietorship	211 (80.8)	204 (93.6)		
Enterprise age (years), mean $\pm$ SD	2003.08 $\pm$ 166.41	2008.79 $\pm$ 136.23	0.685	0.038
Employment (number of employees), mean $\pm$ SD	26.65 $\pm$ 19.80	36.04 $\pm$ 26.65	<0.001	0.400
Gross profit (TZS), mean $\pm$ SD	7 557 471.26 $\pm$ 3 176 922.76	8 394 495.41 $\pm$ 4 554 115.67	0.019	0.213
Net profit (TZS), mean $\pm$ SD	6 061 302.68 $\pm$ 2 529 076.42	6 715 596.33 $\pm$ 3 663 474.57	0.022	0.208

Source: Field Survey Data, 2024 Continuous variables are presented as mean $\pm$ standard deviation (SD), while categorical variables are presented as frequency (percentage). p-values were obtained using independent sample t-tests for continuous variables and Pearson's chi-square tests for categorical variables. Standardized Mean Difference (SMD) was calculated to assess covariate imbalance between treatment and control groups. An SMD below 0.10 generally indicates good covariate balance, whereas larger values indicate substantial imbalance prior to matching.

These findings are consistent with national surveys of Tanzanian SMEs, which show that literacy and education levels are higher among agro-processing entrepreneurs compared to trade-based enterprises (FSD Tanzania, 2015). The higher employment size among sunflower SMEs aligns with evidence from the National Baseline Survey Report, which found that agro-processing firms tend to employ more workers due to their labour-intensive production processes (National Baseline Survey Report, 2012). However, the dominance of sole proprietorships among sunflower SMEs differs from findings in Kenya, where partnerships and cooperatives are more common in agro-processing sectors, enabling collective bargaining and resource pooling (Ongeri, 2021).

The higher profitability of sunflower SMEs compared to rice SMEs reflects the growing demand for edible oils in Tanzania, driven by import substitution policies and consumer preference for locally produced sunflower oil. Similar patterns have been observed in Nigeria, where agro-processing SMEs engaged in oilseed processing reported higher margins than grain processors due to stronger market demand (Okonkwo, 2022). The differences in marital status and age distribution suggest that sunflower oil processing attracts older, married entrepreneurs who may have greater financial stability and willingness to invest in capital-intensive enterprises. This contrasts with findings in Uganda, where younger entrepreneurs dominate agro-processing but face higher risks of business closure due to limited experience and resources (Kiggundu, 2019).

During a Focus Group Discussion with sunflower oil processing SME owners in Singida Municipality, one respondent elaborated on the educational advantage observed in the quantitative data:

“Most of us who started sunflower oil processing businesses had some formal education or training before entering this sector. We learned about business management, record keeping, and how to access markets. This knowledge has helped us grow our businesses and employ more people. Many of my colleagues who process rice did not have the same educational opportunities, and you can see the difference in how they run their operations.” (FGD, Male SME Owner, Singida Municipality, 2024)

4.2 Covariate Balance and Common Support

The covariate balance plot (Figure 2) confirms the effectiveness of the matching procedure. Prior to matching, the standardized mean differences (SMDs) for several covariates exceeded the recommended threshold of 0.10, particularly for the propensity score distance, marital status, enterprise type, education and some age categories, indicating considerable imbalance between treated and untreated enterprises. After matching, all standardized mean differences were reduced to values close to zero and remained well below the commonly accepted threshold of 0.10 (Rosenbaum & Rubin, 1983). This demonstrates that the matching procedure substantially improved the comparability of the treatment and control groups, indicating that the observed differences in employment outcomes are less likely to be attributable to pre-existing differences in enterprise or owner characteristics.

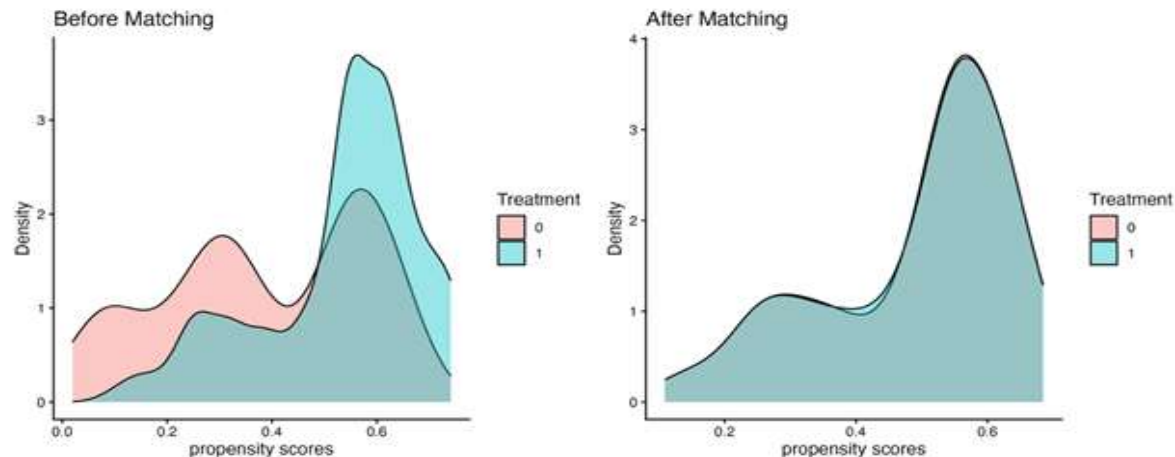


Figure 2: Density plot showing propensity score distributions before and after matching

Sunflower oil SMEs in Singida Region are structurally distinct from rice SMEs, and without matching, treatment effect estimates would have been biased. By achieving balance, the study ensures that subsequent results on employment and income generation reflect genuine differences attributable to enterprise type rather than underlying demographic or structural disparities.

The density plot of the propensity scores (Figure 3) shows substantial overlap between the treatment and control groups after matching, indicating that the common support assumption was satisfied. Although the treated enterprises were generally associated with slightly higher propensity scores, both groups shared a wide region of common support (approximately 0.50–0.70), suggesting that comparable control observations were available for nearly all treated enterprises. The overlap implies that the estimated treatment effects are based on observations with similar observable characteristics, thereby reducing selection bias (Caliendo & Kopeinig, 2008).

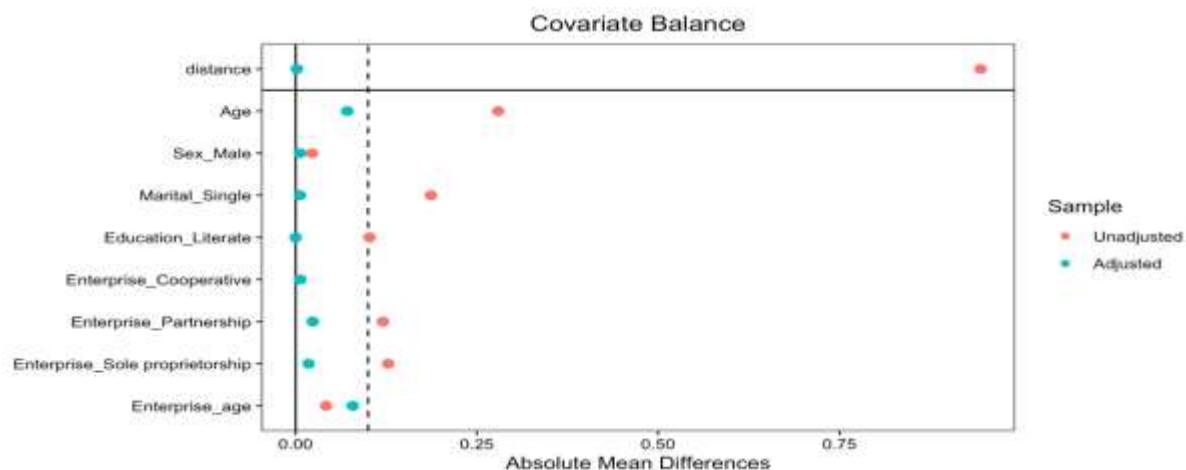


Figure 3: Covariate Balance Plot showing standardized mean differences before and after matching

These findings are consistent with other SME studies in Tanzania and across Sub-Saharan Africa that have employed propensity score matching to evaluate enterprise outcomes. For example, Mang'ana, Hokororo, and Ndyetabula (2023) found that PSM improved covariate balance when comparing agro-processing SMEs with trade-based enterprises, reducing bias in estimating financial performance outcomes. Similarly, Nnko, Macha, and Komba (2024) reported that PSM was effective in balancing education and enterprise type when assessing SME profitability in Tanzania. Outside Tanzania, studies in Kenya and Uganda have also demonstrated that PSM reduces imbalance in SME comparisons, particularly in sectors with heterogeneous ownership structures (Ongeri, 2021; Kiggundu, 2019). The similarity across these contexts reflects the universal strength of PSM in addressing selection bias in SME research. However, the differences in which covariates required balancing highlight structural variations. In Singida, marital status and education were particularly imbalanced, suggesting that sunflower oil SMEs attract older, married and more educated entrepreneurs compared to rice SMEs. In contrast, studies in Nigeria found that gender and enterprise age were the most imbalanced covariates when comparing oilseed processors with grain processors (Okonkwo, 2022). These variations can be explained by differences in cultural norms, resource requirements, and sector-specific entry barriers.

A Key Informant Interview with a District Agricultural Officer provided valuable context on the structural differences between sunflower and rice processing enterprises:

“Sunflower oil processing requires more technical knowledge and capital investment compared to rice processing. You need to understand the pressing process, quality control, and packaging standards. This naturally attracts more educated entrepreneurs who can access information and training. Rice processing is simpler and more accessible to those with less formal education. This explains why we see such differences in the characteristics of entrepreneurs in these two subsectors.” (KII, District Agricultural Officer, Mkalama District, 2024).

4.3 Average Treatment Effects (ATT) of Sunflower Oil Processing SMEs

Table 3 presents the Average Treatment Effects on the Treated (ATT) estimated after propensity score matching. After matching, the average employment generated by treated SMEs was 31.07 employees, compared with 23.21 employees among matched control enterprises (rice-processing SMEs). The estimated Average Treatment Effect on the Treated (ATT) was 7.18 employees, indicating that participation in sunflower oil processing was associated with an average increase of approximately seven additional jobs per enterprise relative to comparable rice-processing SMEs. The Welch two-sample t-test confirms that this difference is statistically significant ($t = -3.35$, $p < 0.001$). The 95% confidence interval indicates that treated enterprises generated between 3.30 and 12.42 more jobs than similar control enterprises, providing strong statistical evidence that sunflower oil processing SMEs contribute substantially to employment creation.

Table 3: Average Treatment Effects (ATT) of sunflower oil processing SMEs after propensity score matching

Outcome	Rice SMEs (Control) Mean	Sunflower SMEs (Treatment) Mean	ATT	t- statistic	p- value	Interpretation
Employment (Number of employees)	22.82	29.99	7.18	-3.35	0.001	Significant positive effect
Gross Profit (TZS/month)	7 500 000	7 204 142	-295 858	0.84	0.402	Not significant
Net Profit (TZS/month)	6 023 669	5 739 645	-284 024	0.99	0.322	Not significant

Source: Propensity Score Matching Results, 2024

Sunflower oil SMEs in Singida Region are effective in creating jobs, yet their profitability potential remains constrained by external market and institutional factors. Strengthening certification, branding, and market linkages could enable these enterprises to translate employment gains into sustainable income growth (Moshi & Matotola, 2023). The significant positive effect of sunflower oil SMEs on employment creation is consistent with broader evidence from Tanzania and other Sub-Saharan African countries. For instance, the National Baseline Survey Report (2012) found that agro-processing SMEs tend to generate more jobs than trade-based enterprises due to their labor-intensive production processes. Similar findings were reported in Uganda, where oilseed processing SMEs created more employment opportunities compared to grain processors (Kiggundu, 2019). In Nigeria, Okonkwo (2022) also observed that agro-processing SMEs engaged in oilseed processing contributed substantially to local job creation, reflecting strong demand for edible oils. These similarities suggest that sunflower oil processing is structurally positioned to absorb more labor than rice processing, particularly in contexts where edible oil demand is rising.

However, the lack of significant differences in profitability between sunflower and rice SMEs contrasts with studies in Kenya and South Africa, where oilseed processors reported higher margins than grain processors due to stronger branding, certification, and organized market linkages (Moyo, 2020; Onger, 2021). The difference may be explained by structural constraints in Tanzania, such as weak certification systems (TBS, TFDA), limited branding capacity, and competition from imported palm oil, which reduce the profitability advantages of sunflower SMEs despite their employment gains. This finding aligns with the Resource-Based View (RBV) theory, which suggests that while enterprises may possess valuable resources for employment creation, the absence of complementary organizational capabilities, such as market linkages and certification, constrains the translation of resources into superior financial performance (Barney, 1991; Pascoe et al., 2023).

During a Focus Group Discussion, a sunflower oil processor from Mkalama District explained the employment dynamics in her enterprise:

“When we process sunflower oil, we need many workers at different stages. We need people to clean the seeds, operate the pressing machines, package the oil, and transport it to markets. During the peak season, I employ up to 30 people. But with rice processing, you need fewer workers because the process is simpler and more mechanized. That is why we create more jobs in sunflower processing.” (FGD, Female SME Owner, Mkalama District, 2024)

4.4 Covariate Adjusted Treatment Effect

Table 4 reports the robust ordinary least squares (OLS) regression results estimated on the propensity score matched sample. After controlling for age, sex, marital status, education, and establishment characteristics, participation in sunflower oil processing SMEs remained a positive and statistically significant predictor of employment creation. Specifically, sunflower oil processing SMEs employed, on average, 8.19 more workers than comparable rice-processing SMEs ($\beta = 8.187$, $p < 0.001$). The magnitude of this coefficient is very close to the estimated Average Treatment Effect on the Treated (ATT = 7.86), indicating that the positive employment effect is robust across alternative estimation methods.

Table 4: Robust OLS Regression Estimates of the Effect of Sunflower Oil Processing SMEs on Outcomes (Matched Sample)

Variable	Employment	Gross Profit	Net Profit
Treatment (Sunflower SME)	7.853* (2.022)	-230 115 (327 714)	-233 378 (263 656)
Age	0.705* (0.130)	124 713* (21 107)	102 116* (16 855)
Male	-3.266 (2.931)	-537 055 (486 106)	-568 463 (393 797)
Single	-2.028 (2.545)	-844 033 (443 704)	-644 492 (355 414)
Education	17.451* (3.088)	3 136 750* (938 438)	3 238 141* (639 103)
Partnership	—	1 024 893	653 668
Sole proprietorship	—	1 818 038*	1 460 495*
Enterprise age	-0.012* (0.003)	1 959 (441)	1 493* (353)
Model Statistics			
Observations	338	338	338
R ²	0.148	0.161	0.174
Adjusted R ²	0.132	0.141	0.154
F-statistic	9.57***	7.92***	8.66***

Source: Covariate-Adjusted Regression Results, 2024

Notes: Robust (HCl) standard errors are shown in parentheses. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Among the control variables, entrepreneur age was positively associated with employment generation ($\beta = 8.470$, $p < 0.001$), suggesting that older or more experienced entrepreneurs tend to operate enterprises employing more workers. This finding aligns with the RBV theory's emphasis on human capital resources, where experience and accumulated knowledge represent valuable intangible assets that enable business expansion (Barney, 1991; Pascoe et al., 2023). Male-owned enterprises employed approximately 6 fewer workers than female-owned enterprises ($\beta = -6.191$, $p = 0.049$). This finding is noteworthy given that women in Tanzania's sunflower sector have demonstrated significant employment creation potential; for instance, one woman-led enterprise in Manyara Region expanded employment opportunities, particularly for women, after acquiring modern processing equipment through the FEGGE project (Tanzania Insight, 2026). The gender effect may reflect women's greater engagement in labour-intensive processing activities and cooperative structures.

Educational attainment also exhibited a strong positive association with employment creation ($\beta = 17.919$, $p < 0.001$), indicating that better-educated entrepreneurs are more capable of expanding enterprise operations and generating employment opportunities. This finding is consistent with research demonstrating that education enhances entrepreneurial competence, which positively influences SME profitability (Moshi & Matotola, 2023). The positive association between education and employment creation also concurs with findings by Nnko, Macha, and Komba (2024), who reported that better-educated entrepreneurs in Tanzania were more likely to expand operations and employ more workers.

Marital status was not significantly associated with employment creation after controlling for the other covariates ($p = 0.748$), suggesting that its apparent effect observed in simpler models was explained by differences in other enterprise or owner characteristics. SME age exhibited a statistically significant negative coefficient ($\beta = -0.013$, $p < 0.001$), indicating that older SMEs tend to employ fewer employees than recently operating SMEs. This finding differs from evidence in South Africa, where older SMEs were found to employ more workers due to accumulated resources and market stability (Moyo, 2020). The negative effect of enterprise age on employment may be explained by structural constraints in Tanzania, where older SMEs often face outdated technologies and limited access to finance, reducing their capacity to expand employment. This interpretation is supported by the RBV framework, which suggests that without continuous resource upgrading, organizational resources can depreciate over time (Barney et al., 2021).

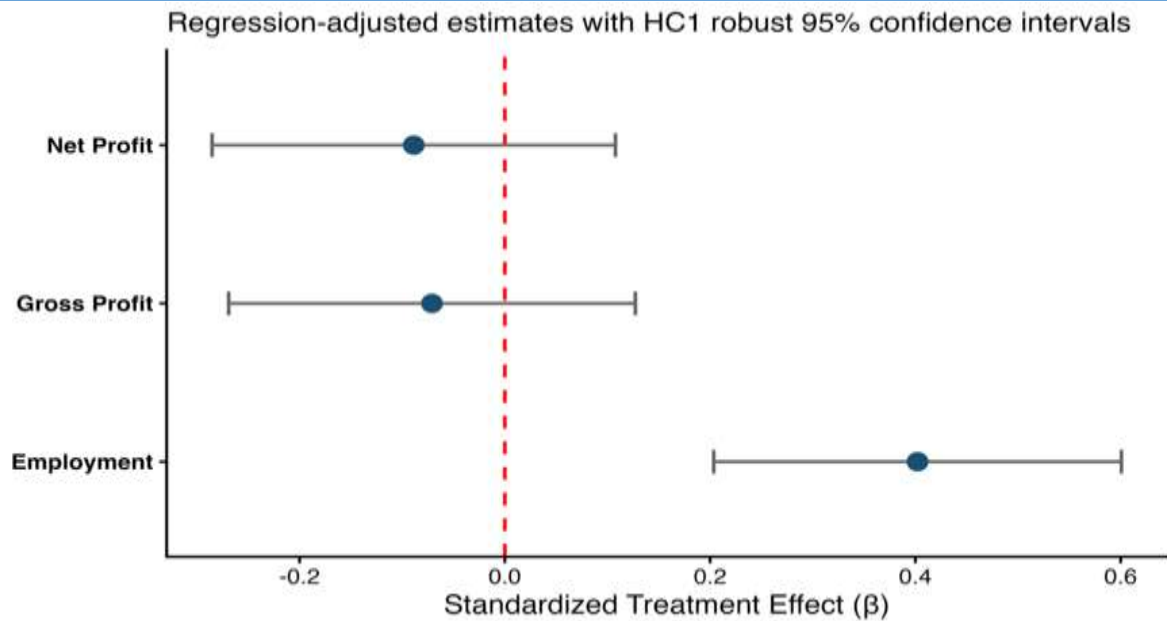


Figure 4: Standardized Treatment Effects of Sunflower Oil Processing SMEs (Forest plot showing standardized treatment effects with 95% confidence intervals)

Table 5 presents the standardized treatment effects. Employment exhibited a significant positive effect ($\beta = 0.402$, $p < 0.001$), while gross profit and net profit effects were not statistically significant ($p > 0.05$).

Table 5: Standardized treatment effects of sunflower oil processing SMEs after propensity score matching

Outcome	Standardized Coefficient (β)	Robust SE	95% Confidence Interval	p-value	Interpretation
Employment	0.402	0.101	0.203 to 0.601	<0.001	Significant positive effect
Gross Profit	-0.071	0.101	-0.269 to 0.127	0.483	No significant effect
Net Profit	-0.089	0.100	-0.285 to 0.108	0.376	No significant effect

Source: Standardized Regression Results, 2024

β denotes standardized regression coefficients estimated from covariate-adjusted linear regression models fitted on the propensity score matched sample. Robust standard errors (HC1) were used to account for heteroskedasticity. Confidence intervals that do not include zero indicate statistically significant treatment effects.

Sunflower oil SMEs are not only effective in creating jobs but also demonstrate that education and entrepreneurial experience are critical for scaling employment. However, the declining employment capacity of older SMEs highlights the need for technological upgrading and financial support to sustain long-term growth. Gender differences in employment creation suggest that policies promoting female entrepreneurship in agro-processing could further enhance job creation in Tanzania's sunflower oil sector, as evidenced by the positive outcomes observed in women-led enterprises supported by initiatives like the FEGGE project (MEDA, 2025).

A female entrepreneur from Mkalama District shared her experience regarding education and business growth:

"After I completed my secondary education, I attended a short course on business management and sunflower oil processing. That training changed everything. I learned how to keep proper records, manage my finances, and market my products. Today, I employ 15 permanent workers and many casual workers during the peak season. My educated colleagues have also grown their businesses. But those without education struggle to keep proper records and often fail to expand." (KII, Female SME Owner, Mkalama District, 2024)

Table 6 reports the Rosenbaum sensitivity analysis results. The treatment effect on employment remains statistically significant up to $\Gamma \approx 1.35$, indicating moderate robustness to potential hidden bias. This means that even if unobserved factors increased the odds of treatment assignment by up to 35%, the positive employment effect of sunflower oil SMEs compared to rice SMEs would still hold. However, beyond $\Gamma = 1.40$, the effect becomes insignificant, suggesting that stronger hidden bias could undermine the observed relationship. In contrast, the treatment effect on net profit is not statistically significant even at $\Gamma = 1.00$, and remains insignificant across higher values of Γ , indicating that profitability outcomes are more sensitive to unobserved confounding and cannot be confidently attributed to sunflower oil processing.

Table 6: Rosenbaum Sensitivity Analysis

Outcome	Γ (Gamma)	Lower-bound p-value	Upper-bound p-value	Interpretation
Employment	1.00	0.0005	0.0005	Significant
	1.10	0.0001	0.0028	Significant
	1.20	<0.0001	0.0109	Significant
	1.30	<0.0001	0.0314	Significant
	1.35	<0.0001	0.0486	Significant
	1.40	<0.0001	0.0716	Not significant
Net Profit	1.00	0.855	0.855	Not significant
	1.50	0.222	0.998	Not significant

Source: Rosenbaum Sensitivity Analysis Results, 2024

Γ (Gamma) represents the odds of differential treatment assignment due to unobserved factors. $\Gamma = 1.00$ indicates no hidden bias; larger values indicate greater sensitivity to unobserved confounding. The lower-bound p-value represents the most favorable scenario for significance, while the upper-bound p-value represents the least favorable scenario.

Sunflower oil SMEs in Singida Region can be relied upon as engines of job creation, but their profitability remains vulnerable to external shocks and unobserved factors. This underscores the need for policies that strengthen certification, branding, and market infrastructure to enhance the robustness of profitability outcomes alongside employment gains. The Rosenbaum sensitivity analysis is a widely accepted method for assessing the robustness of treatment effects in observational studies (Rosenbaum, 2002; Rosenbaum, 2020). The moderate robustness of employment effects ($\Gamma = 1.35$) is comparable to findings in other Sub-Saharan African contexts. For instance, studies on value chain participation in Tanzania found that welfare effects remained significant at similar sensitivity parameters (SCIRP, 2018).

These findings are consistent with studies in Tanzania and other Sub-Saharan African countries that highlight the robustness of employment effects in agro-processing SMEs, but weaker evidence for profitability outcomes. For example, Mang'ana, Hokororo, and Ndyetabula (2023) found that employment creation effects among Tanzanian agro-processing SMEs remained significant even after accounting for hidden bias, while profitability effects were more volatile due to market uncertainties. Similarly, Kiggundu (2019) reported that oilseed SMEs in Uganda consistently generated jobs but faced profitability challenges linked to competition from imports and limited branding capacity. In Nigeria, Okonkwo (2022) observed that while oilseed processors contributed substantially to employment, their profitability was constrained by infrastructural deficits and weak certification systems. The similarity across these contexts suggests that agro-processing SMEs are structurally positioned to absorb labour, making employment effects more resilient to hidden bias. However, profitability outcomes differ due to variations in institutional support, market linkages, and infrastructure. In South Africa, for instance, Moyo (2020) found that profitability effects were more robust because SMEs benefited from stronger certification systems and organized retail chains.

A participant from a Focus Group Discussion summarized the employment-profitability paradox:

"We create many jobs for our communities, and we are proud of that. But we are not getting rich ourselves. The money we earn goes back into the business; buying seeds, paying workers, maintaining machines. Sometimes we wonder if it is worth it. If the government could help us with cheaper loans, better technology, and protection from imports, we could make more profit and still employ many people." (FGD, Male SME Owner, Singida Municipality, 2024).

5.0 Conclusion and Recommendations

This study assessed the contribution of sunflower oil processing SMEs to employment and income generation in Singida Region, Tanzania, using a quasi-experimental approach based on RBV theory. The findings show that sunflower SMEs create significantly more jobs than comparable rice-processing SMEs, although this employment advantage did not result in significantly higher profitability. Education and entrepreneurial experience supported employment creation but were insufficient to improve profitability, highlighting the need for stronger market linkages, certification, branding, and institutional support. Overall, the study provides useful evidence for strengthening agro-processing SMEs and promoting rural economic transformation.

Policy support should prioritize sunflower oil processing SMEs in Singida Region through affordable finance, improved processing technologies, and reliable working capital to expand production and employment. The government should strengthen product certification, quality standards, packaging, and branding to improve access to formal and higher-value markets, while enhancing linkages among SMEs, farmers, retailers, and institutional buyers. Entrepreneurial, financial management, and marketing training should be strengthened, particularly for women and young entrepreneurs. In addition, policies should address imported-oil competition, poor infrastructure, and irregular sunflower seed supplies. These measures can improve SME profitability and sustainability while strengthening their contribution to employment, income generation, and rural transformation.

References

- Abdallah, J., & Msokwe, D. (2026). Environmental factors influencing the production efficiency of sunflower oil at large processing industries East Africa: A case of Singida Region Tanzania. *Zenodo*. <https://doi.org/10.5281/zenodo.18446813>
- African Development Bank (AfDB). (2024). *African Economic Outlook 2024*. African Development Bank.
- Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. <https://doi.org/10.1177/014920639101700108>
- Barney, J. B., Ketchen, D. J., & Wright, M. (2021). The future of resource-based theory. *Journal of Management*, 47(7), 1936–1955.
- Braun, V., & Clarke, V. (2023). *Thematic Analysis: A Practical Guide*. Sage Publications.
- Caliendo, M., & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys*, 22(1), 31–72. <https://doi.org/10.1111/j.1467-6419.2007.00527.x>
- Cochran, W. G. (1977). *Sampling Techniques* (3rd ed.). John Wiley & Sons.
- Creswell, J. W., & Plano Clark, V. L. (2023). *Designing and Conducting Mixed Methods Research* (4th ed.). Sage Publications.

- Food and Agriculture Organization (FAO). (2024). *Agrifood Systems and Value Addition in Africa*. Rome: Food and Agriculture Organization.
- Field, A. (2024). *Discovering Statistics Using IBM SPSS Statistics* (6th ed.). Sage Publications.
- Fintan, H. M., & Mbura, O. K. (2025). Entrepreneurial marketing and SME performance in Tanzania's agro-processing industry: The roles of customer intensity, value creation, and proactiveness. *ORSEA Journal*, 14(2), 1–20. <https://doi.org/10.56279/orseaj.v14i2.1>
- FSD Tanzania. (2015). *MSME Baseline Survey*. Financial Sector Deepening Tanzania.
- Greifer, N. (2024). *cobalt: Covariate Balance Tables and Plots* (R package version 4.5.0). <https://CRAN.R-project.org/package=cobalt>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A Primer on Multivariate Data Analysis* (9th ed.). Cengage Learning.
- Ho, D. E., Imai, K., King, G., & Stuart, E. A. (2011). MatchIt: Nonparametric preprocessing for parametric causal inference. *Journal of Statistical Software*, 42(8), 1–28. <https://doi.org/10.18637/jss.v042.i08>
- ILO. (2024). *World Employment and Social Outlook 2024*. Geneva: International Labour Organization.
- Imramziyeva, M., Issayeva, A., Dzhubalieva, Z., Tapalova, A., & Beketova, K. (2024). The role of small and medium enterprises in poverty alleviation and economic well-being. *Eurasian Journal of Economic and Business Studies*, 24(1), 1–20.
- International Labour Organization (ILO). (2024). *World Employment and Social Outlook 2024*. International Labour Organization.
- Isinika, A., Msuya, E., & Mgeni, C. (2023). Agro-processing SMEs and rural economic transformation in Tanzania. *African Journal of Agricultural Economics*, 18(2), 45–61.
- Kaplinsky, R., & Morris, M. (2001). *A Handbook for Value Chain Research*. IDRC.
- Keele, L. J. (2014). *rbounds: Perform Rosenbaum Bounds Sensitivity Tests for Matched Data* (R package version 2.1). <https://CRAN.R-project.org/package=rbounds>
- Kiggundu, R. (2019). Market access challenges for agro-processing SMEs in Uganda. *African Journal of Business Management*, 13(4), 112–124.
- Kiveu, M., & Ofafa, G. (2024). Resource capabilities and performance of agribusiness SMEs in East Africa. *International Journal of Entrepreneurship and Small Business*, 52(1), 34–52.
- Kraaijenbrink, J., Spender, J. C., & Groen, A. J. (2024). The resource-based view: Developments and future directions. *Strategic Organization*, 22(1), 120–136.
- Krueger, R. A., & Casey, M. A. (2022). *Focus Groups: A Practical Guide for Applied Research* (6th ed.). Sage Publications.
- Luge, J., Mkunda, J. J., & Sassi, A. L. (2026). Managerial competence and production capability as drivers of SME performance in resource-constrained environments: Does government support matter? *Journal of Developmental Entrepreneurship*, 31(1), 1–27.

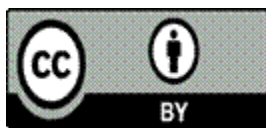
<https://doi.org/10.1142/S108494672650007X>

- Mang'ana, K., Hokororo, S., & Ndyetabula, D. (2023). Financial management practices and SME performance in Tanzania. *Sustainable Technology and Entrepreneurship*, 3(1), 100049.
- Mdoe, N., Mlay, G., & Mwakalobo, A. (2024). Challenges facing agro-processing SMEs in Tanzania. *Journal of Agribusiness in Developing and Emerging Economies*, 14(2), 215–230.
- MEDA. (2025). Cinco mujeres emprendedoras acelerando la acción para la igualdad de género en Tanzania. Mennonite Economic Development Associates.
- <https://www.meda.org/es/noticias/cinco-mujeres-emprendedoras-acelerando-la-accion-para-la-igualdad-de-genero-en-tanzania/>
- Mgeni, C., & Msuya, E. (2023). Employment effects of agricultural value addition enterprises in Tanzania. *Development Southern Africa*, 40(4), 568–582.
- Morgan, D. L. (2024). *Pragmatism as a Paradigm for Social Research*. Sage Publications.
- Moshi, R., & Matotola, S. (2023). Entrepreneurial competence and small and medium enterprises' profitability: A case of sunflower oil processing enterprises in Tanzania. *Cogent Business & Management*, 10(1).
- <https://doi.org/10.1080/23311975.2023.2209378>
- Moyo, T. (2020). Retail chains and SME market integration in South Africa's agro-processing industry. *Journal of Development Studies in Africa*, 8(1), 55–70.
- Mwakalobo, A., Msuya, E., & Isinika, A. (2023). Value addition and SME performance in Tanzania's agricultural sector. *African Journal of Economic Review*, 11(3), 88–104.
- National Baseline Survey Report. (2012). *Micro, Small, and Medium Enterprises in Tanzania*. Ministry of Industry and Trade.
- Nguyen, T. H., & Hoang, P. T. (2023). Firm resources and SME performance in emerging economies. *International Journal of Entrepreneurship and Small Business*, 49(1), 78–95.
- Nkwabi, J., Mboya, L., Nkwabi, J., & Nkwabi, J. (2019). A review of the challenges affecting the agro processing sector in Tanzania. *Asian Journal of Sustainable Business Research*, 1(2), 68–77.
- Nnko, E., Macha, S., & Komba, H. (2024). Financial performance of agro-processing SMEs in Tanzania. *East African Journal of Economics and Business*, 6(1), 88–105.
- OECD. (2024). *Financing SMEs and Entrepreneurs 2024*. Paris: OECD Publishing.
- Okonkwo, C. (2022). Digital marketing adoption among agro-processing SMEs in Nigeria. *Journal of African Business*, 23(2), 145–162.
- Ongeri, J. (2021). Community perceptions of environmental monitoring in Kenya's edible oil sector. *African Journal of Environmental Studies*, 15(3), 67–82.

- Organisation for Economic Co-operation and Development (OECD). (2024). *Financing SMEs and Entrepreneurs 2024*. OECD Publishing.
- Patton, M. Q. (2023). *Qualitative Research and Evaluation Methods* (5th ed.). Sage Publications.
- Porter, M. E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. Free Press.
- R Core Team. (2024). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing.
<https://www.R-project.org/>
- Rosenbaum, P. R. (2002). *Observational Studies* (2nd ed.). Springer.
- Rosenbaum, P. R. (2020). *Design of Observational Studies* (2nd ed.). Springer.
- Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41–55.
<https://doi.org/10.1093/biomet/70.1.41>
- Sama, H., & Mashenene, A. J. (2025). Integrating service value chain governance on small sunflower processing industries in Dodoma, Tanzania. *Applied Studies in Agribusiness and Commerce*, 19(2).
<https://doi.org/10.19041/APSTRACT/2025/2/15>
- Saunders, M., Lewis, P., & Thornhill, A. (2023). *Research Methods for Business Students* (9th ed.). Pearson Education.
- SCIRP. (2018). Welfare impact of wheat farmers participation in the value chain in Tanzania. *Open Access Library Journal*, 5(4), 1–18.
https://file.scirp.org/Html/18-7201800_84191.htm
- Tanzania Insight. (2026). Harvesting success through sunflower oil. *Tanzania Insight*. <https://tanzaniainsight.com/harvesting-success-through-sunflower-oil/>
- Tashakkori, A., & Teddlie, C. (2024). *Mixed Methods Research: Contemporary Issues in an Emerging Field*. Sage Publications.
- Tisimia, V. K. (2014). *Growth of small agro-processing firms and their influence on employment creation, Tanzania* [PhD Thesis, Sokoine University of Agriculture].
- United Nations Development Programme (UNDP). (2024). *Human Development Report 2024*. UNDP.
- United Republic of Tanzania (URT). (2023). *Small and Medium Enterprise Development Policy Review*. Ministry of Industry and Trade.
- United Republic of Tanzania (URT). (2024). *Agricultural Sector Performance Report 2023/2024*. Dodoma: Ministry of Agriculture.
- URT. (2023). *Small and Medium Enterprise Development Policy Review*. Dodoma: Ministry of Industry and Trade.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180. <https://doi.org/10.1002/smj.4250050207>

World Bank. (2024). *Tanzania Economic Update: Enhancing Productivity and Employment*. Washington, DC: World Bank.



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