

Socio-Economic Practices and Livelihoods of Sugarcane Outgrowers in Bungoma County, Kenya: Evidence from Nzoia Sugar Company

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ABSTRACT

Purpose: This study examined the effects of education support, health support, infrastructure and transport support, and housing support practices implemented by Nzoia Sugar Company on the livelihoods of sugarcane outgrowers in Bungoma County, Kenya.

Design/methodology/approach: The study adopted an explanatory cross-sectional survey design. Data were collected from a stratified sample of registered sugarcane outgrowers drawn from the company's operational zones using a structured Likert-scale questionnaire. The measurement scales were assessed for reliability and construct validity before hierarchical regression analysis was conducted. Household and farm characteristics were entered as control variables before the socio-economic support practices were introduced.

Findings: The measurement constructs achieved satisfactory reliability and validity. Household and farm characteristics explained a substantial proportion of variation in outgrowers' livelihoods. The inclusion of the socio-economic support practices significantly improved the model's explanatory power. Education support, health support, infrastructure and transport support, and housing support all had positive and statistically significant effects on livelihood outcomes. Education support demonstrated the strongest effect among the socio-economic support practices.

Research limitations/implications: The cross-sectional design limits the ability to establish changes in livelihood outcomes over time. The study also relied on respondents' perceptions, which may be affected by recall and response biases. Future studies should employ longitudinal designs and incorporate objective livelihood indicators.

Practical implications: Nzoia Sugar Company should adopt an integrated outgrower-support model that combines agricultural education, health outreach, transport coordination, rural infrastructure development and housing-related welfare initiatives. Collaboration with county and national government agencies would strengthen the sustainability and coverage of these interventions.

Originality/value: The study demonstrates that access to a sugarcane market alone is insufficient to improve outgrowers' livelihoods. Company-supported social and economic practices provide additional livelihood benefits beyond those explained by household and farm characteristics.

KEYWORDS: Sugarcane outgrowers, socio-economic support practices, livelihood improvement, contract farming, Nzoia Sugar Company, Kenya.

1.0 INTRODUCTION

Smallholder participation in contract farming and outgrower schemes is widely promoted as a pathway to market access, technology transfer, income growth and rural transformation. Yet the welfare consequences of these arrangements are not uniform. Reviews of contract farming show that participation can improve income and productivity, but outcomes vary with contract design, farmer characteristics, institutional quality and the services bundled with market access (Bellemare & Bloem, 2018; Meemken & Bellemare, 2020; Otsuka et al., 2016; Ton et al., 2018). Evidence from China and Kenya further shows that income and welfare effects depend on selection into contracts and the quality of buyer-farmer coordination (Miyata et al., 2009; Mwambi et al., 2016; Ochieng & Ogutu, 2022; Ogutu et al., 2020). Sugarcane is especially dependent on coordinated relationships because cane is bulky, perishable after harvesting and costly to transport. The livelihood value of an outgrower arrangement therefore depends on more than the purchase of cane; it also reflects whether farmers receive knowledge, health, logistical and welfare support that enables them to sustain production and household wellbeing.

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The Sustainable Livelihoods Framework conceptualises livelihood as the capabilities, assets and activities that households use to make a living and withstand shocks (Chambers & Conway, 1992; DFID, 1999; Scoones, 1998). Livelihood scholarship also stresses the interaction between assets, capabilities and access to markets and institutions (Bebbington, 1999; Scoones, 2009). Contemporary extensions emphasise that livelihood outcomes are dynamic, spatially uneven and shaped by institutions and ecological pressures (Natarajan et al., 2022). For a sugarcane outgrower, livelihood therefore includes income stability, the ability to meet basic needs, food security, asset accumulation, coping capacity and perceived improvement in living standards. It follows that the support environment created by a miller may strengthen or weaken the capacity of cane income to translate into broader household welfare.

African sugarcane outgrower systems illustrate both the opportunities and risks of commercial inclusion. Evidence from Tanzania, Zambia and Uganda indicates that access to markets and collective organisation can support rural accumulation, yet unequal land relations, production risks, food-security pressures and weak farmer bargaining power may limit welfare gains (Bahati et al., 2022; Isager et al., 2018; Matenga, 2017). Studies from Uganda and Ghana also show that commercial crop arrangements can affect food security, nutrition and household vulnerability in ways that are not captured by income alone (Kaahwa et al., 2023; Ragasa et al., 2018). Machimu's (2024) review similarly argues that smallholder sugarcane arrangements require stronger farmer services and institutional coordination if they are to deliver sustainable outcomes. These findings shift attention from whether farmers participate in a scheme to the quality of support embedded within it.

Kenya's sugar industry remains economically important in western counties, but the sector has faced persistent concerns involving mill efficiency, cane supply, farmer arrears, transport bottlenecks and the sustainability of state-owned millers (Office of the Auditor-General, 2024; Snyder & Gitonga, 2024). The Sugar Act, 2024 re-established a statutory framework for sector regulation and placed renewed attention on grower interests and value-chain governance (Kenya Law, 2024). In Bungoma County, sugarcane is intertwined with household income, land use and rural employment, while the county development framework identifies agriculture, roads, health and social welfare as mutually reinforcing development priorities (Bungoma County Government, 2023). Nzoia Sugar Company therefore operates within a setting in which company practices can affect both cane delivery and the welfare environment of outgrower households.

Previous research has examined contract farming, sugarcane production, income, land relations and food security, but fewer studies have estimated the joint contribution of company-driven education, health, infrastructure/transport and housing support to multidimensional livelihood outcomes. Existing studies also often analyse a single intervention without controlling for background differences among farmers. This is important because gender, education, marital status, farming experience, acreage and supplier category can shape the resources available to households and their capacity to benefit from company support. The present study addresses this gap by testing four support dimensions simultaneously and estimating their incremental explanatory contribution after household and farm characteristics are controlled.

The general objective was to determine the effect of the socio-economic practices of Nzoia Sugar Company on the livelihood of sugarcane outgrowers in Bungoma County. Specifically, the study examined the effects of education-support practices, health-support practices, infrastructure/transport-support practices and housing-support practices. The analysis was guided by the following null hypotheses:

H₀₁: *Education-support practices have no statistically significant effect on the livelihood of sugarcane outgrowers.*

H₀₂: *Health-support practices have no statistically significant effect on the livelihood of sugarcane outgrowers.*

H₀₃: *Infrastructure/transport-support practices have no statistically significant effect on the livelihood of sugarcane outgrowers.*

H₀₄: *Housing-support practices have no statistically significant effect on the livelihood of sugarcane outgrowers.*

2.0 LITERATURE REVIEW

2.1 Theoretical foundation

The Sustainable Livelihoods Framework provided the principal theoretical lens. It explains household welfare through access to human, social, physical, financial and natural assets, the strategies households pursue and the institutional and vulnerability contexts within which those strategies operate (DFID, 1999; Scoones, 1998). Its later development emphasises capabilities, power relations and the dynamic interaction of livelihood assets with institutions (Bebbington, 1999; Natarajan et al., 2022; Scoones, 2009). Education support strengthens human capital; health support protects labour and resilience; roads and transport strengthen physical and market access; and housing contributes to physical security and living conditions. The framework therefore predicts that improvements in these support dimensions should be associated with stronger livelihood outcomes. It also justifies a multidimensional dependent variable rather than a narrow income-only measure.

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Stakeholder Theory complements this perspective by treating outgrowers as stakeholders whose welfare and continued participation affect company performance. Firms create durable value when they recognise the legitimate interests of groups that supply resources, bear production risks and influence organisational continuity (Freeman, 1984; Donaldson & Preston, 1995). In the Nzoia system, growers supply the principal raw material and absorb farm-level risks. Education, health, transport and welfare support may consequently be understood as relationship investments that strengthen trust, supply stability and shared value.

Institutional Theory explains why company practices are also shaped by laws, public expectations and sector norms. Organisations seek legitimacy by responding to regulatory, normative and mimetic pressures (Meyer & Rowan, 1977; DiMaggio & Powell, 1983; Scott, 1995). The renewed regulatory emphasis on grower protection in Kenya and county-level expectations regarding rural development create incentives for millers to demonstrate responsible outgrower engagement. Together, the three theories suggest that firm support can improve household assets, strengthen stakeholder relationships and align the company with its institutional environment.

2.2 Education-support practices and livelihood

Education-support practices include farmer training, extension advice, field demonstrations, information on inputs and crop husbandry, contract interpretation and household financial planning. Information constraints can prevent smallholders from adopting productive practices or responding effectively to pests, fertiliser requirements and harvesting schedules. Empirical evidence shows that well-designed extension programmes can improve farm productivity and income, although results depend on the relevance, timing and quality of delivery (Anderson & Feder, 2004; Danso-Abbeam et al., 2018; Ogundari, 2022). Farmer-field-school evidence from East Africa and farm-level extension studies likewise associate relevant advisory support with improved knowledge, productivity and income, while cautioning that programme design affects impact (Cawley et al., 2018; Davis et al., 2012). Education support should therefore enhance human capital and help households convert sugarcane participation into livelihood gains.

2.3 Health-support practices and livelihood

Sugarcane farming and cane handling involve physically demanding work and exposure to injuries, heat and farm chemicals. Illness and injury reduce household labour availability, increase medical expenditure and may force households to divert income from productive or educational investments. Health awareness, occupational-safety training, outreach services and links to health facilities can therefore protect both welfare and productive capacity. The livelihoods perspective treats health as a core human-capital asset. Empirical research links pesticide exposure and unsafe chemical handling to adverse farmer health and productivity outcomes (Antle & Pingali, 1994), while Kenyan evidence documents health risks within smallholder vegetable production (Macharia, 2015). The expected relationship is positive because improved health support reduces avoidable shocks and preserves the labour on which smallholder production depends.

2.4 Infrastructure/transport-support practices and livelihood

Infrastructure and transport are central to sugarcane value chains. Poor feeder roads, delayed harvesting, unreliable transport and weak coordination raise transaction costs and may lead to deterioration of harvested cane before milling. Rural-road evidence shows that transport connectivity changes access to labour and markets, agricultural production and household welfare (Aggarwal, 2018; Asher & Novosad, 2020; Nguyen et al., 2017; Shamdasani, 2021). In sugarcane schemes, farmer associations and logistics institutions play a particularly important role because the timing of cutting, loading and delivery is linked to recoverable sugar and payment outcomes (Isager et al., 2018; Machimu, 2024). Transport support may also improve access to schools, health facilities and input markets, creating effects beyond cane delivery.

2.5 Housing-support practices and livelihood

Housing is an important component of multidimensional welfare because it affects safety, dignity, sanitation, health and protection from environmental risks. Housing-related support need not involve direct construction; it may include savings and credit linkages, access to affordable materials, sanitation programmes or community welfare initiatives that enable households to improve living conditions. International evidence links adequate housing to better health and resilience. Systematic-review, experimental and realist evidence links housing quality and housing improvements to health and wellbeing (Howden-Chapman et al., 2007; Rolfe et al., 2020; Thomson et al., 2013). Multidimensional poverty measures likewise treat housing conditions as a core dimension of wellbeing (OPHI & UNDP, 2024; WHO, 2018). In the outgrower context, housing improvement may also signal that agricultural income and company support are translating into durable household assets (UN-Habitat, 2018).

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2.6 Empirical gap

The literature establishes plausible links between each support dimension and rural welfare, but it offers limited evidence on their joint effects within a single sugar-milling relationship. Contract-farming studies often prioritise income or participation, despite evidence that welfare effects are heterogeneous and may be offset by food-security, land or labour pressures (Bahati et al., 2022; Bellemare & Bloem, 2018; Meemken & Bellemare, 2020; Ragasa et al., 2018). Studies also report heterogeneous livelihood effects across commodities and institutional settings (Kaahwa et al., 2023; Miyata et al., 2009; Ochieng & Ogutu, 2022; Ton et al., 2018). This study contributes a firm-level, farmer-perception model that integrates four support dimensions, measures livelihood broadly and estimates net relationships after six demographic and farm controls.

3.0 RESEARCH METHODOLOGY

3.1 Research design and study area

The study adopted an explanatory cross-sectional survey design. The design was appropriate because data on outgrower experiences and livelihood outcomes were collected at one point in time and used to estimate the relationships specified in the conceptual model. The study was conducted among registered and active sugarcane outgrowers supplying Nzoia Sugar Company in selected areas of Bungoma County, Kenya. The operational sampling frame comprised four outgrower zones: Northern, Eastern, Western and Southern.

3.2 Population, sample and sampling procedure

The target population consisted of 6,700 registered and active outgrowers in the four zones. Using Yamane's (1973) formula at a 95% confidence level and a 5% margin of error produced a sample of 377 outgrowers. The formula was:

$$n = \frac{N}{1 + Ne^2}$$

where n is the required sample size, N is the target population (6,700), and e is the margin of error (.05). Substitution gives $n = 6,700 / [1 + 6,700(.05^2)] = 377.46$, which was rounded to 377. The sample was allocated across the four zones and respondents were selected from zone registers through stratified simple random sampling. The allocation was 94 respondents each in the Northern, Eastern and Western zones and 95 in the Southern zone. A pilot involving 38 outgrowers was used to refine item wording and questionnaire flow before the main survey.

3.3 Instrument and measurement

Primary data were collected using a structured questionnaire. Section A captured demographic and farm characteristics. The remaining sections measured education-support practices (five items), health-support practices (five items), infrastructure/transport-support practices (five items), housing-support practices (five items) and livelihood of sugarcane outgrowers (seven items). All construct items used a five-point scale ranging from 1 = strongly disagree to 5 = strongly agree. Livelihood items covered income stability, basic needs, food security, assets, shock-coping capacity and perceived living-standard improvement. The control variables were gender, education level, marital status, years as an outgrower, sugarcane acreage and supplier category.

Table 1: Operationalization of the Study Variables

Construct	Role	Items	Main indicators	Scale
Education support (ESP)	Independent	5	Training, extension advice, information and skills	1-5 Likert
Health support (HSP)	Independent	5	Health awareness, safety, outreach and access support	1-5 Likert
Infrastructure/transport support (ITSP)	Independent	5	Road access, cane collection, logistics and transport costs	1-5 Likert
Housing support (HOP)	Independent	5	Housing facilitation, living conditions and welfare support	1-5 Likert
Livelihood of outgrowers (LOSO)	Dependent	7	Income, basic needs, food security, assets and resilience	1-5 Likert
Household and farm characteristics	Controls	6	Gender, education, marital status, experience, acreage and supplier category	Categorical/or dinal

Note. Construct items were averaged to obtain composite scores. Data are from the field survey (2026).

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3.4 Validity, reliability and data collection

Content validity was assessed through review by supervisors and academic peers, followed by pilot testing. Construct validity was examined using the Kaiser-Meyer-Olkin measure, Bartlett's test of sphericity, variance explained and factor loadings, with sampling adequacy interpreted using Kaiser's (1974) guidance. Internal consistency was assessed using coefficient alpha (Cronbach, 1951), with .70 treated as the minimum acceptable threshold. Alpha was interpreted as evidence of internal consistency rather than as a complete substitute for other reliability coefficients, consistent with Hayes and Coutts (2020). Trained research assistants administered the questionnaires face to face between February and April 2026. Questionnaires were indexed at data entry to support cross-checking and screening.

3.5 Data analysis and model specification

Data were screened, coded and analysed using SPSS version 27. Descriptive statistics summarised the distribution of each construct. Pearson correlations assessed bivariate associations. Hierarchical multiple regression was used to distinguish the contribution of household and farm controls from the additional explanatory contribution of company socio-economic practices. Statistical decisions were made at the 5% significance level. Only two hierarchical specifications were estimated:

$$\text{Model 1: } LOSO_i = \beta_0 + \gamma_1 GEN_i + \gamma_2 EDU_i + \gamma_3 MAR_i + \gamma_4 YRO_i + \gamma_5 ACR_i + \gamma_6 SUP_i + \varepsilon_i$$

$$\text{Model 2: } LOSO_i = \beta_0 + \gamma_1 GEN_i + \gamma_2 EDU_i + \gamma_3 MAR_i + \gamma_4 YRO_i + \gamma_5 ACR_i + \gamma_6 SUP_i + \beta_1 ESP_i + \beta_2 HSP_i + \beta_3 ITSP_i + \beta_4 HOP_i + \varepsilon_i$$

Model 1 contains only the six household and farm controls. Model 2 retains those controls and adds the four socio-economic practices as direct predictors of livelihood. Regression assumptions were assessed using scatterplots for linearity, the normal probability plot and residual histogram for normality, the residual-versus-predicted plot for homoscedasticity, Durbin-Watson statistics for residual independence and tolerance/VIF statistics for multicollinearity.

3.6 Ethical considerations

Institutional authorisation was obtained before fieldwork. Respondents were informed about the purpose of the study, participation was voluntary, and informed consent was obtained. Questionnaires did not require respondents' names, while the data were analysed and reported in aggregate form to protect confidentiality. Research assistants were trained in confidentiality, neutrality, and respectful engagement with respondents. Generative artificial intelligence tools were used during manuscript preparation to support language refinement, content organisation, formatting, and reference checking. AI was not used to generate data, alter respondents' answers, or make autonomous statistical decisions. All AI-assisted content, numerical results, interpretations, and references were reviewed and verified by the author, who retains full responsibility for the accuracy and integrity of the study.

4.0 RESULTS

4.1 Response rate and measurement quality

All 377 questionnaires were administered and 369 were returned and usable, giving a response rate of 97.8%. The returned and usable counts were identical because no returned questionnaire was excluded from the analytic dataset. The high response rate strengthened coverage of the intended sample, but response rate alone does not guarantee representativeness; the sampling process and respondent characteristics must also be considered (Holtom et al., 2022).

Table 2: Questionnaire Response Rate

Questionnaire status	Frequency	Percentage
Administered	377	100.0
Returned and usable	369	97.8
Not returned	8	2.2

Note. Percentages are based on 377 questionnaires administered. Data are from the field survey (2026).

Table 3: Reliability and Construct-Validity Statistics

Construct	Items	α	KMO	Bartlett χ^2	df	p	Loading range
ESP	5	.887	.831	1069.154	10	< .001	.783-.878
HSP	5	.839	.779	813.092	10	< .001	.698-.850
ITSP	5	.832	.769	781.604	10	< .001	.686-.837

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Construct	Items	α	KMO	Bartlett χ^2	df	p	Loading range
HOP	5	.866	.834	877.605	10	< .001	.769-.868
LOSO	7	.917	.926	1574.784	21	< .001	.765-.844

Note. α = coefficient alpha; KMO = Kaiser-Meyer-Olkin measure; χ^2 = Bartlett's chi-square statistic. Data are from the field survey (2026).

Coefficient alpha values ranged from .832 to .917, indicating satisfactory internal consistency for all five constructs (Cronbach, 1951; Hayes & Coutts, 2020). KMO values ranged from .769 to .926, exceeding the accepted minimum for factor analysis (Kaiser, 1974). All Bartlett tests were significant at $p < .001$, and the retained factor loadings ranged from .686 to .878. The evidence therefore supported the use of composite scores.

4.2 Descriptive statistics

Table 4: Descriptive Statistics for the Study Constructs

Construct	N	Minimum	Maximum	M	SD
Education support (ESP)	369	1.20	4.80	2.5984	1.06152
Health support (HSP)	369	1.20	4.60	2.3378	.90534
Infrastructure/transport support (ITSP)	369	1.20	4.80	2.8325	1.03526
Housing support (HOP)	369	1.00	4.60	2.5768	1.06351
Livelihood of outgrowers (LOSO)	369	1.14	4.86	3.5143	.98585

Note. M = mean; SD = standard deviation. Scores range from 1 to 5. Data are from the field survey (2026).

Livelihood recorded the highest mean ($M = 3.5143$), above the neutral midpoint. Infrastructure/transport support was the highest-rated company practice ($M = 2.8325$), followed by education support ($M = 2.5984$), housing support ($M = 2.5768$) and health support ($M = 2.3378$). All four-practice means were below 3.00, showing that respondents rated the existing support as low to moderate despite reporting comparatively favourable livelihood outcomes.

4.3 Regression assumptions

Scatterplots supported approximately linear relationships between the predictors and livelihood. The normal P-P plot followed the diagonal and the residual histogram was approximately bell shaped. The residual-versus-predicted plot showed no severe funnel pattern. The Durbin-Watson statistic was 1.839 for the control model and 1.747 for the combined model, supporting residual independence. In the combined model, tolerance ranged from .414 to .682 and VIF ranged from 1.465 to 2.417, indicating that multicollinearity was not problematic.

4.4 Correlation analysis

Table 5 Pearson Correlations Among the Study Constructs

Variable	ESP	HSP	ITSP	HOP	LOSO
ESP	-	.371**	.580**	.413**	.246**
HSP	.371**	-	.408**	.386**	.083
ITSP	.580**	.408**	-	.567**	.444**
HOP	.413**	.386**	.567**	-	.443**
LOSO	.246**	.083	.444**	.443**	-

Note. N = 369. ** $p < .01$, two-tailed. The HSP-LOSO correlation was not statistically significant ($p = .112$).

Education support was weakly but significantly correlated with livelihood ($r = .246$, $p < .01$). Infrastructure/transport support ($r = .444$, $p < .01$) and housing support ($r = .443$, $p < .01$) had the strongest bivariate associations with livelihood. Health support had a small, non-significant correlation ($r = .083$, $p = .112$).

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4.5 Hierarchical regression results

Table 6: Hierarchical Regression Model Summary

Step	<i>R</i>	<i>R</i> ²	Adjusted <i>R</i> ²	<i>SEE</i>	ΔR^2	ΔF	df1, df2	<i>p</i>
1: Controls	.911	.830	.827	.40925	.830	293.799	6, 362	< .001
2: Controls + practices	.932	.869	.865	.36107	.039	26.762	4, 358	< .001

Note. Dependent variable = livelihood of sugarcane outgrowers. Step 1 includes gender, education, marital status, years as an outgrower, acreage and supplier category. Step 2 adds ESP, HSP, ITSP and HOP. Durbin-Watson = 1.747 for the final model. Data are from the field survey (2026).

The control model explained 83.0% of the variance in livelihood ($R^2 = .830$, adjusted $R^2 = .827$). After ESP, HSP, ITSP and HOP were added, the combined model explained 86.9% ($R^2 = .869$, adjusted $R^2 = .865$). The increase of 3.9 percentage points was statistically significant ($\Delta R^2 = .039$, $\Delta F [4, 358] = 26.762$, $p < .001$). No separate practices-only regression was estimated or reported; the direct effects were interpreted within the combined control-plus-practices model.

Table 7: Control-Only Regression Coefficients

Predictor	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	VIF
Constant	.612	.076	-	8.020	< .001	-
Gender	.083	.011	.207	7.377	< .001	1.689
Education	.048	.006	.216	7.415	< .001	1.813
Marital status	.081	.011	.231	7.697	< .001	1.936
Years as outgrower	.032	.006	.161	5.396	< .001	1.900
Acreage	.041	.007	.188	6.129	< .001	2.011
Supplier category	.188	.019	.252	9.912	< .001	1.383

Note. *B* = unstandardised coefficient; *SE* = standard error; β = standardised coefficient; VIF = variance inflation factor. Data are from the field survey (2026).

All six control variables were positive and statistically significant. Supplier category had the largest standardised coefficient ($\beta = .252$), followed by marital status ($\beta = .231$), education ($\beta = .216$), gender ($\beta = .207$), acreage ($\beta = .188$) and years as an outgrower ($\beta = .161$).

Table 8: Combined Control-Plus-Practices Regression Coefficients

Predictor	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	VIF
Constant	.378	.084	-	4.529	< .001	-
Gender	.068	.010	.169	6.594	< .001	1.786
Education	.054	.006	.243	9.208	< .001	1.903
Marital status	.072	.009	.206	7.706	< .001	1.949
Years as outgrower	.026	.005	.130	4.845	< .001	1.954
Acreage	.018	.006	.081	2.767	.006	2.351
Supplier category	.167	.017	.223	9.641	< .001	1.465
Education support	.024	.006	.125	4.195	< .001	2.417
Health support	.021	.006	.088	3.222	.001	2.038
Infrastructure/transport support	.067	.027	.071	2.504	.013	2.169
Housing support	.058	.024	.063	2.417	.016	1.830

Note. *B* = unstandardised coefficient; *SE* = standard error; β = standardised coefficient; VIF = variance inflation factor. The model controls for all six household and farm characteristics. Data are from the field survey (2026).

In the combined model, education support had the largest standardised practice effect ($\beta = .125$, $p < .001$), followed by health support ($\beta = .088$, $p = .001$), infrastructure/transport support ($\beta = .071$, $p = .013$) and housing support ($\beta = .063$, $p = .016$). Each

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95% confidence interval excluded zero. The four null hypotheses were therefore rejected on the basis of the combined control-plus-practices regression.

5.0 DISCUSSION

The combined control-plus-practices model shows that socio-economic practices made a statistically significant contribution to livelihood after household and farm characteristics were taken into account. This is the central empirical contribution of the study. Although the controls explained a large proportion of livelihood differences, adding the four practices still improved model performance. Company support therefore mattered beyond the unequal resource positions from which outgrowers entered the cane relationship. The result is consistent with the Sustainable Livelihoods Framework, which treats welfare as the outcome of assets, institutions and vulnerability conditions rather than farm income alone (Bebbington, 1999; Natarajan et al., 2022; Scoones, 1998, 2009). The incremental result is also consistent with contract-farming evidence showing that market participation delivers uneven outcomes unless service quality and institutional design are considered (Bellemare & Bloem, 2018; Meemken & Bellemare, 2020; Otsuka et al., 2016; Ton et al., 2018).

5.1 Education-support practices

Education-support practices had the strongest effect among the four company-practice variables in the final model. Training and advisory information can improve agronomic decisions, input management, timing, record keeping and farmers' understanding of contractual processes. The result agrees with Danso-Abbeam et al. (2018), who found positive productivity and income effects from agricultural extension, and with Ogundari's (2022) meta-analysis showing an overall positive, though heterogeneous, extension effect. The finding is also consistent with farmer-field-school and farm-level extension studies that link access to advisory services with productivity and income gains (Cawley et al., 2018; Davis et al., 2012). In theoretical terms, education support expands human capital and signals responsiveness to a core stakeholder need.

5.2 Health-support practices

The positive health-support coefficient shows that company practices affecting health and safety were associated with stronger livelihood outcomes after controls were introduced, despite the insignificant bivariate correlation. This difference demonstrates the importance of multivariate analysis: the independent contribution of health support becomes clearer once farmer characteristics and other support dimensions are held constant. The finding is substantively plausible because illness reduces labour availability and raises household costs. It is consistent with evidence that farmer health is affected by pesticide exposure and chemical-handling risks and that health losses can undermine productive capacity (Antle & Pingali, 1994; Macharia, 2015). The relatively low descriptive mean further indicates that health support is important but currently underprovided.

5.3 Infrastructure/transport-support practices

Infrastructure/transport support had one of the strongest bivariate relationships with livelihood and remained significant in the final model. The result reflects the physical characteristics of sugarcane: delayed collection and weak road access can increase costs, reduce cane quality and disrupt household cash flow. The finding is consistent with evidence that rural roads change market access, agricultural production and household welfare (Aggarwal, 2018; Asher & Novosad, 2020; Nguyen et al., 2017; Shamdassani, 2021), and with sugarcane research that places logistics and farmer organisation at the centre of scheme sustainability (Isager et al., 2018; Machimu, 2024). Infrastructure support also generates spillovers by improving access to health, education and other markets. Its relatively high descriptive mean suggests that growers saw more evidence of this support than of other practices, but the mean remained below the neutral midpoint, leaving substantial room for improvement.

5.4 Housing-support practices

Housing support was positive and significant after controls. This finding broadens the interpretation of outgrower welfare beyond production outcomes. Secure and adequate shelter improves safety, sanitation, dignity and household stability, while poor housing exposes families to health and environmental risks. Evidence from housing interventions and health research supports these pathways (Howden-Chapman et al., 2007; Rolfe et al., 2020; Thomson et al., 2013; WHO, 2018). Housing is also a visible form of physical-asset accumulation and is included in multidimensional assessments of wellbeing (OPHI & UNDP, 2024). The result does not imply that the company must construct houses directly. It indicates that partnerships, welfare funds, affordable-material linkages, savings mechanisms and sanitation support can form legitimate components of a broader livelihood strategy.

5.5 Integrated interpretation

Taken together, the four findings support an integrated support model. Education builds knowledge, health protects labour, transport and infrastructure improve access, and housing strengthens household physical assets. These practices reinforce one

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another: road access can improve use of health and education services, while knowledge and income management can help households convert cane earnings into housing and resilience. The findings also align with Stakeholder Theory because farmer welfare and company performance are interdependent (Donaldson & Preston, 1995; Freeman, 1984). Institutional Theory further suggests that structured support can strengthen legitimacy under regulatory and normative pressure (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Scott, 1995) as the Kenyan sugar industry renews its regulatory focus on grower interests.

6.0 CONCLUSION

The study concludes that education, health, infrastructure/transport and housing-support practices of Nzoia Sugar Company are significant positive predictors of the livelihood of sugarcane outgrowers in Bungoma County after relevant household and farm characteristics are controlled. All four null hypotheses were rejected. Education support produced the largest standardised effect among the company practices, but the significance of all four dimensions shows that livelihood improvement requires more than one intervention. The company-farmer relationship should therefore be understood as a multidimensional development relationship rather than a narrow cane-purchasing arrangement.

The findings also require a careful distinction between statistical importance and current adequacy. All four support-practice means were below the midpoint even though their final coefficients were significant. The result does not mean that existing support is sufficient; rather, it indicates that variation in support is associated with meaningful variation in livelihood. Strengthening the support package is therefore likely to improve both farmer welfare and the sustainability of cane supply.

6.1 Recommendations

1. Nzoia Sugar Company should expand regular farmer training, field demonstrations, extension visits and practical information on agronomy, harvesting schedules, contract terms, record keeping and household financial planning.
2. Health support should be strengthened through medical outreach, occupational-safety education, safe chemical-handling guidance, referral partnerships with public facilities and assistance with health-insurance registration.
3. The company should coordinate with Bungoma County Government, transporters and farmer groups to improve feeder-road priorities, harvesting schedules, cane collection, communication and timely delivery.
4. Housing-related welfare should be supported through realistic partnerships involving savings groups, credit linkages, affordable building materials, sanitation, water access and community shelter-improvement initiatives.
5. The four practices should be planned as one monitored support package. Indicators should include training coverage and adoption, health outreach and safety incidents, collection delays and transport complaints, and the number and type of housing-welfare interventions reaching outgrower households.

6.2 Contribution of the study

The study contributes to scholarship by modelling four company-support dimensions jointly within a multidimensional livelihood framework. It contributes to management by identifying education support as the strongest company-practice predictor while showing that the lower-rated health dimension is also statistically important. It contributes to policy by demonstrating that grower welfare monitoring should extend beyond cane volumes and payment performance to human capital, health, physical access and living conditions.

6.3 Limitations and further research

The cross-sectional design identifies statistically adjusted relationships but cannot establish changes over time or strong causal effects. The measures were self-reported and may therefore contain recall, perception or common-method bias. The study focused on one company and selected zones in Bungoma County, limiting direct generalisation to other sugar belts. Future research should use longitudinal and mixed-method designs, compare multiple millers and examine mechanisms such as payment timeliness, farm productivity, income, food security and farmer satisfaction. Research should also assess how public-private partnerships and outgrower associations can coordinate support more effectively.

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