American Journal of Development Studies (AJDS)

ISSN: 2837-6676 (ONLINE)

VOLUME 4 ISSUE 2 (2026)



PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Development Studies (AJDS)

Volume 4 Issue 2, Year 2026
ISSN: 2837-6676 (Online)
DOI: https://doi.org/10.54536/ajds.v4i2.8907
https://journals.e-palli.com/home/index.php/ajds

Mango Farming Income and Rural Household Well-Being in Makueni, Kenya: Beyond Production to Livelihood Outcomes

Olive Mukonyo[1*], Vundi Nason[2], Antony Wando Odek[2]

Article Information

Received: October 27, 2025

Accepted: October 24, 2026

Published: November 05, 2026

Keywords

Livelihood Outcomes, Makueni County, Mango Farming Income, Rural Household Well-Being, Sustainable Livelihoods Framework

ABSTRACT

Despite the economic importance of mango farming in Makueni Constituency, Kenya, the relationship between mango farming income and rural household livelihoods remains insufficiently established. This study examined the relationship between mango farming income and rural household livelihoods, focusing on educational expenditure, savings, investment, food security and access to healthcare. Guided by the Sustainable Livelihoods Framework and Production theory, the study adopted a convergent parallel mixed-methods design. From a target population of 28,696 small-scale mango-farming households, 379 respondents were selected, of whom 305 participated, yielding a response rate of 80.5%. Quantitative data were collected using structured questionnaires and analysed in SPSS Version 32 through descriptive statistics, chi-square tests, Spearman's rank correlation and regression analysis. Qualitative data were collected through interviews and analysed thematically. The findings revealed a moderate positive association between mango income and perceived household income ($\varrho = 0.421$, $p < .01$), and a weaker positive association with the overall livelihood index ($\varrho = 0.283$, $p < .01$). These results indicate that higher mango earnings corresponded more closely with perceived income improvement than with overall livelihood outcomes. The findings support measures to increase returns from mango farming and strengthen mango income's contribution to household well-being.

INTRODUCTION

Mango farming has contributed to the livelihood of farm households in terms of cash received from sales, employment opportunities and food accessed. However, despite the volumes and sales achieved, the income from mango farming does not suggest a higher status of farm households. Mango farmers benefit from the farm through prices, marketing costs, post-harvest losses and lucrative markets. For this reason, it is important to establish the proportion of the income realized from the sale of mangoes that contributed to the accessing of household commodities, education expenditures, savings and investments.

International literature on mango-producing regions provides insights into the relationship between agricultural production and farmers' socioeconomic well-being. Although mangoes are cultivated in more than 90 countries (Mujuka *et al.*, 2020), much of the research has focused on market access, post-harvest management, processing, value addition, and interventions aimed at increasing smallholder farmers' incomes (Promkhambut *et al.*, 2023). In the Philippines, labour welfare and social security remain challenges in mango production (Sacramento & Cañete, 2023), while pests, diseases, climatic variability, and unfavourable market conditions constrain smallholder mango production in sub-Saharan Africa (Akanwa & Okoli, 2021; Kalvelage *et al.*, 2023; Nakabonge *et al.*, 2023). Although these studies illuminate production constraints and related welfare concerns, they give less attention to how income earned from mango sales relates to farmers' socioeconomic well-being. This relationship warrants closer examination to establish how returns from mango farming are associated with household welfare beyond production levels and market participation.

In Kenya, market constrains such as transportation costs, distance to market, credit access, middlemen and price fluctuations (Gachoka *et al.*, 2023; Ndiwa *et al.*, 2026), influence the sale of mangoes by the commercial farmers. In Machakos, mango trading is determined by the market accessibility and prices, credit and extension services (Musyoka et al, 2021) while other studies look at post-harvest handling and processing facilities (Okelo *et al.*, 2025). These studies highlight the important role played by production volumes and markets in the success of the commercial farming. However, none of them establishes the extent to which income earned from the sale of mangoes influences the socio-economic wellbeing of farm households. Such disparity is evident in Makueni County where the cultivation of mangoes is quite pronounced. The county has 4,276 hectares of mango farms that produce 39,963 metric tonnes of mangoes (Bundi *et al.*, 2020). However, the total production in the country is estimated at 199,626 tonnes worth KSh 5.99 billion in 2023 (Agriculture and Food Authority, 2024).

The reason for selecting Makueni County is due to the fact that it has the highest volumes of mango production and varying levels of poverty as can be seen from the disparity in figures between the proportion of total national mango production and poverty levels in the

[1] Masters Student, Department of Development Studies, St. Paul's University, Limuru, Kenya
[2] Senior Lecturers, Department of Development Studies, St. Paul's University, Limuru, Kenya
[*] Corresponding author's e-mail: mdsmks566819@spu.ac.ke

County. While the County produces 31% of the national supply, it records a poverty level of 60.6% as compared to the 45.9% national average in 2019 (Kenya National Bureau of Statistics [KNBS], 2019). This indicates a probable connection between the county's socio-economic wellbeing and levels of mango production. However, the statistics do not determine the correlation between the income from mango farming and the socio-economic wellbeing of the residents.

Previous research has concentrated on understanding the practices in mango farming, market dynamics, value addition and income in Makueni County (Adane *et al.*, 2019; Okelo *et al.*, 2025). Yet, there is a gap in establishing the proportion of income earned from mango farming in comparison to the general welfare of the residents in the area. This study sets out to investigate the effect of income from mango farming on rural households' socio-economic wellbeing in Makueni County, Kenya. The study defines income from mango farming as the value realized by households from sales of mangoes. It investigates the relationship of income from mango farming to the selected socio-economic indicators of rural households. It examines the share of income from mango farming as a proportion of overall income from other sources. In addition, it compares the differences between income from mango farming and the overall socio-economic wellbeing of the residents as indicated by education, savings and investment.

LITERATURE REVIEW

This section reviews theoretical and empirical literature on the relationship between mango farming income and rural household well-being in Makueni Constituency, Makueni County, Kenya. It examines the Sustainable Livelihoods Framework and Production Theory, synthesises empirical evidence on mango farming income, income diversification and household livelihood outcomes, and identifies gaps addressed by the current study. It also presents the conceptual framework guiding the analysis.

Theoretical Framework

The Sustainable Livelihoods Framework (SLF) provides the primary theoretical foundation for this study, while Production Theory offers a complementary perspective for explaining the generation of income from mango farming. Chambers and Conway (1992) established a foundational understanding of sustainable livelihoods by linking household capabilities, assets, livelihood activities and the capacity to cope with stresses and shocks. Scoones (1998) subsequently developed an analytical framework connecting livelihood resources, institutional conditions, livelihood strategies and outcomes. More recently, Natarajan *et al.* (2022) revisited the SLF, emphasising the need to account for structural inequalities, spatial differences, changing rural economies and environmental pressures. This theoretical development is relevant to small-scale mango farming because household well-being depends on more than agricultural earnings. It is also shaped by access to productive resources, market opportunities, institutional support and alternative livelihood activities. The SLF therefore provides an appropriate overarching perspective for examining the relationship between mango farming income and rural household well-being in Makueni Constituency, Kenya.

The SLF recognises that households combine livelihood activities and mobilise available resources to meet their needs, although their ability to translate these resources into favourable outcomes varies. In this study, mango farming income refers to earnings generated from mango production, principally through the sale of mango produce. It is operationalised through two dimensions, monthly or seasonal income from mango farming and diversification of household income sources. Monthly or seasonal income captures the amount and timing of earnings from mango sales, whereas income diversification reflects the range of additional income sources available to the household. These dimensions provide complementary insights into household financial resources. Mango earnings indicate the income generated from the crop, while diversification captures the extent to which households supplement agricultural earnings with other sources of income. The study examines how these dimensions relate to household livelihood outcomes, including educational expenditure, savings, investment and other indicators of well-being specified in the research instruments. Consistent with the SLF, the framework does not presume that higher mango income automatically translates into improved well-being. Household expenditure demands, market conditions, agricultural risks and access to productive resources also shape the relationship between income and household outcomes.

Recent scholarship reinforces the relevance of examining livelihoods beyond agricultural earnings alone. Natarajan *et al.* (2022) argue for a broader understanding of rural livelihoods that accounts for structural and relational processes and the connections between rural households and wider economic systems. Similarly, Baghernejad *et al.* (2023) examined strategies for stabilising smallholder farmers' livelihoods through non-farm activities, highlighting the relevance of income diversification to household livelihood strategies. These perspectives support examining mango farming income alongside other household income sources. However, diversification should not automatically be interpreted as evidence of improved well-being, since its significance depends on the availability, stability and returns of alternative activities. The SLF consequently guides this study in examining whether differences in mango farming income and income diversification are associated with differences in household livelihood outcomes, while recognising the wider economic and institutional conditions within which households operate.

Production Theory complements the SLF by explaining the productive processes through which agricultural

resources generate output and potential earnings. Cobb and Douglas (1928) established a foundational production-function model linking productive inputs to output. Subsequent empirical research has extended the application of production functions to smallholder agriculture, examining input productivity, resource-use efficiency and differences in farm performance. For example, Oumer *et al.* (2022) investigated technical efficiency and farm heterogeneity among smallholder maize producers in Ethiopia using alternative stochastic frontier models. Their findings demonstrated that estimates of farm efficiency depend partly on how analytical models account for differences between farms and unobserved farm-specific characteristics. This evidence reinforces the importance of considering both productive resources and variations in farm conditions when examining agricultural production. In the context of small-scale mango farming, Production Theory directs attention to land, labour, capital and other productive inputs that influence harvest volumes and the quantity of produce available for sale. However, agricultural output alone does not determine realised income. Earnings also depend on the quantity marketed, prices received and marketing arrangements. Production Theory therefore explains the productive conditions underlying potential mango farming income, but it does not, on its own, adequately explain how household income relates to savings, educational expenditure, investment or wider well-being.

The two theories therefore perform distinct but complementary functions within the study. Production Theory provides the basis for understanding how productive resources relate to mango output and the potential earnings generated through sales. The SLF provides the overarching perspective for examining how monthly or seasonal mango farming income and diversification of income sources relate to household livelihood outcomes. Their integration distinguishes the generation of agricultural income from its significance within the wider economic and social circumstances of rural households. It also avoids presuming a causal relationship between mango farming income and well-being. Instead, the integrated framework guides the empirical assessment of associations between mango farming income and rural household well-being in Makueni Constituency, Kenya.

Empirical Review

International evidence highlights the importance of examining agricultural income alongside the environmental, market and labour conditions shaping rural household well-being. In Brazil's semiarid Northeast, Hagel *et al.* (2022) investigated three agricultural production systems along the lower-middle São Francisco River using 193 farm household interviews, 60 expert interviews and secondary data. Their findings indicated that irrigated agriculture generated adequate farm income where infrastructure and market access were sufficient, although climate change and market conditions increased the vulnerability of agricultural livelihoods. In the Philippines, Sacramento and Cañete (2023) examined labour relations in mango farming through key informant interviews and secondary data. They highlighted concerns about labour exploitation, workers' welfare and inadequate safety nets within the mango industry. Together, these studies illustrate how agricultural livelihoods depend on production conditions, market access and the distribution of economic benefits. However, neither directly examined the relationship between monthly or seasonal mango-farming income and household-level welfare outcomes such as consumption, education expenditure, savings or productive investment. Their contribution to the present study is therefore contextual rather than direct.

Evidence from Africa provides closer insight into fruit production and household livelihood outcomes. In Ethiopia, Mossie *et al.* (2021) used household data and an endogenous switching regression model to examine participation in apple and mango value chains. They estimated that mango value-chain participation was associated with an 18.5% increase in household consumption expenditure. In Nigeria, Olowo *et al.* (2022) investigated the livelihood implications of cultivating indigenous fruits and vegetables, while Douyon *et al.* (2022) examined crop diversification and household food and nutrition security in southern and central Mali. Collectively, these studies establish the relevance of agricultural activities to household economic and food-related outcomes. Nevertheless, they examine different agricultural activities and welfare measures. Consumption expenditure, for instance, does not independently establish improvements in savings, educational investment or productive assets. Moreover, value-chain participation does not directly measure the amount or timing of income received from mango farming. Consequently, the relationship between mango-specific earnings and multiple dimensions of household well-being remains insufficiently established.

Evidence from Kenya further demonstrates the importance of examining the conditions under which agricultural livelihoods relate to household well-being. Mulwa and Kabubo-Mariara (2022) analysed panel data from 2004, 2007, and 2010 to examine income diversification, climate change, and household food security. Their findings showed that the relationship between income diversification and food security varied across agroecological zones and household circumstances. Similarly, Eichsteller *et al.* (2022), drawing on panel data, focus groups, and life-history interviews from Makueni and Vihiga counties, examined agriculture's contribution to sustained poverty escapes. Their findings highlighted the importance of infrastructure, land access, farming practices, and adaptation to climate-related challenges. In another study, Onakuta *et al.* (2026) examined livestock-restocking interventions and household food security among pastoral households in Loima Sub-County, Turkana County, underscoring the relevance of productive

resources to household welfare. Collectively, these studies indicate that agricultural livelihoods and productive resources are important to household circumstances, but their relationship with well-being depends on broader socioeconomic and environmental conditions. However, none specifically isolates income from mango farming to examine its relationship with household outcomes such as food consumption, healthcare access, education expenditure, and investment.

Research on mango production in Pakistan provides additional evidence on income generation within the sector. Mehdi *et al.* (2020) examined social upgrading and working conditions among workers in certified and non-certified mango orchards in southern Punjab and Sindh. Using survey data from 200 workers and double-log regression analysis, the study identified positive associations between workers' education and income, and a significant relationship between farm-level credit and income. Although this evidence is relevant to understanding income within mango production systems, the unit of analysis was the worker rather than the rural household. Considered alongside the Brazilian and Philippine studies, it also highlights the need to distinguish farm income, workers' earnings and the distribution of benefits within agricultural value chains. These measures represent related but different aspects of rural livelihoods and do not independently establish how monthly or seasonal mango-farming income relates to household welfare.

Across these international and African contexts, the literature identifies agricultural income opportunities, market access, diversification and production conditions as relevant to household livelihoods. However, the studies differ in their populations, research designs and welfare measures, including consumption expenditure, food security, poverty trajectories and workers' welfare (Hagel *et al.*, 2022; Mossie *et al.*, 2021; Douyon *et al.*, 2022; Eichsteller *et al.*, 2022; Sacramento & Cañete, 2023). These differences do not necessarily represent contradictory findings because the studies examine distinct outcomes. They instead expose a measurement issue relevant to the present research: annual or general measures of agricultural income do not necessarily capture monthly or seasonal variations in household cash availability. Examining income by month or season, alongside specified welfare indicators, therefore offers a more focused way to investigate the relationship between mango-farming earnings and household livelihood outcomes.

The gap is particularly relevant to Makueni County. Although Eichsteller *et al.* (2022) examined agricultural livelihoods in Makueni and Mossie *et al.* (2021) investigated mango value-chain participation in Ethiopia, the studies reviewed do not directly establish the relationship between monthly or seasonal income from small-scale mango farming and multiple dimensions of rural household well-being in Makueni. Specifically, further evidence is needed on how mango-farming income relates to household consumption, educational expenditure, savings, productive investment and other selected welfare indicators. The present study addresses this empirical and geographical gap by examining the relationship between mango-farming income and rural household well-being in Makueni, Kenya. By focusing on income rather than production levels or value-chain participation alone, it seeks to provide context-specific evidence on household livelihood outcomes without presuming causation. Figure 1 shows the conceptual framework on which this study is based upon.

Conceptual Framework

The framework depicts the relationship examined between mango farming income and household livelihood outcomes. Monthly or seasonal income captures the timing and amount of earnings from mango farming, while diversification of income sources captures the range of income-generating activities available to households. The dependent variable reflects household conditions across food security, health and nutrition, quality of life, and perceived livelihood change.

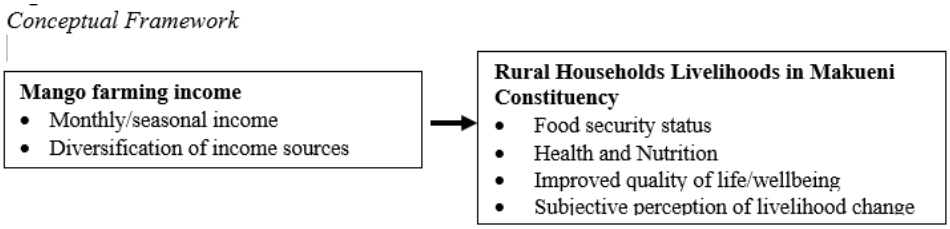


Figure 1: Conceptual Framework

Hypotheses Guiding the Study

The study was guided by the following null hypotheses:

H_{01}: There is no statistically significant relationship between monthly or seasonal income from mango farming and rural household livelihoods in Makueni Constituency.

H_{02}: There is no statistically significant relationship between diversification of income sources and rural household livelihoods in Makueni Constituency.

METERIALS AND METHODS

A convergent parallel mixed-methods design was adopted to examine the relationship between mango farming income and rural household livelihoods in Makueni Constituency, Makueni County, Kenya. The design involved collecting and analysing quantitative and qualitative data separately before integrating the findings

during interpretation (Hirose & Creswell, 2023). The quantitative component examined associations between mango farming income and household livelihood indicators, while the qualitative component explored stakeholders' perspectives on mango production, marketing, seasonal income fluctuations and household livelihood conditions. Integrating the two strands enabled statistical findings to be interpreted alongside contextual evidence from key informant interviews, highlighting areas of convergence, complementarity and divergence.

The study was conducted in Makueni Constituency, Makueni County, in Kenya's Lower Eastern region. The area was selected because of its substantial mango production and the importance of mango farming to rural livelihoods. Bundi *et al.* (2020) reported approximately 39,963 metric tonnes of mango production across 4,276 hectares, while Bett *et al.* (2021) identified Makueni as a major mango-producing area. The study targeted small-scale mango farmers, with a planned sample of 379 respondents determined using the approach of Krejcie and Morgan (1970). Of these, 305 participated in the household survey, yielding a response rate of 80.5%. A multistage sampling procedure involving geographical clustering, proportional allocation across the study wards and random selection of eligible households was used to recruit survey respondents. Additionally, 10 key informants were purposively selected from among agricultural officers, cooperative leaders, traders, mango exporters and county officials with relevant knowledge of mango production, marketing and institutional support.

Data were collected using a semi-structured household questionnaire and a key informant interview guide. The questionnaire captured household characteristics, mango farming income and selected household livelihood indicators. Mango farming income was examined through two dimensions, income from mango production and income from mango sales, as specified in the study instrument. Earnings from other livelihood activities were distinguished from mango farming income and excluded from its calculation. Household livelihood conditions were assessed using the indicators measured in the questionnaire and included in the statistical analysis, including food security and access to healthcare. Trained enumerators administered the questionnaire through face-to-face interviews. Key informant interviews explored market access, post-harvest handling, transport costs, price fluctuations, extension services and institutional support. The qualitative evidence provided contextual insights into the factors shaping mango farming income and helped interpret its relationship with household livelihood conditions.

A pilot study involving 38 respondents, approximately 10% of the planned household sample, was conducted to assess the clarity, relevance and administration of the research instruments. Feedback informed revisions to question wording, response options and questionnaire flow. Internal consistency was assessed using Cronbach's alpha for the multi-item measures. For mango farming income, reliability was assessed separately for its two dimensions: monthly and seasonal income ($\alpha = 0.812$) and diversification of income sources ($\alpha = 0.786$). The overall coefficient for the 20 Likert-scale items was 0.815. These estimates indicated acceptable internal consistency for the respective item sets.

Quantitative data were analysed using SPSS, Version 32. Descriptive statistics, including frequencies, percentages, means and measures of dispersion, were used to summarise household characteristics, mango farming income and livelihood indicators. Chi-square tests of independence examined associations between categorical variables, while Spearman's rank correlation assessed the direction and strength of associations involving ordinal or ranked measures. Multiple linear regression was used to examine associations between the specified explanatory variables and the composite livelihood index. The dependent variable, explanatory variables and diagnostic procedures were interpreted in accordance with the model actually estimated. Qualitative data from key informant interviews and open-ended responses were analyzed thematically through familiarization, coding, grouping related codes and developing themes relevant to the research objectives (Braun & Clarke, 2021). Quantitative and qualitative findings were integrated during interpretation to assess convergence, complementarity and divergence, enabling statistical patterns to be considered alongside stakeholders' accounts of market conditions, income variability and household livelihood experiences (Matović & Ovesni, 2023). The findings were interpreted as associations rather than causal effects.

The study complied with institutional and national research ethics requirements. Institutional authorization was obtained from St. Paul's University, and ethical clearance and a research permit were secured from the National Commission for Science, Technology and Innovation (NACOSTI). Participants received information about the study and provided informed consent before taking part. Participation was voluntary, and respondents were informed of their right to decline or withdraw without adverse consequences. Confidentiality was maintained through participant coding, secure data storage and the removal of identifying information from research records. Findings were reported in ways that protected the identities of participating households and key informants.

RESULTS AND DISCUSSION

This section examines income generated from small-scale mango farming among rural households in Makueni Constituency. It presents the distribution of earnings during the last mango season, the contribution of mango farming to household income, factors affecting earnings, and statistical associations between mango income and household livelihood outcomes. Quantitative findings are integrated with interview evidence to explain variations in earnings and the constraints respondents reported.

Household earnings from mango sales varied considerably across the 305 respondents. Figure 1 presents the distribution of earnings reported for the last mango season.

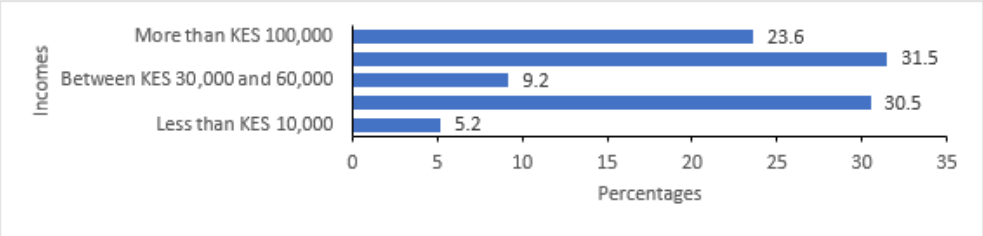


Figure 1: Household Earnings from Mango Farming in the Last Season (KES)
Source: Household survey data (2025)

Most households earned between KES 10,000 and 30,000 (30.5%) or between KES 60,000 and 100,000 (31.5%). Smaller proportions earned less than KES 10,000 (5.2%) or between KES 30,000 and 60,000 (9.2%). Notably, nearly a quarter of households (23.6%) reported earnings exceeding KES 100,000. These findings highlight that while a substantial share of households derives moderate income from mango farming, a smaller subset attains relatively high earnings, reflecting variation in returns and the potential of mango farming to supplement household livelihoods in Makueni Constituency.

Building on the variation in household earnings from mango farming (Figure 2), respondents assessed its relative importance compared with other household income sources. As shown in Table 1 , 59.7% (n = 182) reported that mango farming provided most of their household income, while 6.9% (n = 21) identified it as their main income source. Combined, 66.6% of households relied on mango farming for most or all of their income. In contrast, only 4.3% (n = 13) reported that it contributed little. This distribution highlights the substantial dependence of surveyed households on mango farming, although its relative contribution varied.

The perception ratings in Table 3 reinforce this pattern but reveal a distinction between income improvement and financial security. The statement "Mango farming has helped improve our household income" recorded the highest mean (M = 4.39, SD = 0.86), indicating strong agreement. By comparison, "Mango farming gives us enough income to plan for the future" recorded the lowest mean (M = 3.81, SD = 1.12), alongside the greatest variation in responses. The 0.58-point difference between these means suggests a gap between perceived improvements in current income and confidence in its adequacy for future planning.

Table 1: Importance of mango farming to household income

Importance	Frequency	Percent
It gives us only a little money	13	4.3
It gives us some money	89	29.2
It gives us most of our money	182	59.7
It is our main source of money	21	6.9
Total	305	100

Source: Household survey data (2025)

Dependence on mango sales for daily needs (M = 3.94, SD = 0.87) and anticipated financial hardship without mango farming (M = 3.98, SD = 1.04) further indicate its importance to household finances. Overall, the distinctive finding is that respondents rated mango farming more favourably as a source of current income than as a basis for future financial planning. These descriptive results

Table 2: Perceived Contribution of Mango Farming to Household Income

Statements	N	Min	Max.	Sum	Mean	Stard. Dev.
Mango farming has helped improve our household income.	305	1	5	1339	4.3902	0.85949
Our family depends heavily on mango sales for daily needs.	305	1	5	1203	3.9443	0.86991
Without mango farming, we would struggle more financially	305	1	5	1215	3.9836	1.04333
Mango farming gives us enough income to plan for the future.	305	1	5	1163	3.8131	1.11855
Valid N (listwise)	305					

Source: Household survey data (2025)

reflect respondents' perceptions and do not establish causation.

In this study, spearman's rank test was conducted to show the relationship between the variables being used and that is income of mango, (Q8) Likert index of income, amount of education expenditure, Likert index of saving, investment and Likert index of livelihood as cited the variables above relate to the topic (studies were made regarding income with education and livelihoods, since it requires the use of Likert indices) Likert scales are Ordinal in nature, therefore Spearman's Rank test which deals with Ordinal variables may be used, this test is non-parametric which means it may also be appropriate for data type like income or investment that could possibly not be normally distributed.

As such, there exists a monotonic relationship between the two variables under study. With these variables it may thus be concluded that there is lack of co-linearity among the three variables because, it is possible rank all independent variables and and all data considered has no potential outlier that may sway the results. Correlation thresholds were defined as strong ($\varrho \geq 0.50$), moderate ($0.30 \leq \varrho < 0.50$), and weak ($\varrho < 0.30$) (Cohen, 1988). All reported correlations were significant at $p < 0.01$ (2-tailed), suggesting that the observed associations are unlikely to have occurred by chance. Table 3 presents

Table 3: Spearman's Rank Correlations among Key Variables

	Mango Income	**Income Likert Index**	**Education Expenses**	**Savings Index**	**Investment Activities**	**Livelihood Likert Index**
Mango Income	1	0.421**	0.539**	0.265**	0.522**	0.283**
Income Likert Index	0.421**	1	0.409**	0.659**	0.459**	0.585**
Livelihood Likert Index	0.283**	0.585**	0.301**	0.669**	0.396**	1

Source: Household survey data (2025)

the detailed Spearman's rank correlations among all key variables.

Households reporting higher mango earnings tend to report higher education spending and more investment activity. Moderate positive associations were observed between mango income and income perception (ϱ = 0.421, moderate) and between income perception and investment activities (ϱ = 0.459, moderate), suggesting partial alignment between perceived income and certain productive activities.

Weaker positive associations appeared between mango income and savings index (ϱ = 0.265, weak) and between mango income and overall livelihood index (ϱ = 0.283, weak), indicating that mango income alone corresponds only loosely with household savings and overall livelihood scores. Strong positive correlations were also evident between savings index and overall livelihood index (ϱ = 0.669, strong) and between education expenses and investment activities (ϱ = 0.617, strong), reflecting interconnections among household welfare dimensions.

All correlations were significant at $p < 0.01$ (2-tailed), suggesting that the observed associations are unlikely to be due to chance. Certain assumptions like relation between variables), independent observations, 'as' as ordinal index and calculation of rank correlation have been made. Simultaneously, it needs to be noted that through this analysis one can only make remarks upon relations among variables. Accuracy of the measure itself has been one of the hindrances to study. Along the similar line it is necessary to keep in account that the analysis has not accounted for factors like number of persons in house and other income and other experiences of households. Another possibility is the breakdown in the monotonic relation of the variables calculated for the analysis may not exist. In order to establish relation income earned from mangoes has been set against education and investment in general while on the one hand a strongly observed relation is found with perception on income and some investments and on the other a very weak relation is observed in saving and livelihood. From now on those relations can be taken as an indicator to calculate the relation of income from mangoes over the livelihood on some mediation of controlling variables.

Multiple linear regression was used to study the relationship between household outcome variables and their socioeconomic variables for the small-scale mango production. As the dependent variable, livelihood Likert Index was used which was aggregate of different of livelihood-based indices such as income, spending, saving and investment activities. A composite index was used to capture the multidimensional nature of livelihood outcomes, allowing for a single, continuous variable that reflects overall household welfare while accommodating the ordinal data collected from Likert-

Table 4: Regression Analysis

Predictor	**B**	**Std. Error**	**Beta**	**t**	**Sig.**	**95% CI for B**
Constant	2.288	0.42	–	5.451	0	1.462 – 3.115
Income_Likert_Index	0.09	0.035	0.109	2.582	0.01	0.021 – 0.158

Model Summary: $R = 0.895$; $R^2 = 0.800$; *Adjusted* $R^2 = 0.798$; *Std. Error of Estimate* = 1.228.

scale responses. Predictor variables included Income_Likert_Index, Education Expenses, Savings Index, and Investment Activities. The model produced a strong fit, with R=0.895R = 0.895R=0.895, R2=0.800R^2 = 0.800R2=0.800, and an adjusted R2=0.798R^2 = 0.798R2=0.798, indicating that approximately 80% of the variance in livelihood outcomes is accounted for by the combined predictors. The standard error of the estimate was 1.228, and significance was assessed at $\alpha = 0.05$. Table 4. summarizes the findings.

Income_Likert_Index also shows a positive and statistically significant relationship (B = 0.090, β = 0.109, t = 2.582, Sig. = 0.010; 95% CI: 0.021 to 0.158), although its effect is comparatively modest.

The results can, to a certain extent, be explained in the framework of production theory where production is transformed from inputs such as land, labour and capital in order to produce a produce or final output as a mango, with a target of producing at a cost which the farmers would want to benefit from so that they can improve their livelihood as a means to achieve welfare. We see once again, that individual and investment effects from the both inputs and education, are not significant. Also, that, individuals would not be able to combine non-pecuniary effects into the present production theory.

The integrated findings show that mango farming makes a substantial contribution to household income, although the level of earnings varies across households. Quantitatively, 31.5% of households earned KES 60,000–100,000 from mango sales, while 23.6% earned above KES 100,000. In contrast, 30.5% earned KES 10,000–30,000, 9.2% earned KES 30,000–60,000 and 5.2% earned below KES 10,000 (Figure 2). This distribution indicates variation in the income households obtained from mango farming. Its importance was further reflected in the finding that 59.7% of respondents relied on mango farming for most of their household income, while 6.9% identified it as their main income source. Overall, 66.6% reported that mango farming provided most or all of their household income (Table 1).

Respondents' perceptions reinforce the importance of mango farming as a source of current income. The statement "Mango farming has helped improve our household income" recorded the highest mean rating (M = 4.39, SD = 0.86), indicating strong agreement (Table 2). The qualitative findings provide further evidence of the income constraints experienced by farmers. One respondent explained, "The market prices fluctuate, and greedy middlemen reduce my profit margins" (R004, 2025). Another stated, "I lack training on modern farming techniques and value addition, so my fruits sell for low prices" (R023, 2025). These accounts suggest that the income obtained from mango sales varies with selling prices, marketing arrangements and farmers' ability to obtain better returns for their produce. They help contextualise the observed differences in household earnings without establishing the causes of those differences.

A distinction emerged between perceived income improvement and confidence in future financial planning. Although respondents agreed that mango farming had improved household income (M = 4.39, SD = 0.86), their agreement was lower regarding the statement "Mango farming gives us enough income to plan for the future" (M = 3.81, SD = 1.12). The 0.58-point difference indicates that perceived improvements in current income did not correspond to equally strong confidence in its adequacy for future planning. The greater standard deviation for the future-planning item also indicates more varied responses. Qualitative accounts help explain this distinction. One respondent observed, "The market prices fluctuate, and greedy middlemen reduce my profit margins" (R004, 2025). This account highlights uncertainty in the returns obtained from mango sales, offering context for the lower confidence expressed in future financial planning. However, the qualitative evidence does not establish how widespread this experience was among the surveyed households.

The Spearman's rank correlation results further clarify the relationship between reported mango income and perceptions of household income. Mango income had a moderate positive association with the income perception index ($\varrho = 0.421$, $p < 0.01$). This indicates that households reporting higher mango earnings also tended to report more favourable perceptions of their income. However, the association does not establish that higher mango earnings caused improvements in perceived household income. The findings therefore distinguish between the level of income earned and how households assess its contribution to their financial circumstances.

Taken together, the quantitative and qualitative evidence identifies two related findings. First, mango farming constitutes a major source of household income, although reported earnings vary considerably. Second, respondents viewed mango farming more favourably as a source of current income improvement than as a sufficient basis for future financial planning. The qualitative accounts concerning fluctuating market prices and low returns provide context for this distinction. The findings indicate that the importance of mango farming to household income does not necessarily translate into equivalent confidence in the adequacy of that income for future needs. Given the cross-sectional design, these results demonstrate reported experiences and statistical associations rather than causal effects.

Discussion

The findings indicate that mango farming is an important source of household income in Makueni Constituency, although reported seasonal earnings vary considerably. This reflects the Sustainable Livelihoods Framework (SLF), which views livelihood outcomes as shaped by household resources, livelihood activities, vulnerability, and institutional conditions (Chambers & Conway, 1992; Scoones, 1998). The difference between the perceived contribution of mango farming to current household

income and respondents' confidence in future financial planning suggests that income generation does not necessarily translate into long-term livelihood security. This interpretation is consistent with Natarajan *et al.* (2022), who emphasise the influence of structural inequalities, environmental pressures, and changing rural economies on livelihood outcomes.

The positive associations between mango income, education expenditure, savings, and investment suggest that agricultural earnings are related to households' capacity to meet financial needs and pursue livelihood activities. The stronger association with education expenditure than with savings points to differences in how income relates to immediate household commitments and financial reserves, although the cross-sectional results do not establish how households allocate their earnings. These findings relate to Mossie *et al.* (2021), who reported an association between mango value-chain participation and household consumption expenditure in Ethiopia. They also complement Eichsteller *et al.* (2022), whose research in Makueni and Vihiga highlights the importance of infrastructure, farming practices, land access, and climate adaptation to sustained improvements in household livelihoods.

The qualitative findings show how production and marketing constraints shape farmers' reported experiences of mango income. Pest and disease losses, costly inputs, inadequate water, post-harvest losses, and fluctuating prices were identified as challenges to securing reliable returns. Production Theory provides a complementary perspective by focusing on the relationship between productive inputs and output, while Oumer *et al.* (2022) demonstrate the importance of farm heterogeneity in analysing smallholder production efficiency. The findings also correspond with Hagel *et al.* (2022), who identify infrastructure and market access as important conditions for agricultural income. However, the present study did not directly estimate technical efficiency or the marginal productivity of inputs, so the qualitative evidence identifies perceived constraints rather than quantifying their effects.

The seasonal nature of mango earnings and participants' emphasis on irrigation, storage, value addition, and alternative income sources point to the importance of managing production and market uncertainty. This is consistent with Mulwa and Kabubo-Mariara (2022), who found that the relationship between income diversification and household food security varied across agroecological zones and household circumstances, and with Baghernejad *et al.* (2023), who examined livelihood stabilisation through non-farm activities. These comparisons support viewing mango farming as one component of a wider livelihood system rather than as a sufficient measure of household well-being. Overall, the findings establish associations between reported mango income and selected livelihood indicators, while the qualitative evidence contextualizes the production and market conditions reported by farmers. They do not establish causation or demonstrate the independent contribution of income diversification unless it was separately measured and tested.

CONCLUSION

The study examined the relationship between mango farming income and rural household well-being in Makueni Constituency, Kenya, focusing on income from mango production and sales. Findings indicated that mango farming was an important household income source, with more than half of respondents identifying it as their main source. Statistical analyses showed positive associations between mango income and selected well-being indicators, including educational expenditure, meals per day, healthcare access, and investment. However, the relationship varied across households, indicating that higher income does not necessarily translate uniformly into improved well-being.Key informants identified several production and marketing constraints, including pest infestation, post-harvest losses, high pest-control costs, limited access to finance and inputs, inadequate irrigation, fluctuating prices, dependence on intermediaries, and limited knowledge of improved technologies and value addition.

The study contributes to rural livelihoods research by examining the relationship between mango-specific income and household well-being through the Sustainable Livelihoods Framework. However, the cross-sectional design, reliance on self-reported data, and geographical scope limit generalizability. Future research should investigate seasonal income variations, production costs, market participation, gender differences in income allocation, and the contribution of other household income sources to well-being.

REFERENCES

Adane, F., Legesse, A., Weldeamanuel, T., & Belay, T. (2019). The contribution of a fruit tree-based agroforestry system for household income to smallholder farmers in Dale District, Sidama Zone, Southern Ethiopia. *Advances in Plants & Agriculture Research, 9*(1), 78–84. https://doi.org/10.15406/apar.2019.09.00415

Agriculture and Food Authority. (2024). *AFA* yearbook of statistics 2024. https://www.afa.go.ke/download/2044/?tmstv=1736318020

Akanwa, A. O., & Okoli, U. B. (2021). Climatic risks on fruit quality, health, and livelihoods: A Nigerian case of rural women in fruit farming business. In M. K. Jhariya, A. Banerjee, R. S. Meena, S. Kumar, & A. Raj (Eds.), *Sustainable intensification for agroecosystem services and management. Springer.* https://doi.org/10.1007/978-981-16-3207-5_18

Baghernejad, J., Sabouri, M. S., Shokati Amghani, M., & Norozi, A. (2023). Developing strategies for stabilizing the livelihood of smallholder farmers through non-farm activities: The application of the SWOT-AHP-TOWS analysis. *Frontiers in Sustainable*

Food Systems, 7, Article 1199368. https://doi.org/10.3389/fsufs.2023.1199368

Bett, C., Wawire, N., Kavoi, J., Maingi, S., & Agola, W. (2021). Mechanization levels and options for mango value chain in Makueni County, Kenya. *International Journal of Scientific and Research Publications (IJSRP), 11*(12), 407-418. http://dx.doi.org/10.29322/IJSRP.11.12.2021.p12058

Braun, V., & Clarke, V. (2021). Can I use TA? Should I use TA? Should I not use TA? Comparing reflexive thematic analysis and other pattern-based qualitative analytic approaches. *Counselling and Psychotherapy Research, 21*(1), 37–47. https://doi.org/10.1002/capr.12360

Bundi, A., Mburu, J., Mbogoh, S. G., & Ambuko, J. L. (2020). Factors influencing the adoption of pre-harvest practices among mango farmers in Embu and Machakos counties, Kenya. *International Journal of Postharvest Technology and Innovation, 7*(1), 56–72. https://doi.org/10.1504/IJPTI.2020.108744

Chambers, R., & Conway, G. R. (1992). *Sustainable rural livelihoods: Practical concepts for the 21st century* (IDS Discussion Paper 296). Institute of Development Studies. https://opendocs.ids.ac.uk/articles/report/Sustainable_rural_livelihoods_practical_concepts_for_the_21st_century/26473510

Cobb, C. W., & Douglas, P. H. (1928). A theory of production. *The American Economic Review, 18*(1, Supplement), 139–165. https://www.jstor.org/stable/1811556

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates. https://doi.org/10.4324/9780203771587

Douyon, A., Worou, O. N., Diama, A., Badolo, F., Denou, R. K., Touré, S., Sidibé, A., Nebie, B., & Tabo, R. (2022). Impact of crop diversification on household food and nutrition security in Southern and Central Mali. *Frontiers in Sustainable Food Systems, 5*, Article 751349. https://doi.org/10.3389/fsufs.2021.751349

Eichsteller, M., Njagi, T., & Nyukuri, E. (2022). The role of agriculture in poverty escapes in Kenya: Developing a capabilities approach in the context of climate change. *World Development, 149*, Article 105705. https://doi.org/10.1016/j.worlddev.2021.105705

Gachoka, W. M., Gathungu, G. K., & Munyiri, S. W. (2023). Determinants of market outlets choices among smallholder mango and passion fruit farmers in Kenya. *Journal of Economics, Management and Trade, 29*(11), 12–23. https://doi.org/10.9734/jemt/2023/v29i111158

Hagel, H., Rincon, D. G., & Doluschitz, R. (2022). Fruit production in Brazil's desert and sustainability aspects of irrigated family farming along the lower-middle São Francisco River: A case study. In M. Bahadir & A. Haarstrick (Eds.), *Water and wastewater management* (pp. 269–281). Springer. https://doi.org/10.1007/978-3-030-95288-4_21

Hirose, M., & Creswell, J. W. (2023). Applying core quality criteria of mixed methods research to an empirical study. *Journal of Mixed Methods Research*, *17*(1), 12–28. https://doi.org/10.1177/15586898221086346

Kalvelage, L., Hardie, C., Mausch, K., Conti, C., & Hall, A. (2023). Inside-out strategic coupling for smallholder market integration: Mango production in Malawi as a test case. *Outlook on Agriculture*, *52*(2), 174–185. https://doi.org/10.1177/00307270231179240

Kenya National Bureau of Statistics. (2019). *Poverty statistics in Kenya.*

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607–610. https://doi.org/10.1177/001316447003000308

Matović, N., & Ovesni, K. (2023). Interaction of quantitative and qualitative methodology in mixed methods research: Integration and/or combination. *International Journal of Social Research Methodology, 26*(1), 51–65. https://doi.org/10.1080/13645579.2021.1964857

Mehdi, M., Ahsan, M. B., Ahmad, B., Sadozai, K. N., Hameed, G., & Asif, M. (2020). Value chain development and social upgrading at upstream of mango value in Pakistan. *Sarhad Journal of Agriculture, 36*(2), 574–585. https://doi.org/10.17582/journal.sja/2020/36.2.574.585

Mossie, M., Gerezgiher, A., Ayalew, Z., & Nigussie, Z. (2021). Welfare effects of small-scale farmers' participation in apple and mango value chains in Ethiopia. *Agrekon, 60*(2), 192–208. https://doi.org/10.1080/03031853.2021.1926298

Mujuka, E., Mburu, J., Ogutu, A., & Ambuko, J. (2020). Returns to investment in postharvest loss reduction technologies among mango farmers in Embu County, Kenya. *Food and Energy Security, 9*(1), Article e195. https://doi.org/10.1002/fes3.195

Mulwa, R., & Kabubo-Mariara, J. (2022). Rural households income diversification, climate change and food security in Kenya. In S. Niggol Seo (Ed.), *Handbook of behavioral economics and climate change* (pp. 226–243). Edward Elgar Publishing.

Musyoka, J. K., Isaboke, H. N., & Ndirangu, S. N. (2021). Determinants of quantity of mango supply among small-scale farmers in Machakos County, Kenya. *Machakos University Press.* http://ir.mksu.ac.ke/handle/123456780/8079

Natarajan, N., Newsham, A., Rigg, J., & Suhardiman, D. (2022). A sustainable livelihoods framework for the 21st century. *World Development*, 155, Article 105898. https://doi.org/10.1016/j.worlddev.2022.105898

Ndiwa, A. M., Onyango, K., Bolo, P., Wanyama, R., & Chege, C. G. K. (2026). Agroecological transition can boost Kenya's food system: evidence from a cost–benefit analysis of the mango value chain. *Frontiers in Sustainable Food Systems, 10*, 1777188. https://doi.org/10.3389/fsufs.2026.1777188

Okelo, B. P., Rewe, T., & Ogallo, L. (2025). Mango yields as influenced by agricultural, social and economic

factors in Siaya County, Kenya. *Asian Journal of Agricultural and Horticultural Research, 12*(2), 241–254. https://doi.org/10.9734/ajahr/2025/v12i2382

Olowo, S. F., Omotayo, A. O., Lawal, I. O., & Aremu, A. O. (2022). Improving rural livelihood through the cultivation of indigenous fruits and vegetables: Evidence from Ondo State, Nigeria. *Agriculture, 12*(3), Article 372. https://doi.org/10.3390/agriculture12030372

Onakuta, R. A. ., Wamalwa, F. K. ., & Engairo, P. . (2026). Livestock Restocking Interventions Impact on Food Security among Households in Loima Sub-County, Turkana County, Kenya. *American Journal of Development Studies, 4*(1), 20-24. https://doi.org/10.54536/ajds.v4i1.5902

Oumer, A. M., Mugera, A., Burton, M., & Hailu, A. (2022). Technical efficiency and firm heterogeneity in stochastic frontier models: Application to smallholder maize farms in Ethiopia. *Journal of Productivity Analysis, 57*, 213–241. https://doi.org/10.1007/s11123-022-00627-2

Promkhambut, A., Polthanee, A., Simma, B., Fox, J., & Rambo, A. T. (2023). Reconfiguring farming systems of smallholders with market-led approach: A case study in Northeast Thailand. *Sustainability, 15*(16), Article 12144. https://doi.org/10.3390/su151612144

Sacramento, N. J. J. E., & Cañete, G. C. D. (2023). Is it worth enduring? Labor in Philippine mango fruit farming. *Agrarian South: Journal of Political Economy, 12*(3), 295–318. https://doi.org/10.1177/22779760231188196

Scoones, I. (1998). *Sustainable rural livelihoods: A framework for analysis* (IDS Working Paper 72). Institute of Development Studies(IDS). Brighton.