



Resilience or reinvention? Rethinking Maasai pathways to sustainability in changing climate conditions in Kilosa and Mvomero, Tanzania

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ABSTRACT

Pastoralists in Sub-Saharan Africa face challenges from climate variability, environmental degradation, and socio-economic changes. The Maasai of Tanzania adapt their traditional lifestyles to modern challenges, yet understanding their resilience is limited by rapid ecological and policy shifts. This study examined diversification, indigenous knowledge, community involvement, and government policies in supporting sustainable livelihoods. Using the Portfolio Theory of Risk and Resilience Theory, a mixed-methods approach combined quantitative analysis via PLS-SEM with qualitative data from interviews and focus groups. The target population comprised 386 individuals from 13 Maasai villages across Kilosa and Mvomero. Yamane's formula was used to get a sample size of 130 respondents. Results showed 82% of respondents engaged in income activities beyond pastoralism, and 99% valued indigenous knowledge for adaptation. Community participation was the strongest factor influencing sustainability ($\beta = 0.635$, $p < 0.05$), mediating the effects of diversification and indigenous knowledge. Government support was positive but limited due to low awareness and inconsistent application. Qualitative data reinforced these findings, highlighting the community's desire to blend tradition with innovation amid challenges such as limited access to credit, training, and inclusive decision-making processes. The study concludes that Maasai resilience is rooted in cultural traditions, social cohesion, and local institutions. It recommends inclusive diversification, protection of Indigenous knowledge, stronger community governance, and clearer policy communication to support sustainable pastoralist livelihoods.

Keywords: Climate Change, Community Engagement, Diversification, Indigenous Knowledge, Pastoralism, Resilience

I. INTRODUCTION

Climate change is significantly impacting ecological systems and livelihoods worldwide, with pastoralist communities in Sub-Saharan Africa being among the most affected. In Tanzania's Kilosa and Mvomero districts, the Maasai face a complex array of environmental, economic, and social challenges threatening their pastoral way of life. Unpredictable weather, frequent droughts, and variable rainfall have led to pasture degradation, water shortages, and increased livestock deaths, disrupting traditional mobility strategies (Opiyo, et al., 2015; Smith et al., 2018). Economic factors, such as livestock commodification, market fluctuations, and the encroachment of industrial food systems, have disrupted traditional trade routes and heightened external risks (Lesorogol, 2008). Land fragmentation from conservation, tourism, and agricultural expansion has further restricted access to communal grazing areas, escalating land disputes and weakening social cohesion (Homewood et al., 2012; Benjaminsen et al., 2009). Social changes such as urban migration, increased access to formal education, and intergenerational shifts have prompted many young Maasai to abandon pastoralism, risking the loss of Indigenous knowledge and community solidarity (Galaty, 2002).

In response to these interconnected challenges, many Maasai households are diversifying livelihoods through small-scale farming, wage labor, trade, and tourism (McCabe et al., 2010), strategies aimed at enhancing resilience, defined here as the capacity to absorb shocks and adapt without collapsing (McCabe et al., 2014; Bollig, 2016). Yet, the effectiveness and sustainability of these approaches vary and remain incompletely understood. This study investigated how the Maasai in Kilosa and Mvomero adapt to these complex pressures, blending traditional and new strategies. Through an examination of resilience, reinvention, and sustainability, this study aimed to fill key gaps in understanding how pastoralists adapt to socio-ecological shifts and how these insights can inform the creation of more inclusive and effective policies.



1.1 Research Objectives

This study examined how the Maasai in Kilosa and Mvomero districts responded to climate and socio-economic pressures through adaptive livelihood strategies. It specifically:

- i) Assessed how economic diversification influenced community engagement and livelihood outcomes.
- ii) Establish the role of Indigenous knowledge in shaping adaptive practices and community cohesion.
- iii) Determine the effect of government policy on supporting engagement, diversification, and knowledge integration.
- iv) Analyzed how community engagement mediated the effects of diversification, Indigenous knowledge, and policy on sustainable livelihoods.

II. LITERATURE REVIEW

2.1 Theoretical Review

The study employed the Portfolio Theory of Risk and Return and the Resilience Theory to provide a comprehensive analytical framework. This framework helps understand how economic diversification, the incorporation of Indigenous knowledge, and community engagement collectively contribute to sustainable livelihoods among the Maasai communities in Kilosa and Mvomero, Tanzania.

2.1.1 Resilience Theory

Resilience Theory (Greene et al., 2004; McPeak & Little, 2017) posits that communities with strong social networks, effective decision-making, and robust governance are better equipped to adapt and maintain their functioning in the face of climate change. Among the Maasai, engagement in governance, conservation, and resource management demonstrates a collective adaptive capacity rooted in traditional knowledge and new opportunities (Holland et al., 2022), thereby enhancing responses to droughts and environmental threats. This supports the hypothesis, *H1: Community engagement positively impacts Maasai livelihoods*, based on the idea that resilience depends on the collective strength of social systems, with participatory practices improving livelihood outcomes. Resilience Theory suggests that higher engagement is linked to greater adaptation and sustainability. Additionally, government policy influences resilience by shaping community conditions. Policies promoting inclusion and participation enhance engagement, while restrictive policies hinder adaptation. *H4: Government policy has a positive impact on community engagement*, as evidenced by the effects of policy frameworks, support, and reforms on local participation. These hypotheses, aligned with Resilience Theory, show that internal social dynamics and external policies jointly shape a community's capacity to adapt and prosper. Testing H1 and H4 clarifies how governance and policy support sustainable livelihoods among the Maasai in Kilosa and Mvomero.

2.1.2 Portfolio Theory of Risk and Return

The Portfolio Theory of Risk and Return (Markowitz, 1959) states that agents seek various income sources to maximize returns and reduce risk. Income variance is crucial for stability. Households diversify when benefits outweigh costs (Smith et al., 2018). This supports *H2: Diversification Strategies enhance Community Engagement*, as activities such as crop farming, wage work, eco-tourism, and trade help households stabilize their incomes and withstand shocks like climate change, market fluctuations, and land-use shifts. With unpredictable rainfall and pasture, diversification enables the Maasai to spread risk and increase resilience. It also supports *H3: Indigenous Knowledge positively influences Community Engagement*, as traditional ecological and climate strategies guide livelihood decisions. The Maasai have historically used herding, grazing, and mobility to adapt to climate and socio-economic shifts.

2.2 Empirical Review

The Maasai of Tanzania traditionally depended on livestock herding, but socio-economic and environmental issues have pushed them to diversify. This review examines studies on diversification strategies, indigenous knowledge, and community involvement in achieving sustainable livelihoods. Recently, the Maasai in northern Tanzania have added agriculture to their pastoralist lifestyle due to land pressure, environmental changes, and economic needs. Research shows crop cultivation is now a key part of their livelihoods, affecting social, cultural, and demographic aspects (McCabe et al., 2010). Nkedianye et al. (2020) compared social demography and livelihood diversification among Maasai in Kenya and Tanzania, finding that Tanzanian Maasai in Simanjiro diversified into agriculture, wage labor, and business due to land policies and environmental issues. Homewood et al. (2012) noted that wealthier Maasai diversify into skilled employment, while poorer households may abandon pastoralism, suggesting that economic status influences diversification pathways. Indigenous knowledge is vital to land management and biodiversity conservation (Kangalawe & Lyimo, 2013). Msuya and Kideghesho (2009) stressed the



need to integrate Indigenous practices into conservation, taking into account socio-economic and political factors. Kihwele et al. (2020) confirmed Tanzania's substantial indigenous knowledge of land and biodiversity, but challenges such as limited recognition hinder its use. Community involvement is key to sustainable livelihoods. Ameso et al. (2018) show that livelihood diversification among Maasai reduces reciprocal exchanges, shifting towards individualism. Incorporating Indigenous knowledge can enhance resource management, but it faces challenges such as differing worldviews (McCabe et al., 2014). Hence, studies show that livelihoods depend on socio-economic factors, land policies, and the environment. Including Indigenous knowledge and community participation is crucial for sustainable solutions, but policy and social cohesion need strengthening.

Moreover, studies on Maasai livelihood resilience reveal gaps in the literature, while scholars (Bollig, 2016; McCabe et al., 2014; Berhanu et al., 2007) highlight the role of diversification; they have overlooked the importance of indigenous knowledge and community participation. Maasai cultural assets, resource mapping, mobility, and communal decision-making are underrepresented (Adzawla et al., 2020; Kassie, 2017). Most studies focus on Kenya and northern Tanzania, with little attention to Kilosa and Mvomero districts, which have distinct contexts. Few integrate economic, cultural, and participatory factors, overlooking their synergies (Ameso et al., 2018; Greene et al., 2004). This study, therefore, presents a contextualized and integrated analysis of Maasai resilience, combining practices, knowledge, and participation through a mixed-methods approach tailored to the Kilosa and Mvomero districts.

III. METHODOLOGY

3.1 Research Design

This study used an explanatory sequential mixed-methods approach, combining quantitative and qualitative methods to assess how economic diversification, community engagement, indigenous knowledge, and government policy affect sustainable livelihoods in Maasai communities. The quantitative part tested hypotheses with PLS-SEM, while the qualitative part explored community experiences and challenges.

3.2 Study Area

The research was conducted in the Kilosa and Mvomero districts in Morogoro region, Tanzania. These areas are mainly inhabited by pastoralist Maasai communities, which are facing increasing socio-ecological pressures from climate variability, land-use changes, and limited access to grazing land. The selected villages, Mbwade, Wami Sokoine, Twatwatwa, Melela, and Parakuyo, are typical rural Maasai settlements where sustainable livelihood has become more critical.

3.3 Study Population

The study focused on Maasai pastoral households involved in both traditional and alternative livelihoods within the two districts. The target population comprised 193 individuals from 5 out of 13 Maasai villages, with 3 from Kilosa and 2 from Mvomero.

3.3.1 Sample Size and Sampling Procedure

A multistage sampling method was employed to ensure representativeness and methodological rigour. In the first stage, 5 villages were randomly chosen from a list of 13 eligible Maasai villages in Kilosa and Mvomero districts. Selection criteria included accessibility and the presence of Maasai communities. In the second stage, the target population comprised 193 Maasai individuals in the selected 5 Maasai villages. To determine an appropriate sample size for the quantitative survey, Yamane's formula was used.

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

$$n = \frac{193}{1 + 193(0.05)^2}$$

$$n = \frac{193}{1.4825}$$

$$n = 130$$

Where:

n = sample size; N = population size (193); e = level of precision (0.05)

This resulted in a sample of about 130 respondents, of whom 120 completed the survey questionnaires, yielding a response rate of 92.3%. Respondents were selected through stratified random sampling to represent different genders, ages, and livelihoods, ensuring diversity within the community. For the qualitative component, 20 key informants, including clan leaders, Elders, Morans, and Maasai women, were purposively selected based on their



knowledge and community roles. In addition, six focus group discussions (FGDs) were conducted, each with an average of 5 participants. These discussions were stratified by gender (male/female) and age cohorts (youth/adults/elders) to explore community-level perceptions and contextual insights on sustainable livelihoods and resilience-building efforts.

3.4 Data Collection

Quantitative data were gathered via a structured Kiswahili questionnaire covering household demographics, income, community engagement, and perceptions of economic diversification. Qualitative data were collected through semi-structured interviews and focus groups exploring personal experiences, challenges, and local perspectives on community engagement, diversification, indigenous knowledge, and government policy on sustainable livelihood. These insights identified key themes, integrating qualitative and quantitative results. Participants varied; FGDs were stratified by gender and age. Fieldwork took place from October to December 2024, with ward/village executive officers and local leaders facilitating community entry and recruitment. Discussions and interviews were audio-recorded (with consent), transcribed, and translated into English. Qualitative transcripts were thematically coded inductively by identifying recurring concepts through open coding, organizing them into categories via axial coding, and refining through selective coding. NVivo 12 ensured consistent analysis. Triangulating themes with data strengthened the validity and improved understanding of how predictors influence resilience and livelihoods among the Maasai in Kilosa and Mvomero districts.

3.5 Data Analysis

Quantitative data were analysed using SmartPLS 4.0 (Hair et al., 2021). PLS-SEM tested relationships between Community Engagement (COE), economic diversification (DVS), Indigenous Knowledge (IK), and Government Policies (GOP) on livelihood sustainability (LIS). Reliability was evaluated using Cronbach's alpha, composite reliability, and AVE, all of which exceeded the established thresholds. Discriminant validity was confirmed via Fornell-Larcker. Qualitative data from interviews and FGDs were transcribed, coded, and thematically analysed, then triangulated with quantitative results to enhance validity and insight.

3.6 Ethical Considerations

Ethical approval was granted by the Mzumbe University – Directorate of Research and Postgraduate Studies (DRPS). All participants provided informed consent before data collection. Participants were reassured about the confidentiality of their information, the voluntary nature of their involvement, and their right to withdraw at any time. Data were anonymised and stored securely.

IV. FINDINGS & DISCUSSION

4.1 Descriptive Analysis

This section provides an overview of economic diversification, community engagement, indigenous knowledge, and government policies on sustainable livelihood among Maasai in the Kilosa and Mvomero districts to bolster their resilience against climate change.

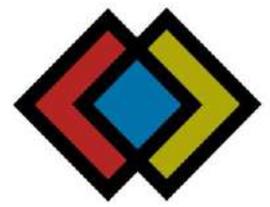
4.1.1 Community Engagement on Sustainable Livelihood

This section examines community engagement in livelihood initiatives, crucial for resilience. The results show 93% agreed on pursuing alternative sources of income and on the effectiveness of local efforts, confirming the active role of community-driven strategies in tackling socio-economic issues. Furthermore, the findings reveal that 90% of respondents concurred that community engagement fosters economic activities. Among these respondents, 42% slightly agreed, 34% moderately agreed, and 14% strongly agreed. These varying levels of agreement underscore the significance of collective decision-making and action in the community's developmental agenda.

4.1.2 Government Policies

This section revealed respondents' views on government policies for diversification, indigenous knowledge, and access to incentives. Results were mixed, and show that 67% agreed that policies support diversification, 35% agreed slightly, 29% agreed moderately, 3% strongly agreed, while 33% disagreed or were uncertain, indicating gaps in implementation. Additionally, 63% agreed with the legal frameworks for protecting Indigenous Knowledge (IK), with 31% agreeing slightly, 22% moderately, and 10% strongly agreeing. These findings underscored the importance of government efforts to preserve cultural heritage and raise awareness.

Moreover, regarding policies and regulations, the results show that 61% of respondents agree that policies encourage community engagement, while 39% are neutral or disagree, highlighting a need for more participatory



policymaking. Additionally, 62% and 59% acknowledge government incentives and grants, but 38%–41% disagree. Lastly, 62% believe the state recognizes Indigenous Knowledge (IK), while 38% remain unconvinced, indicating ongoing challenges in integrating IK into governance.

4.1.3 Diversification Strategy on Sustainable Livelihood

Most respondents see new income activities positively, with 82% agreement, indicating the community's pursuit of diversification beyond traditional pastoral practices. Disagreement was minimal at 17%. Also, the findings show that 80% of participants acknowledged alternative income sources, with 31% moderately, 28% slightly, and 21% strongly agreeing, while 19% disagreed. This suggests diversification is a recognized and experienced policy in the community. Additionally, the results show that 77% of respondents reported that alternative incomes reduced their reliance on pastoralism, with 36% moderately, 24% slightly, and 17% strongly agreeing.

Moreover, the study shows 77% of respondents believe multiple income sources improve household financial stability, with 36% moderately, 27% slightly, and 14% strongly agreeing. It also finds 77% think community income increased due to diversification, with 37% moderately, 28% slightly, and 12% strongly agreeing. These results indicate diversification benefits are recognized at both individual and community levels.

4.1.4 Indigenous Knowledge on Sustainable Livelihood

This section discusses how indigenous knowledge (IK) is preserved and utilized among the Maasai. The importance of IK remains high, with 77% of respondents indicating that traditional practices are maintained and used daily: 37% moderately, 28% slightly, and 12% strongly. This demonstrates IK's influence on behavior and decision-making. Additionally, 99% agree that IK influences decision-making, with 48% agreeing it does so moderately, 26% slightly, and 25% strongly, underscoring its role in governance. Also, 94% see IK integrated into current practices, 51% moderately, 31% slightly, 12% strongly, supporting hybrid systems that blend traditional and scientific methods.

4.1.5 Sustainable Livelihood

This section shows respondents' views on access to services, housing, and economic opportunities. 92% agreed services like healthcare, education, and water are accessible, with 42% slightly, 32% moderately, and 18% strongly agreeing. Only 8% were dissatisfied, suggesting government improved infrastructure access. Additionally, 78% of respondents were satisfied with their housing, with 38% reporting slight satisfaction, 29% moderate satisfaction, and 11% expressing strong satisfaction. The result further shows that 73% found economic opportunities adequate; 27% were unsure or disagreed, indicating room for improvement. Moreover, 75% perceived the community as engaging in sustainability efforts, while 19% were neutral or disagreed, indicating a need for improved communication and inclusion in sustainability planning, particularly among marginalized groups.

4.2 Inferential Analysis

This section presents the results of the PLS-SEM analysis using SMART-PLS, examining measurement and structural models to understand relationships among five main constructs: Diversification Strategy, Indigenous Knowledge, Community Engagement, Sustainable Livelihood, and Government Policy Support. PLS-SEM is chosen for its effectiveness in handling complex models, small to medium-sized samples, and predictive capability (Hair et al., 2021).

4.2.1 Measurement Model Assessment

The results of the measurement model assessment indicated that the SMART-PLS analysis fulfilled all necessary requirements for validity and reliability, and outer loadings (see Table 1) indicated that each indicator had a strong relationship to its latent construct (values ≥ 0.70 are considered acceptable; Hair et al., 2021), with all retained indicators displaying acceptable outer loadings (0.706 to 0.942) after removal of underperforming items (COE1, LIS1, PIDK1, PIDK4). Furthermore, three indicators of internal consistency reliability were utilized: Cronbach's Alpha (α), Composite Reliability (CR or ρ_c), and Dillon-Goldstein's rho (ρ_A).

Table 1

Internal Consistency Reliability Score

Construct	α (Alpha)	ρ_A	CR (ρ_c)	Interpretation
COE	0.856	0.866	0.896	Reliable
DVS	0.946	0.963	0.959	Highly reliable
LIS	0.842	0.854	0.895	Reliable



Furthermore, regarding convergent validity, as measured by Average Variance Extracted (AVE), a construct must have an AVE of at least 0.50 to account for at least 50% of the variance in its indicators. All constructs satisfy the requirement for convergent validity.

Table 2
Convergent Validity

Construct	AVE	Interpretation
COE	0.634	Acceptable
DVS	0.824	Excellent
LIS	0.681	Acceptable

Additionally, discriminant validity was confirmed through the Fornell-Larcker criterion, where each construct’s AVE square root was greater than its correlations with other constructs. These findings confirm that the measurement model was statistically robust and suitable for structural equation modelling and hypothesis testing.

4.2.2 Structural Model Results

The structural model path analysis identified statistically significant associations among several constructs, thereby corroborating the study's hypothesized framework.

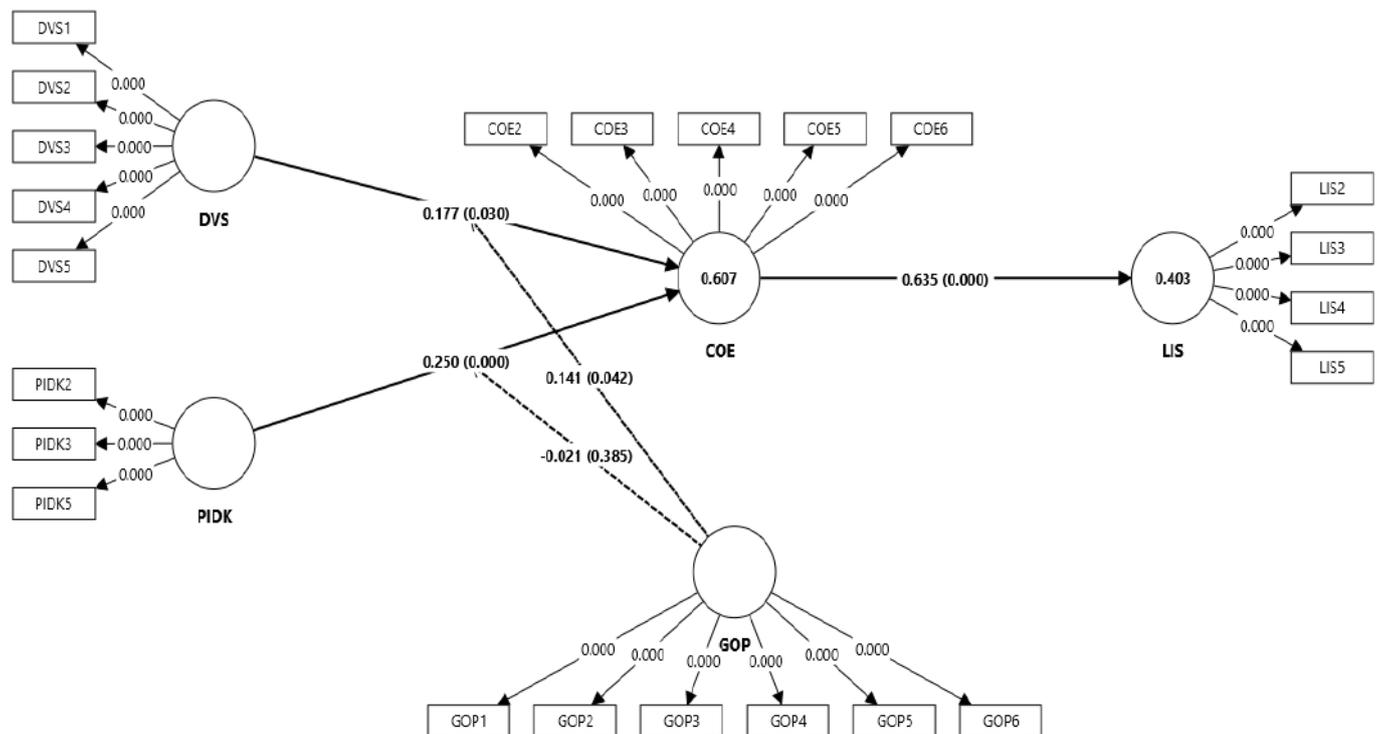


Figure 4
PLS-SEM (Structural model Result)

The standardized path coefficients (β), t-values, and p-values were evaluated. The R² for COE was 0.607, indicating that DVS, GOP, and PIDK explain 60.7% of the variance in COE, while R² for LIS was 0.403, suggesting a moderate level of explanatory power, as other external factors may impact livelihood outcomes, but the model captures 40.3% of the variance in LIS.

Table 3
Direct Effects

Path	Coefficient (β)	t-value	p-value	Result
COE → LIS	0.635	14.190	0.000	Significant (p < .05)
DVS → COE	0.177	1.879	0.030	Significant (p < .05)
GOP → COE	0.508	6.103	0.000	Significant (p < .05)
PIDK → COE	0.250	3.480	0.001	Significant (p < .05)



Community Engagement (COE) has emerged as the most significant predictor of Livelihood Sustainability (LIS), with a coefficient of $\beta = 0.635$ ($p = 0.000$). This underscores the essential role of collective participation, local initiatives, and social organization in fostering resilient livelihoods. Although the Diversification Strategy (DVS) contributes less directly, it exerts both a direct effect on Community Engagement ($\beta = 0.177$, $p = .030$) and an indirect effect on Livelihood Sustainability ($\beta = 0.112$, $p = .033$), see Table 4. Government Policy (GOP) significantly influences Community Engagement ($\beta = 0.508$, $p=0.000$) and also has a notable indirect effect on Livelihood Sustainability through engagement ($\beta = 0.322$, $p=0.000$). These findings suggest that effective policy frameworks enhance community action and improve livelihood outcomes. Indigenous Knowledge (PIDK) also significantly predicts community engagement ($\beta = 0.250$, $p = 0.001$) and, through this pathway, contributes to livelihood outcomes (indirect effect $\beta = 0.159$, $p = 0.001$). Furthermore, the interaction term ($GOP \times DVS \rightarrow COE$, $\beta = 0.141$, $p = .042$) indicates that the positive impact of diversification on engagement is amplified under supportive government policies.

Table 4
Indirect (Mediating) Effects

Indirect Path	Coefficient (β)	t-value	p-value	Result
DVS \rightarrow COE \rightarrow LIS	0.112	1.832	0.033	Significant ($p < .05$)
GOP \rightarrow COE \rightarrow LIS	0.322	5.217	0.000	Significant ($p < .05$)
PIDK \rightarrow COE \rightarrow LIS	0.159	3.452	0.001	Significant ($p < .05$)

The findings indicate that community engagement significantly mediates the relationship between Diversification Strategy and Livelihood Sustainability ($\beta = 0.112$, $t = 1.832$, $p = .033$). This suggests that diversification contributes to sustainability, both directly and indirectly, through community engagement initiatives that facilitate stable livelihoods. Similarly, the indirect effect of Government Policy Support on Livelihood Sustainability via community engagement was significant ($\beta = 0.322$, $t = 5.217$, $p < .05$), underscoring that policy impact is most effective when it activates and supports local participation. Furthermore, the mediation pathway from Indigenous Knowledge to Livelihood Sustainability through community engagement was statistically significant ($\beta = 0.159$, $t = 3.452$, $p = 0.001$), indicating that Indigenous Knowledge enhances sustainability outcomes by strengthening communal cohesion and shared practices. These findings affirm the central role of community engagement as a conduit through which economic, cultural, and institutional resources are transformed into tangible development gains.

4.2.3 Hypothesis Testing

This section presents the results of hypothesis testing from the PLS-SEM model, evaluating the relationships among Diversification Strategy (DVS), Indigenous Knowledge (PIDK), Government Policy Support (GOP), and Community Engagement (COE) with Sustainable Livelihood (LIS). The direct path results are in Table 4 and are explained below.

Table 5
Hypothesis with Direct Effect

Path	β (O)	t-value	p-value	Decision
COE \rightarrow LIS	0.635	14.190	0.000	Supported
DVS \rightarrow COE	0.177	1.879	0.030	Supported
GOP \rightarrow COE	0.508	6.103	0.000	Supported
PIDK \rightarrow COE	0.250	3.480	0.000	Supported

The study evaluated the following hypothesis: *H1: Community Engagement exerts a significant influence on Livelihood Sustainability.* The findings indicate that the path coefficient ($\beta = 0.635$, $p = 0.000$, T-statistic = 14.19, Significant) was the most robust, supporting the hypothesis that increased community involvement significantly enhances livelihood resilience. Secondly, *H2: Diversification Strategy has a significant positive effect on Community Engagement.* The results reveal a significant path coefficient ($\beta = 0.508$, $p = 0.000$, $p < .05$), confirming that enabling policy environments promote grassroots participation. Thirdly, the hypothesis tested was: *H3: Indigenous Knowledge has a significant positive effect on Community Engagement.* The results demonstrate the path coefficient ($\beta = 0.177$, $p = 0.030$, $p < .05$), affirming that supportive policy environments facilitate grassroots participation. Similarly, *H4: Government Policy Support has a significant positive effect on Community Engagement.* The findings reveal a significant path coefficient ($\beta = 0.250$, $p = 0.000$, $p < .05$), underscoring the cultural foundations of local resilience. The model tested whether Government Policy moderates the effects of DVS and PIDK on Community Engagement.



Table 6

Indirect (Mediating) Effects

Indirect Path	β (O)	t-value	p-value	Decision
DVS → COE → LIS	0.112	1.832	0.033	Supported
GOP → COE → LIS	0.322	5.217	0.000	Supported
PIDK → COE → LIS	0.159	3.452	0.000	Supported

All three indirect effects were statistically significant, affirming Community Engagement's mediating role. Specifically, diversification directly contributes to sustainability and affects community participation ($\beta = 0.112$, $p = 0.033$; $p < 0.05$). Furthermore, Government policy primarily influences sustainable livelihood through community engagement ($\beta = 0.322$, $p = 0.000$; $p < 0.05$), underscoring the significance of implementation and participation rather than the mere presence of policy. Similarly, Indigenous Knowledge fosters sustainability by impacting traditions embedded within community governance mechanisms ($\beta = 0.159$, $p = 0.000$; $p < 0.05$).

4.3 Discussion

4.3.1 Community Engagement on Sustainable Livelihood

The most influential factor in the model was community engagement, with 99% of respondents agreeing that community involvement is important for livelihoods and 97% agreeing that community efforts are essential for sustainable development. The high levels of participation indicate the relevance of communal structures for improving adaptive capacity, as community members reported engaging in group-based initiatives and co-creating locally grounded solutions to manage climate variability, economic uncertainty, and institutional gaps. Structural model results confirmed this, as community engagement had the strongest direct impact on livelihood sustainability ($\beta = 0.635$, $p < .05$). This is supported by one focus group discussion, which affirmed that:

“Despite the slow pace of governmental support, community meetings in Wami Sokoine Village facilitate the development of autonomous solutions. These gatherings encompass discussions on a range of topics, including livestock management and the selection of crops for the upcoming season” (FGD Participant, Twatwata Village, Kilosa DC, 12th December 2024).

This evidence supports the notion that collective action mobilizes resources more efficiently and fosters norms and cooperation that can help address environmental and social stressors. This was also confirmed by interviews, where one participant said,

“When we join together, we take care of our livestock and businesses better; we have women’s groups selling dairy products and youth groups organizing livestock markets” (Mbwade Village, Kilosa DC, 10 December 2024).

These results support the tenets of participatory development theory, which posits that local ownership and participation make development more legitimate and sustainable (Chambers, 1994).

4.3.2 Government Policies on Economic Diversification

Government policy support is viewed as both enabling and uneven, 67% of respondents agreed that policies promote diversification, while 33% were unsure or disagreed (attributing lack of communication, enforcement, or contextual relevance of the policy), and only 63% thought that the legal framework protects indigenous knowledge sufficiently, which is consistent with the broader literature on policy disconnects in pastoralist areas, where top-down approaches often do not align with local needs or resonate with indigenous worldviews (Homewood, et.al, 2012; Bollig, 2016). The results of the SMART-PLS also supported this interpretation. A Maasai elder from Mbwade Village emphasized,

“Government policies do not always favour our way of life... If the government engaged our elders before making policies, we would find better ways to work together.” (FGD, Parakuyo Village, Kilosa DC, 24 October 2024).

Similarly, a local government official acknowledged the disconnect, stating that,

“Policy failures frequently occur due to the exclusion of the Maasai in the decision-making process. Decisions are often formulated at a considerable distance from their communities, with little understanding of their lifestyles, needs, and resource management practices. If consultation with Maasai elders and leaders were to occur, these policies would likely be more practical and receive greater acceptance” (Interview, Wami Sokoine Village, Mvomero DC, 12 October 2024).

These insights underscore the need for bottom-up policy processes and culturally sensitive governance models that engage traditional leadership and community voices in decision-making, as advocated in participatory policy



literature (Chambers, 1994; Ellis, 1998). Without such inclusion, policies risk being perceived as externally imposed and may fail to achieve their intended outcomes.

4.3.3 Economic Diversification for Sustainable Livelihood

The results demonstrate the path coefficient ($\beta = 0.177$, $p = 0.030$, $p < .05$), affirming that supportive policy environments facilitate grassroots participation in diversified economic activities for their sustainable livelihood. These findings corroborate evidence that economic diversification enhances adaptive capacity by distributing risk, expanding livelihood options, and improving socio-economic inclusion (McCabe et al., 2010; McCabe et al., 2014). Qualitative data from interviews and focus group discussions supported this conclusion. A Maasai elder in Twatwatwa Village remarked,

“We relied almost entirely on livestock in the past, but now we see the need to diversify. Those who engage in small businesses, tourism, and farming have a better chance of surviving harsh droughts.” (Interview, Mbwade Village, Kilosa DC, 10 December 2024).

Participants also identified key constraints, including limited access to capital, credit, and training, that hindered the scalability of diversification efforts. A focus group participant noted,

“The participants in the focus group discussion from Melela Village expressed a need for increased support, specifically in training and access to loans. Many individuals possess entrepreneurial ideas and a willingness to establish small businesses; however, they are hindered by a lack of knowledge and financial resources. Access to affordable credit and practical skills training would enable them to enhance their livelihoods and make greater community contributions” (FGD, Melala village, Mvomero DC, 25 November 2024).

Recent studies show diversification is often limited by institutional and financial barriers, especially in marginalized rural communities (David-Chavez & Gavin, 2018). Participants highlighted women's active participation in starting local businesses, emphasizing their key role not only in maintaining informal and diverse rural economies but also in strengthening community resilience. This aligns with the literature on women's leadership in adaptive livelihood strategies, especially in settings affected by climate shocks and by exclusion from formal markets, where community involvement becomes crucial for socio-economic stability. (McCabe et al., 2010; Njuki et al., 2021). These findings support Ellis (1998), who argued that livelihood diversification is key in rural Africa, as well as recent calls for gender-responsive, inclusive economic models for rural and pastoral areas (Behrman et al., 2021).

4.3.4 Indigenous Knowledge Integration on Sustainable Livelihood

Indigenous knowledge (IK) is vital for community resilience. 77% of respondents said cultural practices remain relevant, and 99% use IK in decision-making. Additionally, 94% say traditional knowledge is integrated into modern livelihood strategies, creating hybrid systems. Globally, IK is viewed as a dynamic, context-specific system that addresses environmental and socio-economic issues (Opiyo et al., 2015). The structural model confirmed this: the Policy and Institutional Dimensions of Indigenous Knowledge (PIDK) had a positive impact on community engagement ($\beta = 0.250$, $p = 0.05$) and livelihood sustainability through engagement ($\beta = 0.159$, $p = 0.05$). These results show that integrating IK boosts participation and resilience when institutionally recognized. Qualitative evidence supported these findings, with a community leader in Parakuyo Village stating,

“We have lived with nature for generations, using our knowledge to manage pastures, predict the weather, and treat diseases. This knowledge has kept us strong.” (Interview, Parakuyo Village, Kilosa DC, 12 December 2024).

These narratives highlight that IK shapes lifestyles, ecosystems, health, and society. Respondents worry about losing IK, stressing the need for cultural preservation and intergenerational transfer, a concern echoed in global Indigenous scholarship (David-Chavez & Gavin, 2018). This aligns with Smith et al. (2018)'s 'weaving knowledge systems' framework, which integrates indigenous and scientific knowledge through equitable partnerships, respect, and shared governance. Such integration enhances community resilience and development, respecting local culture. Policies must treat IK as a living system, keeping it relevant via inclusive education, documentation, and Indigenous leadership.

4.3.5 Combined Effect of the Four Constructs on Livelihood Sustainability

This structural model explains 60.7% of the variance in Community Engagement ($R^2 = 0.607$) and 40.3% of the variance in Livelihood Sustainability ($R^2 = 0.403$), which can be considered moderate to substantial predictive relevance as per the guidelines proposed by Hair et al. (2021). These results are consistent with the premise that resilience in pastoralist communities is a complex concept, encompassing economic dimensions through livelihood diversification, cultural elements through Indigenous knowledge systems, social dimensions through community engagement, and institutional dimensions through enabling policies.



V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study reveals that the Maasai community adapts by balancing tradition and change amid climate variability, economic transformation, and social uncertainty. Livelihood strategies now combine traditional and emerging income sources, including small-scale agriculture, trade, and services, to reduce reliance on livestock. Indigenous knowledge, shared across generations, continues to guide decisions on seasonality and resource use, sustaining both community cohesion and ecological balance. Community engagement plays a critical role in driving innovation, collective problem-solving, and adaptation, especially when local groups participate actively in project implementation and planning.

5.2 Recommendations

This study provides several policy-relevant recommendations to enhance resilience and sustainability in pastoralist communities. Key priorities include encouraging livelihood diversification beyond livestock through agriculture, trade, and service-based activities; systematically incorporating indigenous knowledge into development planning; strengthening community-led initiatives; and improving adaptive governance systems to support long-term sustainable development.

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