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Research Paper

Tourism-driven livelihood dynamics: A comprehensive empirical study of Mount Kilimanjaro National Park communities in Tanzania

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ABSTRACT

Tourism is pivotal for rural economic development; however, despite hosting a substantial number of tourists, many developing countries with rural landscapes face persistent poverty among local communities. This study aims to delve into the impact of tourism (geoheritage and national parks) on local livelihoods, examining drivers for livelihood portfolio and community decisions to engage in tourism activities. The Multivariate Probit, and instrumental variable models (Instrumental Variable Probit, and Two Stage Least Squares) were employed on data from 582 respondents collected through cross-sectional questionnaires. Results highlight the significant influence of socioeconomic factors—sex, age, household size, credit access, market access, social membership, and education—on livelihood portfolio. Results show that specific tourism activities, such as accommodation services, handcrafts, catering and hospitality, and tour guiding, exert varying effects on household food security, income, and access to essential social services. Challenges hindering participation include education levels, information and awareness, service quality, cultural barriers, financial costs, government policies, competition, resource monopolisation, corruption, and infrastructure deficiencies. Recommendations include investments in skill development, infrastructure enhancement, cultural preservation, financial inclusion, regulatory frameworks, and community awareness programs. These strategies aim to facilitate household participation in tourism activities, promoting geotourism and enhancing the well-being of Mount Kilimanjaro National Park communities. Policymakers are urged to implement these measures to uplift local livelihoods and foster sustainable tourism in the region.

1. Introduction

Tourism stands as a global economic powerhouse, wielding significant influence in shaping economies and fostering international cooperation. Its contribution of approximately 10% to the world's GDP underscores its paramount importance (Adedoyin et al., 2023; Stone & Nyaupane, 2018). Beyond economic metrics, tourism becomes instrumental in achieving global targets related to poverty eradication and improving livelihoods, particularly for marginalized communities (Phelan et al., 2020). In the

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context of developing countries, tourism becomes a potential catalyst for socioeconomic transformation (Samal & Dash, 2023). Africa—especially Sub-Saharan Africa—has become a destination for a wide range of interesting nature-based and culturally rich activities, and Tanzania has been instrumental in this development (World Bank, 2015). In Tanzania, tourism sector employs an average of 1.55 million people contributing to about 10.6% of the country's GDP, 25.94% of the country's foreign exchange, making it one of the most important sectors for development (Njoya, 2023).

Within the tourism industry, critical sectors include geoheritage and national parks, significantly contributing to the GDP of many African countries (Matshusa & Leonard, 2023). The African Geoparks Network (AGN) emphasizes sustainable use and management of geoheritage, promoting geotourism and creating unique geoparks for local socio-economic sustainable development (Scoon, 2020). These geological wonders showcase Africa's rich natural heritage and serve as focal points for sustainable tourism, offering a unique blend of cultural, ecological, and geological attractions, playing a crucial role in promoting environmental awareness and fostering responsible tourism practices (Kara & Mkwizu, 2020).

East Africa, particularly Tanzania, boasts renowned geoheritage and national parks, including Mount Kilimanjaro National Park, Ngorongoro-Legai UNESCO Global Geopark, Gombe National Park, and Oldonyo Murwak. These areas exemplify the intricate relationship between tourism, nature, and people, showcasing the delicate balance between wildlife conservation and community livelihoods (Debbage & Gallaway, 2015). Mount Kilimanjaro National Park, with its iconic Mount Kilimanjaro, stands as a symbol of harmonious coexistence (Mkini Lugalla, Jan, & Westerman, 2023). The Ngorongoro-Legai UNESCO Global Geopark provides a compelling narrative of Earth's evolution, while Gombe National Park, renowned for its chimpanzee populations, highlights the balance between wildlife conservation and community livelihoods (Mgonja, 2023; Mkini Lugalla et al., 2023).

Mount Kilimanjaro, the highest mountain in Africa, reflects the intricate relationship between tourism and rural livelihoods in Tanzania (Kara & Mkwizu, 2020). Tourism activities around Mount Kilimanjaro have spurred income-generating activities among local communities, showcasing the diverse ways in which tourism has become an integral part of their daily lives (Mitekaro, 2016). The symbiotic relationship between tourism and local livelihoods reveals the potential for economic empowerment and community development, emphasizing the need for a comprehensive understanding of the dynamics at play toward the promotion of geotourism.

In the pursuit of promoting geotourism, geoheritage preservation, and safeguarding cultural heritage, the Tanzanian government and tourism authorities have initiated programs aimed at enhancing the well-being of communities residing near significant tourist sites. Despite these efforts, challenges persist, including the displacement of local populations, prohibition of native residents from utilizing natural resources, and low knowledge among residents in utilizing opportunities for household income generation (Mato & Mosoma, 2022). The idea of geotourism is disrupted by this occurrence, which also raises poverty and social unrest.

Despite the apparent economic benefits of geoheritage and national parks around Mount Kilimanjaro, a paradox persists–many people in the vicinity, especially those near tourist sites, continue to grapple with poverty (Bagneto, 2015; Kara & Mkwizu, 2020). This paradox forms the crux of the problem addressed in this study. Moreover, studies like those of Liu et al. (2012) and Huang et al. (2021) highlight the importance of livelihood assets in influencing local community participation in tourism activities. Liu et al. (2012) found that households with greater financial, physical, human, and social capitals were more likely to engage in tourism, while Huang et al. (2021) identified financial and social capitals as key factors in tourism livelihood. Ma et al. (2018) further emphasized the role of livelihood assets in community income, with spatial differences in their impact. Hizmi and Said (2019) underscored the significance of social capital in community-based ecotourism, particularly in promoting economic development, environmental management, and cultural preservation. These studies collectively demonstrate the critical role of livelihood assets, particularly social capital, in local community engagement in tourism activities.

Research in several developing countries has explored similar issues, seeking to uncover the root causes of persistent poverty around tourist sites (Lin et al., 2019; Perić, 2018; Shahzad et al., 2017; Smale et al., 2016). On the other hand, tourism activities in Tanzania have been found to positively influence household welfare, particularly in rural areas. Kyara et al. (2021) and Anderson (2015) both highlight the significant impact of tourism on overall well-being and livelihoods, with the latter emphasizing the need for training programs to enhance local participation. Magigi (2013) further underscored the role of tourism in poverty reduction, particularly through employment creation and income generation. However, Mitekaro (2016) cautioned that government policies may not adequately support local community participation in the tourism sector, suggesting a need for further empirical study. Similarly, Mato and Mosoma (2022), and Mkwizu (2018) argued that low education level, poor infrastructure, and inadequate credit accessibility hindered local community engagement in the tourism activities, thus leading to a poverty trap. These empirical findings indicate that there is limited knowledge regarding factors that influence change and enhance local community utilization of existing opportunities, stemming from the geological and cultural heritage present across most tourists sites in Tanzania. This knowledge aims at poverty alleviation, empowering policy makers to reverse the current situation and foster positive change in the lives of local communities (Njoya, 2023; Mkini Lugalla et al., 2023).

Despite the economic potential of tourism, a substantial portion of the local population remains impoverished, raising questions about the equitable distribution of benefits and the effectiveness of existing strategies. This intricate challenge necessitates an in-depth examination to unravel the complexities of resource distribution, societal impact, and the effectiveness of policies in place. Therefore, the study aims to shed light on the root causes and consequences of this paradox, providing valuable insights for policymakers, researchers, and practitioners engaged in sustainable tourism development in the region. Consequently, the study seeks to fill that gap by providing nuanced insights into the local context and laying the groundwork for actions and policy decisions that are supported by data.

2. Theoretical underpinning

The Sustainable Livelihoods Approach (SLA) (Department for International Development, 1999) or the Sustainable Livelihood Framework (SLF) (United Nations Development Programme, 2017) have applied by both academics and development practitioners, especially in developing countries, to understand the livelihood of the poor with the aim of improving their lives, especially in rural context. Despite its wide use in the development practices, the approach has received criticism for its failure to consider the power dynamics, environmental sustainability and broader structural issues (Natarajan et al., 2022). Therefore, the conceptual framework for this study is informed by the revised SLF for the 21st century which integrates considerations of complexity and independence (multidimensional factors), empowerment and agency, resilience and adaptation, as well as sustainability.

The revised SLF portrays that assets (financial and physical), climate and environment context, and relational power (human, social and political) are key to sustaining livelihoods (ibid.). In the context of tourism around Mount Kilimanjaro, the relational power dynamics are centered on human and social factors, which encompass gender, skills and labour of local communities engaged in tourism-related activities. Social assets extend to community networks and relationships, influencing access to resources and opportunities. Also, financial assets revolve around income generated through tourism ventures, while physical assets include the infrastructure development spurred by tourism. Lastly, natural assets pertain to the environmental resources crucial for agriculture and other livelihood activities.

Central to the SLF is the examination of the diverse strategies employed by local communities. The study explores how residents around Mount Kilimanjaro diversify their livelihood activities, encompassing tourism-related services, agricultural practices, and alternative income-generating endeavors. Applying the SLF, the research aims to unearth how these strategies either contribute to or detract from overall livelihood sustainability, as articulated by Mbowe et al. (2021).

The SLF emphasizes the influence of institutions and policies on livelihood outcomes. In the context of Mount Kilimanjaro, the study will scrutinize the institutional frameworks governing tourism and the policies implemented by authorities, including the Ministry of Tourism and Natural Resources. This examination aims to elucidate how these institutional structures either facilitate or hinder the sustainable development of livelihoods in the region, aligning with insights from several studies (Mitekaro, 2016; Munyao, 2021).

Previous research leveraging the SLF in diverse contexts has demonstrated its efficacy in analyzing livelihood dynamics. Gebreyesus et al. (2022) and Bhattacharya (2017) exemplified how the SLF comprehended livelihood strategies, assessed vulnerability, and informed policy interventions. In the context of tourism, Melita and Mendlinger (2013) in Tanzania and Bires and Raj (2020) in Ethiopia have both used the SLF to assess the effect of tourism on rural livelihoods. By integrating insights from these studies, the current research aims to contribute to the growing body of knowledge on sustainable livelihoods in the context of tourism, particularly around iconic natural landmarks like Mount Kilimanjaro in the Mount Kilimanjaro National Park.

Utilizing the SLA in this study provides a holistic understanding of the intricate dynamics that influence local community livelihoods around world's most famous Kilimanajro National Park (Mount Kilimanjaro). Drawing from both theoretical foundations and empirical evidence (Mato & Mosoma, 2022; Tran et al., 2020), variables derived from livelihood assets, including education, social membership, land ownership, and livestock ownership, emerge as crucial determinants guiding decisions related to livelihood diversification. The same have been used in analyzing the livelihood diversfication and shaping the sustainable livelihood strategies across rural communities (Mugizi et al., 2017; Njoya, 2023). Furthermore, insights from related studies (Mkini Lugalla et al., 2023; Wamboye et al., 2020) corroborate the utilization of identical variables—namely accommodation services, handcrafts, catering and hospitality, and tour guiding—outlined in the SLA framework (Fig. 1). These variables serve as key components in analyzing various tourism activities undertaken by local communities. The synthesis of SLA and empirical findings enhances the robustness of our understanding, emphasizing the consistent relevance of these factors across diverse studies. In Tanzania and many other developing countries, this integrated approach offers a nuanced view of the interaction between livelihood assets and tourism activities, providing important insights for policy considerations and sustainable development initiatives aimed at developing a well-stabilized geotourism sector and eradicating poverty for the communities residing around these rich natural and cultural resources areas (Dwyer, 2023; Serrat, 2017).

3. Material and methods

3.1. Study area

The study area for this research encompasses four villages of Lyasomboro, Masia, Mshiri, and Mbahe (Fig. 2) that are situated around Mount Kilimanjaro National Park in the Kilimanjaro region of Tanzania. These villages were strategically selected due to their close interaction with tourism activities, which directly aligned with the research question examining the impact of tourism on poverty reduction and socio-economic development. Additionally, all these villages were found near the Marangu gate, one of the main entry routes to Mount Kilimanjaro and a significant hub for tourist activity. This area was the focal point for data collection, emphasizing its relevance to the study's objective of understanding how tourism influenced local livelihoods. The purpose of selecting these specific villages was to enhance the accuracy of the information collected and to minimize biases in the data.

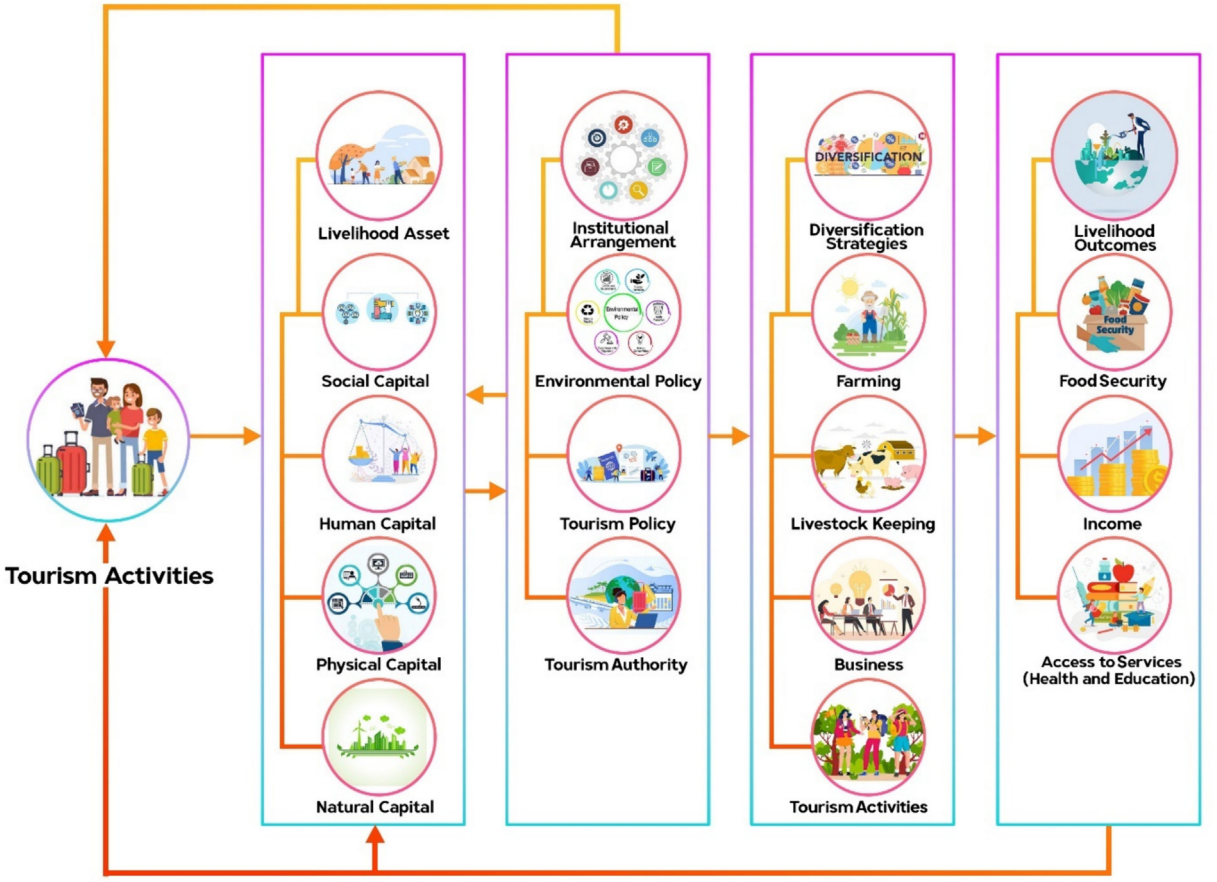

Fig. 1. Conceptual framework.

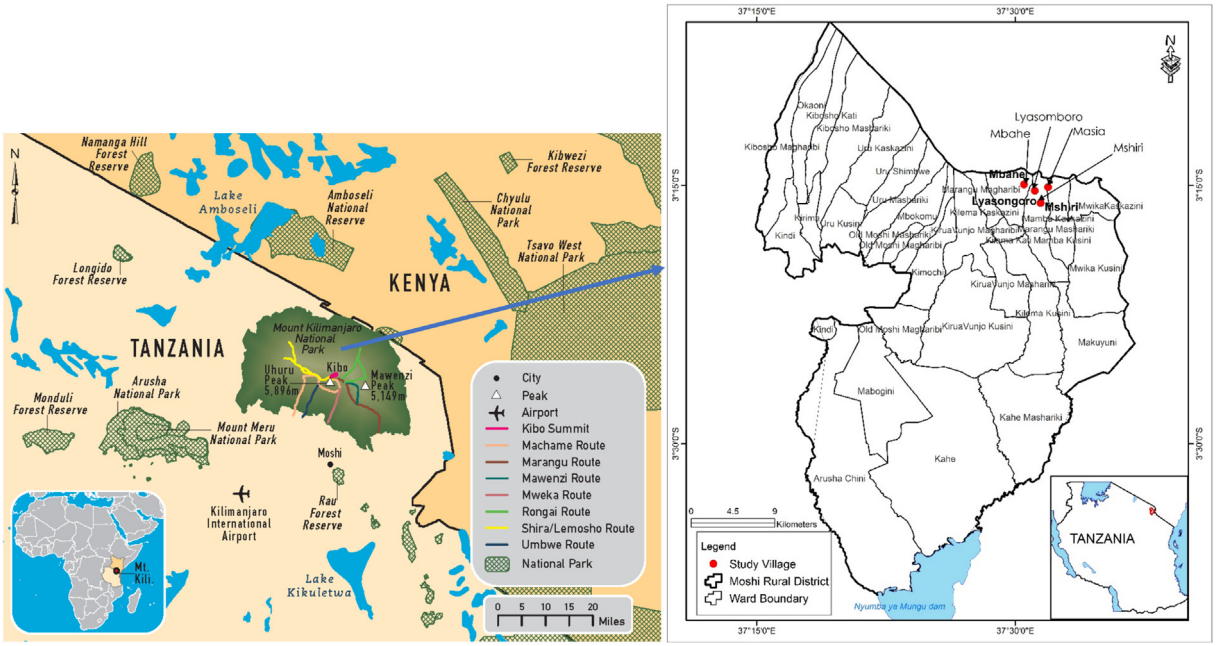

Fig. 2. Map of Tanzania showing Mount Kilimanjaro area.

3.2. Methods

3.2.1. Research design and data collection

This study employed a cross-sectional research design to collect data from four villages around Mount Kilimanjaro National Park in the Kilimanjaro region, Tanzania. The choice of this design was based on its ability to gather data from multiple villages at a single point in time, ensuring a comprehensive snapshot of the current socio-economic conditions and minimizing time-related biases. This approach allowed for the effective comparison of data across different villages, enhancing the reliability and validity of the findings. Moreover, for data collection, a multi-stage sampling technique was employed. Initially, the Kilimanjaro region was purposively selected due to its significant interaction with tourism activities. Within this region, four villages—Lyasomboro, Masia, Mshiri, and Mbahe—were chosen based on their proximity to the Marangu gate, one of the main entry points to Mount Kilimanjaro known for its high tourist traffic. This purposive selection ensured that the selected villages were representative of areas with substantial tourism-related economic activities. In the next stage, households within these villages were randomly sampled. Given the total number of households in the area was 1,978, the estimated sample size for the study was determined to be 614. Out of these, 582 respondents completed the questionnaires, yielding a high response rate of 94.78%. This robust sample size and high response rate provided a reliable data set for analysis. Additionally, structured questionnaires were used for data collection to ensure that respondents provided information relevant to the study's objectives. These questionnaires were designed to capture key variables related to household demographics, economic activities, and the impact of tourism. The structured format of the questionnaires minimized the likelihood of respondents providing extraneous information, thereby enhancing the accuracy and relevance of the collected data. Verbal informed consent was obtained from all subjects before the study.

3.2.2. Analytical modeling

In this study, the influencing factors of livelihood portfolio were analyzed using a multivariate probit model. The choice of the model was due to the fact that households could simultaneously engage in two or more income generating portfolios to make a living from agriculture, breeding, tourism and trade/business activities.

Thus, let Y_i be a vector of binary variables indicating the livelihood portfolio choices for household i :

$$Y_i = (Y_{i1}, Y_{i2}, Y_{i3}, Y_{i4}) \tag{1}$$

where Y_{i1} is a binary outcome indicating whether household i is diversified into farming; Y_{i2} is diversified into livestock keeping; Y_{i3} is diversified into tourism activities; and Y_{i4} is diversified into business or trade. Moreover, the list of equations (Equations 2–5) for the household choice on means of livelihood is given:

$$Y_{i1} = \beta_1 X_i + \mu_{i1} \tag{2}$$

$$Y_{i2} = \beta_2 X_i + \mu_{i2} \tag{3}$$

$$Y_{i3} = \beta_3 X_i + \mu_{i3} \tag{4}$$

$$Y_{i4} = \beta_4 X_i + \mu_{i4} \tag{5}$$

On the other hand, in the multivariate probit, the correlation between the error terms is considered. The correlation matrix $\sum$is estimated (Equation 6).

$$\sum = \begin{bmatrix} 1 & \rho_{12} & \rho_{13} & \rho_{14} \\ \rho_{21} & 1 & \rho_{23} & \rho_{24} \\ \rho_{31} & \rho_{32} & 1 & \rho_{34} \\ \rho_{41} & \rho_{42} & \rho_{43} & 1 \end{bmatrix} \tag{6}$$

Thus, this analytical model will help analyze whether livelihood assets influence local communities living around Mount Kilimanjaro's decision to diversify into any of the existing four livelihood portfolio options.

Moreover, after analyzing the determinants for livelihood portfolios across households, this study estimated the effects of tourism activities on the livelihood outcomes among communities to understand whether household participation in tourism activities significantly affected livelihood outcomes. In doing so, livelihood outcome was measured by three indicators: food security, income, and access to essential services (as shown in Fig. 1 and Table 1), of which instrumental variable models of Instrumental Variable (IV) Probit, and Two Stage Least Squares (2SLS) were used.

The structural equation for the IV Probit used in this study is presented as Equation 7:

$$Y^* = \beta_0 + \beta_1 A_1 + \beta_2 H_2 + \beta_3 \mathrm{CH}_3 + \beta_4 T_4 + \beta_5 D_1 + \ldots \beta_n D_n + \varepsilon \tag{7}$$

Table 1
Description and measurement of variables.

Components	Variable names	Variable descriptions	Expected signs	Type of variable
Demographic factors	Age	The period of time someone has been alive	+/−	Continuous
	Sex	The sex of the respondent	+/−	Categorical
	Household size	Number of people in a family	+	Continuous
	Marital status	Marital status of the respondent	+/−	Categorical
Livelihood asset				
Social capital	Social membership	Household membership in community organization	+/−	Categorical
	Size of social networks	Proportional of household membership in community organization	+/−	Continuous
Human capital	Education level	Levels of education of head of household	+	Categorical
	Skills diversity	Levels of skills of head of household	+/−	Categorical
Physical capital	Land ownership	Household status in land ownership	+/−	Categorical
	Livestock ownership	Household status in livestock ownership	+/−	Categorical
	Infrastructure development	Availability of improved infrastructure	+/−	Categorical
Natural capital	Access to fertile land	Household accessibility to fertile land	+	Categorical
	Dependence on natural resource	Proportional of household income derived from farming	+/−	Continuous
Tourism activities				
Tourism	Proximity to tourist sites	Distance from household to Mount Kilimanjaro National Park	+/−	Continuous
	Participation in tourism-related enterprises	Accommodation services, handcraft, and souvenirs, catering and hospitality, and tour guiding	+/−	Categorical
Livelihood outcomes				
Proxy of livelihood outcomes	Income	Monthly income of households	NA	Continuous
	Food security	Household food security status in the last 30 days	NA	Categorical
	Access to services	Household accessibility to essential social services (healthcare and education)	NA	Categorical
Institutional arrangement				
Arrangement and structure	Government policy	The supportiveness of government policy and regulations on the livelihood of the local community	+/−	Categorical
	Tourism authority	Effectiveness of tourism authorities in enhancing local communities	+/−	Categorical
	Environmental policy	Friendliness of environmental policies in accommodating local communities	+/−	Categorical

where Y^* is the latent variable for household food security, or access to essential services; X_1 to X_4 represent the tourism activities as follows: accommodation service (A), handcraft (H), catering and hospitality (CH), and tour guiding (T); β_1 to β_n are coefficients associated with explanatory variables; D_1 to D_n are other exogenous or control variables; and ε is the error term.

Given that the endogenous variables are dichotomized, then here is Equation 8:

$$Y = \begin{cases} 1, \text{if } Y^* > 0 \\ 0, \text{if } Y^* \leq 0 \end{cases} \tag{8}$$

Therefore, since tourism activities are endogenous (participation in these activities are also influenced by other factors), then the equation that describes their relationship across these factors is presented as Equation 9:

$$\mathrm{TA}^* = \alpha_0 + \alpha_1 D_1 + \ldots + \alpha_n D_n + \eta \tag{9}$$

where TA^* represents participation in tourism activities; and η is the error term.

Moreover, to estimate the instrumental variable equation, the instrument variable Z is introduced, which suppresses the endogenous relations. The instrument variable used only influences outcome variables (food security and access to essential services) indirectly but has direct effects to the decision to participate in tourism activities. Therefore, the distance to tourist attraction (Z) represents the instrumental variable used in this study and the estimated equation with the instrumental variable used in this study is presented as Equation 10:

$$Y^* = \beta_0 + \beta_1 \mathrm{TA}_i + \beta_2 Z_i + \epsilon \tag{10}$$

For the 2SLS, the outcome variable is income, of which the first stage equation represents determinants for the participation in the tourism activities which is the presented as Equation 11:

$$\mathrm{TA}_i = \pi_0 + \pi_1 Z + \pi_2 D_1 + \ldots + \pi_n D_n + \mu_i \tag{11}$$

where TA_i presents the decision to participation in the tourism activities; Z is the instrumental variable; D_i represents exogenous or other control variables used in the study; π is the coefficient to be estimated; and μ_i is the error term.

Additionally, on the second stage, the income equation is estimated which is presented as Equation 12:

$$\text{Income}_i = \beta_0 + \beta_1 \widehat{\text{TA}}_i + \beta_2 D_1 + \beta_3 D_2 + \ldots + \beta_n D_n + e \quad (12)$$

where Income_i is the income of the household i; $\widehat{\text{TA}}_i$ is the predicted value of tourism activities from the first stage regression equation; and D_i presents the vector of other factors that influence household income; β_0 to β_n are the coefficients to be estimated.

Then, these predicted values were used in the second stage equation to estimate the effect of tourism activities on household income, while controlling for other factors. This method helps address endogeneity and obtain consistent estimates of the coefficients.

4. Results

Table 2 presents the general characteristics of local communities around Mount Kilimanjaro. The table includes various variables such as villages, sex, food security, access to essential services (health and education), education level, and marital status. In terms of villages, the results indicated that the majority of respondents were from Lyasomboro (25.09%), Masia (24.40%), Mshiu (25.09%), and Mbahe (25.43%). Regarding gender distribution, a higher percentage of respondents are male (75.95%) compared to female (24.05%). Regarding food security, a significant portion of respondents reported having food security, with 64.78% indicating "Yes" and 35.22% indicating "No." Moreover, access to essential services, including health and education, showed that 50.69% of respondents had access to these services, while 49.31% had no access to these services.

Education level varied among respondents, with 14.43% having no formal education, 17.53% completing primary education, 29.90% completing secondary education, 19.93% having vocational training, and 18.21% having higher learning qualifications. Additionally, marital status among respondents indicated that the majority were married (43.13%), followed by single (21.13%), divorced (19.24%), and widowed (16.49%). These findings provide insight into the demographic and socio-economic characteristics of the local communities around Mount Kilimanjaro.

Moreover, the local communities surrounding Mount Kilimanjaro contributed significantly to the tourism sector through diverse activities such as accommodation services, handicraft and souvenir creation, catering, and tour guiding. This multifaceted engagement not only enriched the region's tourism offerings but also empowered the local population by creating economic opportunities within the tourism industry.

In Fig. 3, an examination of tourism activities undertaken by local communities around Mount Kilimanjaro revealed a multifaceted engagement with the tourism sector. One notable aspect was the provision of accommodation services by a segment of the community, which constituted 11.62%. Another significant contribution came from handicrafts and souvenirs, where 22.58% of the community was involved. This underscored the importance of local artistry and the creation of cultural souvenirs, enriching the tourism experience with indigenous crafts. Moreover, catering to the gastronomic aspect of tourism, catering and hospitality services emerge as a dominant activity, engaging 39.16% of the local community. This high percentage highlighted the integral role played by residents in providing culinary offerings and fostering a hospitable environment for tourists. Furthermore, 26.65% of the community were actively involved in tour guiding. This reflected the demand for knowledgeable locals who could offer guided tours, enhancing the overall tourist experience by providing insights into the local culture, geography, and history.

Table 2
General characteristics of local communities around Mount Kilimanjaro.

Variable	Attribute	Frequency ($N = 582$)	Percentage
Villages	Lyasomboro	146	25.09%
	Masia	142	24.40%
	Mshiu	146	25.09%
	Mbahe	148	25.43%
Sex	Male	442	75.95%
	Female	140	24.05%
Food security	Yes	377	64.78%
	No	205	35.22%
Access to essential services (health and education)	Yes	295	50.69%
	No	287	49.31%
Education level	No formal education	84	14.43%
	Primary education	102	17.53%
	Secondary education	174	29.90%
	Vocational training	116	19.93%
	Higher learning	106	18.21%
Marital status	Married	251	43.13%
	Single	123	21.13%
	Divorced	112	19.24%
	Widowed	96	16.49%

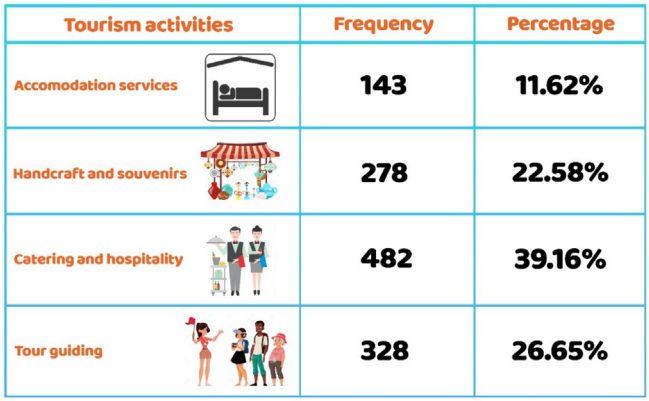

Fig. 3. Tourism activities undertaken by local communities around Mount Kilimanjaro.

Table 3 provides a breakdown of tourism activities across four villages surrounding Mount Kilimanjaro: Lyasomboro, Mshiu, Mbahe, and Masia. The table presents the frequency and percentage distribution of four key tourism-related activities: accommodation services, handcraft and souvenir, catering and hospitality, and tour guiding.

In terms of accommodation services, the highest frequency was observed in Masia with 56 instances, representing 16.37% of the total activity distribution across villages. Lyasomboro followed with 30 instances (9.93%), Mbahe with 45 instances (14.75%), and Mshiu with 12 instances (4.26%). Handcraft and souvenir activities were more evenly distributed across the villages, with the highest frequency recorded in Mbahe (98 instances, 32.13%), followed closely by Masia (94 instances, 27.49%), Lyasomboro (50 instances, 16.56%), and Mshiu (36 instances, 12.77%). Additionally, catering and hospitality activities exhibited variations across villages, with Masia and Mshiu having the highest frequencies of 165 (48.25%) and 124 (43.97%) instances, respectively. Moreover, Lyasomboro and Mbahe had relatively lower compared to the other villages as they had frequencies of 115 (38.08%) and 78 (25.57%) instances, respectively. Lastly, tour guiding activities were most prevalent in Mshiu (110 instances, 39.01%) and Lyasomboro (107 instances, 35.43%) while Mbahe and Masia had notably fewer instances, with 84 (27.54%) and 27 (7.89%) instances, respectively.

Results in Fig. 4 showed that most local communities in Mbahe village engaged in tour guiding; most local communities in Mshiu engaged in catering and hospitality. In contrast, those in Masia and Lyasomboro engaged in handcrafts, souvenirs, and accommodation services, respectively. Moreover, the results showed that the most common tourism activities across all four villages ($A \cap B \cap C \cap D$) were accommodation services, and handcrafts and souvenirs.

Moreover, in analyzing the distribution of tourism activities across villages around Mount Kilimanjaro, a series of set operations were conducted to identify the common elements and intersections among the different sets representing various tourism activities. Set A, representing the accommodation services in Lyasomboro, had 30 elements. Set B, representing the intersection of accommodation services and handcrafts in Lyasomboro and Masia, included elements {30, 94}. Set C, representing handcrafts in Masia, comprised elements {94}, while set D, representing the intersection of handcrafts and catering and hospitality in Mshiu and Masia, consisted of elements {36, 124}. Further set operations were conducted to identify specific intersections. For example, set $A' \cap D' \cap B \cap C$ resulted in elements {124}, indicating the intersection of catering and hospitality in Mshiu and Masia with handcrafts in Masia. Similarly, set $C \cap D \cap A' \cap B'$ resulted in elements {124, 84}, representing the intersection of handcrafts in Masia with catering and hospitality in Mshiu and Masia, while excluding accommodation services in Lyasomboro and handcrafts in Masia. By examining the final intersection, $A \cap B \cap C \cap D$, which resulted in elements {124, 84}, the study concluded that catering and hospitality activities, intersecting with handcrafts in Masia and catering and hospitality in Mshiu and Masia, were the most common tourism activities across all villages around Mount Kilimanjaro (see Table 4). This intersection highlighted the prevalent nature of catering and hospitality services in the region, serving as a key aspect of the local tourism economy.

Table 5 presents the perception of the local community regarding the influence of livelihood assets among communities residing around Mount Kilimanjaro by the use of the five-point Likert scale. The table is structured to show the components of

Table 3
Distribution of tourism activities four across villages around Mount Kilimanjaro.

Tourism activities	Lyasomboro		Mshiu		Mbahe		Masia	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Accommodation services	30	9.93%	12	4.26%	45	14.75%	56	16.37%
Handcraft and souvenir	50	16.56%	36	12.77%	98	32.13%	94	27.49%
Catering and hospitality	115	38.08%	124	43.97%	78	25.57%	165	48.25%
Tour guiding	107	35.43%	110	39.01%	84	27.54%	27	7.89%
Total	302	100.00%	282.00	100.00%	305.00	100.00%	342.00	100.00%

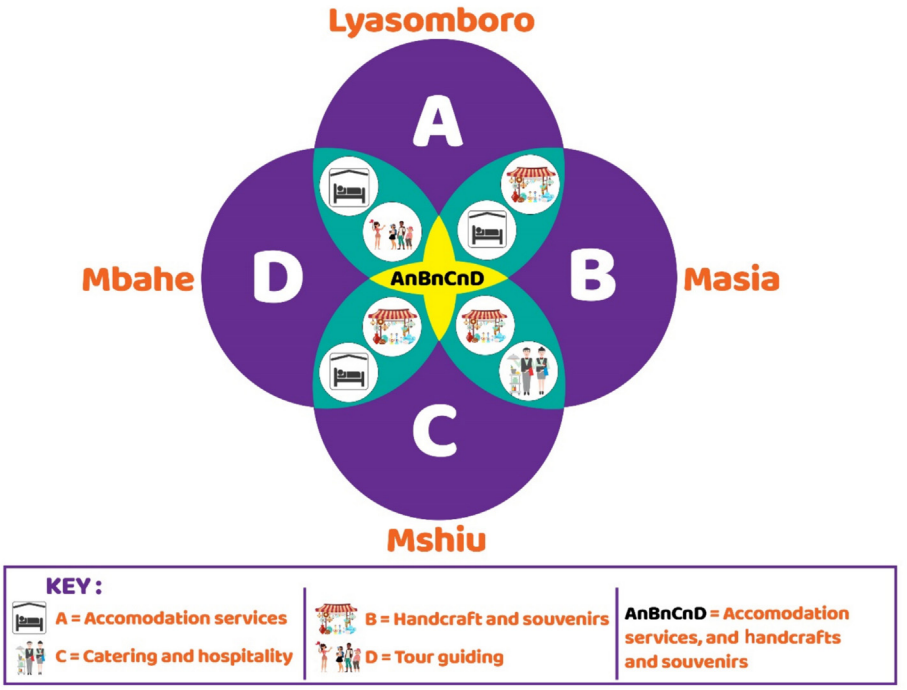

Fig. 4. The most common tourism activities across four villages around Mount Kilimanjaro.

different livelihood assets, including social capital, human capital, physical capital, and natural capital, along with the corresponding levels of agreement or disagreement among respondents.

In terms of social capital, the majority of respondents agreed on social membership, with 83.16% in agreement. When it came to social capital, opinions varied. The majority agreed on social membership, with 83.16% in agreement. In contrast, responses were more divided regarding the size of social networks, with 72.90% disagreeing. Notably, some respondents remained neutral, with 6.19% and 1.72% of the respondents expressing neutrality on social membership and the size of social networks, respectively. Regarding human capital, a significant proportion of respondents agreed on the importance of education level, with 81.10% in agreement. Similarly, a majority agreed on the significance of skills diversity, with 97.25% in agreement.

Moreover, for physical capital, respondents showed varying levels of agreement across different components. While there was notable agreement on infrastructure development, with 82.65% in agreement. Opinions were more mixed concerning land ownership and livestock ownership. A small percentage of respondents remained neutral on these aspects, representing 5.50% for land ownership, 4.30% for infrastructure development, and 13.40% for availability of amenities. In terms of natural capital, respondents expressed strong agreement regarding accessibility to fertile land, with a combined percentage of 81.45% agreeing. However, opinions were more diverse when it came to dependence on natural resources and sustainable use of environmental resources. A small proportion of respondents remained neutral on these aspects, representing 1.55% for accessibility to fertile land, 16.84% for dependence on natural resources, and 3.61% for sustainable use of environmental resources.

Results in Table 6 illustrated the multifaceted determinants of livelihood portfolios among village communities around Mount Kilimanjaro across various sectors, including tourism, farming, pastoralism, and trade/business. In the tourism sector, it was evident that age played a significant role (0.1074, $p < 0.01$), indicating that as individuals grow older, there was an observable increase in their engagement in tourism-related activities. Larger household sizes (0.1704) and credit access (0.1809, $p < 0.05$) were additional factors positively influencing diversified livelihoods in this sector. Moreover, market access (0.1705, $p < 0.01$) and social membership (0.2011, $p < 0.01$) emerged as critical drivers of livelihood portfolios, while livestock ownership exhibited a negative correlation (-0.2292, $p < 0.01$) with involvement in the tourism sector. Furthermore, household income (0.2208, $p < 0.01$) and skills diversity (0.4011, $p < 0.01$) were identified as key positive contributors to livelihood portfolios.

Concerning farming sector, the results underscored the significance of being male (-0.2148, $p < 0.05$) and older (-0.3693, $p < 0.01$), demonstrating a negative correlation with a decreased engagement in farming activities. Larger household sizes (0.2403, $p < 0.01$), credit access (0.1982, $p < 0.01$), and market access (1.5691, $p < 0.01$) significantly influenced diversified livelihoods in farming. Social membership (0.1903, $p < 0.01$), livestock ownership (0.4168, $p < 0.01$), household income (0.4308, $p < 0.01$), and skills diversity (0.2032, $p < 0.05$) were identified as positive contributors. Additionally, education at various levels, including primary education, secondary education, vocational training, and higher education, played significant roles in shaping diversified livelihoods in the farming sector.

Relating to the pastoralist sector, results highlighted the positive correlation of older age (0.2798, $p < 0.01$) and larger household sizes (0.3705, $p < 0.01$) with diversified pastoralist livelihoods. Credit access (0.2931, $p < 0.01$), social membership (0.1001,

Table 4
The most common tourism activities across villages.

Components	Villages								Intersection (All villages)
	Lyasomboro	Lyasomboro and Masia	Masia	Mshiu and Masia	Mshiu	Mshiu and Mbahe	Mbahe	Mbahe and Lyasomboro	
Set operations	$A = A \cap (B \cup C \cup D)'$	$A \cap B \cap C \cap D'$	$B = B \cap (A \cup C \cup D)'$	$A' \cap D' \cap B \cap C$	$C = C \cap (A \cup B \cup D)'$	$C \cap D \cap A' \cap B'$	$D = D \cap (A \cup B \cup C)'$	$A \cap D \cap B' \cap C'$	$A \cap B \cap C \cap D$
Activities	Accommodation	Accommodation services, and handcrafts	Handcrafts	Handcrafts, and catering and hospitality	Catering and hospitality	Catering and hospitality, and tour guide	Tour guide	Tour guide, and accommodation	Catering and hospitality, and tour guiding
Elements	{30}	{30, 94}	{94}	{36, 124}	{124}	{124, 84}	{84}	{84, 30}	{124, 84}

Table 5
Perception of local community on the influence of livelihood assets among local communities living around Mount Kilimanjaro.

Livelihood assets	Components of livelihood assets	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Social capital	Social membership	321 (55.15%)	163 (28.01%)	36 (6.19%)	42 (7.22%)	20 (3.44%)
	Size of social networks	105 (18.04%)	199 (34.19%)	10 (1.72%)	219 (37.63%)	49 (8.42%)
Human capital	Education level	285 (48.97%)	187 (32.13%)	5 (0.86%)	78 (13.40%)	27 (4.64%)
	Skills diversity	384 (65.98%)	182 (31.27%)	0 (0.00%)	14 (2.41%)	2 (0.34%)
Physical capital	Land ownership	209 (35.91%)	190 (32.65%)	32 (5.50%)	84 (14.43%)	67 (11.57%)
	Livestock ownership	198 (34.02%)	285 (48.97%)	17 (2.92%)	42 (7.22%)	40 (6.87%)
	Infrastructure development	372 (63.92%)	109 (18.73%)	25 (4.30%)	56 (9.62%)	20 (3.44%)
	Availability of amenities	183 (31.44%)	101 (17.35%)	78 (13.40%)	198 (34.02%)	22 (3.78%)
Natural capital	Accessibility to fertile land	273 (46.91%)	201 (34.54%)	9 (1.55%)	72 (12.37%)	27 (4.64%)
	Dependence on natural resources	89 (15.29%)	109 (18.73%)	98 (16.84%)	106 (18.21%)	180 (30.93%)
	Sustainable use of environmental resources	367 (63.06%)	104 (17.87%)	21 (3.61%)	49 (8.42%)	41(7.04%)

Table 6
Determinants of livelihood portfolio among village communities around Mount Kilimanjaro.

Variables		(1) Tourism	(2) Farming	(3) Pastoralist	(4) Trade/ Business
Sex (Male)		0.3281*** (0.010)	−0.2148** (0.064)	0.1105** (0.009)	0.0304 (0.104)
Age		0.1074** (0.011)	−0.3693*** (0.0000)	0.2798*** (0.0063)	0.1021** (0.0131)
Household size		0.1704 (0.1092)	0.2403*** (0.0002)	0.3705*** (0.0004)	0.0945*** (0.0025)
Credit access		0.1809** (0.0209)	0.1982*** (0.0020)	0.2931*** (0.0426)	0.1901*** (0.0000)
Market access		0.1705*** (0.0052)	1.5691*** (0.0177)	0.0973 (0.0984)	0.2075** (0.0100)
Social membership		0.2011*** (0.0000)	0. 1903*** (0.0000)	0.1001* (0.0483)	0.0202 (0.1783)
Government policy		−0.2852 (0.5341)	0.1856** (0.0471)	−0.2475** (0.0183)	0.1502 (0.3082)
Livestock ownership		−0.2292*** (0.0000)	0.4168*** (0.0000)	–	0.0963** (0.0069)
Household income		0.2208*** (0.0000)	0.4308*** (0.0056)	0.0693** (0.0097)	0.1475* (0.0521)
Skills diversity		0.4011*** (0.0019)	0.2032** (0.0577)	0.0894* (0.0353)	0.5339*** (0.0000)
Land ownership		0.28007*** (0.0701)	0.4119*** (0.03006)	0.1067*** (0.0108)	0.2100*** (0.03001)
Education levels	Primary education	−0.0110* (0.0084)	0.2321*** (0.0002)	0.3209** (0.0967)	0.0934 (0.1963)
	Secondary education	0.1008** (0.0133)	0.0731* (0.0230)	0.0419 (0.1605)	0.1044*** (0.0032)
	Vocational training	0.1479*** (0.0025)	−0.0942** (0.0042)	−0.0188 (0.1451)	0.1669** (0.0034)
	Higher education	0.2987*** (0.0000)	−0.0089 (0.0189)	−0.1004 (0.2109)	0.3708** (0.0458)
Marital status	Married	0.0956* (0.0198)	0.1800** (0.0045)	0.2807*** (0.0932)	0.1939* (0.0755)
	Divorced	0.1082	0.3721	0.1094	0.0967**

Table 6 *(continued)*

Variables	(1) Tourism	(2) Farming	(3) Pastoralist	(4) Trade/ Business
	(0.1062)	(0.2509)	(0.1194)	(0.0078)
Widowed	0.1077	0.1064**	0.1032	0.2033**
	(0.1607)	(0.0094)	(0.1195)	(0.0560)
Constant	0.3005**	2.0338***	3.0942***	6.0042***
	(0.1004)	(0.0002)	(0.2104)	(0.1104)
Observations	490	490	490	490

Note: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$.
Standard errors in parentheses.

$p < 0.1$), household income (0.0693, $p < 0.05$), skills diversity (0.0894, $p < 0.1$), and land ownership (0.1067, $p < 0.01$) were identified as significant positive factors. Surprisingly, higher education negatively correlated with diversified pastoralist livelihoods (−0.1004).

Lastly, in the trade/business sector, results revealed that older age (0.1021, $p < 0.05$) and larger household sizes (0.0945, $p < 0.01$) positively correlated with diversified trade/business livelihoods. Credit access (0.1901, $p < 0.01$), market access (0.2075, $p < 0.05$), household income (0.1475, $p < 0.1$), skills diversity (0.5339, $p < 0.01$), and land ownership (0.2100, $p < 0.01$) were also positively associated with diversified trade/business livelihoods. However, social membership (0.0202) and livestock ownership (0.0963, $p < 0.05$) showed minimal and negative correlations, respectively.

Results from Table 7 shed light on the determinants influencing local household participation in selected tourism activities around Mount Kilimanjaro, including accommodation services, handicraft, catering and hospitality, and tour guiding. In the accommodation services sector, various factors played a role in shaping participation. Notably, being male (0.0263, $p < 0.05$) and credit access (0.2108, $p < 0.05$) positively contributed to increased involvement. Market access (0.0769, $p < 0.01$), social membership (0.1844, $p < 0.01$), household income (0.1907, $p < 0.01$), skills diversity (0.2095, $p < 0.01$), and higher education (0.1609, $p < 0.05$) were also identified as significant positive determinants. Conversely, having primary education showed a negative correlation (−0.2817, $p < 0.01$) with participation in accommodation services.

For handcraft activities, being male (0.3105, $p < 0.05$) and having larger household sizes (0.1721, $p < 0.05$) positively impacted participation. Additionally, credit access (0.0143, $p < 0.05$), market access (0.2981, $p < 0.01$), social membership (0.0969, $p < 0.1$), and household income (0.0079, $p < 0.1$) played crucial roles. Secondary education (0.0867, $p < 0.05$), vocational training (0.1700, $p < 0.01$), and higher education (−0.1952, $p < 0.05$) were also identified as significant factors.

In the catering and hospitality sector, being male (−0.0075, $p < 0.05$) and having larger household sizes (0.0218, $p < 0.05$) were associated with increased participation. Credit access (0.2352, $p < 0.01$), social membership (0.1001, $p < 0.01$), and household income (0.0105, $p < 0.01$) were positively correlated with participation. Notably, higher education (−0.0932, $p < 0.1$) correlated negatively with participation in catering and hospitality.

Lastly, in the tour guiding sector, being male (0.4073, $p < 0.01$) and credit access (0.0677, $p < 0.01$) positively influenced participation. Market access (0.3853, $p < 0.05$), social membership (0.0989, $p < 0.1$), and household income (0.1010, $p < 0.01$) were also identified as significant positive determinants. Moreover, secondary education (0.0139, $p < 0.01$), vocational training (0.3217, $p < 0.01$), and higher education (0.1899, $p < 0.01$) played crucial roles.

Table 8 presents the effects of tourism activities on household livelihood outcomes, specifically focusing on food security, income, and access to essential social services using IV Probit and 2SLS methods.

Regarding food security, several factors emerged as significant determinants. Being male (−0.0833, $p < 0.1$), married (−0.2953, $p < 0.01$), and older (−0.2710, $p < 0.01$) were associated with negative effects on food security. Credit access (0.2605, $p < 0.01$), market access (0.1905, $p < 0.05$), social membership (0.1364, $p < 0.01$), government policy (0.1404, $p < 0.05$), skills diversity (0.0831, $p < 0.05$), land ownership (0.1932, $p < 0.01$), and infrastructure development (0.3147, $p < 0.01$) also played crucial roles. Among tourism activities, engagement in accommodation services (0.1041, $p < 0.1$) positively affected food security.

When considering household income, various factors exhibited significant impacts. Being male (0.0305, $p < 0.05$), married (0.1809, $p < 0.01$), older (negative coefficient of −0.19063, $p < 0.01$), having larger household sizes (0.1709, $p < 0.05$), credit access (0.1509, $p < 0.05$), market access (0.2106, $p < 0.01$), social membership (0.2324, $p < 0.01$), government policy (0.2078, $p < 0.01$), livestock ownership (0.0233, $p < 0.01$), skills diversity (0.1194, $p < 0.01$), land ownership (0.0721, $p < 0.05$), and infrastructure development (0.2584, $p < 0.01$) were significant determinants. Handcraft and souvenirs (0.2084, $p < 0.01$) and catering and hospitality (0.1532, $p < 0.05$) within tourism activities showed positive effects on household income.

In terms of access to essential social services, being male (0.00952, $p < 0.05$), married (0.0932, $p < 0.05$), older (negative coefficient of −0.09741, $p < 0.01$), having larger household sizes (0.0162, $p < 0.1$), credit access (0.1015), market access (0.0264, $p < 0.05$), social membership (0.0291, $p < 0.1$), government policy (0.1422, $p < 0.01$), livestock ownership (−0.0706,

Table 7
Determinants of local household participation in selected tourism activities around Mount Kilimanjaro.

Variables		(1) Accommodation service	(2) Handcraft	(3) Catering and hospitality	(4) Tour guiding
Sex (Male)		0.0263**	0.3105**	−0.0075**	0.4073***
		(0.0078)	(0.0043)	(0.0292)	(0.0283)
Age		0.2072	0.1025	0.0733	0.3409
		(0.0783)	(0.0941)	(0.3130)	(0.2394)
Household size		0.1204*	0.1721**	0.0218**	0.1479
		(0.0346)	(0.0103)	(0.0393)	(0.4183)
Credit access		0.2108**	0.0143**	0.2352***	0.0677***
		(0.0032)	(0.0067)	(0.0024)	(0.0000)
Market access		0.0769***	0.2981***	0.1774	0.3853**
		(0.0003)	(0.0032)	(0.0985)	(0.0789)
Social membership		0.1844***	0.0969*	0.1001***	0.0989*
		(0.0000)	(0.0372)	(0.0004)	(0.0189)
Government policy		0.1079*	0.1256**	0.2475	0.0358
		(0.0459)	(0.0097)	(0.3211)	(0.1894)
Livestock ownership		0.0426***	0.2165***	0.2150	0.1672**
		(0.0742)	(0.0239)	(0.1832)	(0.0153)
Household income		0.1907***	0.0079*	0.0105***	0.1010***
		(0.0000)	(0.0025)	(0.0001)	(0.0032)
Skills diversity		0.2095***	0.0928*	0.1046**	0.1305***
		(0.0000)	(0.0218)	(0.0103)	(0.0000)
Land ownership		0.1375	0.0120**	0.0031	0.2406
		(0.0884)	(0.0017)	(0.1932)	(0.2037)
Education levels	Primary education	−0.2817***	0.3167**	−0.0093	−0.0731
		(0.0001)	(0.0938)	(0.1482)	(0.3604)
	Secondary education	0.0723**	0.0867**	0.0402*	0.0139***
		(0.0031)	(0.0015)	(0.0100)	(0.0000)
	Vocational training	0.2760***	0.1700***	0.2205**	0.3217***
		(0.0017)	(0.0001)	(0.0214)	(0.0000)
	Higher education	0.1609**	−0.1952**	−0.0932*	0.1899***
		(0.0152)	(0.0082)	(0.0101)	(0.0010)
Marital status	Married	0.0043	0.0482	0.1873**	0.2103
		(0.1904)	(0.1317)	(0.0107)	(0.1608)
	Divorced	0.0041	0.2100	0.0049	0.0710
		(0.5209)	(0.3208)	(0.1016)	(0.2419)
	Widowed	0.0351	0.0058	0.2089	0.1721
		(0.2050)	(0.2104)	(0.1504)	(0.1978)
Constant		0.56012**	0.7833***	1.7530***	0.37196***
		(0.0000)	(0.0156)	(0.0078)	(0.0000)
Observations		582	582	582	582

Note: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$.
Standard errors in parentheses.

$p < 0.05$), skills diversity (0.2658, $p < 0.01$), land ownership (0.0983, $p < 0.05$), and infrastructure development (0.1046, $p < 0.01$) exhibited significant impacts. Furthermore, engagement in accommodation services (0.1258, $p < 0.01$), handcraft and souvenirs (0.1285, $p < 0.01$), and catering and hospitality (0.2109, $p < 0.01$) within tourism activities positively influenced access to essential social services.

Table 9 presents the challenges hindering local communities' participation in tourism activities around Mount Kilimanjaro, as perceived by respondents. The table illustrates the frequency and percentage of responses across various categories of challenges, which have been categorized into five-points Likert scale. Regarding education level, a significant portion of respondents (69.08%) agreed that education-related barriers impede their involvement in tourism endeavors. Similarly, there was strong consensus (85.05%) on the challenge of information and awareness, indicating the need for robust awareness campaigns to educate communities about tourism opportunities and benefits. Conversely, concerning government policy and regulations, a majority (70.28%) agreed that policy barriers existed; there was a notable divergence of opinions. Specifically, 28.86% expressed disagreement, indicating a lack of consensus on the effectiveness of existing policies.

In terms of quality of service, a substantial majority (88.32%) agreed that service-related issues posed hindrances to tourism participation. Similarly, concerns about cultural and social barriers resonated strongly among respondents, with 81.44% in agreement. Additionally, financial costs emerged as a significant concern, with an overwhelming majority (91.23%) agreeing on the financial barriers to tourism participation. Furthermore, the challenges related to competition were widely acknowledged, with 78.35% of respondents expressing agreement. Moreover, concerns about infrastructure were evident, with 61.34% of respondents agreeing on infrastructure-related challenges.

Table 8
Effects of tourism activities on household livelihood outcomes.

Variables		Effects on food security	Effects on income	Access to essential social services
		IV Probit	2SLS	IV probit
Sex (Male)		−0.0833*	0.0305**	0.00952**
		(0.0063)	(0.0098)	(0.0012)
Marital status	Married	−0.2953***	0.1809***	0.0932**
		(0.0006)	(0.0014)	(0.0027)
	Divorced	−0.0927	−0.0261	−0.1080
		(0.0894)	(0.0304)	(0.1209)
	Widowed	0.0326	0.0963	0.1088
		(0.1502)	(0.1599)	(0.1409)
Age		−0.2710***	−0.19063***	−0.09741***
		(0.0000)	(0.0000)	(0.0000)
Household size		0.2267**	0.1709**	0.0162*
		(0.0963)	(0.0100)	(0.0095)
Credit access		0.2605***	0.1509**	0.1015
		(0.0000)	(0.0159)	(0.2187)
Market access		0.1905**	0.2106***	0.0264**
		(0.0203)	(0.0153)	(0.0173)
Social membership		0.1364***	0.2324***	0.0291*
		(0.0021)	(0.0014)	(0.0100)
Government policy		0.1404**	0.2078***	0.1422**
		(0.0021)	(0.0000)	(0.0059)
Livestock ownership		−0.0309***	0.0233***	−0.0706**
		(0.0003)	(0.0021)	(0.0020)
Household income		0.3488***	–	0.0963***
		(0.0016)		(0.0000)
Skills diversity		0.0831**	0.1194**	0.2658***
		(0.0173)	(0.0001)	(0.0052)
Land ownership		0.1932***	0.0721**	0.0983**
		(0.0022)	(0.0063)	(0.0013)
Infrastructure development		0.3147***	0.2584***	0.1046***
		(0.0531)	(0.0293)	(0.0076)
Education levels	Primary education	−0.0483	0.0007	0.0894**
		(0.1073)	(0.2407)	(0.0054)
	Secondary education	0.1608*	0.2203	0.1093***
		(0.0310)	(0.0017)	(0.0000)
	Vocational training	0.1041***	0.1215***	0.0928***
		(0.0000)	(0.0010)	(0.0000)
	Higher education	0.3842***	0.1371*	0.1769***
		(0.0000)	(0.0218)	(0.0000)
Tourism activities	Accommodation services	0.1041*	0.1803***	0.1258***
		(0.0163)	(0.0026)	(0.0010)
	Handcraft and souvenirs	0.0705	0.2084***	0.1285***
		(0.0581)	(0.0000)	(0.0005)
	Catering and hospitality	0.2311**	0.1532**	0.2109***
		(0.0914)	(0.0142)	(0.0018)
	Tour guiding	0.0283**	0.2015***	0.1056**
		(0.0024)	(0.0731)	(0.0149)
Constant		2.06324***	4.07731***	3.96226***
		(0.5381)	(0.2409)	(0.4053)
Durbin Wu-Hausman		6.03942***	4.09634***	3.88423***
R squared		0.3604	0.5908	0.3365
Sample size		582	582	582

Note: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$.
Standard errors in parentheses.

5. Discussion

The results on the determinants of livelihood portfolio across local communities around Mount Kilimanjaro have unveiled the significance of socioeconomic factors in influencing household decisions to engage in tourism activities. The positive coefficients for credit access, market access, social membership, and skills diversity indicate that financial capital and social capital play pivotal roles in shaping livelihood choices. It implies that communities with better access to credit, wider social networks, and diverse skills are more inclined to diversify their livelihoods, embracing a spectrum of activities, including tourism. This finding resonates with the work of Wamboye et al. (2020), who similarly emphasized the critical role of social networks and financial resources in shaping livelihood portfolio among rural populations.

Table 9
Challenges hindering local communities' participation in tourism activities at Mount Kilimanjaro.

Challenges	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Education level	195 (33.51%)	207 (35.57%)	36 (6.19%)	68 (11.68%)	76 (13.06%)
Information and awareness	308 (52.92%)	187 (32.13%)	0 (0.00%)	61 (10.48%)	26 (4.47%)
Quality of service	225 (38.66%)	289 (49.66%)	5 (0.86%)	28 (4.81%)	35 (6.01%)
Cultural and social barriers	367 (63.06%)	107 (18.38%)	0 (0.00%)	98 (16.84%)	10 (1.72%)
Financial costs	431 (74.05%)	100 (17.18%)	0 (0.00%)	4 (0.69%)	47 (8.08%)
Government policy and regulations	214 (36.77%)	195 (33.51%)	5 (0.86%)	63 (10.82%)	105 (18.04%)
Competition	282 (48.45%)	174 (29.90%)	22 (3.78%)	83 (14.26%)	21 (3.61%)
Monopolizing of government resources	203 (34.88%)	241 (41.41%)	8 (1.37%)	43 (7.39%)	87 (14.95%)
Corruption	177 (30.41%)	231 (39.69%)	18 (3.09%)	56 (9.62%)	100 (17.18%)
Infrastructure	238 (40.89%)	119 (20.45%)	68 (11.68%)	59 (10.14%)	98 (16.84%)

On the other hand, the negative coefficient for government policy raises questions about the effectiveness of existing policies in supporting or incentivising certain livelihood activities. This result suggests a potential gap that warrants further exploration and potentially calls for policy adjustments. Interestingly, this finding diverges from the work of Mgonja (2023), who found positive impacts of government policies on livelihood portfolio. The variance in results could be attributed to contextual differences and the need for tailored policy interventions that align with the unique dynamics of the Mount Kilimanjaro region.

The determinants of local household participation in tourism activities underscore the multifaceted nature of community involvement in the tourism sector. The positive correlations between social membership, skills diversity, higher education, and participation in tourism activities align with the idea that knowledge, skills, and social networks are crucial for community engagement in tourism. This finding is consistent with the broader literature highlighting the positive impacts of education and social capital on community participation in tourism activities.

However, the negative coefficient for some education levels, such as primary education, suggests potential barriers or challenges specific to individuals with certain educational backgrounds. This finding emphasizes the need for targeted interventions to address educational disparities and ensure inclusive participation in tourism activities. Interestingly, this result contrasts with the work of Boto-García and Baños-Pino (2022), who found positive associations between all education levels and tourism participation. This discrepancy could be attributed to contextual variations and highlights the importance of considering local nuances in designing interventions.

The positive coefficient for accommodation services suggests a favourable impact on household livelihoods. Communities engaged in providing accommodation services are likely to experience increased income, aligning with the findings of Natarajan et al. (2022), Perić (2018), and Polat and Ozdemir (2021), who emphasized the economic benefits of lodging services in tourism destinations. This positive effect can be attributed to the steady flow of tourists requiring accommodation, contributing to enhanced income and potentially fostering economic resilience among participating households.

The positive coefficient for handicrafts and souvenirs indicates a beneficial effect on household livelihoods. Local communities involved in crafting and selling souvenirs may experience improved income opportunities. This finding resonates with studies by Munyao (2021) and Phelan et al. (2020), highlighting the significance of cultural and artistic expressions in tourism-related livelihoods. Additionally, the creation and sale of handcrafted items may contribute to the preservation of local cultural heritage, adding a dimension of cultural sustainability to the economic benefits.

The positive coefficient associated with catering and hospitality activities suggests a positive impact on household livelihoods. Communities engaged in providing catering services may benefit from increased income and economic opportunities. This result aligns with the broader literature on the economic contributions of the hospitality sector to local communities (Chili & Ngxongo, 2017; Seberíni, 2020). The positive effect observed in this study underscores the potential for catering and hospitality to serve as key drivers of economic development within the context of Mount Kilimanjaro.

The positive coefficient for tour guiding activities implies favourable effects on household livelihoods. Local guides may experience increased income and employment opportunities, contributing to improved livelihoods. This finding aligns with studies emphasizing the role of tour guides as important stakeholders in the tourism value chain (Emili & Galli, 2023; Upadhaya et al., 2022; Veer, 2021). The positive impact on livelihood outcomes underscores the significance of investing in training and capacity-building programs for local guides to enhance their skills and professionalism (Mawufemor et al., 2019).

Moreover, in outlining the challenges hindering local communities' participation in tourism activities, this study shows widespread agreement on challenges related to education, information and awareness, quality of service, cultural and social barriers, financial costs, and government policy, and underscores the multifaceted obstacles that communities face. This result is in tandem with the findings of Tran et al. (2020) and Mawufemor et al. (2019), who also identified similar challenges in their studies. The high agreement on challenges related to competition, monopolizing government resources, corruption, and infrastructure highlights systemic issues requiring comprehensive and coordinated interventions. Addressing these challenges necessitates community-level initiatives, broader policy reforms, and collaborative efforts involving various stakeholders.

6. Conclusion

In conclusion, this study offers valuable insights into the determinants of livelihood portfolio and the impact of tourism activities on households around Mount Kilimanjaro National Park, within the context of promoting, preserving, and sustaining geoheritage and geotourism. Socioeconomic factors, such as sex, age, household size, credit access, and market access, significantly influence livelihood choices. Specific tourism activities, including accommodation services, handicrafts, catering, and tour guiding, positively impact household livelihood outcomes.

The findings of this study hold substantial policy implications for stakeholders committed to promoting sustainable geotourism and enhancing the livelihoods of communities around Mount Kilimanjaro National Park, and other national parks in developing countries. These policy implications include the following aspects:

Firstly, recognizing the positive influence of tourism activities on household livelihoods, particularly in accommodation services, handicrafts, catering, and tour guiding, underscores the need for targeted interventions. Policymakers should prioritize the development of tailored training programs to enhance the skills of individuals engaged in these specific geotourism-related activities. Investing in skill development can improve the quality of services offered by local communities, enhancing their competitiveness and attractiveness to tourists.

Challenges related to inadequate infrastructure, including transportation and access to amenities, hinder the full potential of geotourism. Policymakers should allocate resources to address these infrastructure gaps, fostering an environment conducive to geotourism growth. Improved infrastructure attracts more tourists and stimulates economic opportunities for local communities. Moreover, policymakers can support artisans and local cultural events to preserve and promote the distinctive geoheritage of Mount Kilimanjaro, contributing to the authenticity of geotourism experiences and creating avenues for economic empowerment within the local community. For example, investment in road and transportation networks in ecotourism sites like Costa Rica's Monteverde Cloud Forest Reserve has significantly improved accessibility, attracting more tourists and driving economic growth in surrounding communities.

Recognizing the positive influence of credit access on livelihood choices, policymakers can develop and promote inclusive financial strategies. Community-based credit programs and initiatives facilitating access to capital for individuals and businesses engaged in geotourism activities can catalyze local economic development. This should go hand in hand with strengthening regulatory frameworks, creating an enabling environment for sustainable geotourism. Addressing challenges related to government policies and regulations requires a collaborative approach, with policymakers engaging local communities to refine and streamline regulatory frameworks, ensuring alignment with the unique needs and aspirations of the region.

Examples of policies and reforms that could address challenges related to government policies and regulations include the establishment of specific incentives or tax breaks for businesses engaged in geotourism activities, the development of clear guidelines for land use and resource management to promote sustainable tourism practices, and the implementation of community-based decision-making processes to ensure that local voices are heard in the formulation of policies affecting their livelihoods. Additionally, reforms could involve the provision of training and capacity-building programs for local stakeholders to enhance their understanding of regulatory requirements and compliance procedures, as well as the establishment of mechanisms for monitoring and evaluating the impact of policies on local communities and ecosystems. These initiatives aim to create an enabling environment for sustainable geotourism while addressing the challenges posed by existing government policies and regulations. Furthermore, supporting local artisans and cultural events to preserve and promote the unique geoheritage of Mount Kilimanjaro can draw from experiences in heritage tourism destinations like Petra in Jordan. By providing financial incentives, technical assistance, and marketing support to local artisans, policymakers can revitalize traditional crafts and cultural practices, fostering a vibrant cultural ecosystem that enhances the authenticity of geotourism experiences.

Furthermore, the study recommends the implementation of community awareness programs, pivotal in addressing information gaps and fostering a sense of ownership among residents. These programs involve initiatives that inform and educate communities about the benefits and opportunities associated with geotourism, increasing their participation in geotourism-based activities. Grounded in the study's findings, these policy implications provide a roadmap for policymakers and practitioners to foster sustainable and inclusive geotourism development around Mount Kilimanjaro. Implementing these targeted strategies can unlock the transformative potential of geotourism, creating lasting positive impacts on the livelihoods of local communities.

Despite providing valuable information, this study possesses several limitations. Firstly, its focus on a limited number of villages around Mount Kilimanjaro may not fully capture the diversity of experiences and perspectives within the region. Additionally, the cross-sectional research design used in this study may have limitations in determining the causal effects of tourism activities on household livelihoods due to its lack of temporal depth and longitudinal data. Furthermore, using households as the unit of analysis may not fully account for variations in individual participation in tourism activities within households. Future

studies could benefit from employing more granular units of analysis to better understand the nuanced dynamics of tourism engagement at the individual level. Moreover, the study does not provide a clear demarcation of tourism activities, which may have led to ambiguity in the interpretation of findings. Future research should aim to categorize and define tourism activities more precisely to facilitate a better understanding of their impacts on local communities. Lastly, while this study offers insights into the perceptions and experiences of local communities regarding tourism activities, there is a need for further research employing lab or field experiments to better understand how these activities directly impact the welfare and socio-economic outcomes of the communities around Mount Kilimanjaro. Such experimental studies could provide more rigorous evidence of the causal relationships between tourism activities and community well-being, thus informing more targeted policy interventions and development initiatives.

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Ethical statement

Ethical approval for this study was obtained from Moshi Municipal Council, Kilimanjaro with Reference No. MDC/E.50/15 VOL. V/112. Verbal informed consent was obtained from all subjects before the study.

CRediT authorship contribution statement

Felician Andrew Kitole: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jennifer Kasanda Sesabo:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Availability of data

Data and all materials will be available upon reasonable request.

Declaration of competing interest

The authors declare that they have no known competing financial interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijgeop.2024.07.001.

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