REGULAR RESEARCH ARTICLE

Unraveling Factors Influencing Local Willingness to Participate in Sustainable Komodo Conservation and Protected Area Tourism

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ABSTRACT

Komodo National Park is at the forefront of balancing environmental conservation with the challenges and opportunities of sustainable tourism. This research delves into the attitudes and engagement levels of the local communities within Komodo's distinctive ecological context, aiming to unravel the factors that drive or hinder their involvement in sustainable tourism and conservation activities. Through Exploratory Factor Analysis, we distilled key influences on community engagement, followed by a K-Mean Cluster Analysis to segment the community by their involvement levels. Logistic Regression was then employed to explore the likelihood of continued participation in these initiatives. The analysis identified three primary factors affecting community participation: the degree of involvement in sustainable tourism activities, the extent of community and environmental involvement, and the level of awareness regarding tourism development policies. The Cluster Analysis illuminated diverse engagement patterns across demographic lines, revealing how differences in settlement type, income levels, marital status, gender, and age contribute to varied participation rates. Interestingly, the logistic regression pointed to a paradox where higher engagement in sustainable tourism correlates with a lower probability of future participation, hinting at possible sustainability fatigue among highly active community members. These intricate dynamics of community engagement in sustainable tourism within Komodo National Park, highlight the importance of tailored, demographic-specific approaches to foster inclusive participation in conservation efforts. The insights gained underscore the complexity of promoting sustainable tourism in sensitive ecological areas and offer critical recommendations for policymakers and conservation stakeholders aiming to enhance sustainable development in Komodo and similar settings globally.

KEYWORDS

Komodo National Park; Sustainable tourism; Community engagement; Conservation efforts; Environmental awareness.

1. INTRODUCTION

The Komodo National Park, a bastion of biodiversity and the eminent home of the Komodo dragon (*Varanus komodoensis*), is an ecological treasure and a magnet for sustainable tourism. This Indonesian island's global allure has been heightened by its UNESCO World Heritage status, drawing attention to its delicate balance of marine and terrestrial ecosystems (Cochrane, 2013). The intersection of conservation and tourism here is a delicate dance, with sustainable tourism offering a pathway to meld ecological stewardship with economic opportunity (Benu et al., 2020). In the evolving narrative of Komodo, local communities have historically thrived in a symbiotic relationship with

their environment. Yet, the burgeoning tourism sector introduces complex dynamics, necessitating a nuanced understanding of sustainable development (Aktymbayeva et al., 2023). It is within this context that the present research is situated, focusing on the critical role of local community engagement in sustainable tourism initiatives (Chan et al., 2021).

By its very design, sustainable tourism aims to respect and preserve the environment and local traditions while contributing to economic development (Mathew and Nimmi, 2022). As the custodians of their land, local communities of Komodo are integral to this equation, and their participation is a lynchpin to achieving true sustainability (Asriyani and Verheijen, 2020). Their deep-rooted knowledge and vested interest in the region's well-being position them as indispensable stakeholders. However, while the theoretical framework around community-based sustainable tourism is well-established, empirical evidence detailing the actual drivers and deterrents of community participation (Delas Alas et al., 2022; Tien et al., 2024), especially in the developing world context is less robust. This research aims to address this gap in the literature by investigating the multifaceted factors that influence community engagement in Komodo's sustainable tourism.

Pursuing sustainable tourism has become a focal point in the discourse on balancing economic development with environmental preservation and social equity (Marques et al., 2022; Sharpley, 2020). Within this context, the role of local communities is crucial. Yet, the intricacies of their participation in tourism management remain insufficiently explored, especially in unique ecological settings like Komodo National Park, Indonesia. The existing literature frequently highlights the importance of community engagement in sustainable tourism but often does so without a deep dive into the specific factors that facilitate or hinder such engagement in developing countries (Kunasekaran et al., 2022; Scheyvens and van der Watt, 2021). There remains a gap in understanding how individual behaviors, demographic characteristics, and policy awareness interact to affect community participation in sustainable tourism (Demirović Bajrami et al., 2020; Shafieisabet and Haratifard, 2020; Sharmin et al., 2020). Furthermore, while the theory of willingness to pay has been explored in various contexts (Khan et al., 2022; Lee and Wang, 2017; Perdana et al., 2021), its application to sustainable tourism engagement is not well-documented, particularly concerning how it might impact individuals' willingness to participate in further conservation or tourism management activities. Participation in sustainable tourism spans a diverse spectrum, from locals spearheading conservation efforts to embarking on ecotourism ventures, advocating for supportive policies, and volunteering for environmental maintenance (Nguyen et al., 2023; Phan et al., 2022; Soe and Yeo-Chang, 2019; Suryawan and Lee, 2023b; Thuy Phan et al., 2023). Grasping why and how individuals choose to participate is key to crafting strategies that prioritize the park's ecological integrity and ensure that the economic advantages of tourism are felt across the community. Such inclusive and equitable approaches to tourism development are essential to ensure that the benefits extend to all stakeholders, harmonizing environmental stewardship with community prosperity.

Critiques have emerged concerning whether the current tourism model is genuinely sustainable, with some pointing out the rapid increase in visitor numbers (Benu et al., 2020), placing undue pressure on local ecosystems and communities. This surge in tourism, while contributing to economic growth, raises concerns about the long-term viability of conservation efforts and the equitable distribution of tourism's benefits among local populations. The phenomenon has sparked a debate on whether the current trajectory of tourism development is exacerbating inequalities, marginalizing

residents from accessing natural resources integral to their livelihoods and cultural practices. Historically, there have been instances in Komodo where the interests of conservation and local communities have clashed (Asriyani and Verheijen, 2020). As sustainable tourism evolves in Komodo, it is crucial to examine whether these historical tensions are being addressed and if newer tourism models promote a more inclusive conservation approach that benefits both the environment and local communities.

This study aims to identify and analyze the factors that influence local community participation in sustainable tourism management in Komodo National Park, Indonesia. This study adds to the body of knowledge on sustainable tourism in several ways. It addresses the call for more empirical studies on community engagement in sustainable tourism within developing country settings (Chan et al., 2021; Wondirad et al., 2020). Additionally, it delves into the underexplored area of how willingness to participate affects sustainable tourism outcomes, offering new insights into an important aspect of tourism studies. Our findings, derived from the context of Komodo National Park, provide valuable lessons that apply to similar conservation-focused tourism settings worldwide. Therefore, this study addresses a significant gap in scholarly knowledge and lays the groundwork for future research to further explore community engagement dynamics in various cultural and geographical settings, enhancing our understanding of sustainable tourism practices globally.

2. DATA AND METHOD

2.1 Study location

Figure 1 showcases the geographical context of our study, situated within what is commonly referred to in academic literature as the "Komodo district" in the Manggarai Barat Regency, East Nusa Tenggara province, Indonesia. While officially recognized as a *kecamatan* (sub-district), this area, for our research and in line with previous studies, includes parts of Flores Island and encompasses the entirety of Komodo and Rinca Islands, along with several smaller surrounding islets. Our investigation particularly focuses on Labuan Bajo town and Komodo village. Labuan Bajo, serving as the gateway to Komodo National Park, has become a pivotal hub for tourism, providing essential accommodations and services for visitors drawn to the area's unique biodiversity and cultural heritage, including the iconic Komodo dragons. The study contrasts Labuan Bajo's urbanization and tourism development with the traditional lifestyle maintained in Komodo village, offering insights into the diverse impacts of tourism on local communities and environments.'

In our study of sustainable tourism and community engagement within the Komodo district, the contrasting lifestyles of Komodo Village and Labuan Bajo emerge as pivotal elements. Komodo Village, steeped in a "traditional way of life," relies heavily on fishing, small-scale agriculture, and the burgeoning tourism sector, reflecting a longstanding harmony with the environment. This lifestyle is a testament to generations of living in sync with nature, where community practices are woven into the fabric of the land and sea. In contrast, Labuan Bajo has witnessed rapid urbanization, spurred by the tourism industry's growth. This change has broadened the spectrum of livelihoods, drawing many to tourism-driven occupations such as hospitality, tour operations, and artisanal crafts, thereby reshaping the town's social and economic landscape.
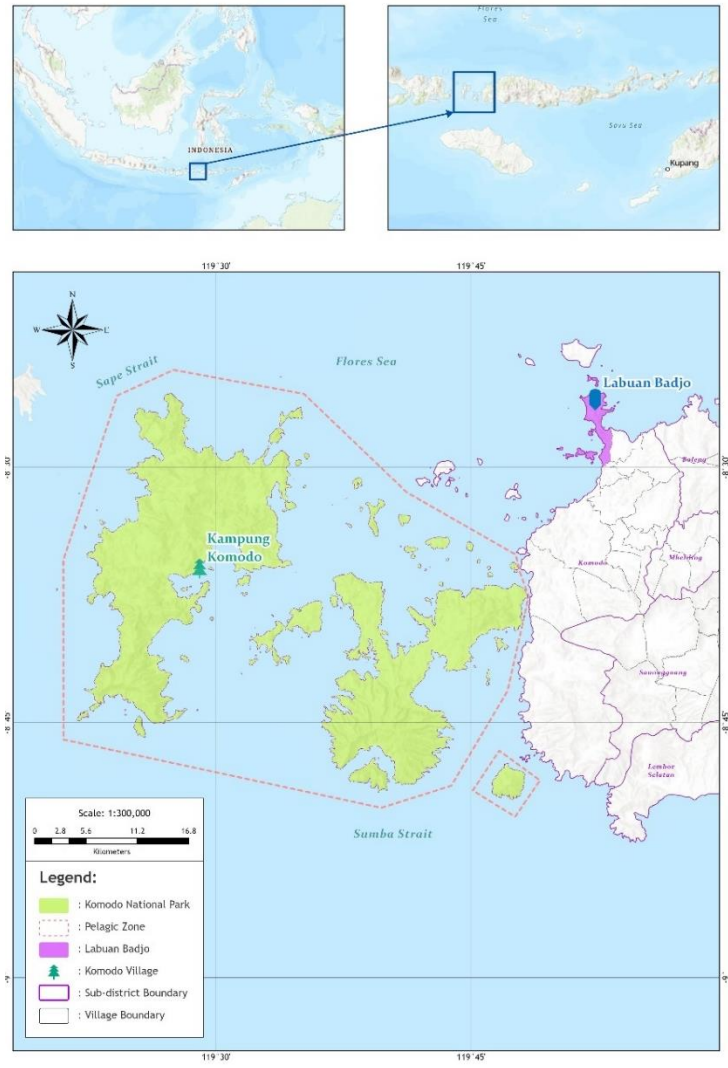
Figure 1. Geographic overview of the research area in the Komodo district, situated within the West Manggarai Regency, East Nusa Tenggara Province, Indonesia.

The demographic evolution in Labuan Bajo, marked by significant population increases through both natural growth and migration, underscores the dual-edged sword of tourism-led development. As people flock to the area for job opportunities, the pressure on resources, environmental sustainability, and community cohesion intensifies. Furthermore, the socio-economic structure, educational opportunities, and healthcare services play vital roles in shaping the community's ability to participate in and benefit from the tourism economy. The varying impacts of tourism, notably on income distribution, educational access, and healthcare quality, necessitate a deeper exploration of sustainable tourism's broader consequences. This context sets the stage for our research, underscoring the critical need to investigate the formulation and implementation of sustainable tourism initiatives. Such initiatives must not only safeguard Komodo's biodiversity but also enhance the socio-economic conditions of its

residents. Our study delves into these intricate dynamics, aiming to illuminate sustainable tourism's capacity to forge a harmonious balance between economic growth, environmental stewardship, and social inclusivity. Through this lens, we seek to enrich the dialogue on sustainable tourism, offering insights that could inform policy and practice in Komodo and beyond, ensuring that tourism development catalyzes comprehensive community well-being and ecological conservation.

2.2 Hypotheses development

The willingness of individuals to participate in conservation programs in Komodo, Indonesia, can be influenced by various factors, both in technical and social realms (Fig. 2). Prior research has identified key determinants that significantly affect community engagement in conservation efforts (Kuang and Lin, 2021; Nugroho and Numata, 2022; Wu et al., 2020; Zhang et al., 2020). These determinants encompass attitudes towards sustainable tourism, community involvement, environmental policies, and demographic factors (Chan et al., 2021; Demirović Bajrami et al., 2020; Grilli et al., 2021; Ibnou-Laaroussi et al., 2020).

The studies referenced efforts (Kuang and Lin, 2021; Nugroho and Numata, 2022; Wu et al., 2020; Zhang et al., 2020) offer broad insights into community engagement in conservation across different contexts. However, our observation of a "gap" is not in research on determinants per se but in detailed, context-specific applications that measure how these determinants play out in Komodo's unique conservation and tourism environment. Therefore, our hypotheses are formulated to bridge this gap by directly testing the identified determinants within the Komodo context, offering new empirical data and insights specific to this locale.

Hypothesis 1 (H1): A higher mean value of sustainable tourism engagement performance negatively impacts individuals' willingness to participate in conservation programs.

A higher average score in sustainable tourism engagement performance is associated with a decrease in individuals' willingness to participate in conservation programs. This hypothesis is based on the notion that individuals highly engaged in sustainable tourism might perceive their efforts as sufficient, leading to a reduced perceived need to participate further in conservation activities. This concept aligns with the theory of moral licensing, which suggests that past good deeds can make individuals less likely to engage in future beneficial actions (Merritt et al., 2010), as they feel they have already contributed positively. This phenomenon has been observed in various environmental contexts, indicating a potential inverse relationship between sustainable tourism engagement and willingness to participate in additional conservation efforts (Grilli et al., 2021; Nepal et al., 2022).

Hypothesis 2 (H2): A higher mean value of community and environmental involvement negatively impacts individuals' willingness to participate in conservation programs.

A higher average score in community and environmental involvement is associated with a decrease in individuals' willingness to participate in additional conservation programs. This hypothesis posits that extensive involvement in community activities might lead to a saturation effect (Gallagher et al., 2019; Leibold et al., 2004), where individuals feel they have already contributed significantly to environmental causes. As a result, they may perceive less need or have reduced motivation to engage in further conservation efforts. This concept aligns with the saturation theory in environmental psychology (Hidayetoglu et al., 2012; Seamon and Gill, 2016), which suggests that extensive engagement in specific environmental actions can lead to a decreased propensity for additional environmental engagement.
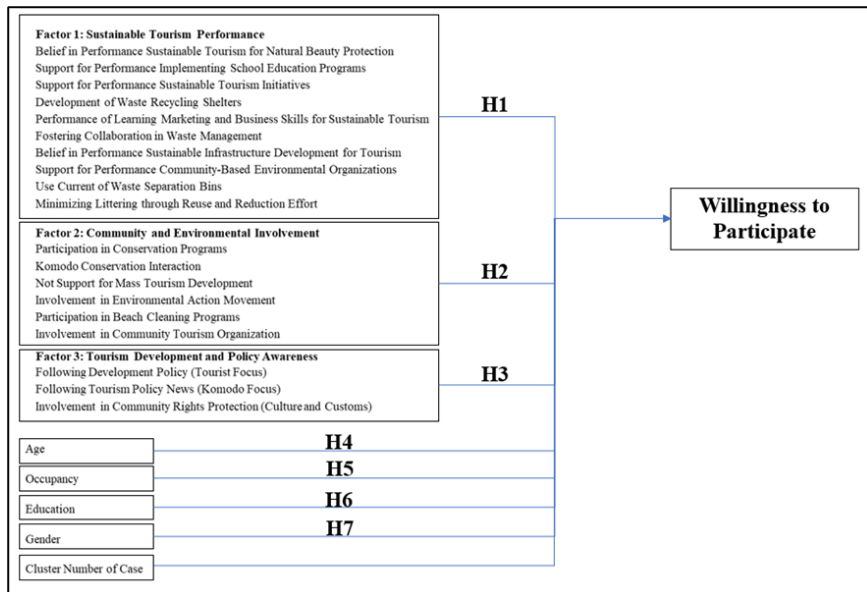
Figure 2. Hypotheses developed for willingness of individuals to participate in conservation programs in Komodo region.

Hypothesis 3 (H3): The mean value of tourism development and policy awareness influences individuals' willingness to participate in conservation programs.

The average level of tourism development and policy awareness is proposed to significantly impact individuals' willingness to participate in conservation programs. This hypothesis is grounded in the belief that awareness and knowledge of tourism development and policies can either motivate or discourage individuals from participating in conservation activities. This effect is contingent on how individuals perceive these policies, whether they see them as facilitative or barriers to conservation efforts. The relationship between policy awareness and environmental behavior has been explored in studies showing that greater awareness can lead to increased engagement in environmental activities (Gao and Tian, 2019; Suryawan and Lee, 2023a; Suryawan et al., 2024), depending on the perceived effectiveness and fairness of the policies.

Hypothesis 4 (H4): Age, specifically being older than 29 years (coded as 1), positively influences individuals' willingness to participate in conservation programs.

Age significantly affects the willingness to participate in conservation programs, with individuals older than 29 years (coded as 1) showing a greater propensity for involvement. This hypothesis is based on the premise that increased awareness and a sense of responsibility towards environmental conservation come with age. Older individuals, having more life experience and possibly greater exposure to environmental issues, may be more motivated to contribute to conservation efforts (Jarosz, 2023; Suryawan and Lee, 2023a).

Hypothesis 5 (H5): Occupational dependence on tourism (coded as 1) positively influences individuals' willingness to participate in conservation programs.

Occupational reliance on tourism (coded as 1) positively correlates with a willingness to participate in conservation programs. This hypothesis suggests that individuals whose livelihoods depend on tourism are more likely to engage in conservation activities (Holland et al., 2022), recognizing the direct relationship

between a healthy environment and the sustainability of their occupation.

Hypothesis 6 (H6): Possessing higher education (coded as 1) positively influences individuals' willingness to participate in conservation programs.

Higher education (coded as 1) predicts increased willingness to participate in conservation programs. This hypothesis draws on the notion that education broadens individuals' understanding of environmental issues and equips them with the knowledge to appreciate the importance of conservation efforts. Educated individuals are often more informed about environmental challenges and therefore may be more inclined to take active roles in addressing them (Uralovich et al., 2023).

Hypothesis 7 (H7): Gender, specifically being male (coded as 1), positively influences individuals' willingness to participate in conservation programs.

Gender, specifically being male (coded as 1), is hypothesized to positively influence the willingness to participate in conservation programs. This hypothesis is rooted in the gender differences observed in environmental behaviors, where societal roles and cultural norms may influence the inclination toward environmental activism (Bibi and Sartini, 2023; Rorintulus, 2023). However, this hypothesis acknowledges that gender roles are varied and context-dependent.

Through its carefully crafted hypotheses, our study seeks to fill a critical gap in the existing research by offering context-specific empirical data on the dynamics of conservation engagement in the Komodo district. This endeavor aims to augment the current literature with in-depth analysis and provide nuanced insights into the specific conservation efforts within this unique region. The survey instrument, detailed in Table 1 and presented in the local language, is meticulously designed to investigate the community's engagement determinants in sustainable tourism within the Komodo region. It is structured into three main sections, starting with an introductory narrative that briefly sets the stage for the survey's focus on sustainable tourism management. This initial section is intended to convey the survey's purpose clearly, helping respondents understand its significance and decide on their participation fully. Through this cohesive approach, our research strives to comprehensively understand the factors influencing conservation participation in Komodo, contributing valuable perspectives to the global discourse on sustainable tourism and environmental stewardship.'

Table 1. Item for EFA for sustainable Komodo conservation and protected area tourism

No	Question	Item
1	I believe in the performance of sustainable tourism for natural beauty protection	Belief in Performance Sustainable Tourism for Natural Beauty Protection
2	I support the performance of implementing education programs in schools	Support for Performance Implementing School Education Programs
3	I support the performance of sustainable tourism initiatives	Support for Performance Sustainable Tourism Initiatives
4	I am involved in the development of waste recycling shelters	Development of Waste Recycling Shelters
5	I perform in learning marketing and business skills for sustainable tourism	Performance of Learning Marketing and Business Skills for Sustainable Tourism
6	I foster collaboration in waste management	Fostering Collaboration in Waste Management
7	I believe in the performance of sustainable infrastructure development for tourism	Belief in Performance Sustainable Infrastructure Development for Tourism
8	I support the performance of community-based environmental organizations	Support for Performance Community-Based Environmental Organizations

No	Question	Item
9	I currently use waste separation bins	Use Current of Waste Separation Bins
10	I minimize littering through reuse and reduction effort	Minimizing Littering through Reuse and Reduction Effort
11	I participate in conservation programs	Participation in Conservation Programs
12	I often interact with Komodo conservation programs	Komodo Conservation Interaction
13	I do not support mass tourism development	Not Support for Mass Tourism Development
14	I am involved in an environmental action movement	Involvement in Environmental Action Movement
15	I participate in beach cleaning programs	Participation in Beach Cleaning Programs
16	I am involved in a local community tourism organization	Involvement in Community Tourism Organization
17	I follow the development policy with a tourist focus	Following Development Policy (Tourist Focus)
18	I am accustomed to following tourism policy news, especially in Komodo	Following Tourism Policy News (Komodo Focus)
19	I am involved in protecting local community rights (culture and customs)	Involvement in Community Rights Protection (Culture and Customs)

The survey we developed includes 19 carefully selected questions (listed in Table 1) that aim to evaluate the significance of various factors related to sustainable tourism in Komodo, derived from an extensive review of existing literature, insights from expert consultations, and the creation of new metrics. These questions, some of which are adapted from previous research to fit our study's specific context, and others entirely new, developed with expert guidance, focus on sustainable tourism practices and their management. Responses are collected using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), to gauge the perceived importance of each factor. The survey also includes a critical question asking respondents about their willingness to actively engage in sustainable tourism management actively, offering a simple yes or no choice to capture their intent. The final section of the survey gathers demographic information from participants, including gender, age, education level, income, and job status. To ensure the questionnaire's validity, we consulted six subject matter experts, conducting in-depth interviews and obtaining a thorough survey review. Their valuable feedback led to refined survey questions that more accurately reflect our research goals. A pilot test with seven volunteers confirmed the survey's practicality, indicating it was ready for wider distribution without further modifications. The reliability of the survey questions was confirmed through a Cronbach's alpha test, with results surpassing the recommended standards, demonstrating the high reliability of our measures (Suryawan and Lee, 2024; Ulhasanah and Goto, 2018).

2.3 Sample and data collection

The data collection was systematically disseminating questionnaires and in-depth interviews within the targeted communities. Aiming for a comprehensive overview, we engaged with a diverse sample size of 520 households, carefully selected through proportional systematic random sampling. This method ensured broad representation across various demographics and regions known for their proximity to tourism activities, specifically within the Manggarai Barat Regency. Trained personnel conducted one-on-one interviews, focusing on household members aged 18 and above to ensure informed consent and adult perspectives. The interviewers were equipped with skills to facilitate

open, ethical, and clear communication, ensuring that respondents fully understood the purpose of the study and the use of the information collected.

Interviewees were selected based on their availability and willingness to participate, ensuring a wide representation of the community, including heads of households, employed adults, and members involved in tourism-related occupations. In total, 548 interviews were attempted, with a successful completion rate leading to 520 usable responses. This discrepancy accounts for non-responses and incomplete questionnaires.

The questions we formulated for our interviews, as outlined in Table 1, were intricately designed to draw out detailed responses across several critical themes. These included the level of personal and household participation in conservation activities, the community's perceptions of tourism's impact on their social and environmental landscape, their awareness and attitudes towards the principles and practices of sustainable tourism, and how factors like gender and education influence these perceptions and activities. Aimed at unraveling the nuanced relationships between conservation efforts, tourism development, and the dynamics of community engagement, these questions serve as a cornerstone for our research. Through this carefully structured and ethically guided methodology, our study endeavors to provide a comprehensive analysis and contribute valuable insights into the ongoing discourse surrounding sustainable tourism and conservation efforts in the communities around Komodo National Park.

2.4 Analytical performance

Statistical analyses were performed using the Statistical Packages for Social Sciences (SPSS, version 24, IBM Corp., Armonk, NY). Preliminary analytical procedures in this research encompassed both exploratory factor analysis (EFA) and reliability assessment. Initially, EFA was applied to deduce the latent structure within a set of 19 items from the survey. Essential EFA quality indicators included: (1) the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) surpassing 0.70 and a significant Bartlett's test of sphericity ($p < 0.001$), (2) varimax rotation for component clarity, (3) Eigenvalues greater than 1 or explained variance exceeding 50%, and (4) factor loadings above 0.50 as thresholds for item inclusion (Makkar and Singh, 2021; Melkamu Asaye et al., 2022; Suryawan et al., 2023). The reliability of the Likert-scale questions was verified using Cronbach's alpha, with an acceptable range from 0.45 to 0.98, noting that values above 0.6 are typically deemed satisfactory.

Following the EFA, K-Means clustering was utilized to segment the dataset into distinct groups (Nandapala and Jayasena, 2020). This step aimed to identify homogeneous clusters of survey responses based on the extracted factors. The number of clusters was determined based on the elbow method, ensuring the most statistically appropriate segmentation. This clustering allowed for a nuanced understanding of different respondent profiles and their specific attitudes towards sustainable tourism. Given that the dependent variable, residents' willingness to participate (WTP) in sustainable tourism management, was binary, logistic regression was deemed an appropriate model to investigate its association with the exploratory factors identified through EFA. The model's robustness was assessed via: (1) the Omnibus test to ascertain model improvement over the null model, indicated by a Chi-square test p-value below 0.05, (2) the Hosmer & Lemeshow goodness-of-fit test, preferring models with larger p-values (greater than 0.05), and (3) the model's explanatory power, gauged by the percentage of correctly classified instances (Vicente and Reis, 2008).

An extensive literature review was undertaken before the fieldwork to establish a foundation for our research. Keywords such as "conservation participation,"

"community-based tourism," "sustainable development in Komodo," and "impact of tourism on local communities" were utilized across multiple academic databases, including Google Scholar, Scopus, and Web of Science. This search yielded over 200 relevant publications, further narrowed to 80 core articles and reports that directly informed our research objectives and methodology.

3. RESULTS AND DISCUSSION

Table 2 encapsulates the Exploratory Factor Analysis (EFA) results of a survey to unravel the latent constructs behind sustainable tourism in Komodo, Indonesia. The EFA discerned three distinct factors, each representing a specific dimension of attitudes and perceptions within sustainable tourism and conservation. The first factor, "Sustainable Tourism Engagement," is characterized by a robust eigenvalue of 6.916, explaining a substantial 33.896% of the variance within the data set. This factor includes items that reflect the respondents' beliefs and support for sustainable tourism practices, such as the performance of sustainable tourism for natural beauty protection and the importance of educational programs in schools. Notably, the factor loading for these items ranges from 0.775 to 0.852, indicating a strong correlation with the factor, and Cronbach's alpha for this factor is 0.938, suggesting excellent internal consistency among the items. Under "Community and Environmental Involvement," the second factor, the eigenvalue is registered at 3.984, accounting for 17.855% of the variance. This dimension covers aspects such as participation in conservation programs and interaction with Komodo conservation efforts, with factor loadings from 0.556 to 0.789. Notably, the item not supporting mass tourism development shows a loading of 0.723, suggesting a nuanced view among respondents. The reliability coefficient for this factor stands at 0.832, reflecting good internal consistency. The third factor, "Tourism Development and Policy Awareness," portrays an eigenvalue of 1.077, contributing to 11.291% of the variance. This factor aligns with the cognitive aspect of sustainable tourism, including awareness of tourism development policies and involvement in community rights protection, with items such as following development policy with a tourist focus showing a loading of 0.806. The reliability of this factor is also robust, with a Cronbach's alpha of 0.807.

The EFA overall exhibits an excellent measure of sampling adequacy with a Kaiser-Meyer-Olkin (KMO) value of 0.924, well above the acceptable threshold, and Bartlett's Test of Sphericity reaches statistical significance ($p < 0.001$), reinforcing the appropriateness of the factor analysis for the data. Moreover, the total variance explained by the factors combined amounts to 63.041%, indicating that most of the variability in sustainable tourism engagement, community involvement, and policy awareness among residents can be encapsulated within these factors. These results are supported by the Cronbach's alpha scores, which exceed the commonly accepted threshold of 0.6 (Makkar and Singh, 2021; Melkamu Asaye et al., 2022; Suryawan et al., 2023), indicating that the survey items are reliable measures of the constructs they are intended to assess.

Table 2. Results of EFA

Factor and Items	Loadings	Eigenvalues	% of variance	Cronbach's alpha
Factor 1: Sustainable Tourism Performance		6.916	33.896	0.938
Belief in Performance Sustainable Tourism for Natural Beauty Protection	0.832			
Support for Performance Implementing School Education Programs	0.820			
Support for Performance Sustainable Tourism	0.815			

Factor and Items	Loadings	Eigenvalues	% of variance	Cronbach's alpha
Initiatives				
Development of Waste Recycling Shelters	0.806			
Performance of Learning Marketing and Business Skills for Sustainable Tourism	0.805			
Fostering Collaboration in Waste Management	0.791			
Belief in Performance Sustainable Infrastructure Development for Tourism	0.789			
Support for Performance Community-Based Environmental Organizations	0.779			
Use Current of Waste Separation Bins	0.778			
Minimizing Littering through Reuse and Reduction Effort	0.775			
Factor 2: Community and Environmental Involvement		3.984	17.855	0.832
Participation in Conservation Programs	0.789			
Komodo Conservation Interaction	0.778			
Not Support for Mass Tourism Development	0.723			
Involvement in Environmental Action Movement	0.712			
Participation in Beach Cleaning Programs	0.694			
Involvement in Community Tourism Organization	0.536			
Factor 3: Tourism Development and Policy Awareness		1.077	11.291	0.807
Following Development Policy (Tourist Focus)	0.806			
Following Tourism Policy News (Komodo Focus)	0.770			
Involvement in Community Rights Protection (Culture and Customs)	0.746			
KMO and Bartlett's Test				
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.924			
Bartlett's Test of Sphericity Approx. Chi-Square	5526.543; p < 0.0001			
Total % of Variance	63.041			

Furthermore, the high loadings of individual items on their respective factors provide empirical support for the conceptual framework that underlies the survey (Nguyen et al., 2023; Suhardono et al., 2024; Suryawan and Lee, 2024), suggesting that the residents' perceptions and attitudes towards sustainable tourism are multifaceted and deeply rooted in the specifics of the Komodo context. The elucidation of these factors through EFA is critical, as it allows for a structured approach to understanding the complex interplay of variables that influence sustainable tourism practices. The detailed loadings and reliability scores presented in Table 2 give researchers and policymakers actionable insights into which areas of sustainable tourism require emphasis and how they might tailor interventions to foster greater community engagement and policy coherence.

Table 3 delineates the findings from a K-Mean Cluster Analysis that has been applied to group individuals according to their engagement with sustainable tourism, community involvement, and policy awareness in Komodo, Indonesia. This statistical method segments respondents into clusters based on their proximity to the mean values of the factors considered. In sustainable tourism engagement, the analysis identifies a cluster with a markedly high mean score, indicative of a strong bias towards sustainable

tourism practices. This cluster, which could be referred to as "Pro-Sustainable Tourism," stands in contrast to the "Low Engagement" and "Low Awareness and Involvement" clusters, where the mean scores fall below zero, signaling an unwillingness or lesser involvement in such activities. The "Community-Focused" cluster, with a mean score below zero, signals moderate engagement with sustainable tourism endeavors.

Table 3. Results of K-Mean Cluster Analysis

Factor	Cluster				Mean Square	F
	Low Engagement	Community-Focused	Pro-Sustainable Tourism	Low Awareness and Involvement		
Sustainable Tourism Performance	-0.369	-0.632	1.579	-0.385	146.072	933.010; p < 0.001
Community and Environmental Involvement	-1.153	0.647	0.217	-1.035	97.663	222.971; p < 0.001
Tourism Development and Policy Awareness	1.192	0.041	0.065	-1.075	68.854	113.716; p < 0.001

When it comes to community and environmental involvement, a clear dichotomy emerges. One cluster showcases a robust positive mean score, suggesting that individuals in this group are significantly involved in community-based environmental activities. This contrasts with the "Low Engagement" and "Low Awareness and Involvement" clusters, which show substantially negative mean scores, denoting minimal community and environmental involvement. The factor of tourism development and policy awareness yields a cluster with a high positive mean, highlighting a group with acute awareness and likely knowledge of tourism policies and development. The negative means in other clusters point towards a lower level of policy awareness or perhaps a different focus in their engagement with tourism. Statistically significant F-values for each factor confirm the distinctness of the clusters, with p-values indicating the high reliability of the clustering. Each factor's mean square value, a measure of variance within the clusters, further quantifies the spread and distinctiveness of the groups identified.

Table 4 illustrates the segmentation of respondents by examining cluster analysis in the context of sustainable tourism in Komodo, Indonesia. The k-means cluster analysis reveals four distinct classes that offer insight into community engagement patterns in the Komodo district. Class 1, characterized by low engagement, consists mainly of island residents with incomes below IDR 2,000,000, displaying minimal involvement in sustainable tourism, with a slightly higher proportion of single and female members, particularly within the 30-39 age range. In contrast, Class 2, which is exclusively female and has a higher income level, shows a community-focused approach to sustainability, with a notable presence of younger individuals aged 18-29 and a predominance of married status.

Class 3 represents individuals actively engaged in pro-sustainable tourism activities and includes the highest number of urban residents compared to islanders. This class encompasses a broader range of income levels, particularly the IDR 3,000,001-4,000,000 bracket, and shows a balanced mix of marital statuses, with a significant proportion of participation among individuals in the 30-39 age bracket, indicating active engagement with sustainable tourism practices. Lastly, Class 4, marked by low awareness and involvement, shares similarities with Class 1 regarding the representation of urban residents and low-income levels. This class has a fairly

balanced distribution of marital status and gender, with a subtle male majority. Notably, it has fewer younger individuals and a larger population over the age of 39, suggesting variations in engagement and awareness across different age groups. Together, these classes underscore the diverse ways in which demographics such as location, income, marital status, gender, and age intersect to shape the landscape of sustainable tourism and conservation efforts within the region. The analysis provides a framework for understanding the nuances of community engagement, highlighting the importance of tailored strategies to foster inclusive and effective participation across the spectrum of the Komodo district's population.

Table 4. Segmentation of Cluster Analysis

Variable		Class 1		Class 2		Class 3		Class 4	
		Low Engagement		Community-Focused		Pro-Sustainable Tourism		Low Awareness and Involvement	
Settle-ment	Urban	30	5.77%	124	23.85%	62	11.92%	51	9.81%
	Islands	39	7.50%	104	20.00%	68	13.08%	42	8.08%
	χ2 = 3.702, df = 3, pvalue < 0.001								
Income	< IDR 2.000.000	21	4.04%	75	14.42%	37	7.12%	32	6.15%
	IDR 2.000.000 - 3.000.000	21	4.04%	84	16.15%	50	9.62%	35	6.73%
	IDR 3.000.001-4.000.000	10	1.92%	26	5.00%	10	1.92%	9	1.73%
	>IDR 4.000.000	17	3.27%	43	8.27%	33	6.35%	17	3.27%
	χ2 = 6.321, df = 9, pvalue = 0.707								
Marital Status	Married	37	7.12%	127	24.42%	68	13.08%	42	8.08%
	Single	32	6.15%	101	19.42%	62	11.92%	51	9.81%
	χ2 =2.976, df = 3, pvalue = 0.395								
Gender	Male	38	7.31%	150	28.85%	73	14.04%	48	9.23%
	Female	31	5.96%	78	15.00%	57	10.96%	45	8.65%
	χ2 = 7.303, df = 3, pvalue =0.063								
Age	18-29	24	4.62%	80	15.38%	64	12.31%	40	7.69%
	30-39	30	5.77%	91	17.50%	50	9.62%	31	5.96%
	>39	15	2.88%	57	10.96%	16	3.08%	22	4.23%
	χ2 = 12.695, df = 6, pvalue = 0.048								

The analysis reveals that both urban and island residents favor sustainable tourism, though for slightly different reasons. Urban dwellers, with easier access to resources and more exposure to sustainability initiatives, are likely to engage in sustainable tourism practices. This suggests that their participation is influenced by the availability of information and resources that foster a sustainability-oriented mindset. Conversely, island residents display a similar commitment to sustainable tourism, largely attributed to their livelihoods' direct reliance on a healthy natural environment. This distinction underlines the significant impact of geographical location on individuals' approach to sustainable tourism. On the other hand, island residents showcase a commitment to sustainable tourism, which might be attributed to their direct dependence on the natural environment for their livelihoods (Basile et al., 2021; Nurhasanah and Van den Broeck, 2022). This suggests that geography plays a vital role in shaping individuals' sustainability outlook and practices. The income brackets reveal a compelling narrative; individuals with middle-range income levels demonstrate a stronger community focus, potentially indicating a more collective approach to environmental responsibility. Interestingly, those at the polar ends of the income spectrum show tendencies toward lower engagement or awareness, which could be due to differing priorities or levels of empowerment to participate in such activities. Higher-income individuals might not

perceive the immediate benefits of active involvement, while lower-income residents might face barriers to participation, such as lack of time or resources.

These findings underscore the importance of tailoring sustainable tourism initiatives to resonate with the demographic realities of local populations. Recognizing each demographic's unique contributions and barriers is crucial for crafting effective policies and interventions. For instance, strategies targeting urban residents might focus on leveraging their access to resources for sustainability, while for islanders, emphasizing the conservation of their natural habitat, which is integral to their livelihood, could be key. Furthermore, initiatives that address the barriers faced by lower-income groups, whether through educational programs or community-based projects, can work towards a more inclusive approach to sustainability (Devaraj et al., 2021; Mohd Satar et al., 2021). Similarly, understanding the gender dynamics at play can help in developing gender-sensitive strategies that empower all individuals to contribute to sustainable tourism efforts (Angula et al., 2021; Pécot et al., 2024).

Table 5 showcases the coefficients from a logistic regression model aimed at understanding the factors influencing the local community's likelihood to engage in tourism management programs in Komodo, Indonesia. The model integrates various exploratory variables, such as levels of sustainable tourism engagement, community and environmental involvement, and tourism development and policy awareness. The model reveals that sustainable tourism engagement is negatively associated with the propensity to participate in tourism management programs. A coefficient of -0.813 suggests that higher engagement in sustainable tourism activities corresponds to a lower likelihood of participation, potentially indicating a sense of sufficiency in their contribution or a form of moral licensing where previous good deeds may reduce the inclination to undertake new ones. This could also reflect time constraints (Kannan and Veazie, 2023), as engagement in one area might lead to reduced availability for others.

Table 5. Coefficients of the logistic model explaining community propensity to participate in a tourism management program.

Exploratory variables	β	S.E.	Exp(β)	p-value
Factor 1: Sustainable Tourism Engagement (Mean value of Item in Factor 1)	-0.813	0.189	0.444	<0.001
Factor 2: Community and Environmental Involvement (Mean value of Item in Factor 2)	0.063	0.187	1.065	0.734
Factor 3: Tourism Development and Policy Awareness (Mean value of Item in Factor 3)	0.488	0.171	1.630	0.004
Age (1 if more than 29 year old, Otherwise=0)	0.465	0.195	1.592	0.017
Occupancy (1=Tourist dependent, Otherwise=0)	0.383	0.196	1.467	0.050
Education (1=Higher education, Otherwise=0)	1.028	0.194	2.796	<0.001
Gender (1=Male, Otherwise=0)	0.442	0.193	1.556	0.022
Cluster Number of Case (Class 1 until 4)	0.355	0.139	1.426	0.011
Constant	-0.753	0.924	0.471	0.415
-2LL	641.487			
Hosmer & Lemeshow test	0.522			
Classification accuracy	65.38			

Community and environmental involvement, however, does not appear to have a statistically significant impact, with a p-value of 0.734, which suggests that this factor alone, without considering other contextual variables, does not markedly influence participation in tourism management programs. This aligns with findings from Aman et al. (2022) and Zhang et al. (2020) who argue that community involvement is complex

and often influenced by a web of social, economic, and cultural factors. Tourism development and policy awareness show a positive relationship with the likelihood of participation, indicated by a coefficient of 0.488. This underscores the importance of awareness and understanding of tourism policies as a driver for community engagement (Goebel et al., 2020; Roxas et al., 2020), that informed communities are more likely to contribute actively to tourism-related initiatives.

Demographic variables significantly enrich our model by highlighting the impact of age on conservation participation, revealing a nuanced interplay between life stages, environmental awareness, and community responsibility. Older adults, especially those over 29 years, often experience stability in their lives, marked by settled lifestyles that afford them the time and resources to engage more actively with community and environmental issues. This starkly contrasts with younger individuals who are typically immersed in establishing their livelihoods and employment, and managing early life transitions, making older adults' involvement in conservation not just a choice but a viable action enabled by their circumstances. The positive influence of age is evident as those older are more inclined towards conservation, driven possibly by a stronger sense of community responsibility and a deeper understanding of the long-term benefits of sustainable tourism and conservation (Demirović Bajrami et al., 2020; Mathew and Nimmi, 2022; Suryawan and Lee, 2023a). This commitment to environmental stewardship is often rooted in a desire to ensure that future generations inherit a thriving natural world, reflecting a generational perspective shaped by firsthand environmental changes and the historical context of conservation efforts (Darkson et al., 2020; Yasué et al., 2020). Such a broad understanding enhances older individuals' willingness to engage in conservation, motivated by a profound sense of duty to their community and an earnest commitment to protect the environment for the benefit of future generations.

Education emerges as a strong predictor of participation, with those having higher education showing an increased propensity to engage in such efforts. This finding echoes evidence that education enhances understanding and appreciation of sustainable practices (Tu and Wu, 2021; Žalėnienė and Pereira, 2021). Alongside education, occupation and gender are key factors positively influencing conservation participation. In the context of many Indonesian communities, the influence of traditional gender roles, deeply ingrained through cultural practices (Bibi and Sartini, 2023; Rorintulus, 2023), becomes evident as these norms delineate specific tasks as more suitable for men or women. This cultural and gendered framework often positions men, particularly in conservation work requiring physical or field-based labor, in roles perceived as more fitting for their gender (Poor et al., 2021; Retnaningsih et al., 2022). Such gendered perceptions contribute to a higher rate of male engagement in formal conservation roles, underpinned by a greater likelihood of men obtaining the necessary qualifications or accessing relevant training opportunities. Moreover, men's dominant role in decision-making within communities and households further enables their active participation in conservation (Aswandi and Kholibrina, 2021; Yuliati et al., 2024), especially in capacities that require leadership or external negotiation.

Interestingly, the Bajo communities present a contrasting narrative to the prevalent gender norms in conservation participation within Indonesia. Despite the general trend of low education levels among its members, the Bajo are committed to gender parity, offering equal decision-making opportunities for both men and women (Maulidyna et al., 2021). This egalitarian approach within households sees a division of decision-making responsibilities, where men tend to lead in educational decisions, while women take precedence in economic, social, and religious domains (Halim et al., 2020). This

unique model within Bajo communities illustrates how cultural contexts and social structures can vary significantly across Indonesian communities, influencing the dynamics of gender roles and participation in conservation efforts. A case study that further exemplifies the challenges associated with gender norms and participation in conservation is observed in the tourism sector of Bali (Cukier et al., 1996) and Yogyakarta (Musadad, 2018). Here, existing male leadership and networking systems significantly marginalize women, limiting their access to information, participation, and decision-making opportunities. Initial meetings in these areas were notably male-dominated, particularly by members of youth organizations, underscoring a systemic issue of gender disparity in conservation and tourism-related initiatives. This scenario reflects the broader challenges faced by women in conservation across Indonesia, highlighting the need for more inclusive practices and policies that recognize and address gender-specific barriers to participation.

The model's constant and the cluster number of case coefficients suggest that additional, unobserved heterogeneities influence the propensity to participate, which may require further investigation to comprehend the nuances of community engagement in Komodo. The logistic regression model's goodness-of-fit, evaluated through the Hosmer & Lemeshow test, indicates an adequate fit with a p-value of 0.415, and classification accuracy of 65.38% suggests a moderate level of predictive power. These results corroborate the model's effectiveness in capturing the essential factors impacting participation, although there is room for improvement.

The inverse relationship between sustainable tourism engagement and willingness to participate suggests that policymakers should consider the potential of 'sustainability fatigue.' As individuals become extensively involved in certain sustainability activities, their willingness to take on additional responsibilities might wane. To mitigate this, there is a need for policies that provide recognition and respite for highly engaged individuals, perhaps through incentives or shared responsibilities, ensuring continued engagement without burnout. Awareness of tourism development and policy is a pivotal motivator for community involvement (Khatibi et al., 2021). This emphasizes the need for transparent communication and education initiatives to keep communities informed and engaged with policy developments. Creating platforms for dialogue and feedback can empower residents to participate more actively in decision-making processes related to tourism (Moosavi and Browne, 2021; Temeljotov Salaj et al., 2020). Future research should delve into the qualitative aspects of why individuals with high levels of sustainable tourism engagement might be less willing to participate in management programs. Exploring the psychological and social underpinnings of this phenomenon could yield deeper insights. There is also a need to explore the complex interplay between income levels and participation. Moreover, the logistic model's moderate classification accuracy indicates that unexplored variables might affect participation. Future studies could expand on the variables considered, potentially including cultural, social, and psychological factors that influence community engagement in sustainable tourism.

4. CONCLUSIONS

Exploring factors influencing community participation in sustainable tourism management in Komodo, Indonesia, has yielded a multifaceted understanding of the interplay between individual behaviors, demographic characteristics, and policy awareness. The research employed robust analytical techniques, including exploratory factor analysis and logistic regression, to discern the patterns and predictors of community engagement. The findings underscore that while sustainable tourism

engagement is generally perceived as a positive pursuit, a complex relationship exists where increased personal involvement in sustainable tourism activities may paradoxically diminish the likelihood of further participation in broader tourism management programs. This insight is crucial for sustainable tourism policymakers and practitioners, as it indicates the need for strategies that recognize and address potential sustainability fatigue among the most active community members. Demographics play a significant role in shaping participation in sustainable tourism initiatives. The research highlights the importance of age, education, occupation, and gender as critical determinants. Older residents, those with higher education, individuals whose livelihoods are tied to tourism, and males are more inclined to participate in tourism management programs. These findings suggest that targeted educational campaigns and inclusive policies catering to these demographic groups' specific needs and motivations could enhance overall community engagement. The model's classification accuracy points to a moderate level of predictiveness, suggesting that while the identified factors are significant, other unexamined elements may also impact participation. Future research should consider these additional factors, including psychological motivations, cultural values, and social norms.

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