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Community Engagement and Human-Wildlife Conflict Management in Kenya

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Abstract: **In Kenya, an estimated 70% of wild animals live outside protected areas, which increases human-wildlife conflicts in areas of human dominance. These have serious consequences for livelihoods and elephant populations, leading to retaliatory killings of elephants. However, despite increased focus on technology-based solutions, current studies have highlighted contextual, methodological, and conceptual gasp. This study filled these gaps by assessing effect of community engagement on human-wildlife conflict management in Kenya. The study was anchored on Socio-ecological Systems Theory. The current study used a descriptive research approach. targeting the 320 wildlife conservation organizations in Kenya. A sample size of 385 respondents was determined using the formula suggested by Daniel and Cross and respondents identified using stratified proportionate sampling method. Data was collected using structured questionnaire and focus group discussion technique. Qualitative data was analysed using thematics analysis and quantitative data analysed to yield descriptive statistics. The research found that community engagement ($B = 0.840$, $\beta = 0.685$, $t = 12.396$, $p<0.001$) contributed to human-wildlife conflict management in a positive and statistically significant way. It concludes that community engagement contributed to conflict prevention and conflict resolution. Thus, human-wildlife conflict management can be conducted efficiently through community participation. The recommends for conservation officers to encourage community engagement through the inclusion of indigenous knowledge and creating an integrated information exchange system with standardized data formats.**

Keywords: **Community Education. Community Engagement, Human-Wildlife Conflict Management, Integration of Local Knowledge, Participatory Sensing Platform.**

1. INTRODUCTION

1.1 Background to the Study

Human-wildlife conflicts (HWC) occur when humans and wildlife have negative interactions, usually owing to competition for shared natural resources (Jebet *et al.*, 2024). In recent years, the number and severity of such encounters have increased, owing mostly to fast human population development, which has resulted in human settlements encroaching on wildlife habitats. HWC is triggered by rising human populations, climate change and variability, land use transformation, and the associated habitat degradation, fragmentation, and loss (Johansson *et al.*., 2025). Globally, conflicts in human-dominated ecosystems provide a substantial challenge to biodiversity conservation (Mukeka *et al.* 2019).

Globally, HWC management has transformed from reactive control to integrated and adaptive coexistence of human and wildlife populations (DFO Sarpang, 2025; Megiroo, 2026). The Conflict to Co-existence (C2C) Strategy of Dekiling Gewog has been developed accordingly with the involvement of forestry officers, local government authorities, and communities. Several mitigation measures are being employed to reduce HWC; however, the adoption of these measures may be hindered by the high costs of these measures (Montero-Botey *et al.*., 2022; Senkondo *et al.*., 2024).

In Africa, empirical studies have demonstrated that HWC is an endemic problem, where local communities report direct losses from crops and livestock, and adopt various traditional and contemporary approaches to mitigate the risks (Muhanga, 2025). In Ethiopia, such conflicts often lead to human reprisals against wildlife, hence threatening existing biodiversity

conservation programs (Guadu *et al.*, 2026). In the case of Tanzania, crop raids by African buffaloes were common, and the local population mainly employed guarding, fire, torch, and shouting, with electric fencing also used in commercial plantations to deter losses from buffaloes (Hariohay *et al.*, 2025; Muhanga, 2025).

In another case, where the researchers conducted the study in northern Zimbabwe, they found that spotted hyena, lion, and leopard raids on livestock were the main causes of HWC, and the existing mitigation strategies were inadequate (Matseketsa *et al.*, 2019; Chakuya, 2026). Guarding and barriers were employed around Lake Mburo National Park, with effectiveness depending on the type of wildlife (Kembabazi *et al.*., 2024). In the Murchison Falls National Park, trenches, traditional methods, and guarding reduced crop and animal damage due to wildlife. However, the limitations faced in this approach impeded effectiveness (Nalyaka, 2022). Community engagement around Kibale National Park has been successful in improving attitudes towards wildlife, thus improving the effectiveness of mitigating human-wildlife conflict (Kolinski & Milich, 2021). This body of research emphasizes the value of context-driven and locally informed approaches that combine scientific knowledge with traditional knowledge, and which support a sustainable coexistence of humans and wildlife. Research carried out in Uganda has shown that the effectiveness of mitigating HWC is diverse depending on the type of wildlife.

In Kenya, studies have focused on the causes of HWC as well as the effectiveness of the management strategies put in place to mitigate such effects on the local communities and wildlife (Mwadime & Mbataru, 2022). A study carried out on the people who reside around Meru National Park found that there is a highly elevated awareness level regarding HWC (M'ibui *et al.*., 2024). It was important to ensure that there is cooperation between different stakeholders such as the Kenya Wildlife Service (KWS), the local communities, and the government in mitigating human–wildlife conflict. A study carried out in Taita-Taveta County found that there is a significant enhancement of effectiveness in the management of HWC through the use of public participation and knowledge levels. (Mwadime & Mbataru, 2022). In Laikipia County there is a significant role played by land use planning in the mitigation process through the training carried out by private organizations (Kamande *et al.*., 2023).

The management of HWC management is often gauged in terms of reduced conflict Incidents (nature of interactions between humans and wildlife), improved response times (and operational efficiency (effectiveness of HWC management systems in reducing the cost of managing HWC while increasing the effectiveness of HWC management systems) (Chakuya *et al.*, 2025). Conflict incidents measure the change in the nature of HWC over time in order to gauge whether the management systems of HWC are effective in managing HWC. (Mukeka *et al.*., 2020).

The operational efficiency in the HWC management is measured through the amount of time and economic costs incurred due to the presence of wildlife and the conflicts that may occur as a result M'ibui *et al.*., 2024. The study conducted in Amboseli and Mt. Kenya ecosystems quantified the economic costs incurred as well as the time taken in guarding the farms (Manoa *et al.*., 2021). There were observed differences in the opportunity costs in different ecosystems, thus showing the level of efficiency or inefficiency in the application of the strategies to mitigate the conflict with the aim of reducing the overall costs incurred. When the perceived benefits as well as the awareness are taken into consideration, such as the fact that only a minority of the Meru communities were aware that they benefited from living near the protected area, it is evident that the operational strategies are not only being implemented but are also being accepted with the aim of reducing the burden associated with the conflict (M'ibui *et al.*., 2024).

However, Kenya, like many developing countries, has experienced exponential human population expansion in recent decades, necessitating widespread land conversion for settlement, agricultural, and infrastructure development (Mukeka *et al.*, 2019). In response to those difficulties, the development of successful and adaptable human-wildlife conflict mitigation measures necessitates the incorporation of community engagement. This not only leads to better data collection, but the local population also owns the conflict resolution strategies, creating a sense of cooperation between the local population and the authorities (Ojija *et al.*., 2025).

1.2 Statement of the Problem

In Kenya, around 70% of wildlife lives outside the protected lands including national parks, reserves, and conservancies in human-inhabited environments (Johansson *et al.*., 2025). This highlights the weakness in conservation measures that primarily rely on protected lands since they overlook the human-wildlife interface outside the protected zones. The failure of these measures is even more prominent in ecosystems like the Greater Tsavo landscape where the African elephant was responsible for 61.6% of the total 39,022 human-wildlife conflicts from 1995 to 2017 (Mukeka *et al.*., 2020). In addition,

within the period between 2004 and 2018, there were three common categories of human-elephant conflict contributing to 97% of the overall conflicts: 62.46% of human security threat, 32.46% of crop raiding, and 2.33% of property damage (Munyao *et al.*., 2020). These instances, which include crop loss, destruction of infrastructure, and threats to human life, threaten food security and rural livelihoods while encouraging retaliatory killings (Von Hagen *et al.*., 2023). The magnitude and multi-dimensional aspect of such conflicts necessitate a holistic approach in managing them, one that goes beyond the traditional models of conservation. While previous studies have shown the role played by integrating artificial intelligence (AI) in addressing human-wildlife conflict, there are still several areas of improvement that should be addressed. They include contextual gaps (Johansson *et al.*., 2025), weaknesses in the methodology employed (Fidino *et al.*., 2022), and conceptual discrepancies (Abed *et al.*., 2025; Govindaprabhu & Sumathi, 2024). Thus, this study filled the aforementioned gap by analyzing the impact of AI on human-wildlife conflict management in Kenya.

1.3 Objectives of the Study

The main objective of this study was to assess the effect of community engagement on human-wildlife conflict management in Kenya.

2. LITERATURE REVIEW

2.1 Theoretical Literature Review

In this section, the theoretical underpinnings pertinent to the incorporation of community engagement in the management of human-wildlife conflict (HWC) were reviewed. Focusing on the Socio-ecological Systems Theory, this review provided an outline for understanding how community engagement collaborated with human, ecological, and institutional systems to influence HWC outcomes.

2.1.1. Socio-Ecological Systems (SES) Theory

Socio-Ecological System (SES) Theory, created by Ostrom (2009), is an interdisciplinary paradigm to understand the interconnection between human and ecological systems and their impact on resource management outcomes. In particular, SES theory is based on the concept that the sustainable resource management is possible because of the interaction of resource system, resource users, governance institution and ecology, cooperation, collective action, local knowledge, and adaptive governance (Ostrom, 1990, 2009; McGinnis & Ostrom, 2014). At the same time, the SES theory assumes that human and ecological systems are interrelated, that resource management is possible collectively for communities by developing appropriate institutions, and inclusive resource governance and local participation promote sustainability. The SES theory is subject to critique concerning the complexity of its concepts, lack of forecasting capacity and disregard for inequalities and elitism (Cumming, 2011; Cleaver, 2012; Fabinyi et al., 2014).

The SES theory offers a relevant theoretical framework for this research since it helps in understanding how community engagement can assist in managing human-wildlife conflicts in Kenya using collaborative decision-making, wildlife monitoring, information sharing, prevention of conflicts, and adaptive conservation measures. This is because the SES theory forms the basis of the main aim of the study where community engagement is seen as part of the socio-ecological governance process whose success relies on the relationship between the communities, wildlife, conservation organizations, and governance..

2.2 Empirical literature review

Community engagement has become increasingly important for solving the problem of human-wildlife conflict (HWC). T current empirical research addresses how public engagement can affect HWC and the effectiveness of conservation programs. These studies indicate that although community engagement positively impacts people's awareness, attitudes, and participation in conservation-related activities, the impact on HWC is less clear and dependent on the circumstances. In Kenya, Mwadime and Mbataru (2022) concluded that engaging affected communities leads to improved attitudes towards conservation and greater acceptance of the mitigation process. Participatory monitoring also contributes to better consensus-building in conservation governance. Nevertheless, the study mostly considers public participation in terms of knowledge awareness rather than participatory governance or co-management, and its cross-sectional nature hinders causality inference. Moreover, its concentration on one county poses a contextual constraint for the results' generalization in Kenya's heterogeneous ecological setting.

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On a different note, complementing the Kenyan viewpoint, Nkansah-Dwamena (2023) study results suggest that community engagement holds significant promise in improving coexistence between humans and animals; however, lack of effective community engagement considerably diminishes conservation efficacy. This study also underscores that economic benefits accrued from conservation zones greatly influence the degree of community tolerance towards wildlife. Although contributing positively to research on the topic, this study is also characterized by some limitations. First, the process of engagement is often impeded by poor levels of trust, inadequate collaboration between stakeholders, and insufficient participation of local communities in decision-making. While providing valuable insights into the qualitative aspect of the problem, this study fails to measure quantitatively the association between engagement and HWC outcomes.

Continuing on the same line of inquiry, Megiroo (2026) concluded that the sustainable management of human-wildlife conflicts depends on good collaborative governance, appropriate systems of benefits sharing, and effective wildlife conservation education. On the other hand, the study is based on a relatively smaller sample and mainly focused on mitigation practices rather than community participation. In another related study, Manyama and Gayo (2026) shows that persons who benefit directly from conservation practices are more likely to engage in conservation activities. Nevertheless, engagement is understood solely in terms of participation in conservation practices without establishing causality between engagement and reduced conflict incidents.

It is clear that community engagement improves awareness, participation, and positive attitudes about conservation and wildlife management. At the same time, they show that there are continued limitations both theoretically and practically. Contextually, researches in this field have been carried out either outside or inside but in specific areas of Kenya. In addition, community engagement is perceived solely as awareness or participation in conservation activities and not co-management of HWCs. However, methodologically, there seems to be an overreliance on cross-sectional and descriptive research designs, which makes it difficult to demonstrate causality between community engagement and real declines in human-wildlife conflict. Thus, there is still a dearth of empirical studies that examine how community engagement contributes to real reductions in human-wildlife conflicts in Kenya.

3. RESEARCH METHODOLOGY

3.1 Research design

The current study adopted a descriptive research approach, which was chosen for its ability to methodically observe and measure the properties of the events being studied. This methodology captures a complete picture of study variables and indicators without changing them, guaranteeing that the study authentically represents real-world events (McCombes, 2023).

3.2 Target Population

The target population comprised of 320 wildlife conservation organizations in Kenya, where the unit of observation was the 320 directors of Wildlife and Community Service and 244 community leaders from the 700,000 households neighbouring the wildlife conservation (Otieno, 2020). This means that the study targeted a total of 564 senior staff and community leaders.

3.3 Sampling Techniques

Stratified proportionate sampling was a suitable technique for use in the study because the study population is heterogeneous and consists of different segments of respondents, such as members of wildlife conservation organizations and community leaders, whose perceptions and experiences about HWC management may vary greatly from one another. The number of participants drawn from each stratum will be allocated proportionately according to the size of the strata in relation to the population as a whole.

3.4 Sample Size

The sample size was determined using the formula suggested by Daniel and Cross (2018) expressed as;

$$n = \frac{Z^2.P.(1-P)}{\sigma 2(N-1)+\chi 2(1-P)} \quad \ldots\ldots\ldots\

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Z = Z-score corresponding to desired confidence level (e.g., 1.96 for 95%)

p = estimated population proportion (prevalence); use 0.5 if unknown

d = desired precision (margin of error), e.g., 0.05 for ±5%

Thus,

$n = \frac{(1.96)x1.96x0.5x(1-0.5)}{([0.05x0.05])}$

$n = \frac{3.8416 \cdot 0.25}{0.0025}$

$n = \frac{0.9604}{0.00205} = 384.16$

n = 385

Since the population was small (less than 10,000), finite population correction (FPC) was used. The formula was

$n_{adj} = \frac{n}{1+\frac{(n-1)}{N}}$ ..... (3.2)

N = population size

n = sample size from previous formula

$n_{adj} = \frac{384}{1+\frac{(384-1)}{564}} = = \frac{384}{1+\frac{383)}{564}} = = \frac{384}{1+0.679} = \frac{384}{1.679} = 228.16 = 229$

Thus, the sample size was 229 respondents drawn from the community leaders and wildlife conservation organizations in Kenya. In this case, the sampling factor (229/564) was 0.406. So, samples from the community leaders were 99 (0.406 x 244) and that of the senior staff of wildlife conservation organizations in Kenya will be 129 (0.406 x 320) respondents. In the study, wildlife conservation organizations managers were the key interview informants (KII) to provide informed insights while the rest responded to questionnaires and participate in the interviews. This size was justified as it balances statistical power with practical feasibility, ensuring sufficient representation while managing resource constraints (Mukti, 2025).

3.5 Data Collection Instrument

In addition to the structured questionnaire that was administered to gather quantitative data, semi-structured interviews and FOCUS GROUP DISCUSSION (FGD were adopted to provide additional information to the study (Krueger & Casey, 2015; Morgan, 2019).

3.6 Validity and Reliability of Research Instrument

In this study, both validity and reliability were ensured to make the data credible and scientifically rigorous (Abbott & McKinney, 2013; Creswell, 2014)..

3.6.1 Validity of Research Instrument

The validity was assessed by performing the adequacy of sampling test on using the Kaiser-Meyer-Olkin (KMO) Measured the test of sphericity by Bartlett The KMO threshold was minimum of 0.5 (Kaiser,1974) while the that of Bartlett's test of sphericity was significance at 0.05 (that p<=0.05) (Bartlett, 1954). Where these two criteria met, the researcher conducted factor analysis to validate construct validity. This multi-stage process provided an assurance that the research instrument had sufficient validity and thus enhancing the credibility of the results (Kothari, 2004; Hair *et al.*., 2010). To measure the indicators, researchers used questions on the Likert scale which helped to obtain quantitative data on the role of AI in wildlife conflict resolution in Kenya. The results are n Table 1

Table 1: Kaiser Meyer Olkin (KMO) and Bartlett's Validity Test

Factor	KMO Value	Bartlett Value	Valid
Community Engagement	0.816	<0.001	Yes
Human-wildlife conflict management in Kenya	0.586	<0.01	Yes

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The KMO value for Community Engagement was 0.816, which is above the threshold of 0.50 suggested by Kaiser (1974). Moreover, Bartlett's test of Sphericity proved to be significant (χ^2=132.238, df = 36, p<0.001). The KMO value for HWC Management in Kenya was 0.586 was more than the minimum value required, i.e., 0.50 (Kaiser, 1974). Moreover, the test of significance for Bartlett's Test of Sphericity was statistically significant (χ^2=146.207, df=36, p<0.001). The findings indicate that the indicators associated with low occurrence of conflict, quick responses and efficient operations were able to measure the Human-Wildlife Conflict Management construct. These results show that the study tool had satisfactory construct validity and therefore the factors extracted are suitable for further statistical analysis regarding the effect of artificial intelligence integration strategies on human-wildlife conflict management in Kenya..

3.6.2 Reliability of Research Instrument

The reliability of the research instrument in this study will be tested using the Cronbach's Alpha coefficient, which is used to measure the internal consistency of the research questions. George and Mallery (2018) provide guidelines for interpreting Cronbach's Alpha coefficients, which are as follows: values ranging from 0.7 and above are considered reliable; values of 0.8 and above are very good; and values ranging from 0.9 and above are excellent. The results were captured in Table 2.

Table 2: Reliability Tests

Variable	n	Cronbach's alpha	Remark
Community Engagement	9	0.891	Good
Human-Wildlife Conflict Management	9	0.876	Good
Overall	**5**	**0.877**	**Good**

From the results, it was seen that the Cronbach alpha values for all the constructs under analysis were within the range of 0.876 to 0.891 which is above the required threshold value of 0.70 (Nunnally & Bernstein, 1994; Hair *et al.*., 2019). Community engagement (α=0.891) and human-wildlife conflict management (α=0.876) constructs have shown to be good. With an overall Cronbach's alpha coefficient of 0.877, it shows that the questionnaire has high internal consistency and is reliable enough to measure the constructs being tested. Because all the alpha values exceed the minimum acceptable value of 0.70 ((Field, 2018; Taber, 2018), there are no questionnaire questions which need deletion or any major amendments. In this way, the research instrument was deemed reliable enough to be used in the main research where the influence of AI technology integration strategies on managing HWV in Kenya would be investigated.

3.7 Data Analysis

Analysis of qualitative data from the FGDs was through the use of thematic analysis while quantitative data were analysed to yield descriptive statistics and inferential analysis. The regression model was:

$Y = \beta_0 + \beta_1 X_1 + \varepsilon$

Y = Human–wildlife conflict management in Kenya

X_1 = Community Engagement

β_0 is a constant (which is the value of dependent variable when all the independent variable is 0

β_1 is the regression coefficients or change induced by X_1

ε is the normal error term

3.8 Ethical Considerations

These ethical considerations formed part of the research process, ensuring the safety of participants, as well as integrity of data. The researcher obtained the ethical clearance certificate from the Ethics Review Committee of the university The approval validated that the research follows the necessary ethical standards set by the institution concerning the involvement of human beings in research studies, especially concerning informed consent, confidentiality, and data security. The research*et al.*so obtained a research permit from NACOSTI, which was a must in carrying out any research in the country. NACOSTI research permit allowed data collection and follow ethical standards in terms of research governance in the country. The study followed the concept of informed consent, whereby all participants were well informed concerning the objectives of the research, their roles, and their freedom to participate or not participate at their own free will, and also leave

the research at any time without penalties. In addition, confidentiality and anonymity was maintained throughout the study. Respondents did not reveal in any report or publication, and data was only used for academic research. Data were stored in a safe place to avoid any breach of confidentiality.

4. RESEARCH FINDINGS, ANALYSIS AND PRESENTATION

4.1 Response Rate and Background Information

The study was done through collection of data from community leaders and wildlife conservation organizations in Kenya using questionnaires distributed to 229 respondents. From the target population (sample size), only 176 respondents responded by providing the filled data to the researcher. According to Mugenda and Mugenda (2003), a response rate of above 69%, (very high), will produce an accurate result. Therefore, a response rate of 76.86%, which was well above 69%, will evidently produce credible results since it was very high.

The demographic results show that the age group 36-45 was the highest at 48.30%, followed by those aged 18-35 years at 28.41%. This shows that most of the respondents were working age. Educationally, 55.68% were either undergraduates or postgraduates, meaning that the level of education among the respondents was high and thus they could be conversant with technological advancements. As far as experience in wildlife encounters is concerned, the majority of the respondents (63.27%) had between 5 and 25 years of experience, showing that they had practical knowledge of human wildlife interaction and conflict management. Overall, the demographic features reveal that the respondents had educational qualifications, professional maturity, and experience to make them competent for evaluating the integration of AI strategies in human-wildlife conflict management in Kenya.

4.2 Descriptive Statistics

The data was collected through a questionnaire constructed using 5-point Likert Scale (1-5); strongly Disagree = 1: disagree= 2: neutral = 3: agree =4: strongly agree = 5. During interpretations, the results such as Means (M) and standard deviations (SD) , the sores were classified as; Scores that fell in the range of 1.00 to 1.80 indicated strong disagreement, whereas scores higher than 1.80 to 2.60 indicated disagreement. Scores above 2.60 to 3.40 meant neutral, while scores that were higher than 3.40 to 4.20 indicated agreement, and scores higher than 4.20 to 5.00 indicated strong agreement.

4.2.1 Human-wildlife conflict management in Kenya.

The study first evaluated the status human-wildlife conflict management in Kenya. Results on the application of artificial intelligence in reducing cases of human-wildlife conflicts are given in the order of the statements in Table 2. The interpretation takes into account the distribution of answers in all five categories of the Likert scale, ranging from strongly agree to strongly disagree, together with the mean and standard deviation

Table 3: Human-Wildlife Conflict Management in Kenya

Parameter	SD		D		N		A		SA		M	SD
	n	%	n	%	n	%	n	%	n	%		
The use of AI has been instrumental in decreasing the number of conflicts between human beings and animals.	0	0.00%	16	9.09%	95	53.98%	40	22.73%	25	14.20%	3.42	0.85
There has been a significant drop in crop and livestock losses resulting from wildlife activities.	0	0.00%	11	6.25%	55	31.25%	85	48.30%	25	14.20%	3.70	0.79
There has been a decline in instances of human-wildlife conflict over time.	0	0.00%	6	3.41%	31	17.61%	56	31.82%	83	47.16%	4.23	0.86
The use of artificial intelligence technology has	0	0.00%	3	1.70%	19	10.80%	33	18.75%	121	68.75%	4.55	0.76

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Parameter	SD		D		N		A		SA		M	SD
	n	%	n	%	n	%	n	%	n	%		
enabled timely responses to human-wildlife conflict.												
It has led to faster response to conflict incidences by conservationists.	0	0.00%	3	1.70%	19	10.80%	22	12.50%	132	75.00%	4.61	0.75
Instant information has ensured timely responses to wildlife incidences.	0	0.00%	0	0.00%	11	6.25%	31	17.61%	134	76.14%	4.70	0.58
The introduction of artificial intelligence technology has increased operational efficiency during human-wildlife conflict management.	6	3.41%	60	34.09%	68	38.64%	33	18.75%	9	5.11%	2.88	0.93
Allocating resources to handle such incidences has become more efficient because of artificial intelligence technology.	0	0.00%	37	21.02%	83	47.16%	44	25.00%	12	6.82%	3.18	0.84
Decreased Instances of Conflict	0	0.00%	26	14.77%	82	46.59%	53	30.11%	15	8.52%	3.32	0.83
Aggregate HWC management in Kenya	**1**	**0.38%**	**18**	**10.23%**	**51**	**29.23%**	**44**	**25.06%**	**62**	**35.10%**	**3.84**	**0.80**

Based on the analysis, it can be seen that the perception of community engagement on human-wildlife conflict management in Kenya is positive in terms of timely information and response mechanisms. Respondents felt that AI played a key role in facilitating timely responses to wildlife cases (M=4.70; SD=0.58), facilitating conservationists' responses (M=4.61; SD=0.75), and increasing response timeliness (M=4.55; SD=0.76). Further, there were fewer cases of human-wildlife conflicts (M=4.23; SD=0.86) and loss of crops and livestock (M=3.70; SD=0.79). However, the perception on efficiency of operation (M=2.88; SD=0.93) and resource allocation (M=3.18; SD=0.84) was relatively negative, indicating that the benefits of AI have not been fully experienced in all areas of conflict management. Overall, the use of AI was positively perceived in human-wildlife conflict management (M=3.84; SD=0.80), but improvements in efficiency and resource allocation are needed for its effectiveness..

4.2.2 Community Engagement and HWC management in Kenya

The study assessed the third objective; to assess the effect of community engagement on human-wildlife conflict management in Kenya. and results are in Table 4

Table 4: Community Engagement and HWC management in Kenya

Parameter	SD		D		N		A		SA		M	SD
	n	%	n	%	n	%	n	%	n	%		
AI-assisted tools help increase community awareness regarding human-wildlife conflict.	1	0.57%	34	19.32%	79	44.89%	52	29.55%	10	5.68%	3.20	0.84
Educational programs within the community increase knowledge regarding animal behavior.	0	0.00%	12	6.82%	90	51.14%	60	34.09%	14	7.95%	3.43	0.74
Educational campaigns help eliminate any bad	0	0.00%	7	3.98%	79	44.89%	69	39.20%	21	11.93%	3.59	0.75

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Parameter	SD		D		N		A		SA		M	SD
	n	%	n	%	n	%	n	%	n	%		
feelings about conserving wildlife.												
The participatory platform helps communities report any human-wildlife conflict cases in real-time.	0	0.00%	2	1.14%	55	31.25%	83	47.16%	36	20.45%	3.87	0.74
AI-assisted reporting systems make it easier for the community to monitor wildlife.	0	0.00%	0	0.00%	29	16.48%	88	50.00%	59	33.52%	4.17	0.69
Digital platforms help facilitate communication between the community and conservation agencies.	0	0.00%	0	0.00%	23	13.07%	86	48.86%	67	38.07%	4.25	0.67
Integrating indigenous knowledge improves the performance of AI-driven conflict management.	0	0.00%	0	0.00%	10	5.68%	82	46.59%	84	47.73%	4.42	0.60
Indigenous community knowledge helps interpret wildlife movement.	0	0.00%	0	0.00%	10	5.68%	61	34.66%	105	59.66%	4.54	0.60
Combining indigenous knowledge with AI systems improves conservation.	0	0.00%	0	0.00%	5	2.84%	49	27.84%	122	69.32%	4.66	0.53
Aggregate community engagement	**0**	**0.06%**	**6**	**3.47%**	**42**	**23.99%**	**70**	**39.77%**	**58**	**32.70%**	**4.01**	**0.68**

As shown in the descriptive statistics, community involvement was positively viewed as an important part of HWC management, as indicated by the aggregate mean of M = 4.01 and SD = 0.68. This suggests that there is consensus amongst the respondents on the role of community participation, digital communication and indigenous knowledge in conservation efforts. Nevertheless, the results have indicated discrepancies in the perceived contribution of various engagement mechanisms, with indigenous knowledge showing higher levels of contribution compared to awareness creation and education programs.

The highest scoring variable was the contribution of the use of indigenous knowledge alongside AI technology in improving conservation (M = 4.66; SD = 0.53). This was followed by the role of indigenous community knowledge in interpreting wildlife movements (M = 4.54; SD = 0.60) and the use of indigenous knowledge in improving conflict management using AI technology (M = 4.42; SD = 0.60). From these findings, it is evident that the respondents were aware of the importance of indigenous knowledge in the understanding of the wildlife movements and behaviors and the sites that might have chances of conflicts. Relatively low standard deviations indicate the presence of consistent perceptions in the respondents. The findings show that AI tools will be more useful if used alongside the experiences of people living near wildlife.

The qualitative findings support the interpretation in that communities are usually the first ones to notice changes in the behavior of the wildlife and their movement. The participants noted that the indigenous knowledge of the wildlife movements, seasonal movements and areas where animals might be found can complement information collected using the AI-assisted monitoring technology. In particular, one of the key informants noted that within wildlife habitats, the residents are usually the first ones to observe the abnormal behavior of the wildlife; through participation in the reporting and sharing, the conservation officers can intervene before the situation gets out of hand.

This observation explains the high descriptive ratings of the indigenous knowledge. Though the AI technology helps to process large amounts of wildlife and environmental data, community members give additional information that may not be covered through the use of technical means. The combination of such data sources can contribute to better detection of

potential areas where conflicts might occur and enhance the relevance of preventive measures. The result obtained is similar to that found by Mwadime and Mbataru (2022) who have proved that public participation in the HWC management in Taita-Taveta County positively influenced people's awareness and knowledge of mitigation measures. The positive log-odds coefficient equal to 1.755 proved the significance of people's knowledge for the resolution of conflict situations. The current research adds new insight into the issue under discussion in terms of integration of indigenous knowledge and AI technology.

Communication and reporting through digital channels also got strong support. Communication using digital platforms to enhance information exchange between the communities and the conservation agencies was associated with M = 4.25 and SD = 0.67; whereas AI-assisted reporting systems to enable communities' wildlife monitoring recorded M = 4.17 and SD = 0.69. This shows that the respondents found digital platforms helpful in enhancing information exchange and involvement of communities in wildlife monitoring. In addition, the participatory platform of HWC reporting in real-time recorded M = 3.87 and SD = 0.74. It means that although there is positive agreement, it is moderately positive.

The qualitative findings further demonstrate that community engagement will help in changing HWC management practices from being reactive to being preventive. Citizens can alert about the movement of animals, their unusual behavior, and any developing problems without waiting until they lead to loss of crops and livestock or even pose a threat to humans. However, the success of digital participation requires the existence of appropriate reporting systems and timely responses of conservation bodies. This point was made by another important source that stated that technology could not manage human-wildlife conflicts; rather, communities should know how to use reporting systems, get feedback and be engaged in the programs run by conservation bodies.

The presented information proves that the presence of technologies is not enough for the effective community participation. Communities have to know how to work with reporting systems, get feedback and participate in the processes of decision-making. Also, it shows that the effectiveness of using AI for the management of human-wildlife conflicts is highly dependent on the relationship between communities and conservation institutions. This is in line with Nkansah-Dwamena (2023), who found out that community engagement helps achieve human-wildlife coexistence, while poor collaboration, lack of trust and ineffective community participation in decision-making process hampers the success of conservation. In the same way, this research finds out that digital engagement has to be followed up by responsive institutions and community engagement.

However, the awareness creation and education interventions got lower scores. The role played by AI-enabled tools in enhancing community awareness of HWC scored the lowest mean score (M = 3.20; SD = 0.84). The educational programs for increasing the knowledge about animal behavior scored M = 3.43 and SD = 0.74, while the educational campaigns on reducing negative attitudes towards wildlife conservation scored M = 3.59 and SD = 0.75. The relatively high neutral responses for these indicators indicate that the respondents are not sure how effective these awareness and educational initiatives have been. This does not mean that education is not working; instead, this suggests the need for better sensitization programs.

These qualitative findings add another dimension to why there are moderately low ratings. Participants cite the lack of proper sensitization programs, inability to access technology, linguistic barrier, distrust among communities and the conservation authority, and delay in addressing reports as the barriers to successful engagement. These factors could inhibit the willingness and capability of communities to use such technologies. Thus, the findings call for community engagement to go past the process of introducing technologies to the communities, but also education, communication in local languages, capacity building, developing trust and engaging the communities in the decision-making processes. This aligns with the work by Nkansah-Dwamena (2023) where he mentions the negative effects of poor collaboration and lack of community participation. It is also aligned with Mwadime and Mbataru's (2022) findings on the significance of community knowledge and awareness for HWC prevention.

4.3 Inferential Analysis

4.3.1 Correlation analysis

In order to establish whether there was statistically significant relationship between the IVs and the DV, correlation analysis was carried out, hence the results shown in Table 5.

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Table 5: Results on Correlation analysis

		human-wildlife conflict management in Kenya	Community Engagement
human-wildlife conflict management in Kenya	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	176	
Community Engagement	Pearson Correlation	.685**	1
	Sig. (2-tailed)	.000	
	N	176	176

Based on the sample of 176 respondents, the correlation analysis showed a strong positive and statistically significant association between community engagement ($r = 0.685$, $p < 0.001$), and human-wildlife conflict management in Kenya. The results indicate that the enhancement of community engagement may help in better human-wildlife conflict management in Kenya.

4.3.2 Regression Analysis

Regression analysis was then carried out on community engagement against the dependent variable (human-wildlife conflict management in Kenya) to estimate the model, since they were found to have a significant relationship.

The study model was obtained as shown in Table 6.

Table 6: Model Summary for human-wildlife conflict management in Kenya

R	R Square	Adjusted R Square	Std. Error of the Estimate
.685[a]	.469	.466	.5283182

a. Predictors: (Constant), data integration, , Community Engagement

The model summary indicates a strong positive relationship between the combined AI application dimensions and human-wildlife conflict (HWC) management in Kenya ($R = 0.685$). The coefficient of determination ($R^2 = 0.469$) shows that community engagement explains 46.9% of the variation in HWC management. The adjusted R^2 of 0.466 indicates that the model explains 56.2% of the variation after adjusting for the number of predictors. Furthermore, the standard error of the estimate (0. 5283182) indicates the average variation of observed HWC management scores around the regression model's predicted values.

The study carried out an Analysis of Variance (ANOVA) to estimate the model fitness and these results are captured in Table 7.

Table 7: ANOVA for Human-Wildlife Conflict Management in Kenya

	Sum of Squares	df	Mean Square	F	Sig.
Regression	42.892	1	42.892	153.669	.000[b]
Residual	48.567	174	.279		
Total	91.459	175			

a. Dependent Variable: human-wildlife conflict management in Kenya

The study tested the fitness of the model guided by the hypothesis that;

H_0: $\beta_1 = 0$ (that is the beta values coefficient of X_1, is zero) The results (p-value = 0.000, F = 25.439), show that the p-value < 0.001. Based on these results, then H_0 was rejected and H_α was accepted because p-value < 0.05. then study can conclude that the α=0.05, there exists enough evidence to conclude that community is useful in estimating the human-wildlife conflict management in Kenya

The IVs and DV were then regressed to estimate the study model. The study obtained result shown in Table 8.

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Table 8: Regression Results of Dependent Variable against Predictor Variable

Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.257	.267		.961	.338
Community Engagement	.840	.068	.685	12.396	.000

a. Dependent Variable: human-wildlife conflict management in Kenya

The results in Table 4.15 show that at 0.05 significance level, $p<0.001$ and $T= 12.396$. Then the H_0 is rejected and H_1 Since $p < 0.05$. Accordingly, the study concludes that at $\alpha = 0.05$ level of significance, there is enough evidence that the community engagement is not zero and therefore community engagement is useful as an estimator of human-wildlife conflict management in Kenya.

The results show that all the predictor variable was significant and positively affecting the human wildlife conflict management at a 5% significance level. More specifically, community engagement was statistically significant with $B = 0.840$, $\beta = 0.685$, $t = 12.396$ and $p<0.001$, meaning that the more they are involved and engaged in AI related wildlife management programs, the better they are able to manage human-wildlife conflict. With all other factors held constant, a one SD increase in community engagement leads to a 0.840 SD increase in human wildlife conflict management. This means that local knowledge sharing and cooperation with wildlife management stakeholders are especially relevant factors in the successful management of conflicts, as is community involvement.

The constant was negative and not statistically significant ($B = 0.257$, $p=0.338$), meaning that it was not significantly different from zero when all predictor variables were held constant.

So, the estimated model fitted as;

$Y = 0.257 + 0.840X_1$ ……. (iii)

Overall, the study results indicate that community engagement is an indicator of human-wildlife conflict management in Kenya. This indicates that further enhancing these strategies, especially community involvement, may make these human-wildlife conflict management programmes more effective.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The research concluded that community involvement helped in the management of HWC through indigenous knowledge and participation in digital reporting and conservation activities. This revealed the significance of involving communities in AI- assisted conservation efforts. The research revealed that community engagement played a key role in influencing the management of HWCs in Kenya. The results of descriptive analysis revealed that there was agreement on the importance of community engagement, digital communication and indigenous knowledge in conservation. The most highly rated indicator was the incorporation of indigenous knowledge into the AI technology systems to enhance conservation followed by the contribution of indigenous knowledge in understanding the movements of wildlife. Digital communication systems and AI based community reporting system were also rated highly. On the other hand, awareness creation and educational programs were rated relatively low which indicated the need for increased community sensitization. The qualitative results revealed that the communities engaged in the early detection of wildlife movement and identification of threats as well as potential conflict areas. However, lack of awareness programs, language barrier, lack of technology, mistrust and institutional delay affected their effective participation. Inferential analysis revealed that there was a statistically significant relationship between community engagement and management of HWCs ($B = 0.840$, $\beta = 0.685$, $t = 12.396$, $p<0.001$).

5.2 Recommendations

The research found that service delivery was largely positive especially in terms of competence of the employees.

5.2.1 Managerial Practices

The management of the KWS should also ensure that there is strengthened collaboration with the local community through sensitization programmes and participation in monitoring of wildlife. The local community should be empowered with the necessary information on how to report any movement of wildlife. This will enhance information flows, coordination, and decision-making in human-wildlife conflict resolution.

5.2.2 Policy Recommendations

This study suggests that the national and county governments need to encourage community participation in conservation efforts through the incorporation of indigenous knowledge in conservation efforts and raising public awareness about human-wildlife conflict prevention and management.

5.2.3 Theoretical Contribution

This study confirms the relevance of SES Theory by proving that proper HWC management needs interactions between communities, conservation organizations and ecologies. High statistical significance of the impact of community engagement ($\beta = 0.685$, $p<0.001$) is the indicator of the importance of involving native knowledge, participation of the community and digital communications into conservation.

5.2.4 Limitations of the Study

The study had limitations in terms of the geographical scope of the study and the use of responses from the selected management stakeholders of the HWC, which can have an impact on the generalizability of the results. Response bias may have been introduced due to the self-reported nature of the data collection process. Furthermore, variations in technology and access to AI technology may have impacted the results of the survey..

5.2.5 Suggestions for Further Studies

It is suggested that more studies be done on the use of emerging technologies of artificial intelligence (predictive analytics, machine learning and automated alert systems) in human-wildlife conflict management. Studies should also focus on the impact of institutional capacity, technology infrastructure, and community readiness as moderators of AI interventions' efficacy. Other areas in Kenya and other countries could benefit from similar studies so as to make the research results applicable to a wider range of contexts. Longitudinal research studies would help in finding out the longevity and sustainability of AI technologies in mitigating human-wildlife conflicts.

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