

Information Asymmetry and Community Participation in Carbon Credit Initiatives: Evidence from Forest-Dependent Communities in Eastern Province, Zambia

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Abstract: Carbon credit initiatives have expanded rapidly across forest-dependent landscapes in Zambia, yet the extent to which host communities are meaningfully informed and involved in decision-making remains uncertain. This study examined the effect of information dissemination on community participation in decision-making in carbon credit projects in Sinda and Vubwi districts of Eastern Province, with information asymmetry and knowledge gaps treated as related conditions. A quantitative, cross-sectional survey design was adopted. The sample of ninety-one households was determined using Yamane's formula, and respondents were selected through a multistage procedure concluding with simple random sampling. Data were collected using a structured questionnaire and analysed in the Statistical Package for the Social Sciences version 26 through descriptive statistics and multiple linear regression. Most respondents were from Sinda (73.6 per cent) and the rest from Vubwi (26.4 per cent). Descriptive results revealed high perceived information asymmetry (mean 4.27 of five) and low information dissemination (mean 1.33 of four), and only about a quarter of respondents (25.3 per cent) reported involvement in decision-making. The regression model was significant and explained 30.5 per cent of the variance in community participation, with information dissemination the only significant predictor (standardised coefficient 0.726, p less than 0.001), while asymmetry and knowledge gaps were not significant. The findings indicate that the quality and frequency of deliberate information flows, rather than asymmetry alone, drive informed engagement. The study recommends transparent, locally appropriate communication, robust free, prior and informed consent and accountable benefit-sharing to deepen genuine participation in carbon credit governance.

Keywords: Carbon Credits, Information Asymmetry, Community Participation, Decision-Making, Information Dissemination, Forest-Dependent Communities, Climate Finance, Eastern Province, Zambia.

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I. INTRODUCTION

Forests occupy a central place in the economic and ecological life of Zambia, covering close to sixty per cent of the national land area and providing the resource base on which a large share of rural households depend for energy, food, building materials and income (Interactive Country Fiches, 2021). About one sixth of the rural population relies heavily on forests, which contribute roughly twenty per cent of rural household income. At the same time, Zambia experiences one of the highest rates of forest loss in the world, with national strategies estimating annual deforestation of between 250,000 and 300,000 hectares, driven largely by charcoal and fuelwood production, agricultural expansion, mining and timber extraction (World Vision, 2021; Mulenga,

et al., 2019). Because land use, land use change and forestry account for the bulk of the country's greenhouse gas emissions, Zambia has been identified among the leading emitters from deforestation and forest degradation, a position that has made the forest sector a focus of national mitigation and climate finance ambition (Government of the Republic of Zambia, 2022).

Against this background, carbon credit initiatives, particularly those structured around Reducing Emissions from Deforestation and Forest Degradation, conservation and sustainable management of forests, have become a prominent instrument for channelling international finance towards forest protection. Eastern Province has emerged as a national epicentre of this activity. The Zambia Integrated Forest

Landscape Programme and its successor emission reductions programme, supported by the BioCarbon Fund and the World Bank, unlock up to thirty million United States dollars in results-based payments for emission reductions generated through forest conservation, climate-smart agriculture and improved land use across the province (World Bank, 2024). Private initiatives operate alongside these jurisdictional efforts, including a large community forests project reported to be among the largest such schemes in the world by number of beneficiaries, and a community conservation scheme that has channelled carbon payments to chiefdoms and farmer cooperatives (BioCarbon Partners, 2023).

The promise of these schemes rests on a straightforward logic. If communities that hold and use forests receive credible incentives, supported by accurate information and a genuine voice in how projects are designed and governed, they will manage forests sustainably and share equitably in the resulting benefits. In practice, this logic is frequently undermined by a structural feature of carbon markets, namely the uneven distribution of information among the actors involved. Project developers, verifiers, intermediaries and buyers typically command detailed technical knowledge of measurement, contract terms, pricing and benefit-sharing, while host communities often confront these arrangements with limited understanding and few independent sources of advice (Brookings Institution, 2025; Öko-Institut, 2023). This condition, in which one party to a transaction possesses materially more or better information than the other, is described in economics as information asymmetry (Akerlof, 1970).

Information asymmetry matters because it shapes the capacity of communities to participate meaningfully. Where people do not understand what a carbon project entails, what risks it carries, what they are entitled to and how decisions are made, their participation tends to be nominal rather than substantive (The Nature Conservancy, 2023; Rocky Mountain Institute, 2023). In the southern African context, evaluations of community-based natural resource management have repeatedly traced disappointing participation and benefit outcomes to weak information flows, limited transparency and the persistence of centralised control over decisions (Milupi, et al., 2020; International Institute for Environment and Development, 2021). Despite the scale of carbon investment in Eastern Province, relatively little systematic evidence exists on how information conditions shape community involvement in these specific initiatives, and much of the available literature is qualitative or drawn from other countries and project types. This study responds to that gap. Its overarching objective is to assess the effect of information dissemination on community participation in decision-making in carbon credit projects in Sinda and Vubwi districts of Eastern Province, while describing the levels of asymmetry, knowledge gaps and dissemination that communities report. By providing quantitative evidence from forest-dependent communities at the forefront of carbon finance in Zambia, the article contributes to scholarly and policy debate on how the governance of climate finance can be made more transparent,

inclusive and accountable to the communities on whose forests it depends.

The significance of this enquiry extends beyond the academic. Carbon credit initiatives in Eastern Province involve binding commitments that stretch across decades, attach conditions to the use of customary land, and promise revenues whose scale and distribution are difficult for communities to verify. Where the people who host these projects do not understand the arrangements into which they are entering, the moral and legal foundations of the schemes are weakened, and the prospect of long term conflict over land, benefits and obligations rises. The study is also situated within a wider international moment of scrutiny for voluntary carbon markets, in which investigations have questioned whether forest carbon credits deliver the reductions they claim and have linked weak outcomes to opaque methodologies and uneven information between the parties to a trade (Probst, et al., 2024; West, et al., 2023). By examining the information environment as communities themselves experience it, this article connects that macro level debate to the micro level reality of village participation. The remainder of the article reviews the relevant literature, sets out the methodology, presents the descriptive and regression results, discusses them in the light of theory and prior evidence, and concludes with recommendations.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

➤ *Information Asymmetry and its Consequences*

The concept of information asymmetry occupies a foundational position in the economics of markets and institutions. A seminal analysis of markets characterised by quality uncertainty showed that when sellers know more about the quality of a good than buyers, markets can unravel, with high-quality offerings driven out and trust eroded (Akerlof, 1970). The insight was extended through the related ideas of signalling, where better informed parties take costly actions to convey credible information, and screening, where less informed parties design mechanisms to elicit it (Spence, 1973). Although these foundations are several decades old, their relevance has grown, because they capture a generic problem that recurs wherever transactions, contracts or collective decisions bring together actors of unequal knowledge.

Carbon markets exemplify this problem in acute form. Recent scholarship documents that buyers and the wider public frequently lack the information needed to distinguish high-quality credits from low-quality ones, with one systematic assessment estimating that only a small fraction of credits issued by investigated projects represented real and additional emission reductions (Probst, et al., 2024; West, et al., 2023). Analysts argue that integrity problems in voluntary carbon markets are worsened by information asymmetry between sellers and buyers, which fuels distrust and creates space for greenwashing (Brookings Institution, 2025). In response, market bodies have placed transparency at the centre of their core principles and codes of practice, precisely in order to bridge the information gap between supply and

demand (Integrity Council for the Voluntary Carbon Market, 2023; Voluntary Carbon Markets Integrity Initiative, 2023; Rocky Mountain Institute, 2023).

Most of this debate concerns the buyer side of the market. Yet a parallel and arguably more consequential asymmetry operates at the supply end, between project developers and the host communities whose forests and labour generate the credits. Assessments of benefit-sharing arrangements in voluntary carbon projects have found that the terms on which communities engage are frequently opaque, that information about revenues and their distribution is incomplete, and that local actors rarely possess the technical or legal capacity to interrogate contracts (Öko-Institut, 2023; The Nature Conservancy, 2023). In carbon projects communities effectively delegate the measurement, sale and administration of forest carbon to developers and intermediaries whose specialised knowledge they cannot easily verify, a classic principal and agent problem compounded by long time horizons and technical complexity. Where such asymmetry persists, trust becomes a fragile substitute for verification, and communities are poorly placed to negotiate, to hold project actors to account or to give consent that is genuinely informed.

➤ *Community Participation in Natural Resource Governance*

Participation has been a guiding ideal of natural resource governance for several decades, yet its meaning is contested. The influential ladder of citizen participation distinguished between degrees of involvement ranging from manipulation and tokenism at the lower rungs to genuine partnership and citizen control at the upper rungs, cautioning that activities labelled as participation may amount to little more than the appearance of involvement (Arnstein, 1969). This distinction remains pertinent to carbon projects, where consultation meetings, sensitisation campaigns and signed consent forms can coexist with a near total absence of community influence over substantive decisions. The quality of participation is also shaped by its timing. Where engagement begins only after a project has been designed and its essential terms settled, communities are left to react to decisions rather than to shape them, and consultation becomes a formality that ratifies choices already made.

Empirical research on community-based natural resource management in Zambia and the wider region offers a sobering record. Studies of game management areas and joint forest management arrangements have found that, despite a rhetoric of devolution, central authorities often retain effective control, benefit flows to communities are modest, and engagement is frequently inadequate (Milupi, et al., 2020; Milupi, et al., 2021). Governance assessments have linked these shortcomings to weak transparency, limited information sharing and unaccountable decision structures, and have argued that strengthening community voice depends on improving access to information and on building local institutional capacity (International Institute for Environment and Development, 2021). For carbon credit initiatives specifically, reviews stress that communities need detailed information about project risks and opportunities, and that the

process of sharing this information must be deliberate and documented if participation is to be more than nominal.

➤ *Carbon Credit Initiatives and REDD+ in Zambia*

Zambia has pursued forest carbon finance through both jurisdictional programmes and project-level initiatives. At the national level, the country has developed a strategy for reducing emissions from deforestation and committed under its Nationally Determined Contribution to substantial emission reductions, with much of the anticipated mitigation arising from the forest and land use sector (Government of the Republic of Zambia, 2022). Recognising the difficulty of achieving measurable reductions at national scale, policy has increasingly emphasised sub-national programmes, of which the Eastern Province emission reductions programme is the most advanced (World Bank, 2024).

Eastern Province presents a compelling setting because it combines high forest dependence, significant deforestation pressure and an unusual concentration of carbon initiatives. The province lies within the miombo woodland belt, faces deforestation fronts along the borders with Malawi and Mozambique, and ranks among the poorer regions of the country, conditions that make carbon revenue both attractive and consequential for local livelihoods (BioCarbon Partners, 2023). The coexistence of a jurisdictional programme, a large private project and a community conservation scheme means that many communities are simultaneously exposed to multiple project logics, intermediaries and information sources, which can compound rather than reduce confusion where coordination and transparency are weak. Community members may struggle to distinguish between projects, to understand which commitments apply to them, or to identify whom to approach with questions and grievances. The Zambian experience therefore demonstrates that community-oriented design is necessary but not sufficient, and that without strong and continuous information flows even well-intentioned schemes can leave participants poorly informed.

Critical accounts of forest carbon projects in Zambia and comparable settings have raised questions about how benefits are calculated and distributed, about the clarity of carbon rights, and about whether communities understand the long horizons and permanence obligations that such projects entail. The Government has moved to address some of these concerns through work on carbon regulation and benefit-sharing rules, intended to clarify carbon ownership and to facilitate orderly access to carbon finance (Government of the Republic of Zambia, 2022). Nonetheless, the regulatory architecture remains in development, and the practical experience of communities continues to depend heavily on the conduct of individual project actors and on the information those actors choose to share. This study contributes province-specific evidence on that experience.

➤ *Information Dissemination, Knowledge Gaps and Participation*

Information dissemination refers to the deliberate flow of accurate, accessible and timely information from project actors to communities through appropriate channels. It is conceptually distinct from, though related to, information

asymmetry and knowledge gaps. Asymmetry describes the structural imbalance of information between parties, knowledge gaps describe the resulting deficits in community understanding, and dissemination describes the active process intended to narrow both. In principle, stronger dissemination should reduce asymmetry and close knowledge gaps, thereby enabling informed participation. In practice, dissemination may be weak, intermittent or conducted in technical language and unfamiliar formats, leaving asymmetry and gaps largely intact.

The channels and formats through which information travels are as consequential as its content. In rural forest-dependent communities, where literacy is uneven and access to written or digital material is limited, information conveyed only through formal documents, technical briefings or occasional large meetings is unlikely to reach or to be understood by most households. Effective dissemination in such settings depends on repeated, face to face communication in local languages, on the use of trusted intermediaries such as community committees and traditional leaders, and on formats that connect abstract carbon concepts to familiar experiences of forest use and livelihood. Dissemination that ignores this mismatch may satisfy a procedural requirement to inform while failing to achieve genuine comprehension, which is the outcome that ultimately matters for participation.

A recurrent theme in the literature is that information sharing in forest carbon projects is often supply driven and instrumental, designed to secure consent or to satisfy safeguard requirements rather than to build genuine comprehension (The Nature Conservancy, 2023). Forest managers have at times delayed sharing information or avoided particular terminology in order to manage community expectations, a practice that may protect projects in the short term but corrodes trust and informed engagement over time. Environmental education and locally grounded communication have therefore been proposed as remedies, on the argument that raising awareness, building relevant knowledge and cultivating supportive attitudes are preconditions for effective community-based management. Where such efforts are absent, communities may remain unaware even of the basic risks attached to projects, including risks to tenure, to customary access and to the permanence of their own commitments.

➤ *Conceptual Framework*

The conceptual framework guiding the study positions information dissemination as the principal independent variable influencing community participation, with information asymmetry and knowledge gaps as related conditions that may constrain that participation. Community participation in decision-making is treated as the outcome of interest. The framework draws together the economics of information asymmetry, which explains why imbalances of knowledge distort transactions and weaken the bargaining position of the less informed, and the governance literature on participation, which explains why informed involvement is a precondition for legitimate and equitable outcomes. The empirical task that follows is to estimate the strength of these

relationships using survey data from forest-dependent communities in Eastern Province, with the central expectation that dissemination, as the active flow of usable information, will be the most powerful driver of participation.

III. METHODOLOGY

➤ *Research Design and Approach*

The study adopted a quantitative research approach within a cross-sectional survey design. This design was appropriate because the objective required the measurement of defined constructs across a sample of community members at a single point in time, and the estimation of statistical relationships among those constructs. A quantitative approach allowed the levels of information asymmetry, knowledge gaps, information dissemination and participation to be expressed numerically and analysed using inferential techniques, supporting generalisation within the study population and comparison with findings reported elsewhere. The deductive logic of the study, which began from theory and tested expected relationships, aligns naturally with a quantitative survey strategy.

➤ *Study Area*

The study was conducted in selected forest-dependent communities in Sinda and Vubwi districts of Eastern Province, Zambia, where carbon credit initiatives and forest conservation programmes are currently being implemented. Eastern Province was chosen because it has become a major focus of carbon credit and Reducing Emissions from Deforestation and Forest Degradation activities, owing to its extensive forest resources and its growing involvement in climate change mitigation programmes (World Bank, 2024; BioCarbon Partners, 2023). The two districts host communities taking part in carbon credit initiatives under programmes such as the Zambia Integrated Forest Landscape Project, jurisdictional emission reductions programmes and other forest conservation projects operating within the province. The communities concerned are predominantly rural, depend on miombo woodland resources for energy, agriculture and supplementary income, and have varying degrees of exposure to project sensitisation and benefit-sharing activities. This setting offered an information rich environment in which the relationship between information conditions and community participation could be meaningfully examined.

➤ *Population and Sampling*

The target population comprised adult members of forest-dependent households participating in carbon credit initiatives in the two districts. The quantitative sample size was determined using Yamane's formula, a widely applied approach for studies in which the population can be reasonably estimated. The formula is expressed as n equals N divided by one plus N multiplied by e squared, where n is the required sample size, N is the estimated population size and e is the margin of error. Based on an estimated population of approximately one thousand participating households and a margin of error of 0.10, the calculation produced a sample of ninety-one households. A multistage sampling procedure was then used to select the respondents. The districts of Sinda and

Vubwi and their communities were selected because carbon credit initiatives were being implemented there, participating households were identified from project records and community registers, and individual household respondents were finally selected using simple random sampling, a probability technique in which every household on the list had an equal chance of selection. All ninety-one questionnaires were adequately completed and included in the analysis.

➤ *Data Collection*

Primary data were collected through a household survey using a structured questionnaire administered to the selected respondents in face-to-face sessions. The questionnaire comprised closed-ended questions and items measured on a Likert scale, covering the demographic characteristics of respondents, their awareness of carbon credit initiatives, their main sources of project information, their level of understanding of carbon credits, their perceptions of information asymmetry, their exposure to information dissemination, their involvement in project activities and decision-making, and their level of trust in project institutions. The use of closed-ended and scaled items made it possible to quantify the responses and to compare them across respondents. Items were translated and explained in local languages where necessary to ensure comprehension, and the use of trained enumerators helped to standardise administration and to accommodate respondents with limited literacy, which is an important consideration in rural forest-dependent communities. Before the main study the instrument was pilot tested in a community with characteristics similar to those of the study area but not included in the final sample, and the lessons learned were used to refine it.

➤ *Measurement of Variables*

Three composite measures and one binary outcome were constructed from the questionnaire items. The information asymmetry index, scored from zero to five with higher values indicating greater asymmetry, captured the perceived imbalance of information between communities and project actors. The knowledge gaps index, scored from one to four with higher values indicating larger gaps, captured deficits in respondents' understanding of carbon credit concepts, measurement and benefit-sharing. The information dissemination index, scored from zero to four with higher values indicating better dissemination, captured the frequency, clarity and accessibility of information received from project actors. Community participation, the dependent variable, was recorded as a binary indicator coded one where a respondent reported involvement in project decision-making and zero otherwise.

➤ *Data Analysis*

Data were coded, captured and analysed using the Statistical Package for the Social Sciences, version 26. Descriptive statistics, including frequencies, percentages, means and standard deviations, were computed to summarise the characteristics of respondents, the levels of each variable and the extent of community participation. Multiple linear regression was then used to estimate the combined and

individual effects of information asymmetry, knowledge gaps and information dissemination on community participation. Because the dependent variable was binary, the regression operated as a linear probability model, which is widely used for its interpretability while acknowledging its known limitations. The model summary, analysis of variance and coefficient outputs were examined to assess overall fit, statistical significance and the relative contribution of each predictor, and statistical significance was assessed at the conventional five per cent level. Results were presented in the standardised tabular and graphical formats produced by the software.

The regression model was specified to express community participation as a linear function of the three information predictors. The model took the following form.

$$CP = \beta_0 + \beta_1IA + \beta_2KG + \beta_3ID + \varepsilon$$

In this model, CP represents community participation, IA represents information asymmetry, KG represents knowledge gaps and ID represents information dissemination. The term β_0 is the constant, the terms β_1 , β_2 and β_3 are the coefficients of the independent variables, and ε is the error term. The unstandardised coefficients indicate the change in the probability of participation associated with a one-unit change in each predictor, holding the others constant, while the standardised coefficients allow the relative strength of the predictors to be compared on a common scale. Prior to estimation the data were screened to confirm completeness and to ensure that the composite indices fell within their defined ranges, and the small number of predictors relative to the sample reduced the risk of overfitting.

➤ *Validity, Reliability and Ethical Considerations*

Validity was addressed in two ways. Content validity was ensured through expert review, in which the supervisor and specialists in climate governance, environmental management and social research examined the instrument and judged whether the items adequately covered the concepts under study. Construct validity was strengthened by aligning the questionnaire items with the study objectives and with the theoretical concepts underpinning the research, so that each item related clearly to the variable it was meant to measure. Reliability, the degree to which an instrument produces consistent results, was assessed using the Cronbach alpha coefficient, with a value of 0.70 or above taken to indicate acceptable internal consistency for the Likert-scale items. Ethical considerations were observed throughout. Informed consent was obtained from all respondents, who took part voluntarily and were free to withdraw at any stage, their identities were kept confidential and their responses reported anonymously, and the study sought to avoid raising expectations of benefits that it could not deliver. Ethical clearance was obtained from the relevant university authorities, and permission was sought from the local authorities in the study area before data collection began.

IV. RESULTS AND FINDINGS

➤ Distribution of Respondents by District

The survey was conducted in Sinda and Vubwi districts, and the distribution of respondents between the two districts is shown in Figure 1. Most respondents were drawn from Sinda district, which accounted for sixty-seven respondents or 73.6 per cent, while Vubwi district accounted for twenty-

four respondents or 26.4 per cent. The larger number of respondents from Sinda reflects the greater concentration of carbon credit and forest conservation activities in that district at the time of the study, as well as the larger number of participating households. The two districts together provided the ninety-one households on which the analysis that follows is based.

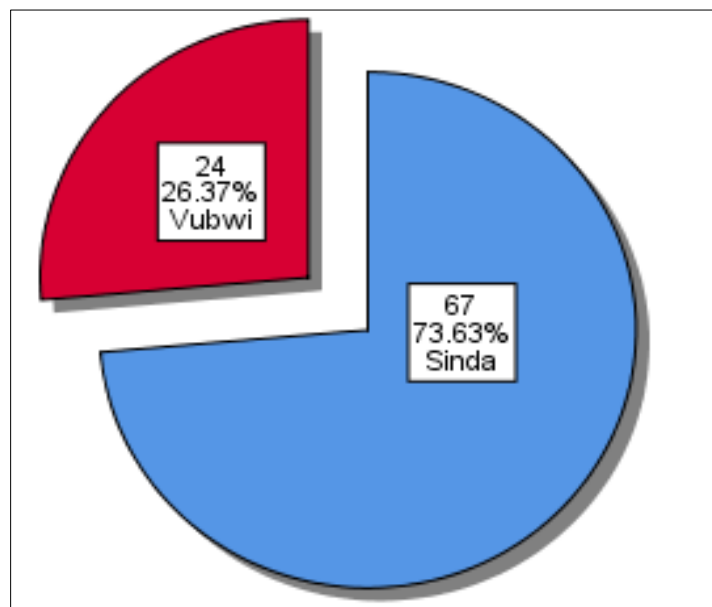


Fig 1 Distribution of Respondents by District

Source: Field Data (2026) SPSS Output

➤ Descriptive Statistics

The descriptive results, summarised in Table 1, reveal a striking pattern in the information environment experienced by respondents. Perceived information asymmetry was high, with a mean of 4.27 on a scale from zero to five, indicating that community members generally felt poorly informed relative to project actors. The knowledge gaps index recorded a moderate mean of 2.77 on a scale from one to four,

suggesting substantial deficits in understanding of carbon credit arrangements. Most notably, the information dissemination index was low, with a mean of only 1.33 on a scale from zero to four, signalling that deliberate, accessible information flows from project actors to communities were weak. Community participation was also low, with a mean of 0.25 on the binary measure, meaning that only about a quarter of respondents reported involvement in decision-making.

Table 1 Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Information Asymmetry index (0-5, higher = more asymmetry)	91	.00	5.00	4.2747	1.32553
Knowledge Gaps index (1-4, higher = bigger gap)	91	1.00	4.00	2.7692	.94372
Information Dissemination index (0-4, higher = better dissemination)	91	.00	4.00	1.3297	1.30004
Community Participation (1 = involved in decision-making)	91	.00	1.00	.2527	.43699
Risk Perception/Awareness (1 = aware of risks)	91	.00	1.00	.2527	.43699
Trust in project institutions (1-4)	91	1.00	4.00	2.4066	.81620
Valid N (listwise)	91				

Source: Field Data (2026) SPSS Output

The contrast between the high level of asymmetry and the low level of dissemination is itself an important finding. It indicates that the information deficit experienced by communities is not being adequately addressed by project communication, and it foreshadows the low participation observed. The standard deviation of the dissemination index, at 1.30 around a low mean, further reveals considerable unevenness in the information that communities received,

with some respondents reporting almost no dissemination at all. This variation is analytically valuable, because it is precisely the differences in dissemination across respondents that the regression analysis exploits to estimate its effect on participation. Figure 2 presents the mean scores of the three information variables, with error bars denoting one standard deviation.

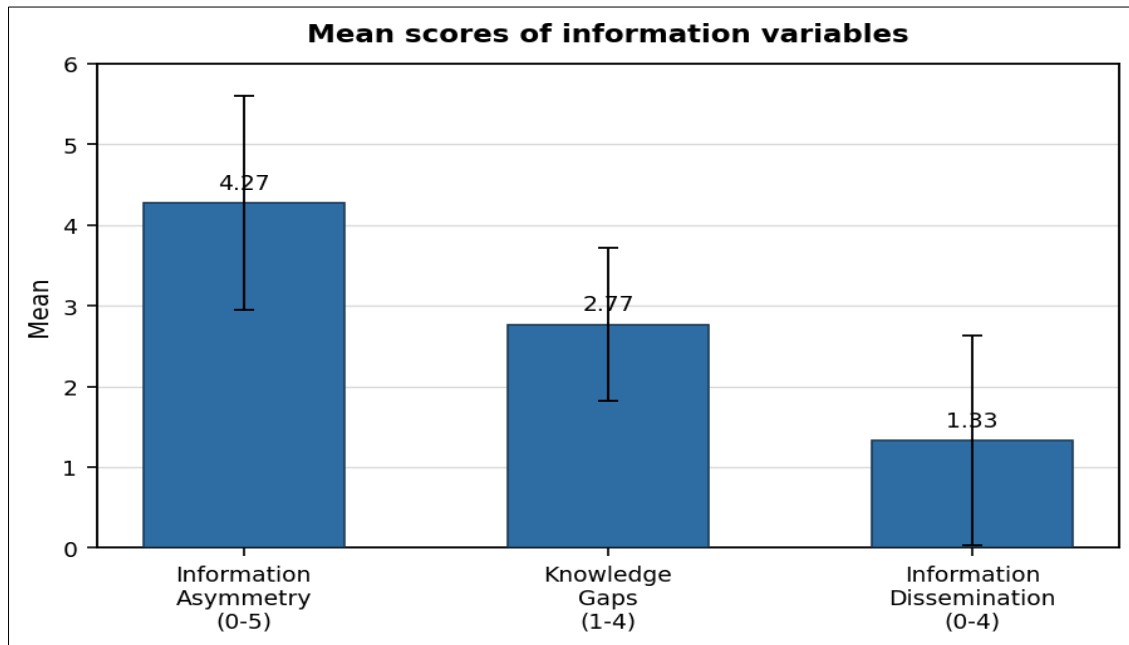


Fig 2 Mean Scores of the Information Variables

Source: Field Data (2026) SPSS Output

➤ Community Participation in Decision-Making

The level of community participation in decision-making was low. As shown in Figure 3, only 25.3 per cent of respondents reported being involved in project decisions, while 74.7 per cent reported no such involvement. This pattern is consistent with the weak dissemination recorded in the descriptive statistics and echoes the wider regional

evidence that participation in externally initiated conservation and carbon projects is frequently nominal rather than substantive (Milupi, et al., 2020). The finding suggests that, for the majority of community members, engagement with carbon credit initiatives takes the form of being acted upon rather than taking part in shaping decisions that affect their forests and livelihoods.

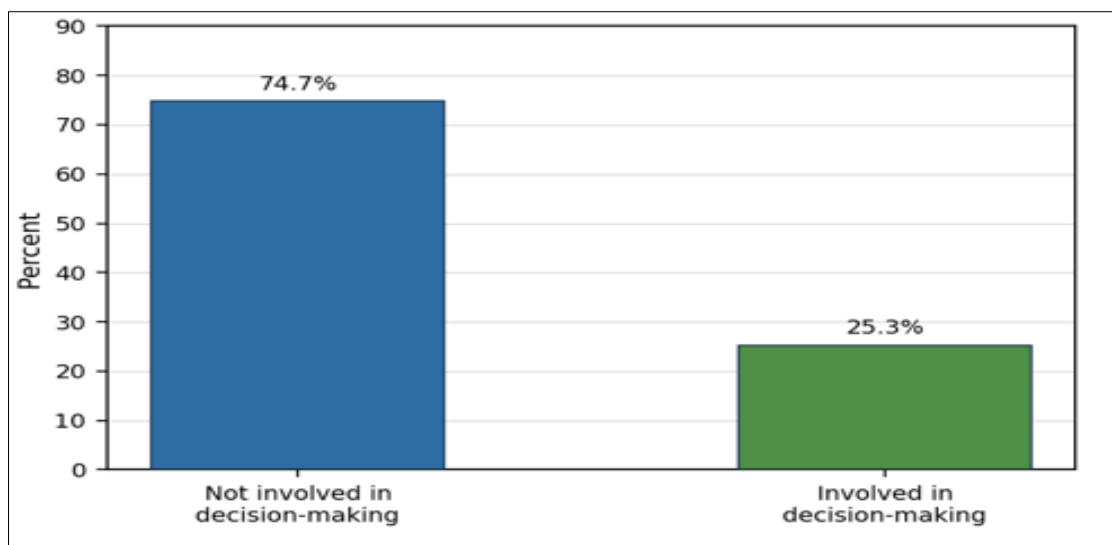


Fig 3 Community Participation in Carbon Credit Decision-Making

Source: Field Data, (2026) SPSS Output

➤ *Regression Analysis*

Multiple linear regression was used to estimate the effect of information asymmetry, knowledge gaps and information dissemination on community participation in decision-making. The model summary, presented in Table 2, shows a multiple correlation coefficient of 0.552 and an R

square of 0.305, indicating that the three predictors jointly explained 30.5 per cent of the variance in participation. The adjusted R square of 0.281 confirms that the model retained substantial explanatory power after accounting for the number of predictors, which is a respectable result for cross-sectional survey data in the social sciences.

Table 2 Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.552 ^a	.305	.281	.37055
a. Predictors: (Constant), Information Dissemination index (0-4, higher = better dissemination), Knowledge Gaps index (1-4, higher = bigger gap), Information Asymmetry index (0-5, higher = more asymmetry)				

Source: Field Data, (2026) SPSS Output

The analysis of variance, reported in Table 3, establishes that the model as a whole was statistically significant. The F statistic of 12.723 with three and eighty-seven degrees of freedom was significant at a probability of less than 0.001, allowing the null hypothesis of no

relationship between the predictors and community participation to be rejected. In substantive terms, the combined information variables make a genuine and reliable contribution to explaining whether community members participate in project decision-making.

Table 3 Analysis of Variance

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.241	3	1.747	12.723	.000 ^b
	Residual	11.946	87	.137		
	Total	17.187	90			
a. Dependent Variable: Community Participation (1 = involved in decision-making)						
b. Predictors: (Constant), Information Dissemination index (0-4, higher = better dissemination), Knowledge Gaps index (1-4, higher = bigger gap), Information Asymmetry index (0-5, higher = more asymmetry)						

Source: Field Data, (2026) SPSS Output

The coefficients reported in Table 4 reveal which of the three predictors drives the result. Information dissemination was the only statistically significant predictor of community participation, with an unstandardised coefficient of 0.244, a standardised coefficient of 0.726 and a probability of less than 0.001. This indicates a strong, positive and significant relationship, whereby community members who received better information dissemination were substantially more likely to be involved in decision-making. In practical terms, each one-point improvement on the dissemination index was

associated with an increase of about twenty-four percentage points in the probability of participation, a substantial effect for a single variable. By contrast, information asymmetry, with a standardised coefficient of 0.219 and a probability of 0.146, and knowledge gaps, with a standardised coefficient of 0.023 and a probability of 0.837, were not statistically significant once dissemination was taken into account, and their coefficients, though positive, should not be interpreted given their lack of significance. The constant term was likewise not significant.

Table 4 Regression Coefficients

Coefficients^a					
		Unstandardized Coefficients		Standardized Coefficients	
Model		B	Std. Error	Beta	t
1	(Constant)	-.411	.327		-1.26
	Information Asymmetry index (0-5, higher = more asymmetry)	.072	.049	.219	1.47
	Knowledge Gaps index (1-4, higher = bigger gap)	.011	.052	.023	.206
	Information Dissemination index (0-4, higher = better dissemination)	.244	.056	.726	4.37
a. Dependent Variable: Community Participation (1 = involved in decision-making)					

Source: Field Data, (2026) SPSS Output

V. DISCUSSION

The findings of this study converge on a clear and policy relevant conclusion. Among the three information related constructs examined, the deliberate dissemination of information is the decisive factor associated with community participation in decision-making. This pattern carries important implications for how carbon credit initiatives in Eastern Province, and in comparable settings, ought to be designed and governed.

The first observation concerns the severity of the information deficit. Respondents reported high information asymmetry alongside low information dissemination, a combination that places communities in a structurally disadvantaged position. This finding is consistent with the wider literature on carbon markets, which identifies information asymmetry as a persistent source of mistrust and inequity and which has prompted market bodies to make transparency a central principle (Brookings Institution, 2025; Integrity Council for the Voluntary Carbon Market, 2023). It is also consistent with assessments of benefit-sharing in voluntary carbon projects, which find that the terms of community engagement are frequently opaque and that local actors lack the information needed to negotiate effectively (Öko-Institut, 2023; The Nature Conservancy, 2023). The present study extends this evidence to the community side of carbon projects in a Zambian province, demonstrating that the asymmetry so often discussed in relation to buyers and sellers is mirrored, and arguably intensified, in the relationship between developers and forest-dependent communities.

The second observation concerns the low level of participation. With only a quarter of respondents reporting involvement, the evidence indicates that participation in these initiatives is, for most community members, nominal. This accords closely with the cautionary distinction drawn in the

participation literature between genuine influence and the mere appearance of involvement (Arnstein, 1969), and with empirical findings from Zambian community-based natural resource management, where engagement has frequently been inadequate and benefit flows modest despite the formal rhetoric of devolution (Milupi, et al., 2020; Milupi, et al., 2021; International Institute for Environment and Development, 2021). The coexistence of weak dissemination and weak participation in the present data is unlikely to be coincidental.

The third and most analytically significant observation concerns the regression results. Information dissemination was the only significant predictor of participation, while information asymmetry and knowledge gaps were not significant once dissemination was included. This finding warrants careful interpretation. It does not imply that asymmetry and knowledge gaps are unimportant, since both were pronounced in the descriptive data and both are conceptually prior to dissemination. Rather, it suggests that these constructs exert their influence largely through dissemination, which is the active mechanism by which information reaches communities. Asymmetry and knowledge gaps describe states of the information environment, whereas dissemination describes the flow that can change those states. When the flow is measured directly, it absorbs much of the explanatory weight, a result that is theoretically coherent and that points clearly to the lever most amenable to intervention.

This interpretation aligns with a strand of the literature that emphasises the quality and intentionality of communication rather than the existence of gaps as such. Studies of forest carbon and conservation projects have repeatedly noted that information is often shared in a manner that is instrumental, technical or delayed, and that genuine comprehension depends on accessible, repeated and locally

grounded communication (The Nature Conservancy, 2023). The dominance of dissemination in the present model gives empirical support to these arguments and suggests that improving the active flow of information would do more to advance participation than would addressing asymmetry or knowledge in the abstract. It is also notable that the standardised coefficient for dissemination, at 0.726, is unusually large for a single social science predictor, underscoring how central communication is to whether communities take part in decisions about their forests.

The findings should be read in the light of the study's limitations. The sample of ninety-one households, while determined through an accepted formula and adequate for the analysis undertaken, is modest, and the cross-sectional design precludes strong causal claims. The use of a linear probability model for a binary outcome, although common and interpretable, carries known statistical limitations. Self-reported measures of participation may be subject to recall and social desirability effects, the latter being a particular risk where respondents hope to benefit from the projects under study. Finally, the study captures forest-dependent communities in Sinda and Vubwi districts at a particular time, and conditions may differ across the wider and diverse project landscapes of Eastern Province and Zambia as a whole. These limitations temper the generalisations that can be drawn, but they do not undermine the core finding, which is robust within the data and well aligned with theory and prior evidence.

Beyond its immediate findings, the study offers a practical message. If dissemination is the lever that most effects participation, then the design of carbon projects should treat community communication as a core function rather than a procedural afterthought. This means budgeting for sustained engagement, employing staff with the skills and local languages required to communicate effectively, and measuring the reach and comprehension of information rather than merely recording that meetings were held. It also means aligning project level practice with the transparency principles now promoted at the level of global carbon market standards, so that the integrity expected of the market as a whole is reflected in the relationships between developers and communities (Integrity Council for the Voluntary Carbon Market, 2023; Rocky Mountain Institute, 2023; Voluntary Carbon Markets Integrity Initiative, 2023). For regulators in Zambia, the finding strengthens the case for embedding explicit standards of community information and participation in the emerging framework for carbon trading, so that the quality of dissemination does not rest solely on the goodwill of individual developers.

The study also makes a modest theoretical contribution by clarifying the relationship between three constructs that are often used loosely and sometimes interchangeably. Information asymmetry, knowledge gaps and information dissemination are distinct, and the evidence here suggests that they stand in a particular relation to one another. Asymmetry is the structural condition, knowledge gaps are its cognitive consequence for communities, and dissemination is the active process through which both may be altered. By measuring all

three and finding that only dissemination predicts participation, the analysis supports a view in which dissemination mediates the influence of the other two. This framing connects the economics of information, which explains why asymmetry matters, to the governance literature on participation, which explains why informed involvement is necessary for legitimacy, and it suggests that interventions should target the process of communication rather than the abstract state of imbalance.

These implications gain added weight when set against the scale of carbon investment now flowing into Eastern Province. With a jurisdictional programme offering results-based payments alongside large project-level initiatives, the number of communities exposed to carbon arrangements is growing rapidly (World Bank, 2024; BioCarbon Partners, 2023). If the weak dissemination documented here is representative, then the expansion of carbon finance risks reproducing nominal participation on a far larger scale, embedding patterns of shallow engagement across the province. Conversely, if developers and regulators act on the evidence that dissemination is the decisive lever, the same expansion could become an opportunity to establish strong communication norms from the outset. The trajectory of community engagement in Zambian carbon markets may therefore depend less on the structural inevitability of asymmetry than on deliberate choices about how, and how well, communities are informed.

VI. CONCLUSION AND RECOMMENDATIONS

This study set out to assess the effect of information dissemination on community participation in decision-making in carbon credit projects in Sinda and Vubwi districts of Eastern Province, Zambia, with attention to information asymmetry and knowledge gaps. The evidence shows that forest-dependent communities experience high information asymmetry and weak information dissemination, that only about a quarter of community members participate in project decision-making, and that information dissemination is the single significant predictor of participation, explaining, together with the other information variables, almost a third of the variance. The structural state of asymmetry and the static measure of knowledge gaps, although pronounced, did not predict participation once dissemination was accounted for. The clear implication is that the active and intelligible flow of information, rather than the mere existence of imbalance, is what most powerfully shapes community engagement, and that strengthening this flow is the most promising route to deeper and fairer participation.

On the basis of these findings, several recommendations are advanced. First, project developers and jurisdictional programmes should invest in sustained, two-way communication that is delivered in local languages, uses accessible formats and is repeated over the life of the project rather than confined to an initial sensitisation. Second, the informed dimension of free, prior and informed consent should be strengthened and documented, ensuring that communities understand project risks, benefit-sharing

arrangements and their own obligations before consenting. Third, transparency in benefit-sharing should be enhanced through the regular, public disclosure of revenues and their distribution. Fourth, independent capacity building and advisory support should be provided to communities and local committees so that they can interrogate information and represent their interests on more equal terms. Fifth, accessible grievance and redress mechanisms should be established to give substance to participation. Finally, the developing national framework for carbon regulation and benefit-sharing should embed clear standards for community information and participation, so that good practice does not depend solely on the discretion of individual project actors.

By acting on these recommendations, those responsible for carbon credit initiatives in Eastern Province can move beyond the nominal participation documented here towards the genuine, informed engagement on which the legitimacy, equity and durability of forest carbon finance ultimately depend. Future research should extend the analysis through larger and more representative samples, longitudinal designs and comparative work across the wider and varied project landscapes of the province, in order to deepen understanding of how information conditions shape community outcomes over time.

REFERENCES

- [1]. Akerlof, G., 1970. The market for lemons: quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84(3), pp. 488-500.
- [2]. Arnstein, S., 1969. A ladder of citizen participation. *Journal of the American Institute of Planners*, 35(4), pp. 216-224.
- [3]. BioCarbon Partners, 2023. Climate finance and community conservation in Zambia, Lusaka: BioCarbon Partners.
- [4]. Brookings Institution, 2025. Improving carbon credit markets: transparency, quality and fungibility, Washington, DC: Brookings Institution.
- [5]. Government of the Republic of Zambia, 2022. Eighth National Development Plan 2022-2026, Lusaka: Ministry of Finance and National Planning.
- [6]. Integrity Council for the Voluntary Carbon Market, 2023. The Core Carbon Principles, London: Integrity Council for the Voluntary Carbon Market.
- [7]. Interactive Country Fiches, 2021. Forest: Zambia, Geneva: United Nations Environment Programme.
- [8]. International Institute for Environment and Development, 2021. Strengthening governance of community-based natural resource management in Zambia, London: International Institute for Environment and Development.
- [9]. Milupi, I., Mubita, K., Monde, P. & Simooya, S., 2021. Community participation and community based natural resource management in Zambia. *International Journal of Research and Innovation in Social Science*, 5(9), pp. 421-430.
- [10]. Milupi, I., Somers, M. & Ferguson, W., 2020. Inadequate community engagement and sustainable wildlife resource management in Zambia. *African Journal of Ecology*, 58(3), pp. 343-351.
- [11]. Mulenga, B., Tembo, S. & Richardson, R., 2019. Electricity access and charcoal consumption among urban households in Zambia. *Development Southern Africa*, 36(5), pp. 585-599.
- [12]. Öko-Institut, 2023. Assessing the transparency and integrity of benefit-sharing in voluntary carbon market projects, Freiburg: Öko-Institut.
- [13]. Probst, B. et al., 2024. Systematic assessment of the achieved emission reductions of carbon crediting projects. *Nature Communications*, Volume 15, p. 9562.
- [14]. Rocky Mountain Institute, 2023. Radical transparency for voluntary carbon markets, Boulder, CO: Rocky Mountain Institute.
- [15]. Spence, M., 1973. Job market signaling. *Quarterly Journal of Economics*, 87(3), pp. 355-374.
- [16]. The Nature Conservancy, 2023. Fairer carbon market frameworks for communities, Arlington, VA: The Nature Conservancy.
- [17]. Voluntary Carbon Markets Integrity Initiative, 2023. Claims Code of Practice, London: Voluntary Carbon Markets Integrity Initiative.
- [18]. West, T. et al., 2023. Action needed to make carbon offsets from forest conservation work for climate change mitigation. *Science*, 381(6660), pp. 873-877.
- [19]. World Bank, 2024. Zambia and the World Bank sign agreement to cut carbon emissions in Eastern Province, Washington, DC: World Bank.
- [20]. World Vision, 2021. Restoring Zambia's forests through community action, Lusaka: World Vision Zambia.