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The Roles of Social Forest Navigation and Community Engagement in Achieving Successful Forest Reclamation and Empowered Ecosystems

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This study explores the complex interrelationships among empowered ecosystems (EE), social forest navigation (SFN), community engagement (CE), and forest reclamation (FR) with the aim of enhancing community forests in Indonesia. To test the proposed hypotheses, the research utilized confirmatory factor analysis (CFA) and path analysis within a quantitative framework. The results reveal that both SFN and CE exert significant positive direct effects on FR and EE. Additionally, FR serves as a crucial mediating variable in the relationships between CE and EE, as well as between SFN and EE. These findings underscore the vital role of social and community initiatives in facilitating effective forest reclamation, thereby empowering ecosystems. The implications of this research are substantial for community leaders, policymakers, and environmental organizations involved in sustainable forest management. By offering a more nuanced understanding of the intricate dynamics linking community involvement, forest reclamation, social engagement, and empowered ecosystems, this study contributes to the existing body of knowledge. However, it is important to note the study's limitations, which include a focus on a specific geographic region and reliance on self-reported data. Despite these constraints, the thorough examination of mediating effects distinguishes this research and advances the theoretical framework for community forest empowerment. Furthermore, this work lays a significant foundation for future studies aimed at deepening our understanding of the interplay between community empowerment and environmental conservation in diverse contexts.

Keywords: SFN, CE, EE, FR.

Introduction

In recent years, initiatives aimed at mitigating the detrimental impacts of deforestation and environmental degradation have increasingly focused on FR (Ukhurebor et al., 2022). The persistent degradation of forest ecosystems over recent decades has spurred a global movement advocating for sustainable practices (Duguma et al., 2019; Nguyen et al., 2023). Communities play a pivotal role in FR by providing direct support and shaping public perceptions of these efforts (Nzyoka et al., 2021). Moreover, the emergence of social media and other digital communication platforms has significantly transformed the ways individuals engage with one another. According to Lewis Hood & Gabrys (2024), social forest navigation, which includes online interactions on platforms such as Instagram, Twitter, and Facebook, is increasingly influencing public perceptions of environmental issues, including forest reclamation. Song et al. (2021) further assert that the public's engagement with reforestation initiatives is significantly affected by the discussions and information disseminated through these online channels.

Community involvement is essential for the success of FR efforts, irrespective of their scale (Stanturf et al., 2019). Active participation from local communities, stakeholders, and individuals can greatly facilitate the restoration of damaged forest ecosystems (Reyes-García et al., 2019). Such involvement may manifest through direct engagement in field activities as well as online advocacy and support. Moewaka Barnes et al. (2021) and Zhang, Yu, & Tian (2023) highlight that empowering communities requires more than merely possessing technical knowledge of reclamation; individuals must also have the capacity to understand, manage, and actively participate in the development and preservation of their environment. In Indonesia, SFN is gaining traction, with platforms like Facebook, Twitter, and Instagram playing a substantial role in shaping public discourse around FR (Dermawan, Hospes, & Termeer, 2022; Erbaugh, 2019; Sahide et al., 2020). By participating in online discussions and engaging in practical activities such as tree planting and environmental monitoring, individuals cultivate a stronger sense of community empowerment and a deeper understanding of the importance of forest reclamation.

Despite the ongoing challenges and conflicting interests among various stakeholders, successful FR efforts in Indonesia have been bolstered by collaborative conflict resolution and government support (Dhiaulhaq, McCarthy, & Yasmi, 2018; Fisher et al., 2017; Fisher et al., 2018). Notably, the private sector has also contributed essential financial resources and expertise to these initiatives. The growth of ecotourism in Indonesia has further expanded opportunities for local communities to engage in reforestation, environmental protection, and economic empowerment (Surya et al., 2020). Within the broader context of forest reclamation, Indonesia is actively exploring innovative approaches to foster resilient ecosystems through advanced technologies and cross-sector collaboration (Firdaus, Wibowo, & Rochmayanto, 2017; Wiati et al., 2022). While research

indicates that collaborative conflict resolution, government support, private sector involvement, ecotourism, and advanced technology all contribute positively to FR in Indonesia, significant gaps remain.

First, the effectiveness of collaborative conflict-resolution strategies among stakeholders warrants further investigation. Second, while private sector engagement is recognized as crucial, there is a need for deeper exploration of its impacts, motivations, and potential conflicts. Third, although ecotourism is linked to forest reclamation, more research is necessary to understand its empowering effects on local communities, particularly regarding socioeconomic impacts and sustainability. Additionally, further examination of beneficial technologies, the challenges of their integration, and the dynamics of cross-sector collaboration is essential. Lastly, the long-term ecological, social, and economic sustainability of EE, along with potential barriers to their development, require investigation. Addressing these research gaps will provide valuable insights for policymakers, practitioners, and researchers focused on sustainable development and environmental conservation in Indonesia. Currently, the complex relationship between social forest navigation and community participation in empowering communities concerning FR has not been comprehensively explored in the literature. Therefore, the primary objective of this study is to bridge this knowledge gap and contribute to our understanding of how online dynamics intersect with community participation to enhance the effectiveness of FR efforts. By examining the critical roles of CE and social forest navigation, this study aims to lay a foundation for developing more effective policies and practices within the broader context of environmental and forest conservation.

Literature Review and Hypotheses Development

The Relationships that Social Forest Navigation Has with Empowered Ecosystems and Forest Reclamation

SFN was introduced by Abrams et al. (2020) to depict the intricate network of relationships that emerges when individuals within forest communities collaborate. This concept emphasizes a dynamic process in which community members actively shape and navigate their social interactions, community dynamics, and collaborative initiatives related to forest management. The notion of EE, as explored by Khalid et al. (2019) and Guerreiro & Botetzagias (2018), underscores a direct link between community empowerment and effective environmental stewardship. Their research suggests that communities that experience higher levels of empowerment are more likely to successfully advance their forest reclamation projects. Furthermore, significant contributions to the discourse on forest reclamation have been made by Wang (2023) and Norah & Mukanzi (2019). Norah and Mukanzi's (2019) investigation into participatory approaches to forest restoration reinforces the idea that the success of forest reclamation initiatives is enhanced when a greater number of community members engage in the process. Similarly, Wang (2023) research on adaptive management strategies further enriches our understanding of community-driven approaches in this domain. Scholars across various disciplines have examined the interconnected dynamics among empowered ecosystems, SFN, and FR. Munandar (2021) made a noteworthy contribution by analysing the reciprocal relationship between online discourse and community empowerment. This work supports the hypothesis that SFN positively correlates with both EE and successful outcomes in FR initiatives. Building on the insights from these scholars, we propose the following hypotheses:

H1a: SFN has an effect on FR.
H1b: SFN has an effect on EE.

The relationships that CE has with EE and FR

CE as the process of involving local individuals in decision-making and activities that impact their daily lives and the broader community (Jackson et al., 2018; Siregar et al., 2022). In the context of forestry projects, sustainable development, and environmental conservation, CE aims to instil a sense of ownership among locals, thereby encouraging active participation in these initiatives (Haji, Valizadeh, & Hayati, 2021; Ilyas & Sampurno, 2022). Understanding the intricate relationships between community engagement, forest reclamation, and EE is essential for developing effective environmental management strategies. The significance of CE for environmental initiatives has been underscored by researchers such as MacFarlane (2020) and Maulana & Wardah (2023). Maulana & Wardah (2023) examined the role of social capital in fostering community engagement, while MacFarlane (2020) study highlighted the positive effects of community participation in decision-making processes. Both studies support the assertion that increased community involvement enhances the success of FR projects. The concept of EE has been further elaborated upon by Kohsaka & Rogel (2021) and Muhamad Khair, Lee, & Mokhtar (2020). Kohsaka & Rogel (2021) emphasized the importance of local knowledge and practices in creating EE, while Muhamad Khair et al. (2020) focused on the relationship between community empowerment and sustainable ecosystem management. These studies suggest that sustainable FR initiatives are positively correlated with the degree of community empowerment. The crucial role of community involvement in forest restoration has been well-documented in the works of Disterheft et al. (2015) and Dreiss et al. (2017). Disterheft et al. (2015) highlighted the importance of collaborative approaches for achieving effective outcomes, whereas Dreiss et al. (2017) concentrated on strategies for adaptive management. Collectively, this literature reinforces the idea that FR efforts are unlikely to succeed without robust community participation. The interdependent nature of community involvement, forest restoration, and EE is emphasized in the literature. Surya et al. (2020) propose that community involvement and the development of EE can be viewed as two facets of the same concept. This

relationship supports the notion that engaging communities is critical for achieving self-sustaining ecosystems and effective forest restoration initiatives. The research suggests that community involvement has multifaceted and complementary ties to both forest restoration and EE. Insights from these studies can inform the formulation of hypotheses to guide empirical research and promote more sustainable and integrated approaches to forest management and environmental conservation. The proposed hypotheses are as follows:

H2a: CE has an effect on FR
H2b: CE has an effect on EE

The Relationship Between FR and EE

According to Ukhurebor et al. (2022), FR entails the intentional restoration of degraded or deforested areas back to their original ecological condition, thereby enhancing their ecological functionality. Successful FR is contingent upon various factors, including community involvement, government regulations, and the ecological resilience of the species being reintroduced (Mañas-Pellejero & Paz, 2022; Purnamasari et al., 2022; Rawat et al., 2022). EEs are characterized by the active participation of local communities in the restoration and management of their natural environments (Broeckhoven & Cliquet, 2015; Jánský & Tomášek, 2023; Pinilla Burgos, 2022). This empowerment involves equipping communities with the necessary knowledge, resources, and decision-making authority, enabling them to significantly contribute to the sustainability and biodiversity of their ecosystems (Hussein et al., 2022; Katırcı, Saymanlıer, & Dağ, 2023; Petriello et al., 2021). The existing literature suggests a strong interdependence between FR and EEs, indicating that community participation is essential in reclamation efforts. By providing both economic and ecological empowerment to local communities, these initiatives foster a sense of ownership and accountability, which are critical for the success of FR and the long-term resilience of restored areas. Research by Barrett et al. (2019) and Moeliono et al. (2023) further underscores the positive relationship between ecosystem empowerment and community engagement. Barrett et al. (2019) examined community-led reclamation initiatives, emphasizing the importance of community empowerment in sustaining ecological restoration. Similarly, Moeliono et al. (2023) highlighted the necessity of empowering local communities to act as environmental stewards, which contributes to the overall success of FR efforts. The relationship between FR and EEs is also significantly shaped by government policies and institutional support. Wambwa, Mundike, & Chirambo (2023) emphasized the importance of establishing clear policies that promote community involvement and empowerment in reclamation initiatives. Effective policies foster an enabling environment that encourages communities to actively participate in and contribute to FR projects. In summary, the literature indicates a mutually reinforcing connection between FR and EEs, wherein the success of reclamation initiatives is closely tied to the engagement of empowered communities, supported by well-designed policies and institutional frameworks. Understanding this interdependent relationship is vital for developing sustainable strategies for environmental preservation and ecosystem management. Therefore, we propose the following hypotheses:

H3: FR Is Related to Empowered Ecosystems

FR as a Mediator

The significance of community involvement in FR projects has been emphasized by Sapkota, Stahl, & Rijal (2018), while Korneeva & Belyaev (2023) examined the adaptive strategies essential for successful forest reclamation. These studies suggest that FR may serve as a mediating factor in the relationship between CE and EEs. Zauhar & Santoso (2023) further explored the intricate connections among forest reclamation, EEs, and community engagement, finding that FR plays a crucial mediating role in the symbiotic relationship between community involvement and the development of EEs. This research supports the assertion that a positive correlation exists among community involvement, forest restoration, and the cultivation of EEs. According to the literature, FR facilitates the achievement of EEs by acting as a mediator in its relationship with community engagement. Understanding these interrelated dynamics is vital for formulating effective strategies for environmental conservation. Testing hypotheses based on this mediation model could enable the development of more comprehensive, long-term strategies for forest management and ecological preservation. Therefore, we propose the following hypotheses:

H4a: FR mediates the relationship between SFN and EE.
H4b: FR mediates the relationship between CE and EE.

The relationships among social forest navigation, forest reclamation, community engagement, and EEs are depicted in the graphic through solid arrows, illustrating their direct connections. Specifically, SFN exerts a direct and significant influence on both FR and EEs, as indicated by the orange arrows. Similarly, CE directly affects both EEs and forest reclamation, represented by the blue arrows. The green arrows illustrate the interdependence between FR and EEs, highlighting their direct link. Dashed arrows are employed to signify the indirect relationships that SFN and CE have with EEs, with FR acting as a mediating factor.

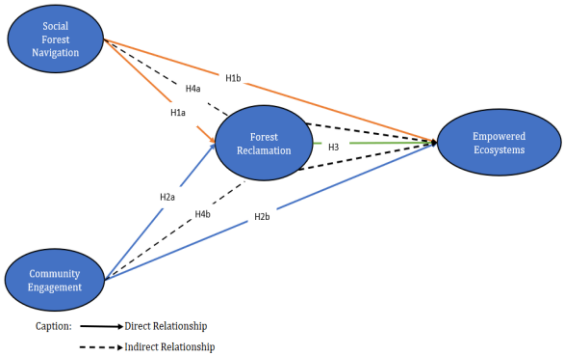

Figure 1: Study Framework.

Thus, Figure 1 provides a visual representation of the dynamic interactions among social forest navigation, community engagement, forest reclamation, and EEs within the research framework. This visualization aids in elucidating the complex relationships among these elements. The use of color-coded solid and dashed arrows enhances clarity regarding the intricate web of connections proposed in the model. Overall, Figure 1 effectively illustrates the research framework, drawing upon insights from existing literature. It encapsulates the fundamental concepts derived from prior studies and serves as a visual guide for comprehending the intricate components of the proposed research model. By incorporating key elements from the literature, this diagram represents the connections, dependencies, and overall framework of the research, making it a valuable reference for researchers, practitioners, and stakeholders seeking a comprehensive understanding of the dynamics within the model.

Methodology

Research Approach and Design

In this study, the development of EEs serves as the dependent variable, and a quantitative approach is utilized to examine its relationships with SFN and CE. The study also explores the mediating role of FR in the relationships between the independent and dependent variables to provide a deeper understanding of these dynamics. Notably, this observational study does not employ control or experimental groups. The independent variables CE and SFN reflect the levels of community involvement in FR efforts and the use of media platforms for social navigation. These variables were assessed using a quantitative instrument, specifically a questionnaire. The dependent variable, EEs, measures the extent to which the communities have successfully empowered their ecosystems. Additionally, FR is considered a mediating variable that helps clarify how reforestation activities enhance the effects of SFN and CE on the development of EEs. By examining these relationships, the study aims to elucidate the intricate interplay among these variables and their collective impact on empowering ecosystems.

Population, Sample, Instruments, and Measurement

This rigorous methodology helped ensure that the data collected was representative, valid, and reliable, thus enabling precise insights to address the research questions (see Table 1). The study examined the participation of local communities in FR projects in Indonesia, specifically investigating the effects of SFN and CE on the development of EEs. A random sampling technique was employed (Olken & Rotem, 1995) to ensure the inclusion of approximately 300 individuals. Of the questionnaires distributed, 287 were returned; however, the analysis focused on responses from 271 participants. This dataset provided valuable insights into the complex dynamics being explored. A structured questionnaire was meticulously designed to assess factors related to community participation, indicators of successful reclamation, and the level of empowerment within the ecosystem. The research instrument underwent validation through content analysis by experts, ensuring its relevance and appropriateness. Additionally, the reliability of the results was confirmed by retesting a subset of the sample.

Data-Collection and -Analysis Procedures

Participant preferences determined whether surveys were administered face-to-face or online. To ensure both validity and reliability, data were collected using pre-tested questionnaires. This study adopted a systematic approach to data analysis by employing structural equation modelling (SEM) in conjunction with the Smart PLS application. The conceptual model incorporated key variables, including SFN, CE, FR, and ecosystem empowerment. Following data collection and preparation, the Smart PLS application calculated model estimation parameters, such as path coefficients, which elucidated the significance and strength of inter-variable relationships (Chen et al., 2011). To assess statistical significance and model quality, we conducted goodness-of-fit evaluations and hypothesis testing. This analytical framework provided insights into the relative importance of each variable in explaining ecosystem empowerment and FR in Indonesia. The research report presents and interprets the results of this analysis, contributing to the understanding of these complex dynamics.

Research Ethics, Reliability, and Validity

This study placed a strong emphasis on research ethics by securing approval from the relevant research ethics institution. Ensuring the rights and safety of participants was paramount, and comprehensive information regarding informed consent was provided. The reliability of the research was further enhanced by consistently employing standardized instruments and utilizing a representative sample (Martin & Czellar, 2016). To ensure the overall validity of the study, strict controls were maintained over variables, and an experimental design was implemented to promote internal validity. This comprehensive approach underscores the commitment to conducting the research ethically, reliably, and robustly (Pedhazur & Schmelkin, 2013). The results of the CFA are presented in Table 2 and were utilized to validate the theoretical constructs proposed in the research model. This validation process contributes to the credibility of the findings and supports the study's theoretical framework.

SFN, CE, FR, and EE exhibit strong connections to their respective latent constructs, as evidenced by substantial outer loadings. The measurements of internal consistency specifically Cronbach's Alpha, rho_A, composite reliability (CR), and average variance extracted (AVE) all demonstrate high values, indicating that the measurement model is both reliable and possesses convergent validity. Most notably, the results of the CFA reinforce the strength of the model's theoretical foundations, ensuring that the selected items accurately represent the latent constructs associated with community, forest, and empowerment themes. This validation confirms the robustness of the model in capturing the complexities of SFN, CE, forest reclamation, and EE

Table 1: Study Instrument.

Variable	Items and Indicator	Reference
Social Forest Navigation	1. SFN1: I actively engage in discussions, share information, and contribute to social platforms related to forest navigation. 2. SFN2: I frequently interact with social media content, discussions, or events related to social forest navigation. 3. SFN3: I actively seek information, updates, or resources regarding forest-related topics on social media. 4. SFN4: I participate and contribute within online communities or groups focused on forest-related discussions and activities. 5. SFN5: I expand my social network within the context of forest-related topics, thus showcasing the reach and influence of my engagement. 6. SFN6: I regularly share forest-related content, including articles, images, or experiences, thus demonstrating my involvement and commitment to social forest navigation. 7. SFN7: I receive feedback and reactions in response to my contributions, thus indicating the impact and influence of my social forest navigation activities.	Abrams et al. (2020)
Community Engagement	1. CE1: I actively participate in community events and initiatives related to environmental conservation and forest reclamation. 2. CE2: I contribute my time and effort to community projects aimed at promoting sustainable practices and preserving natural ecosystems. 3. CE3: I collaborate with fellow community members to address environmental challenges and collectively work toward positive change. 4. CE4: I engage in discussions and decision-making processes within the community to support environmentally friendly policies and practices. 5. CE5: I volunteer for community-driven initiatives focused on raising awareness about the importance of forest conservation and ecosystem empowerment. 6. CE6: I foster a sense of community cohesion by encouraging fellow members to actively participate in environmental activities and projects. 7. CE7: I actively seek opportunities to involve community members in educational programs and workshops that promote sustainable living and forest protection.	Muhamad Khair et al. (2020); Surya et al. (2020)
Forest Reclamation	1. FR1: I actively participate in forest reclamation projects, thus contributing to the restoration and rehabilitation of degraded forest areas. 2. FR2: I engage in the planting of native trees and vegetation as part of efforts to reclaim and revitalize deforested or damaged ecosystems. 3. FR3: I support and adhere to sustainable forestry practices, thus ensuring that reclamation activities prioritize the long-term health and resilience of the forest. 4. FR4: I collaborate with environmental organizations and local authorities to implement effective science-based strategies for forest reclamation. 5. FR5: I advocate for the responsible use of land and resources, thus promoting policies that prioritize the reclamation and protection of forests. 6. FR6: I actively involve local communities in forest-reclamation initiatives, thus fostering a sense of shared responsibility for environmental stewardship. 7. FR7: I monitor and assess the progress and impact of forest-reclamation projects, thus adapting strategies to address emerging challenges and ensure long-term success.	Rawat et al. (2022); Ukhurebor et al. (2022)
Empowered Ecosystems	1. EE1: I actively contribute to the development of ecosystems that empower local communities and promote biodiversity. 2. EE2: I advocate for sustainable land-use practices that enhance the resilience and vitality of ecosystems within my community. 3. EE3: I engage in educational initiatives to raise awareness about the importance of ecosystem empowerment and the interconnectedness of all living organisms. 4. EE4: I actively participate in conservation efforts, thus working toward the restoration of ecosystems and the protection of endangered species. 5. EE5: I support policies and practices that prioritize the wellbeing of ecosystems, thus fostering a balance between human activities and the preservation of natural habitats. 6. EE6: I collaborate with environmental organizations and community groups to implement projects aimed at enhancing the overall health and functionality of ecosystems. 7. EE7: I strive to create a sense of environmental stewardship within my community, thus encouraging individuals to actively participate in activities that contribute to the empowerment of ecosystems.	Barrett et al. (2019); Moeliono et al. (2023)

Table 2: Confirmatory Factor Analysis.

Construct	Items	Outer Loading	Cronbach's Alpha	rho_A	CR	AVE
Social Forest Navigation	SFN1	0.932	0.979	0.979	0.982	0.886
	SFN2	0.946				
	SFN3	0.947				
	SFN4	0.944				
	SFN5	0.936				
	SFN6	0.949				
	SFN7	0.934				
Community Engagement	CE1	0.875	0.974	0.977	0.978	0.865
	CE2	0.942				
	CE3	0.946				
	CE4	0.921				
	CE5	0.961				
	CE6	0.912				
	CE7	0.951				
Forest Reclamation	FR1	0.883	0.967	0.969	0.972	0.834
	FR2	0.923				
	FR3	0.947				
	FR4	0.920				
	FR5	0.923				
	FR6	0.896				
	FR7	0.899				
Empowered Ecosystems	EE1	0.926	0.954	0.957	0.963	0.789
	EE2	0.890				
	EE3	0.942				
	EE4	0.888				
	EE5	0.727				
	EE6	0.920				
	EE7	0.908				

Source: Primary data from research, 2024

Findings

Descriptive Statistics

In the initial segment of the survey, participants were asked to provide key demographic information, specifically regarding gender, age range, and educational qualifications. This demographic data facilitated a comprehensive understanding of the participants' backgrounds, serving as a foundational basis for the detailed analysis of their perspectives and insights in the subsequent sections of the questionnaire (see Table 3). The gender distribution among the participants revealed a slight disparity, with 58.30% identifying as male and 41.70% as female. In terms of age distribution, 33.58% of respondents fell within the 30–40 age range, while those under 30 comprised 28.41% of the sample. Additionally, 19.56% were between the ages of 41 and 50, and 18.45% were over 50, indicating a relatively even distribution across the age groups. Regarding educational qualifications, nearly half (49.08%) of participants held a bachelor's degree (S1), 35.79% had completed high school, and 14.39% had obtained a diploma (D3). Only 0.74% of respondents had earned a master's degree or higher (S2). The perspectives of the respondents will be analysed in depth, building on the comprehensive demographic breakdown. Given that gender, age, and educational level can potentially influence responses, it is crucial to consider these demographic factors in the analysis of the results.

Table 3: Descriptive Statistics.

Measurement	Latent Construct/Value	f	(%)
Gender	Male	158	58.30
	Female	113	41.70
		271	**100.00**
Age	< 30	77	28.41
	30 - 40	91	33.58
	41 – 50	53	19.56
	> 50	50	18.45
		271	**100.00**
Education	High school	97	35.79
	D3	39	14.39
	S1	133	49.08
	S2	2	0.74
		271	**100.00**
	Total Respondents	**271**	**100.00**

Classic Assumption Test

Table 4 indicates that all variables exhibit significance levels greater than 0.05, allowing us to conclude that the data distribution is normal. Subsequent analyses, as presented in Tables 5 through 9, demonstrate linear relationships among the variables, Table 5 confirms that the relationship between SFN and forest reclamation is linear. Table 6 establishes a linear relationship between CE and FR. Table 7 indicates a linear connection between SFN and empowered ecosystems. Table 8 reaffirms the linear relationship between CE and EE. Furthermore, Table 9 reiterates the linear relationship of CE with EE, underscoring the consistency of this finding across multiple assessments. According to Table 10, the Variance Inflation Factor (VIF) values for all variables are less than

10, and the Tolerance (TOL) values are greater than 0.1. This suggests that the multiple linear regression model does not suffer from multicollinearity, indicating that there are no strong correlations among the independent variables. Thus, these variables can be confidently utilized in the research analysis.

Table 4: Normality Test: One-Sample Kolmogorov–Smirnov Test.

		Soc_f_Nav	Comm_Nav	Forest_Recl	Emp_Eco
N		271	271	271	271
Normal Parameters[a,b]	Mean	30.5018	29.6531	59.7528	29.8044
	Std. Deviation	4.76397	4.73888	7.01491	4.37867
Most Extreme Differences	Absolute	.237	.238	.173	.222
	Positive	.173	.156	.111	.118
	Negative	-.237	-.238	-.173	-.222
Kolmogorov-Smirnov Z		1.902	1.920	1.844	1.655
Asymp. Sig. (2-tailed)		.540	.650	.521	.612

a. Test distribution is Normal.
b. Calculated from data.

Table 5: Linearity Test for SFN and FR.

Dependent Variable: Forest Reclamation					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	5686.780[a]	12	473.898	16.088	.000
Intercept	143002.637	1	143002.637	4854.783	.000
Soc_f_Nav	5686.780	12	473.898	16.088	.000
Error	7599.656	258	29.456		
Total	980863.000	271			
Corrected Total	13286.435	270			

a. R Squared = .428 (Adjusted R Squared = .401)

Source: Primer data Analysis 2024

Table 6: Linearity Test for CE and FR.

Dependent Variable: Forest Reclamation					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	10517.120[a]	19	553.533	50.170	.000
Intercept	181266.943	1	181266.943	16429.334	.000
Comm_Nav	10517.120	19	553.533		
Error	2769.315	251		50.170	.000
Total	980863.000	271	11.033		
Corrected Total	13286.435	270			

a. R Squared = .792 (Adjusted R Squared = .776)

Source: Primer data Analysis 2024

Table 7: Linearity Test for SFN and EE.

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	10517.120[a]	19	553.533	50.170	.000
Intercept	181266.943	1	181266.943	16429.334	.000
Social Forest engagement	10517.120	19	553.533		
Error	2769.315	251		50.170	.000
Total	980863.000	271	11.033		
Corrected Total	13286.435	270			

a. R Squared = .792 (Adjusted R Squared = .776)

Sources: Primer data Analysis 2024

Table 8: Linearity Test for CE and EE.

Dependent Variable: Empowered Ecosystems					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	10517.120[a]	19	553.533	50.170	.000
Intercept	181266.943	1	181266.943	16429.334	.000
Comm_Nav	10517.120	19	553.533		
Error	2769.315	251		50.170	.000
Total	980863.000	271	11.033		
Corrected Total	13286.435	270			

a. R Squared = .792 (Adjusted R Squared = .776)

Sources: Primer data Analysis 2024

Table 9: Linearity Test for CE and EE.

Dependent Variable: Empowered Ecosystems					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	7790.142[a]	16	486.884	22.500	.000
Intercept	203112.640	1	203112.640	9386.437	.000
Community Engagement	7790.142	16	486.884		
Error	5496.293	254		22.500	.000
Total	980863.000	271	21.639		
Corrected Total	13286.435	270			

a. R Squared = .586 (Adjusted R Squared = .560)

Sources: Primer data Analysis 2024

Table 10: Multicollinearity Test Results.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	62.431	3.012		11.321	.000		
	Social Forest Navigation	.031	.124	.007	.123	.832	.921	1.045
	Community Engagement	.035	.234	.015	.112	.321	1.012	1.034
	Forest Reclamation	.065	.211	.012	.223	.812	.932	1.012
	Empowered Ecosystems	.026	.121	.006	.232	.522	.943	1.011

a. Dependent Variable: Internal Factor

Sources: Primer data analysis 2023

Direct Relationships

Table 11 indicates that each variable demonstrates significance levels greater than 0.05: specifically, SFN (X1) at 0.507, CE (X2) at 0.507, FR (Y) at 0.500, and EE (Z) at 0.713. This suggests that there are no issues with heteroscedasticity in the regression model. The path analysis results, as illustrated in Table 4 and Figure 2, provide valuable insights into the hypothetical relationships among SFN, CE, FR, and EE. For the first hypothesis, H1a (SFN to FR) and H1b (SFN to EE) yield positive and statistically significant path coefficients, with T statistics of 5.853 and 6.285, respectively, and p-values of 0.000 for both. This strongly supports the assertion that SFN significantly impacts both FR and EE. The positive coefficients imply that social navigation activities notably enhance the effectiveness of FR projects and contribute to the development of EE. For the second hypothesis, H2a (CE to FR) and H2b (CE to EE) also reveal positive and statistically significant path coefficients, with T statistics of 3.262 and 6.322, respectively, and p-values of 0.001 and 0.000. These findings reinforce the idea that CE is crucial for supporting FR and fostering EE. Thus, active community involvement significantly enhances both FR efforts and EE. The third hypothesis, H3 (FR to EE), shows a positive and statistically significant path coefficient, with a T statistic of 4.697 and a p-value of 0.000. This finding underscores the substantial role that FR plays in the development of EE. In summary, the results of the path analysis support all hypothesized relationships among the constructs. Empirical evidence confirms the positive effects of SFN, CE, and FR on the development of EE, as indicated by the positive and statistically significant path coefficients. These findings significantly contribute to the existing theoretical framework by affirming the interrelated nature of social and community factors and their influence on environmental outcomes in the context of community forest empowerment.

Table 11: Heteroscedasticity Test Results.

Model		Coefficients				
		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.612	2.413		.812	.507
	Social Forest Navigation	.027	.065	.034	.723	.507
	Community Engagement	.030	.062	.042	.611	.500
	Forest Reclamation	.079	.153	.035	.712	.421
	Empowered Ecosystems	.068	.112	.045	.670	.713

Sources: Primer Data Analysis 2024

Table 12: Path Analysis.

Hypothesis	Construct*	Original Sample	STDEV	T Statistic	p-Value	Result
H1a	SFN -> FR	0.399	0.068	5.853	0.000	Supported
H1b	SFN -> EE	0.351	0.056	6.285	0.000	Supported
H2a	CE -> FR	0.166	0.051	3.262	0.001	Supported
H2b	CE -> EE	0.324	0.051	6.322	0.000	Supported
H3	FR -> EE	0.221	0.047	4.697	0.000	Supported

Source: Analysis of primer data 2024

Indirect Relationships

The results of the mediation analysis, presented in Table 5, elucidate the mediation effects within the hypothesized pathways, specifically regarding the influences of SFN and CE on EE through the intermediary role of FR. For hypothesis H4a (SFN through FR to EE), the path coefficient is 0.088, with a standard deviation of 0.024, a T statistic of 3.732, and a p-value of 0.000. These results strongly support the hypothesis that SFN exerts a significant indirect influence on EE via the mediation of FR. The positive coefficient suggests that individuals engaging in social navigation activities positively impact both the success of forest reclamation initiatives and the subsequent development of EE. In a similar vein, for hypothesis H4b (CE through FR to EE), the path coefficient is 0.037, with a standard deviation of 0.014, a T statistic of 2.584, and a p-value of 0.010. This finding further substantiates the hypothesis that community engagement significantly influences EE indirectly through forest reclamation. Specifically, the positive coefficient indicates that active CE enhances the success of FR efforts, thereby contributing to the empowerment of ecosystems. Collectively, these results provide robust empirical evidence supporting the presence of mediating effects, highlighting forest reclamation as a critical intermediary process through which both social forest navigation and CE facilitate the development of EE. The statistically significant path coefficients and T statistics underscore the strength and significance of these mediation effects. This nuanced understanding of the mediated pathways enriches the theoretical framework by illuminating the intricate dynamics between social and community variables and their cascading impacts on

environmental outcomes, particularly within the context of community forest empowerment. The findings underscore the importance of fostering both SFN and CE as means to enhance FR efforts, ultimately leading to more empowered and sustainable ecosystems

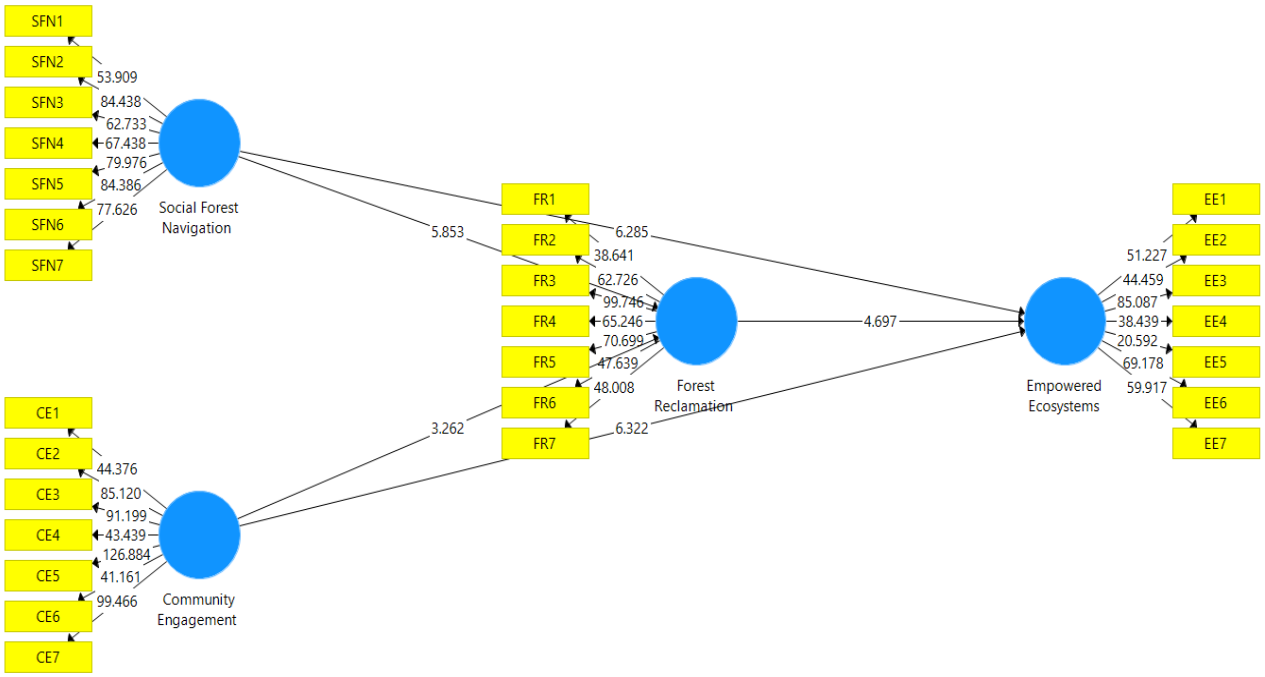

Figure 2: Path Analysis for the Relationships among SFN, CE, EE, and FR.

Table 13: Mediation Results.

Hypothesis	Construct*	Original Sample	STDEV	T Statistic	p-Value	Result
H4a	SFN -> FR -> EE	0.088	0.024	3.732	0.000	Supported
H4b	CE -> FR -> EE	0.037	0.014	2.584	0.010	Supported

*) SFN=Social Forest Navigation; CE=Community Engagement; FR=Forest Reclamation; EE=Empowered Ecosystems

Source: Analysis of primer data 2024

Discussion

The results of this study affirm hypotheses H1a and H1b, highlighting the significant influence of SFN on both FR and EE. The findings indicate that individuals actively engaging on social media to share information and discuss forest conservation positively impact efforts to restore degraded forest areas and promote EE. This underscores the vital role of social involvement in fostering environmentally sustainable ecosystems (Munandar, 2021). The implications of these findings are particularly relevant for the empowerment of community forests in Indonesia. The confirmed relationships suggest that fostering SFN could act as a catalyst for community-driven initiatives that facilitate successful FR and the development of empowering ecosystems. This reliance on social factors emphasizes the need for comprehensive approaches that prioritize community involvement as a critical prerequisite for effective environmental preservation initiatives in Indonesia. The study further supports hypotheses H2a and H2b, confirming that CE significantly affects both FR and EE. The active participation of individuals in community events and discussions about forest conservation is shown to greatly aid in recovering damaged forest areas. Local communities can enhance ecosystem resilience by engaging in collaborative initiatives, thereby contributing to the establishment of environmentally sustainable ecosystems (Kohsaka & Rogel, 2021; Muhamad Khair et al., 2020). This highlights the importance of actively promoting CE as a pathway to successful reclamation efforts. Engaging communities in these initiatives fosters ownership and accountability, crucial for restoring forests and developing ecosystems that empower local populations. Thus, comprehensive strategies that incorporate community involvement are essential for promoting sustainable environmental conservation efforts in Indonesia. Support for hypothesis H3 indicates that FR significantly impacts the development of EE. Effective FR initiatives are essential for enhancing ecosystem resilience and health, suggesting that revitalizing degraded forest areas is a foundational step toward empowering communities. As ecosystems are restored and forests replanted, communities gain access to sustainable resources, leading to improved quality of life and stronger foundations for sustainable development (Rawat et al., 2022). This finding emphasizes the need for integrated forest management strategies that address both community empowerment and environmental conservation. The data also confirm hypotheses H4a and H4b, demonstrating that FR serves a critical mediating role in the relationship between SFN, community engagement, and EE. The positive effects of social navigation on EE manifest through successful FR. Participants engaged in social navigation increase the likelihood of FR success, thereby

strengthening the ecosystem. Similarly, FR acts as a bridge between CE and EE, with community-led projects significantly contributing to forest restoration efforts. The acceptance of hypotheses H4a and H4b illustrates the interconnectedness of these variables in the context of community forest empowerment in Indonesia. Both social navigation and CE are vital for enhancing ecosystem resilience, while effective FR facilitates these positive outcomes. These findings highlight the importance of integrated strategies that emphasize community and social-driven projects in FR, which are crucial for supporting both ecosystems and local communities. This comprehensive approach can ultimately foster sustainable environmental practices and community empowerment in Indonesia.

Conclusion

Within the framework of community forest empowerment in Indonesia, this research aimed to explore the intricate relationships among SFN, CE, FR, and EE. The findings confirmed all the hypotheses, illustrating the significant positive effects of SFN and CE on both FR and the development of EE. The results highlight the interdependence of these factors, emphasizing the necessity of implementing community- and social-driven programs to enhance effective forest restoration and empower ecosystems. Specifically, successful FR emerged as a critical factor that directly contributes to healthier, more resilient ecosystems and improved community wellbeing. Active participation in both social media and community initiatives should be central to community forest empowerment efforts. This engagement not only boosts FR but also fosters a sense of ownership and accountability among community members. Recognizing FR as a mediator between social/CE and EE suggests that well-planned reclamation projects can yield broader ecological and community benefits. This underscores the importance of strategic planning in reclamation efforts to maximize their impact. The insights gained from this study provide valuable guidance for Indonesian policymakers, environmental organizations, and community leaders involved in designing and implementing sustainable forest management strategies. Incorporating these findings into policy frameworks can enhance the effectiveness of community empowerment initiatives. This study clarifies the complex interactions between social engagement, community involvement, FR, and EE, setting the stage for future research. Further investigations could explore specific strategies for enhancing community participation and the long-term impacts of FR on ecosystem health and community resilience. Overall, this research contributes to a deeper understanding of sustainable environmental conservation and community empowerment in Indonesia's forests, paving the way for holistic strategies that integrate social, ecological, and community dimensions.

Theoretical, Empirical, and Social Implications

This study enhances our theoretical understanding by developing and validating a framework that integrates SFN, CE, FR, and EE within the context of community forest empowerment. The confirmation of all hypothesized relationships provides valuable insights into how social dynamics and community involvement influence environmental outcomes. This lays a foundation for advancing theories in environmental sociology, community empowerment, and sustainable ecosystem management. The findings hold significant utility for environmentalists, policymakers, and practitioners involved in community forestry. By elucidating the connections among SFN, CE, FR, and EE, the study guides the development and implementation of effective programs. It underscores the necessity of fostering social and community-based initiatives to ensure the success of FR efforts and the resulting development of resilient ecosystems. The social implications of this research are particularly relevant for community forest empowerment initiatives in Indonesia. The study advocates for integrated and participatory approaches to environmental conservation, highlighting how social navigation and CE can positively impact FR and ecosystem empowerment. These efforts not only restore ecological balance but also empower local communities, fostering sustainable livelihoods, enhancing biodiversity, and improving overall quality of life. In summary, this research provides critical theoretical, empirical, and social insights into the complex relationships between community and social factors and their environmental consequences. The knowledge gained here has the potential to influence future scientific inquiries, inform policy development, and inspire community-driven initiatives aimed at harmonizing community empowerment with environmental sustainability, not just in Indonesia, but in other regions facing similar challenges.

Limitations and Recommendations for Future Research

This study offers valuable insights, but several limitations may affect its generalizability to other contexts. The research was conducted exclusively in Indonesia, meaning that findings may not be directly applicable to other countries or cultural settings. Caution is warranted when extrapolating these results to different contexts. The study primarily utilized quantitative data, potentially overlooking qualitative dimensions that could enrich our understanding of CE in FR. Self-reported measures can introduce biases in responses, affecting the reliability of the data. The reliance on cross-sectional data limits the ability to establish causal relationships, making it difficult to discern the directionality of the observed effects. Factors such as economic conditions, political climate, and unforeseen events were not considered in the research design, which could influence the dynamics of the relationships studied. To address these limitations and further enhance our understanding, future research could explore the avenues. Conducting research across different cultures would enhance the external validity of the findings and provide a broader perspective on the relationships explored. Employing qualitative methods, such as focus groups and interviews, could illuminate the motivations and experiences of community members participating in forest-related activities. Implementing longitudinal research designs would allow for the examination of causal relationships over time, providing deeper insights into how social engagement influences FR and ecosystem empowerment. Investigating the impact of external factors, such as policy frameworks and socioeconomic conditions, would contribute to a more

comprehensive understanding of the complexities involved in community forest empowerment. Conducting comparative research in various regions or countries would help assess the applicability and robustness of the conceptual framework presented in this study. By following these recommendations, future research can build upon the findings of this study, leading to a more nuanced understanding of the intricate relationships among community involvement, social engagement, FR, and EE.

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