
| RESEARCH ARTICLE

A Hybrid Pentahelix Communication Model for Ujung Kulon Geopark Governance

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| ABSTRACT

Effective governance of Ujung Kulon National Geopark requires coordination among public institutions, local communities, academic institutions, businesses, and the media to reconcile conservation priorities with community welfare. This study examines stakeholder mapping, communication across the five helices, and the mechanisms required to move from formal representation to operational collaboration. A constructivist qualitative approach was adopted through a single-case study conducted in Ujung Kulon National Geopark, Pandeglang Regency, Banten Province. Thirteen participants were selected purposively. They represented government and the geopark management body (n = 4), communities and local organizations (n = 6), academia (n = 1), business (n = 1), and the media (n = 1). Semi-structured interviews were conducted between 29 September and 5 December 2025. Participant observation and document analysis provided additional evidence. The data were organized through condensation, display, and verification. Thematic analysis involved initial coding, category development, identification of core themes, and comparison across the five helices. Credibility was strengthened through source and method triangulation, member checking, peer debriefing, and an audit trail. The findings indicate that stakeholder mapping remains largely administrative, institutional roles have yet to become operational, and communication is predominantly episodic, one-way, and fragmented. Communication failures create institutional uncertainty and may also threaten geosite protection. This risk was evident when project contractors damaged a geosite because they were unaware of its conservation significance. Communities were not involved from the planning stage, despite the local capacity generated through educational initiatives and mangrove and marine conservation activities. Academic, business, and media actors also lacked clear follow-up mechanisms, a shared roadmap, and common communication guidelines. The study proposes a Hybrid Pentahelix Collaborative Communication Model that combines an actor network with a four-stage convergence cycle: structured information exchange, dialogue and clarification, alignment of meaning and trust, and shared commitment and collective action. The model connects conservation integrity with local benefits through communication that is iterative, documented, and open to evaluation.

| KEYWORDS

collaborative communication; pentahelix; communication convergence; geopark governance; community participation; conservation

| ARTICLE INFORMATION

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1. Introduction

A geopark represents a form of territorial governance that brings together the protection of geological heritage, environmental education, sustainable tourism, and local economic development. Geological resources remain its foundation, yet they are not the sole measure of success. The long-term viability of a geopark also depends on the ability of institutions and communities to agree on how the area should be protected, understood, and used. UNESCO identifies integrated management, community participation, education, networking, and sustainable development as essential components of geopark development (UNESCO, 2015). In Indonesia, Ujung Kulon was designated a National Geopark through Minister of Energy and Mineral Resources Decree No. 393.K/GL.01/MEM.G/2023, issued on 10 November 2023 (Kementerian Energi dan Sumber Daya Mineral Republik Indonesia, 2023). This designation provides a stronger legal basis for conservation and regional development. It also creates a greater need for focused coordination and communication across sectors.

Ujung Kulon National Geopark spans eight subdistricts in Pandeglang Regency: Carita, Labuan, Pagelaran, Sukaresmi, Panimbang, Cigeulis, Cimanggu, and Sumur. The area is closely connected to coastal settlements, tourism activities, geological sites, conservation zones, community groups, and the wider Ujung Kulon landscape. Stakeholders enter this governance setting with different mandates, resources, and interests. Government institutions are responsible for regulation and planning. Academia provides the scientific foundation, while business actors require certainty to develop investment and geotourism activities. Communities contribute local knowledge and experience directly related to their livelihoods. The media translates geopark information into narratives that are more accessible to the public. Together, these actors reflect the pentahelix framework, which brings government, academia, business, communities, and the media into a shared governance arrangement (Carayannis & Campbell, 2010; Leydesdorff, 2012).

The presence of all five helices does not, by itself, produce collaboration. Collaborative governance develops through sustained interaction, mutual trust, shared objectives, clear institutional arrangements, and the capacity to undertake collective action (Ansell & Gash, 2008; Emerson et al., 2012). Formal representation within an organizational structure may coexist with relationships that remain hierarchical, episodic, or largely symbolic. Studies of Indonesian geoparks have reported similar concerns. Weak coordination, limited stakeholder capacity, and the absence of meaningful community participation can hinder the effective implementation of the pentahelix approach (Naibaho & Su, 2025; Octavianti et al., 2023). Governance analysis must therefore look beyond a list of represented actors. Greater attention should be paid to how roles are negotiated and how communication connects each actor's contribution to collective work.

Differences in perspective place communication at the center of geopark governance. Each stakeholder brings distinct knowledge, authority, risks, and interests. One actor may understand conservation as ecological protection, while another may experience it as an administrative restriction. Conservation may also be associated with scientific responsibility, tourism opportunities, or the continuity of local livelihoods. Rogers and Kincaid (1981) conceptualize communication as a process of convergence that develops through repeated interaction. Participants exchange information, clarify interpretations, and adjust their actions until a workable level of mutual understanding is reached. In environmental governance, this process helps address power imbalances while connecting scientific knowledge with the lived experience of local communities (Gerlak et al., 2023; Reed, 2008).

Effective geopark management also relies on the quality of public and science communication. Geological and ecological knowledge must be presented in forms that can be understood and used by residents, schools, visitors, business operators, and public officials. Research across UNESCO Global Geoparks has emphasized the need for communication that is strategic, interactive, and inclusive. One-way information delivery alone is insufficient to foster public engagement (Rodrigues et al., 2025). Inconsistent messages can erode trust. Limited opportunities for dialogue may also prevent communities from understanding how conservation relates to land, access to protected areas, economic opportunities, and everyday life.

Findings from the first author's thesis point to a gap between formal institutional arrangements and collaborative practice in Ujung Kulon National Geopark. All five pentahelix groups have been identified, yet communication is commonly activated only around specific activities. Roles remain unclear. Regular forums have not been established, and public information lacks a consistent management mechanism. Local capacity is nevertheless present. The Youth Forum has conducted educational activities, while community groups have developed mangrove and marine conservation initiatives. Other resources include academic expertise, geotourism potential, and the willingness of local media to support public

education. The central problem is not the absence of actors or initiatives. It lies in the lack of a communication mechanism capable of connecting these existing capacities with the geopark's formal programmes.

This article revisits the first author's thesis data with a more specific analytical focus. It addresses three questions: (1) how are pentahelix stakeholders positioned within the governance of Ujung Kulon National Geopark; (2) what communication patterns and barriers shape relationships among these stakeholders; and (3) what communication mechanisms are required to connect conservation objectives with community welfare? The principal contribution of the study is the Hybrid Pentahelix Collaborative Communication Model. Rather than offering a static map of stakeholders, the model connects an institutional network with a four-stage communication cycle comprising information exchange, dialogue and clarification, alignment of meaning and trust, and shared commitment and collective action.

2. Literature Review

2.1 Collaborative Governance and Participation

Collaborative governance takes place when government and non-government actors participate in public decision-making across institutional boundaries. The presence of multiple parties in a forum cannot be regarded as collaboration unless they have a genuine opportunity to influence the process. Ansell and Gash (2008) identify face-to-face dialogue, trust building, commitment to the process, shared understanding, and intermediate outcomes as essential elements. Emerson et al. (2012) place greater emphasis on principled engagement, shared motivation, and the capacity for joint action. Both perspectives suggest that collaboration should be assessed through the quality of interaction rather than formal organizational membership.

Participation is particularly important in conservation because the resulting decisions may affect access to land, the use of natural resources, cultural practices, and local sources of income. Arnstein (1969) distinguishes participation that gives citizens meaningful influence from tokenistic consultation that leaves decisions unchanged. Reed (2008) finds that stakeholder participation in environmental management is more effective when it begins at an early stage. The process must be transparent, local knowledge should be recognized, and community input needs to have a visible connection to final decisions. Bennett et al. (2017) reinforce this argument by positioning the human dimension as an integral part of successful conservation.

Differences in power may restrict such participation. Government institutions, academia, business actors, communities, and the media do not have equal authority, knowledge, resources, or access to formal procedures. One-way communication tends to preserve these inequalities. Appropriate facilitation, opportunities for feedback, and transparent responses can strengthen the influence of actors who are often underrepresented. Collaborative communication should not be measured by the number of meetings held. Its value lies in whether the available procedures allow stakeholder voices to shape decisions.

2.2 The Pentahelix in Geopark Development

The pentahelix connects government, academia, business, communities, and the media through distinct but complementary roles. Government provides policy authority and coordination. Academia contributes research, education, and evaluation. Business offers access to markets and economic resources. Communities provide local knowledge and social legitimacy. The media broadens the circulation of information and improves the visibility of the area. This framework brings together capacities that are otherwise dispersed across institutions and social groups (Carayannis & Campbell, 2010; Leydesdorff, 2012).

Within geopark development, the pentahelix is expected to connect geoconservation, education, geotourism, local economic activity, and public communication. Sustainable geotourism requires effective interpretation, adequate protection of conservation assets, and benefits that can be experienced by surrounding communities (Dowling & Newsome, 2010; Farsani et al., 2011). Pásková and Zelenka (2018) also identify integrated management and stakeholder cooperation as important conditions for geopark sustainability.

A structure involving numerous actors does not necessarily produce functional cooperation. Empirical studies show that multi-actor arrangements are frequently constrained by weak coordination, uneven capacity, and unclear divisions of responsibility (Naibaho & Su, 2025; Octavianti et al., 2023). The pentahelix is therefore better understood as an evolving set

of relationships rather than a fixed arrangement of actors. Its effectiveness depends on how roles are negotiated and how different contributions are connected to programme implementation.

2.3 Communication Convergence and the Construction of Shared Meaning

Communication within the convergence model follows a circular process. Rogers and Kincaid (1981) explain that participants exchange information, interpret messages, correct misunderstandings, and gradually develop shared meaning through repeated interaction. Convergence does not require all actors to hold identical interests or perspectives. It requires a sufficient level of mutual understanding to recognize differences, allocate responsibilities, and coordinate action.

The diversity of interests involved in geopark management makes this perspective particularly relevant. Regulators may prioritize site protection, while communities may be more concerned about access and the effects of conservation on their livelihoods. Business actors require certainty before undertaking economic activities. Academia seeks to maintain scientific integrity. The media needs verifiable information before communicating it to the public. These interests may remain isolated when no appropriate space exists for discussion. Participatory dialogue is needed to connect sectoral knowledge with community empowerment and collective action (Melkote & Steeves, 2001).

The model developed in this study also adopts a network perspective. Collaboration emerges from patterns of relationships among actors rather than from the individual characteristics of institutions (Monge & Contractor, 2003). Provan and Kenis (2008) show that networks with many participants often require a coordinating organization, particularly when trust is unevenly distributed. The Ujung Kulon Geopark Management Body can perform this role. Merely forwarding administrative information would not be sufficient. The management body needs to organize information exchange, facilitate dialogue, and ensure that agreements are followed by action.

Empirical evidence from Banten further demonstrates the importance of this function. Official documents, digital platforms, face-to-face meetings, and social media may extend the reach of information. The availability of multiple channels does not necessarily create dialogue or shared understanding when communication remains limited to technical clarification (Syuryadi et al., 2026).

2.4 Analytical Framework and Research Gap

Three bodies of literature provide the analytical foundation for this study. Collaborative governance explains the institutional conditions that enable or restrict joint work. The pentahelix identifies the groups of actors involved and the capacities they can contribute. Communication convergence describes the process through which fragmented interpretations may develop into mutual understanding.

These perspectives are still commonly applied in isolation. Pentahelix research may end with stakeholder mapping without explaining how relationships among the identified actors operate. Communication studies may examine dialogue and message exchange without connecting them to the distribution of authority and institutional responsibility. This separation leaves a gap between formal structures, actor composition, and the communication processes that make collaboration work.

This study brings the three perspectives together within a single analytical framework. Collaborative governance is used to assess role clarity, trust, the quality of participation, and joint capacity. The pentahelix helps map stakeholder domains and their potential contributions. Communication convergence explains how fragmented interpretations can move toward shared understanding and collective action. The resulting research gap is processual: how can a formal pentahelix structure be activated through a communication cycle that is sufficiently structured to support institutional coordination while remaining sufficiently dialogic to enable meaningful community participation?

3. Methodology

3.1 Research Design and Case Context

This study adopted a constructivist qualitative approach using a descriptive-exploratory single-case study design. The design allowed communication to be examined within a clearly bounded governance setting. Institutional structures, local experiences, and conservation policies were treated as integral to the communication process rather than as separate contextual factors (Creswell & Poth, 2018; Yin, 2018).

Ujung Kulon National Geopark in Pandeglang Regency, Banten Province, was selected as the case. The geopark covers eight subdistricts: Carita, Labuan, Pagelaran, Sukaesmi, Panimbang, Cigeulis, Cimanggu, and Sumur. These areas define the geographical boundary of the case. Interviews were conducted at the participants' workplaces or at locations associated with their activities. The distribution of participants was not intended to provide a geographical sample representing each subdistrict.

3.2 Participants and Data Sources

Participants were selected purposively based on their responsibilities, experience, and direct knowledge of the management of Ujung Kulon National Geopark. The thesis dataset comprised 13 interviews conducted between 29 September and 5 December 2025. The names recorded in the thesis were not reproduced in this article. Each participant was assigned a code corresponding to the pentahelix domain they represented. This measure was taken to reduce the risk of identification. Table 1 presents the composition of the participants.

Table 1. Participant Composition and Analytical Codes

Pentahelix domain	Number	Code	Represented role
Government and geopark management body	4	G1– G4	Tourism office; regional planning agency/geopark secretariat; provincial energy and mineral resources/geoscience agency
Communities and local organizations	6	C1– C6	Community leader; tourism awareness group (<i>Pokdarwis</i>); residents; Youth Forum; marine conservation group; mangrove conservation group
Academia	1	A1	Lecturer in biology/ecology and mentor to environmental community groups
Business	1	B1	Tourism area manager and destination development representative
Media	1	M1	Local reporter and radio broadcaster
Total	13	—	Five pentahelix domains

Semi-structured in-depth interviews served as the primary source of data. The interviews explored the distribution of roles, communication channels, coordination experiences, public understanding, forms of participation, institutional constraints, local potential, and expectations regarding the proposed communication model. Participant observation supplemented the interview data. The observations focused on social and communicative activities related to education, tourism, conservation, and community initiatives.

The documents examined included the geopark's organizational structure, policy and planning documents, activity records, and public information materials. Interview, observational, and documentary evidence were reviewed together. This approach allowed information from one helix to be compared with the experiences and evidence obtained from the others.

3.3 Data Analysis and Trustworthiness

Two analytical procedures were used to organize and interpret the data. The framework developed by Miles et al. (2014) guided data condensation, data display, and conclusion drawing and verification. Thematic analysis was then used to identify recurring patterns of meaning across the dataset (Braun & Clarke, 2006).

Each relevant unit of meaning was initially assigned a code. Codes that conveyed related meanings were grouped into categories. Relationships among these categories were examined to identify the core themes. The terms *initial codes*,

categories, and *core themes* were used to maintain consistency with thematic analysis. The study does not claim to employ grounded theory.

Data from each helix were initially reviewed and analyzed separately. Cross-helix comparison was then conducted to identify similarities, differences, and patterns of relationships. Interview evidence was organized in a matrix covering six dimensions: governance, communication, participation, educational–conservation–economic potential, constraints, and expectations regarding the model. The model was developed by bringing together recurring empirical problems, relevant theoretical mechanisms, and the actions considered necessary by the participants.

The trustworthiness of the findings was strengthened through source and method triangulation. Member checking was conducted using interview summaries or preliminary interpretations. The analytical process was also examined through peer debriefing with supervisors or academic colleagues. Field notes, interview logs, coding decisions, and the development of interpretations were retained as an audit trail. Prolonged observation was not undertaken. The study therefore does not claim to have captured every informal communication practice or spontaneous interaction occurring within the geopark.

3.4 Ethical Considerations

To protect confidentiality, each participant was assigned a code: G1–G4, C1–C6, A1, B1, or M1. All personal names were removed from the quotations. Several pentahelix domains included only one participant. Their occupational roles and institutional affiliations were therefore described in broad terms to limit the possibility of identification.

The quotations were translated from Indonesian into English for publication. Care was taken to retain their original meaning and contextual significance. Details of ethical approval and participant consent are reported in the Statements and Declarations section.

4. Results and Discussion

4.1 Formal Mapping Has Not Yet Produced a Functional Division of Roles

The stakeholder mapping for Ujung Kulon National Geopark formally includes all five pentahelix domains. The working relationships among these actors, however, have yet to become fully functional. Government institutions and the Geopark Management Body remain at the center of decision-making because they control planning, public budgets, and secretarial functions. Academia, communities, business actors, and the media are also represented in the institutional structure. Their formal inclusion has not always been followed by clear assignments, follow-up procedures, or responsibilities that can be evaluated.

Uncertainty over the division of roles was also found among government institutions. One participant explained:

“Many government agencies still do not understand their roles, so the Tourism Office often works alone.” (G1)

Another participant observed that “the organizational structure of the Geopark Management Body is too large, making it difficult to move” (G2). A large organizational structure does not necessarily create the capacity to work collectively. Similar difficulties were found in partnerships with universities. Several memoranda of understanding had been signed, but their implementation often ended before any concrete activities were developed. This finding is consistent with Emerson et al. (2012), who argue that joint capacity depends on procedures, knowledge, resources, and leadership capable of translating commitment into action.

Communication failures also carried consequences for site protection. A government participant gave the following example:

“The geosite was damaged because the contractor did not know it was part of the geopark.” (G4)

The incident shows that conservation information did not always reach those responsible for work in the field. The consequences extended beyond administrative disorder and created a direct risk to site protection. Communication management should therefore be treated as part of geoconservation rather than as an additional function. Stakeholder

mapping becomes operationally meaningful only when roles, authority, information flows, and protection responsibilities are incorporated into working procedures.

4.2 Event-Driven, One-Way, and Fragmented Communication

Communication between the management body and other stakeholders tended to become active when an event or administrative need arose. The same pattern appeared during public activities organized by the geopark. Participants did not identify a permanent forum with a regular schedule and a cross-helix agenda. Feedback was not systematically documented, while responsibility for follow-up remained inconsistent.

"Coordination usually takes place only when there is an activity." (G1)

"Outside those activities, there is no regular forum." (G2)

Episodic communication may help address urgent tasks, but it does not necessarily respond to longer-term needs. Stakeholders had limited space to clarify their responsibilities or discuss differences in interpretation. Communities encountered a similar situation. Their involvement often began only after a government institution required their assistance.

"We are only involved when the government needs data; we are not invited to help design the programme." (C2)

"We have never received a direct explanation, so we do not know what we are expected to do." (C3)

Inconsistent information was not confined to relations between the management body and communities. Fragmentation was also found in communication among government agencies and in the delivery of public information. A media participant explained:

"We are always ready to collaborate, but information from the Geopark Management Body is not always timely or consistent." (M1)

This pattern suggests that communication has not progressed far beyond information delivery. Clarification, adjustment of understanding, and the construction of shared meaning have yet to become routine practices. Syuryadi et al. (2026) found a similar condition in the communication of a government programme in Banten. Multiple channels may support administrative order, but they do not necessarily build shared understanding when feedback remains limited to requirements, procedures, schedules, and reporting.

4.3 Community Participation, Local Initiatives, and Divergent Meanings

Limited public understanding of the geopark restricted community participation. Residents also had little influence over planning. A community leader noted that public understanding remained low even though the geopark development process had been underway for several years. Information about the geopark was more often encountered through government activities than through a sustained learning process. One community participant described the situation as follows:

"We have never been invited to take part in programme planning, so we do not know where the development is heading." (C5)

This form of involvement resembles tokenistic rather than substantive participation because community presence has not been accompanied by meaningful influence over decisions (Arnstein, 1969). Communities tend to be involved when a particular activity requires their participation, while programme direction remains beyond their influence.

Field evidence also shows that communities have independently developed a range of initiatives. The Youth Forum has conducted educational activities in schools to address limited geosite literacy. A marine conservation group has worked to protect underwater ecosystems. A mangrove group has combined environmental restoration with efforts to improve fisheries productivity.

"Mangrove conservation has increased fish yields, but it has not been included in the geopark programme." (C6)

These initiatives have generated both ecological and economic benefits. Their connection to formal governance remains weak. The geopark programme has yet to fully recognize the capacities emerging within local communities. Excluding these activities from planning also reduces opportunities to build legitimacy through benefits that residents can directly observe and experience.

Differences in interpretation were also evident in concerns about land. According to the academic participant, some residents feared that the geopark would take over their land or restrict its use. Promotional messages alone cannot resolve such concerns. Communities require open explanations of geographical boundaries, local rights, possible restrictions, risks, and benefits. Bennett et al. (2017) argue that conservation gains legitimacy when governance arrangements give sufficient attention to social interests and community experience.

4.4 Academic, Business, and Media Capacities Remain Disconnected

Academia, business, and the media possess capacities that could support the development of Ujung Kulon National Geopark. Evidence for each of these helices came from a single participant. The findings in this section should therefore be read as the perspectives of the interviewed informants rather than as generalizations about their respective sectors.

The academic participant identified several opportunities for university involvement, including education, biodiversity research, geosite interpretation, and field-based activities. This willingness to contribute was not supported by a clear follow-up mechanism. No shared data platform had been established, and research agendas had not yet been connected to the management body's practical needs.

"Pentahelix synergy has not yet worked, and many MoUs have not been followed up." (A1)

"We are ready to become involved in education, research, and even a Geopark Camp." (A1)

These statements point to a gap between available academic capacity and the extent to which it is actually used. University partnerships should not end with the signing of formal agreements. Research, education, documentation, and evaluation need to be incorporated into programmes with clear objectives and follow-up arrangements.

The business participant also identified considerable potential in geotourism, special-interest tourism, water sports, and local enterprises. The certainty required to develop these opportunities remained insufficient. Changes in organizational structures, unclear policy direction, and limited interpretive facilities made long-term planning difficult.

"Frequent changes in the organizational structure make it difficult for us to plan long-term collaboration." (B1)

"Industry actors need clear policy direction before they can invest." (B1)

Business participation requires clarity regarding roles, conservation standards, a development roadmap, and the relationship between private programmes and public priorities. Provan and Kenis (2008) explain that networks need sufficient stability for participants to assess risk and make commitments.

The media also has the capacity to explain scientific concepts to the public, develop narratives about geosites, support tourism promotion, and broaden conservation awareness. Performing these functions requires accurate, consistent, and timely information. A media participant stated:

"We need a clear communication SOP so that the geopark narrative remains consistent." (M1)

The media's function becomes restricted when its involvement occurs only when an activity requires coverage. Its educational and intermediary roles cannot develop under such conditions. The media should be involved in communication planning while retaining its editorial independence.

Table 2. Cross-Helix Communication Findings Based on the Thesis Data

Empirical pattern	Evidence from the thesis	Consequence	Interpretation
Stakeholder mapping remains administrative	Government agency roles are unclear; the management structure is too large; MoUs are not followed up	Actor contributions remain disconnected	Formal representation has not produced joint capacity
Communication depends on specific activities	No regular forum exists outside scheduled activities	Coordination remains short-term and follow-up is weak	Collaboration is episodic
Information flows remain predominantly one-way	Communities receive information after the programme framework has been determined	Feedback is limited and community influence remains low	The convergence process is incomplete
Public information is fragmented	Messages are inconsistent or delayed; no communication SOP is available	Public confusion increases and message credibility declines	Information is not managed in an integrated manner
Local initiatives remain disconnected from governance	Youth education and marine and mangrove conservation have not been incorporated into the geopark programme	Community capacity is not strengthened through policy	Local knowledge and benefits remain unrecognized
Non-state actors face uncertainty	Businesses lack a roadmap; academic partnerships receive little follow-up	Investment, research, and programme continuity weaken	Network coordination remains unstable

4.5 Empirical Basis for Model Development

The proposed model was not produced merely by combining several theories. Its components were developed by tracing recurring problems in the data, the needs expressed by participants, and the theoretical mechanisms capable of addressing those problems. Table 3 shows how these three elements are connected.

Table 3. Relationships among Empirical Problems, Actor Needs, and Model Components

Empirical problem	Identified need	Theoretical mechanism	Model component
Information is inconsistent, delayed, and undocumented	Communication SOP, shared data, and regular updates	Reduction of information asymmetry	Structured information exchange
Forums are held only when activities occur	Regular forums, role clarification, and documented responses	Dialogue and principled engagement	Dialogue and clarification
Meanings of conservation, land, benefits, and risks differ	Explanations of rights, boundaries, benefits, and shared priorities	Meaning convergence and trust building	Alignment of meaning and trust
MoUs, CSR initiatives, and local activities are not sustained	Action plans, designated responsibilities, indicators, and evaluation	Joint capacity and collective action	Shared commitment and collective action

The novelty of the model lies in the process that connects the actors rather than in the addition of new categories to the pentahelix. The institutional network is combined with a recurring communication process. Stakeholder input is developed into decisions, which are then translated into action. The results of implementation generate new information that can be used to improve the next cycle.

4.6 Hybrid Pentahelix Collaborative Communication Model

The model is described as hybrid because it combines two different arrangements. The first is a network of pentahelix actors. The second is a cyclical communication process. It also brings formal institutional coordination together with participatory communication at the community and public levels.

The Geopark Management Body functions as a network facilitator rather than the sole owner of information. It is responsible for ensuring that every helix receives verified information, has opportunities to express its interests, and can clarify differences in interpretation. The resulting commitments need to be recorded, and their implementation should be open to joint evaluation.

The first stage is **structured information exchange**. Every actor requires the same basic information about policy, management boundaries, conservation values, responsibilities, programmes, budgets, schedules, and local opportunities. A communication SOP, shared repository, contact directory, and scheduled updates are needed to prevent inconsistent information.

The second stage is **dialogue and clarification**. Institutional mandates, perceptions of risk, local experiences, and economic interests do not always align. These differences need to be discussed before decisions are made. Cross-sector forums, village dialogues, thematic working groups, and documented response mechanisms can support this process.

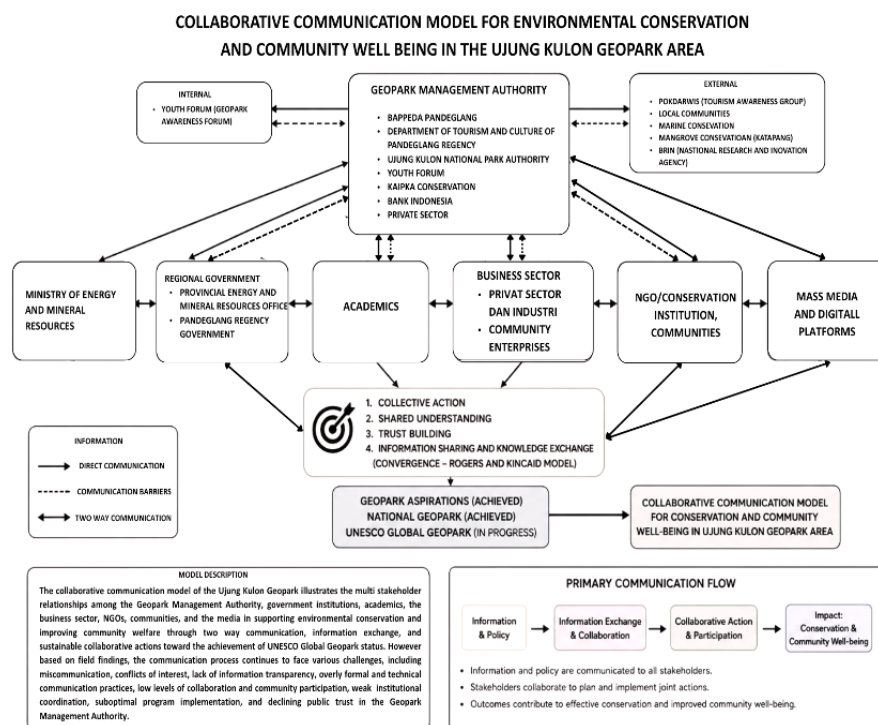
The third stage is **alignment of meaning and trust**. The model does not require all actors to hold identical views. They need a sufficient level of understanding to explain the relationship among conservation, education, tourism, and community welfare. Each actor should also understand its responsibilities and the reasons behind agreed restrictions or opportunities.

The fourth stage is **shared commitment and collective action**. Agreements need to be translated into an action plan that identifies responsibilities, resources, schedules, indicators, and evaluation procedures. Information generated during implementation is then used to improve decisions in the next cycle. This adaptive quality distinguishes the model from collaborations that end with a meeting or the signing of an agreement.

Table 4. Operational Stages of the Hybrid Pentahelix Communication Model

Stage	Communication task	Illustrative mechanisms	Expected outcome
1. Structured information exchange	Ensure that all actors have access to the same verified information	Communication SOP; shared repository; scheduled updates; contact directory	Reduced information asymmetry and message inconsistency
2. Dialogue and clarification	Discuss differences in interpretation, local knowledge, risks, and constraints	Cross-sector forum; village dialogue; working groups; documented feedback	Stakeholder concerns and responses become visible
3. Alignment of meaning and trust	Connect conservation with welfare, education, tourism, and institutional mandates	Joint problem formulation; role matrix; negotiated priorities	Stronger operational understanding and trust
4. Shared commitment and collective action	Translate agreements into programmes, responsibilities, resources, schedules, and evaluation	Action plan; joint implementation; monitoring; public progress reports	Conservation action is connected to local benefits

Figure 1. Hybrid Pentahelix Collaborative Communication Model for the Governance of Ujung Kulon National Geopark



The model retains the distinct functions of the five helices. Government directs policy and safeguards the public interest. Academia provides knowledge and scientific interpretation. Business supports sustainable economic activity. Communities contribute local knowledge, implementation capacity, and social legitimacy. The media develops coherent public communication. Each helix is directly connected to the Geopark Management Body and participates in the same communication cycle. No single helix is positioned as the sole intermediary in the convergence process.

Several features of this model overlap with the meaning-based participatory public communication proposed by Syuryadi et al. (2026). The common elements include attention to message consistency, audience needs, alignment of meaning, and feedback mechanisms. The scope of the present model is different. It operationalizes relationships among five helices and links meaning alignment to the division of responsibilities, commitment formation, and collective action in geopark conservation governance.

4.7 Implications and Limitations

The theoretical contribution of the model lies in its explanation of the relationship between actor composition and communication processes. The pentahelix identifies the parties that may contribute. Collaborative governance describes the institutional conditions that enable or constrain joint work. Communication convergence explains how actors build an operational understanding. The presence of all relevant stakeholders within a formal structure does not guarantee collaboration when the process connecting them is absent.

The Geopark Management Body has a central role in applying the model. Cross-sector forums need to be supported by written procedures, a role matrix, a shared information repository, and a schedule for evaluation. Community dialogue should be incorporated into the formal planning cycle. Youth education, mangrove and marine conservation, tourism awareness groups (*Pokdarwis*), homestays, and local enterprises should be recognized as existing capacities rather than treated as peripheral activities. Academia can support scientific interpretation and evaluation. Business actors require conservation standards and a clear roadmap. The media should participate in communication planning without compromising its editorial independence.

Four limitations should be considered. The findings are based on participants' perceptions and do not provide a quantitative measure of institutional effectiveness. The period of participant observation was limited, meaning that some informal communication may not have been captured. Academia, business, and the media were each represented by only one participant. Findings concerning these three helices reflect the perspectives of the interviewed informants rather than their sectors as a whole. The study was also confined to one national geopark, and the proposed model has not yet been tested through long-term implementation. The study therefore does not claim that the model has produced ecological change, increased visitor numbers, raised household income, or strengthened institutional trust.

5. Conclusion

This study finds that communication problems in Ujung Kulon Geopark stem from ineffective relationships among stakeholders rather than from a lack of relevant actors. Government institutions, the Geopark Management Body, communities, academics, businesses, and the media are already represented within the governance structure. Their involvement, however, has not been translated into clearly defined and actionable responsibilities. Institutional arrangements remain only partially operational, collaborative initiatives are not consistently followed up, and stakeholder interactions tend to occur only when specific activities are organised.

Communication remains intermittent, predominantly one-way, and fragmented across disconnected channels. Communities often receive information only after activity plans have been developed, leaving them with limited opportunities to participate in the initial discussions. The capacities of academics, businesses, and media organisations have yet to be integrated through a shared research agenda, development roadmap, or communication guidelines. Community-led initiatives have demonstrated that conservation can generate tangible local benefits, but these efforts remain weakly connected to official geopark programmes. The damage caused to a geosite by project personnel who were unaware of its conservation value further demonstrates that communication failures can have direct environmental consequences.

The Hybrid Pentahelix Collaborative Communication Model is proposed as a mechanism for addressing these challenges. It combines a stakeholder network with a four-stage communication cycle comprising structured information exchange, dialogue and clarification, the alignment of meaning and trust, and shared commitment and collective action. Within this model, the Geopark Management Body serves as a communication facilitator and ensures that agreed actions are followed through. The framework is intended to safeguard conservation integrity while supporting community well-being. Its effectiveness must nevertheless be assessed through practical implementation, long-term evaluation, and comparative testing across other geoparks.

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