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# The Role of the parties in mangrove ecosystem recovery in Juntinyuat Coast, West Java, Indonesia

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**ABSTRACT**

Coastal abrasion is a problem that needs to be addressed thoroughly. If not properly managed, coastal abrasion can lead to other environmental issues, such as damage to mangroves and coastal ecosystems. The local government is actively carrying out mangrove ecosystem restoration program to conserve the coastal ecology by involving related agencies, industries, and the community surrounding the Juntinyuat coastal area. The focus of this research is to find out the planning, implementation, and monitoring carried out in relation to the restoration of the mangrove ecosystem based on the involvement of the parties in overcoming coastal abrasion on the coast of Juntinyuat, Indramayu Regency, West Java. Data were collected by conducting observations, interviews, and documentation to the community and the parties involved in restoring the mangrove ecosystem on the Juntinyuat coast. The results showed that mangrove ecosystem damage in the coastal area of Juntinyuat generates a high level of abrasion. The damage caused by abrasion threatens settlements, ponds, and agricultural land, as well as threatens the gas and oil pipelines of Pertamina Gas in the West Java operation area (Pertagas OWJA). There is a relationship between the critical condition of the mangrove ecosystem in the Juntinyuat coastal area and the initiation of efforts to restore the mangrove ecosystem. The initiation of mangrove ecosystem restoration arose from the critical condition of mangroves, which necessitates careful planning to restore damaged mangrove conditions. Related parties concerned with the preservation of the mangrove ecosystem subsequently coordinate to plan the mangrove ecosystem restoration program on the Juntinyuat coast. The mangrove ecosystem restoration was conducted after an initial survey in mid-2014. The role of the parties in planning, implementing, and monitoring the restoration of the mangrove ecosystem is running well and maximally with a clear division of duties and responsibilities. Currently, the results of the restoration of the mangrove ecosystem on the Juntinyuat coast can be felt together with the denser mangrove cover, reducing the abrasion impact, and making it a mangrove ecotourism area. In the future, it is necessary to form a coordinating team for the strategy of mangrove ecosystem management at the regency and sub-district levels to synergize policies and programs for managing mangrove ecosystems. Empowerment activities need to be carried out intensively to encourage a change in the role of mangrove management.

**ABSTRAK**

Abrasi pantai merupakan masalah yang perlu ditanggulangi secara tuntas. Jika tidak dikelola dengan baik, abrasi pantai dapat menimbulkan masalah lingkungan lainnya, seperti kerusakan mangrove dan ekosistem pesisir. Pemerintah setempat secara aktif melakukan program restorasi ekosistem mangrove untuk melestarikan ekologi pesisir dengan melibatkan instansi terkait, industri, dan masyarakat sekitar kawasan pesisir Juntinyuat. Fokus penelitian ini adalah untuk mengetahui perencanaan, pelaksanaan, dan pemantauan, yang dilakukan terkait restorasi ekosistem mangrove berdasarkan pelibatan para pihak dalam penanggulangan abrasi pantai di pesisir Juntinyuat, Kabupaten Indramayu, Jawa Barat. Pengumpulan data dilakukan dengan melakukan observasi, wawancara, dan dokumentasi kepada masyarakat serta pihak-pihak yang terlibat dalam pemulihan ekosistem mangrove di pesisir Juntinyuat. Hasil penelitian menunjukkan bahwa kerusakan ekosistem mangrove di kawasan pesisir Juntinyuat menghasilkan tingkat abrasi yang tinggi. Kerusakan akibat abrasi mengancam pemukiman, tambak, dan lahan pertanian, serta mengancam jaringan pipa gas dan minyak milik Pertamina Gas di Wilayah Operasi Jawa Barat (Pertagas OWJA). Terdapat hubungan antara kondisi kritis ekosistem mangrove di kawasan pesisir Juntinyuat dengan inisiasi upaya restorasi ekosistem mangrove. Inisiasi restorasi ekosistem mangrove berawal dari kondisi mangrove yang kritis, sehingga diperlukan perencanaan yang matang untuk memulihkan kondisi mangrove yang rusak. Pihak terkait yang terkait dengan pelestarian ekosistem mangrove selanjutnya berkoordinasi untuk merencanakan program restorasi ekosistem mangrove di pesisir Juntinyuat. Restorasi ekosistem mangrove dilakukan setelah survei awal pada pertengahan tahun 2014. Peran para pihak dalam perencanaan, pelaksanaan, dan pemantauan pemulihan ekosistem mangrove berjalan dengan baik dan maksimal dengan pembagian tugas dan tanggung jawab yang jelas. Saat ini, hasil restorasi ekosistem mangrove di pantai Juntinyuat dapat dirasakan seiring dengan semakin rapatnya tutupan mangrove, mengurangi dampak abrasi, dan menjadikannya sebagai kawasan ekowisata mangrove. Di masa depan, perlu dibentuk tim koordinasi strategi pengelolaan ekosistem mangrove di tingkat kabupaten dan kecamatan, untuk mensinergikan kebijakan dan program pengelolaan ekosistem mangrove. Kegiatan pemberdayaan perlu dilakukan secara intensif untuk mendorong perubahan peran pengelolaan mangrove.

**Keywords:** *abrasion, Juntinyuat, mangrove ecosystem, recovery, role of the parties*

## INTRODUCTION

Mangrove forest ecosystems have crucial ecological functions as spawning, nursery, and rearing areas, or foraging for certain fish and animals, as well as functioning as areas of protection against abrasion and seawater intrusion (Supriharyono, 2009). Economically, mangrove forests provide several environmental services to humans directly and indirectly. Mangrove forest will function properly if the use of mangrove forests is managed sustainably.

According to data from the KLHK (2017), Indonesia has the world's largest mangrove ecosystem, housing the highest biodiversity. With a coastline of 95,181 km, Indonesia has a mangrove area of 3,489,140.68 hectares (ha). This amount is equivalent to 23% of the world's mangrove ecosystems. From the area of mangroves in Indonesia, 1,671,140.75 ha is in good condition, while the remaining area of 1,817,999.93 ha is in damaged condition. On the island of Java, the decline in mangrove forests is caused by land conversion for fish farming activities (ponds), human settlements, and other uses as a result of the surrounding community's limited understanding and awareness of the ecological importance of mangroves, and the uncertainty of land status (Kustanti et al., 2014; Oni et al., 2019). West Java has approximately 15,276 ha (38.06%) of degraded mangroves, with Karawang Regency suffering the most damage (32.85%), followed by Bekasi 10,481 ha, Indramayu 8,720 ha, Subang 7,346 ha, Cirebon 190 ha, Ciamis 170 ha, Garut 32 ha, and Sukabumi 9 ha (Dishut Jabar, 2018a). Mangrove loss in Indramayu Regency has caused severe erosion in the villages of Ujung Gebang, Limbangan, and Juntinyuat (Dishut Jabar, 2018b).

One of the issues that should be addressed thoroughly is coastal abrasion in the Indramayu coastal area. If not managed properly, coastal abrasion may cause other environmental issues, such as damage to mangroves and coastal ecosystems. The Juntinyuat Coast in Indramayu Regency has experienced abrasion as a result of the degradation of the mangrove forest area. Collaboration with all stakeholders to restore coastal ecosystems and mangrove forests in targeted areas of damage and abrasion is an alternative solution to the problem. Currently, ecosystem restoration has become a global concern (Rochmayanto, 2021). The local government is actively carrying out the mangrove recovery program as part of a larger plan to preserve coastal ecosystems by involving relevant agencies, companies, and the community surrounding the Juntinyuat coastal area. As a development actor, companies have an operational impact from natural resource exploration activities that have significant environmental impacts. PT. Pertamina Gas Western Java Area (WJA) is one of the companies that has a working area along the Juntinyuat coast. This existence makes the company have a responsibility to participate in restoring the mangrove ecosystem on the Juntinyuat coast. This responsibility is stated in the company's policies and programs regarding environmental sustainability, one of which is the mangrove restoration program. Efforts to restore the mangrove ecosystem is done by companies in collaboration with local governments, related agencies, and local communities. It is being undertaken to preserve coastal ecosystems and the biodiversity that exists within them.

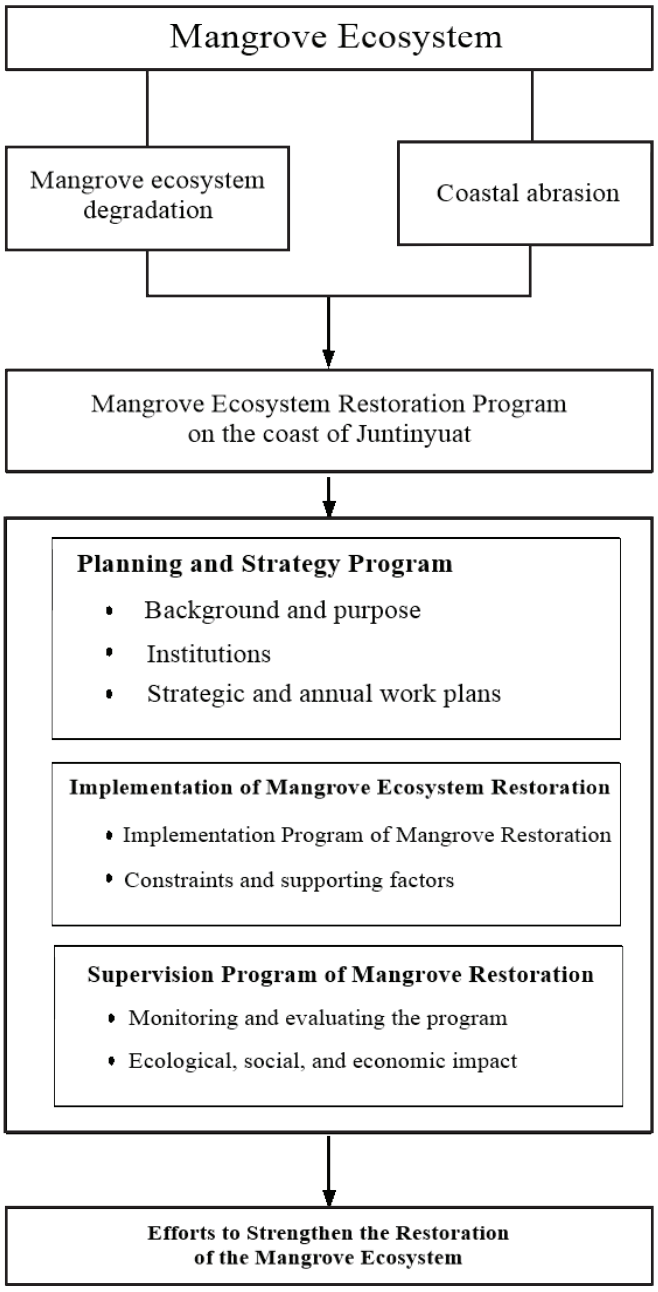


**Figure 1.** The research framework.

Based on the description above, the research question is: how effective is stakeholder-based mangrove recovery in preventing coastal abrasion on the coast of Juntinyuat, Indramayu Regency, West Java? This study has several sub-focuses based on the research focus mentioned above, including:

1. How is the planning of the stakeholder-based mangrove recovery program on the Juntinyuat coast in coastal abrasion prevention?
2. What is the management strategy of the stakeholder-based mangrove recovery program on the Juntinyuat coast in dealing with coastal abrasion?
3. How is the process of implementing a stakeholder-based mangrove recovery program on the Juntinyuat coast dealing with coastal abrasion?
4. How is the monitoring of a stakeholder-based mangrove recovery program on the Juntinyuat coast in coastal abrasion prevention?

The objectives of the research are to understand the planning, the management strategy, the process of implementing, as well as the supervision of the stakeholder-based mangrove recovery program on the coast of Juntinyuat to cope with coastal abrasion.

Most of the mangrove ecosystem conditions along the north coast of West Java Province have been degraded or damaged, ranging from moderate to severe levels. The condition of the damaged mangrove ecosystem needs to be restored to reestablish its ecosystem function. Ecosystem degradation that is not appropriately handled causes abrasion in coastal areas. One of the coastal areas that is experiencing degradation and abrasion is the Juntinyuat coast of Indramayu Regency. Efforts to restore the mangrove ecosystem on the coast of Juntinyuat have been carried out by PT. Pertamina Gas WJA through the planting of mangrove seedlings along the coast. The effort involves various parties, including local government, related agencies and the participation of the community around the area. The outline of the research framework is shown in Figure 1.

## METHODS

### Study Site

This research was conducted in the coastal area of Juntinyuat, Indramayu Regency, West Java Province (**Figure 2**). The location of the research is along a stretch of coast where a mangrove ecosystem exists. All research activities were carried out from June to December 2021.

### Research Methods

The research was conducted with a qualitative approach. Prastowo (2016) define qualitative methodology as a research technique that generates qualitative descriptive data in the form of written or spoken words from people and observed behavior. Furthermore, according to Lincoln in Ahmadi (2016), the word qualitative expresses an emphasis on processes and meanings that are not tested or measured precisely in quantity, amount, intensity, or frequency.

Qualitative research is carried out under natural conditions and is inventive. In qualitative research, the researcher is the key instrument. Therefore, researchers must hold broad theory and insight to ask questions, analyze and construct objects under study to be more precise. This research emphasizes more on meaning and is value bound.

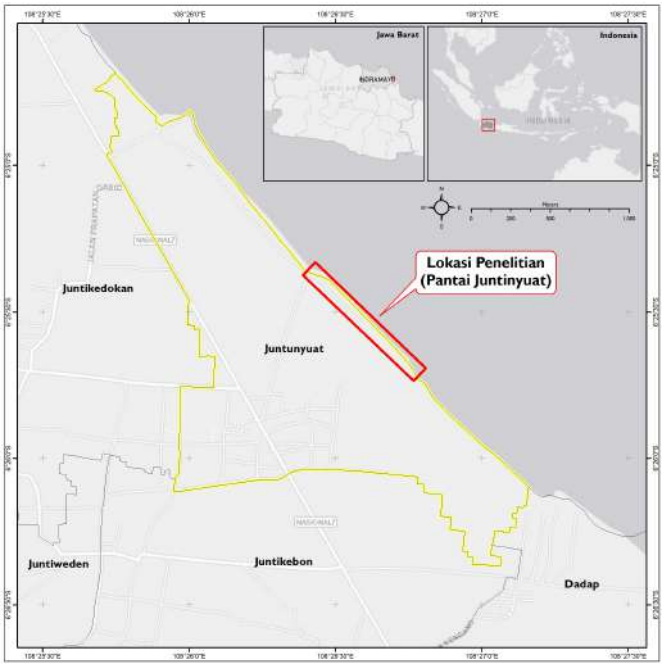


**Figure 2.** Location of research in the coastal area of Juntinyuat Sub-district, Indramayu, West Java.

### Data Collection

Data collection techniques are the most strategic step in research because the primary purpose of a study is to obtain data. According to Sugiyono (2016), qualitative research employs at least four data collection methods: observation, interviews, documentation, and a combination of the first three.

The data collection in this study was carried out by observation, interview and documentation. Observation consisted of observing the processes that occurred during the research process to obtain more comprehensive results. Interview is a technique used to obtain the whole picture and valid results about program implementation. Interviews in this research were conducted with relevant parties involved in the program, both internally and externally. Documentation involves the documents and written information regarding the implementation of the mangrove restoration program.

### Data Analysis

Data analysis was carried out after all data were collected from observations, interviews, and field documentation. Data analysis is a step taken after getting the data to organize and sort it into patterns or categories so it can be appropriately structured. Sugiyono (2016)

explains that the analysis starts by formulating and explaining the problem before going into the field and continuing until the research writing is finished. The data analysis technique used in this research is the Flow Model (Miles & Huberman, 2012), which is divided into three stages: data reduction, data presentation, and conclusion.

## RESULTS

### General Conditions of the Research

Juntinyuat Village has an area of 281.10 ha, which is divided into 35 neighborhood units (RT) and 5 (five) community units (RW) with a land elevation of 1 meter above sea level (m asl). Comparable to Indonesia, Juntinyuat Village has a tropical climate with an average temperature of 27° Celsius and average annual precipitation of approximately 18,517 millimeters. Land use patterns in Juntinyuat Village are characterized by rural communities that cultivate rice fields. The economic condition of the community is satisfactory. According to the profile of Juntinyuat Village, the community's occupations ranged from laborers, fishermen, and educators to private employees. The majority of the population is engaged in agriculture and entrepreneurship.

### Critical Condition of the Mangrove Ecosystem

The critical condition of the mangrove ecosystem on the Juntinyuat coast can be seen from several characteristics based on the community's narrative around the area and field conditions. The critical condition characteristics of the mangrove ecosystem include the denudation of the Juntinyuat coastal land (K1), conversion of land into agricultural land (K2), a large pile of garbage on the mangrove trees (K3), and the disruption of young mangrove trees by bruising waves and human activities (K4).

The village chief of Juntinyuat explained that the mangrove ecosystem on the coast of Juntinyuat has been in poor condition since the 2000s, several areas have been damaged which may affect the occurrence of abrasion on the Juntinyuat coast. The severe damage to the mangrove ecosystem is caused by several factors such as encroachment and conversion of mangrove forests into non-forest areas such as ponds, agricultural areas, and cultivation.

Uncontrolled use is one of the factors contributing to the destruction of the mangrove ecosystem in the Juntinyuat coastal region, as the local population is highly dependent on the area. Consequently, the conversion of mangrove forests for various purposes (plantations, ponds, agricultural land, tourism, etc.) without considering the sustainability and function of the surrounding environment.

Damage to the mangrove ecosystem along the coast of Juntinyuat has led to a relatively high level of abrasion in the Juntinyuat region. This happened due to natural factors and a lack of maintenance by the communities. In the past ten years, abrasion in the Juntinyuat coastal region has obliterated nearly half of the village.

### Initiation of Mangrove Ecosystem Recovery

The damage to the mangrove ecosystem and the situation of coastal abrasion, which is increasingly eroding the coastal area of Juntinyuat, encourages parties to pay more attention to the preservation of the mangrove ecosystem. The parties' involvement in preserving the mangrove ecosystem offers hope for the sustainability of the ecology around the mangrove ecosystem and improving environmental conditions.

The restoration initiatives of the mangrove ecosystem in the coastal area of Juntinyuat is one of the response from the parties in an effort to improve the environment. From the results of in-depth interviews with stakeholders and document studies, there are initiatives to restore the condition of the mangrove ecosystem on the Juntinyuat coast. The initiation began with determining an environmental policy (P1), followed by the issuance of a Decree on the Determination of Mangrove Conservation Areas (P2), and the formation of a team charged with the restoration of mangrove ecosystems along the coast of Juntinyuat (P3).

The subsequent initiation was to conduct an initial survey of the current condition of the mangrove ecosystem on the Juntinyuat coast (P4). P4 was then followed by a stakeholder meeting (P5) involving various related parties to discuss the results of the survey that had been carried out. Finally, formulate a strategic plan and work plan (P6) to restore the mangrove ecosystem on the Juntinyuat coast. As an outcome of these initiations, several parties have agreed to collaborate to restore the mangrove ecosystem (P7), in this case, PT. Pertamina Gas WJA and the Department of Forestry and Plantations (Dishutbun) of Indramayu Regency.

### The Implementation of Mangrove Ecosystem Restoration

The restoration of the mangrove ecosystem in the Juntinyuat coastal area was implemented after an inventory of information, and an initial survey of the site was undertaken in mid-2014 to determine the activities to be conducted to rehabilitate the coastal border conservation area along the Juntinyuat coast. The following activities were conducted to restore the mangrove ecosystem:

a. Training community on the cultivation and utilization of mangrove fruit
b. Technical plans preparation for planting

c. Planting ceremony
d. Rehabilitation/planting of mangrove and coastal forest plant species
e. Maintaining/embroidering of mangrove and coastal forest
f. Creating bulletin/prohibition boards
g. Monitoring and evaluating the activities

The implementation of the mangrove ecosystem restoration program from 2014 to 2021 has experienced quite a lot of dynamics in the process of restoring the mangrove ecosystem (**Figure 3**). Such as a small percentage of mangrove plant growth due to many dead mangrove seedlings and uncertain natural conditions up to management changes in the company.

**Figure 3.** Implementation of planting with Dishutbun (Forestry and Plantation Agency) in 2014.

### Monitoring and Recovery Impact

Periodic monitoring and evaluation in the Juntinyuat mangrove area is needed to determine the development or the increase in value of biodiversity contained in the area. The monitoring and evaluation activities involve creating an inventory of biodiversity including the diversity of flora, fauna and aquatic biota. In addition, the absorption value of biomass from the mangrove area was also estimated.

The purpose of the monitoring program (C1) for the restoration of the mangrove ecosystem is to determine the recovery area's condition and any issues or obstacles that could impede the restoration's implementation along the coast of Juntinyuat. One of the monitoring programs is plant maintenance activities (clearing weeds and replacing dead plants), both mangrove plants and coastal ecosystem plant species (C2). Maintenance is carried out periodically, foremost by observing the plant's growth. Plants may grow well, poorly, or even perish. Several factors cause plants to fail or even die, including poor seed origin, damaged seeds during transportation, improper planting techniques, human or animal disturbances, garbage disturbances, tidal waves, and many others (C3).

Based on the statement mentioned above, the follow-up plan as a sustainable solution step (C4) must account for the planting season, which is September to October, due to the tidal influence of seawater. Furthermore, another follow-up plan is to look for references to planting methods (C4) involving wave arresters and mangrove groups, village parties, and related institutions in the implementation program. One other possible sustainable solution related to seedlings (C4) is planting seedlings in polybags filled with soil.

The direct and indirect effects of the mangrove ecosystem restoration on the coast of Juntinyuat Indramayu can be observed from the economic, environmental, and socio-cultural aspects of the community around the area (C5). In this study, the impact is measured based on the actual effect that the community can perceive. According to Kusmana & Sukristijono (2016), local communities derive direct and indirect benefits from mangrove wood products and mangrove ecosystems by utilizing mangrove ecosystem resources. Additionally, the mangrove ecosystem has potential benefits such as coastal conservation areas and disaster mitigation.

## DISCUSSION

### Initiation and Planning for Ecosystem Recovery

Mangrove ecosystems are essential habitats for wildlife, most of which are waterbirds and several species of land birds. The presence of waterbirds can be seen as an indicator of biodiversity in mangrove forest areas. One of the coastal areas where the mangrove ecosystem is in poor condition is the north coast of Java Island, especially the Indramayu area, West Java. The conditions of the mangrove ecosystem in the Juntinyuat Coastal area, Indramayu, and its surroundings are critical, if no efforts are to be made to improve the mangrove ecosystem.

The research result demonstrates that implementing a program to restore the mangrove ecosystem along the coast of Juntinyuat, Indramayu, involves multiple stages

of processes and activities. The stages of processes and activities start from planning, implementing strategies, and implementing programs, until monitoring and evaluating the mangrove ecosystem restoration program on the Juntinyuat coast.

At each phase of the activity process, codes are used to summarize the implementation stages of the mangrove ecosystem recovery program (**Table 1**), as well as for its planning, organizing, and implementation activities (**Table 2**). Based on the collected data, the frequency of program implementation varies at each stage of the implementation process, ranging from once to multiple times. The frequency of implementation at this stage shows how much influence it has on the success of mangrove ecosystem restoration involving various related parties, including companies, local governments, related agencies, village governments, and community groups.

**Table 1.** Code of conditions/activities in the recovery of mangrove ecosystem.

| Conditions /activities | Code | Information |
|---|---|---|
| Critical Condition | K1 | Deforestation on the coast |
| | K2 | The conversion of mangrove land into agriculture |
| | K3 | Piles of garbage around the mangrove |
| | K4 | Disruption of young mangroves |
| Planning | P1 | Environmental policy |
| | P2 | Area Determination Decree |
| | P3 | KEHATI Team Decree |
| | P4 | Initial survey |
| | P5 | Stakeholder meeting |
| | P6 | Strategic Plan & Work Plan |
| | P7 | Cooperation of the stakeholders |
| Organizing | O1 | Duties of HR/stakeholders |
| | O2 | Counseling |
| | O3 | Training |
| | O4 | Seed management |

The denudation of coastal land and the conversion of mangrove ecosystem areas into agricultural land on the Juntinyuat coast created a sense of empathy and care from various parties to improve these conditions. Additionally, the large pile of garbage in the mangrove area and the leaning of young mangroves are factors that support the efforts to restore mangrove ecosystems. The initiation was carried out by determining environmental policies, establishing mangrove ecosystem conservation areas to maintain existing mangroves, and immediately forming a team that directly handled the restoration. The critical condition of the mangrove ecosystem on the Juntinyuat coast triggered initiatives to restore the mangrove ecosystem. This context will form the relationship between K1, K2, K3, and K4 with P1, P2, and P3.

In order to understand more about the current damage to the mangrove ecosystem on the Juntinyuat coast, an initial survey was carried out at the location of the mangrove ecosystem, and then the results were discussed with the responsible parties. The follow-up of the meeting was to formulate a strategic plan by involving the parties to establish cooperation in efforts to restore the mangrove ecosystem. This concept will connect the critical conditions of mangroves (K1, K2, K3, K4) and P4, P5, P6, and P7 to the initiation and planning of mangrove ecosystem restoration.

The initiation and planning of mangrove ecosystem restoration will run better and more effectively if it is prepared with a strategy for carrying out the plans that have been made. Some of the strategic steps taken were to determine the main functions and tasks of each party involved in the restoration of the mangrove ecosystem, then provide counseling and training related to the importance of maintaining the mangrove ecosystem and how to manage seedlings properly and correctly. This concept shows a relationship between planning (P5, P6, P7) and recovery strategies (O1, O2, O3, O4).

Figure 4 below describes the connection between the critical condition of the mangrove ecosystem in the coastal area of Juntinyuat and the efforts to restore the mangrove ecosystem. Initiating mangrove ecosystem restoration from critical conditions also requires careful planning. Figure 4 also shows a link between mangrove ecosystem restoration planning and strategies carried out in the mangrove ecosystem restoration plan on the Juntinyuat coast.

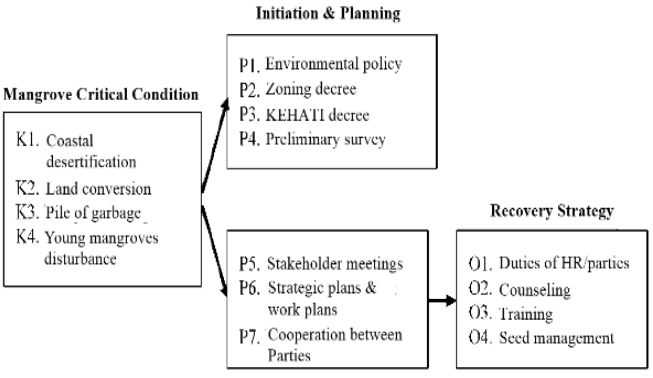


**Figure 4.** The connection between critical mangrove conditions, the initiation and the strategy of recovering mangrove ecosystems.

## Linkage of Planning to Implementation and Successful Mangrove Recovery

Careful planning in the mangrove ecosystem restoration program is needed so that during

implementation, it can be carried out maximally to provide significant results. This program planning is complemented with a strategy to implement the mangrove ecosystem restoration program, especially on the Juntinyuat coast.

The planning stage of the mangrove ecosystem recovery program is the longest activity in the process, where many meetings were held between relevant stakeholders; this shows how vital the shared vision and mission are in the planning process toward mangrove ecosystem restoration. The involvement of various stakeholders proves that the restoration of the mangrove ecosystem cannot only be done or held responsible by one party - it is a shared responsibility among the stakeholders in protecting the environment. In addition, preliminary survey activities are an essential stage in defining the planning of mangrove ecosystem restoration programs by field conditions. The initial survey was carried out twice to ensure that the plans followed the field conditions and needs, namely on the coast of Juntinyuat.

Stakeholder involvement can be done to speed up the recovery process. The mutual management approach is based on norms, regulations, and sanctions from communities around natural resources such as mangrove ecosystems. This type of management is considered more efficient since regulations, prohibitions, and sanctions are made based on the habits and knowledge of the people around the natural resources (Kustanti, 2011; Kustanti et al., 2014). Regulations, prohibitions, and sanctions in controlling the number of beneficiaries and the number of resources allowed to be taken are considered more in favor of the physical condition of the existing natural resources and the socio-economic conditions of the people who use the natural resources. The connection between planning and implementation and the success of the mangrove ecosystem restoration can be seen on Figure 5.

*"Indeed, this mangrove planting activity does not stop here, but will continue to be carried out because along this coast there is Pertagas, which is a gas pipeline asset that must be protected from the impact of shoreline erosion or abrasion in a natural way."* (SL, 35 y.o)

The implementation of efforts to restore the mangrove ecosystem by planting and replanting mangrove trees in the Juntinyuat coastal area is carried out by involving the local community. In addition, the company and related agencies conduct training on mangrove cultivation and raise awareness among the public on the importance of maintaining the mangrove ecosystem. The purpose of doing this is to involve community participation to discover how to cultivate mangroves that will impact the community economically.

*"Saving the fate of the coast based on planting mangrove trees is the most effective and natural way. Apart from protecting the coast, mangrove trees can also provide economic benefits for the community in the future."* (ND, 37 y.o)

**Table 2.** Code of planning, organizing, and implementation activities.

| Conditions /activities | Code | Information |
|---|---|---|
| Planning | P5 | *Stakeholder* meeting |
| | P6 | MoU/ Dishutbun Cooperation |
| | P7 | Strategic Plan & Work Plan |
| Organizing | O1 | Duties of HR/parties |
| | O2 | Counseling |
| | O3 | Training |
| | O4 | Seed management |
| Actuating | A1 | Planting |
| | A2 | Stitching |
| | A3 | Water breaker repair |
| Controlling | C1 | Program monitoring |
| | C2 | Plant maintenance |
| | C3 | Obstacles/obstacles |
| | C4 | Sustainable solutions |
| | C5 | Recovery impact |

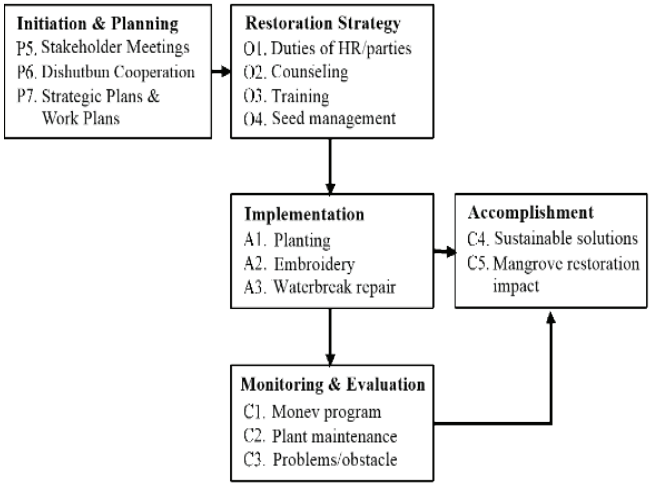


**Figure 5.** The connection between planning and implementation and the success of the mangrove ecosystem restoration

Ecosystem restoration efforts are required to restore damaged vegetation or ecosystem function in line with conservation area management goals. The process of ecosystem recovery, which includes natural succession, rehabilitation, and restoration, is in line with the level of damage that has been done. The success of mangrove rehabilitation activities is influenced by various factors, including the availability of healthy plant seedlings in sufficient quantities, at the right time. According to Kusmana et al. (2010), several stages of mangrove rehabilitation activities include making nurseries, planting mangroves, and monitoring and evaluating the

growth of mangrove plants. In addition, understanding autecology and hydrological patterns are also important in supporting the success of mangrove rehabilitation (Wibowo et al., 2021).

One of the impacts of the restoration of the mangrove ecosystem on the coast of Juntinyuat is the development of mangrove ecotourism. Based on the results of interviews with the Juntinyuat village government and ecotourism managers, mangrove ecotourism on the Juntinyuat coast is included in one of the Juntinyuat BUMDES (Village Owned Enterprises) in the tourism sector. Juntinyuat mangrove ecotourism is managed directly by the village and local communities. This exemplifies the strength of the direct collaboration between the government and the surrounding community in managing ecotourism. With such collaboration, the procurement of infrastructure was carried out quickly.

Mangrove ecotourism on the Juntinyuat coast is located in a strategic location, easily accessible from the main road, either by vehicle or on foot. PT. Pertamina Gas WJA also contributed to the development of mangrove ecotourism on the coast of Juntinyuat, because it has the oil pipeline that traverses the coast of Juntinyuat; consequently, a regular flow of funds from the company is used for the management of mangrove ecotourism.

Tourists have a good perception of the natural scenery around the Juntinyuat mangrove ecosystem. It is proven by the number of tourists who take pictures of the mangrove ecotourism. Because of having a good perception from tourists, ecotourism activities will not damage existing natural resources. The existence of ecotourism can increase the economy for ecotourism management and the surrounding community. Furthermore, the funds collected can be used to manage mangrove ecotourism on the Juntinyuat coast.

The development of mangrove ecotourism on the Juntinyuat coast requires support and collaborative partnership from stakeholders such as the management, village government, the private sector, and the Department of Culture and Tourism. Stakeholders have the primary task and function of achieving the goals of ecotourism development.

## CONCLUSION

The planning of a stakeholder-based mangrove recovery program on the Juntinyuat coast is due to the damage level of the mangrove ecosystem, and the increasing coastal abrasion at the coastal area of Juntinyuat, which encourges involved parties to take part in the mangrove ecosystem preservation. The parties' involvement in preserving the mangrove ecosystem provides a glimpse of hope for the sustainability of the ecology around the mangrove ecosystem and improves environmental conditions.

The management strategy of a stakeholder-based mangrove recovery program on the Juntinyuat coast in combating coastal abrasion is carried out by engaging the parties to continue to be mutually responsible for the environment. Planning and strategy for mangrove ecosystem restoration must be accompanied by implementation in line with the plan and regular monitoring and evaluation.

A stakeholder-based mangrove recovery program on the Juntinyuat coast was implemented after an inventory of information, and an initial site survey was carried out in mid-2014 to determine the activities to rehabilitate the coastal border conservation area on the Juntinyuat coast. The activities to restore the mangrove ecosystem include (a) training on the cultivation and utilization of mangrove fruit, (b) preparation of technical plans for planting, (c) ceremonial planting, (d) rehabilitation /planting of mangrove species and coastal forest plant species, (e) maintaining/embroidering mangrove forest and coastal forest plants, (f) creating bulletin/prohibition boards, and (g) monitoring and evaluation programs.

The monitoring and evaluation of a stakeholder-based mangrove recovery program identified that the benefits of the existence of the mangrove ecosystem were to protect the coast from erosion and abrasion. The presence of mangroves on the coast is useful to keep the coastline stable and not eroded by waves. The success of the mangrove ecosystem restoration program on the Juntinyuat coast is inseparable from the involvement of many stakeholders. The participation of companies, local governments, and local communities is vital in establishing great collaboration among stakeholders and having their respective main tasks and functions as one of the best steps in successfully restoring the mangrove ecosystem. The mangrove ecosystem restoration in the coastal area of Juntinyuat needs to pay attention to leadership change conditions. The management of the company and the village government have all changed, but must be ensured that the mangrove areas status is not altered to for other purposes, as well as is still well-managed so that create benefits to the economy of local community, environment, and culture.

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