
EFFECTIVENESS OF PATROL OPERATIONS AT BITUNG CLASS II SEA AND COAST GUARD BASE IN PREVENTING ENVIRONMENTAL POLLUTION AT SEA BY COMMERCIAL VESSELS

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Received: 02/04/2026 | Revised: 04/05/2026 | Accepted: 20/05/2026 | Published: 11/06/2026

Abstract

This study aims to analyze the effectiveness of patrol operations at the Bitung Class II Sea and Coast Guard Base (PLP) in preventing marine pollution by merchant vessels and to identify factors that hinder its effective implementation. The background of this study is the persistent gap between the ideal conditions of marine environmental surveillance and the reality in the field, where marine pollution caused by merchant vessel activities still occurs despite the existence of national and international regulations governing it. This study uses a qualitative approach with a public administration perspective. Data were collected through interviews, observations, and documentation, then analyzed descriptively qualitatively using an effectiveness approach that includes input, process, output, and outcome. The analysis focused on patrol planning and implementation, inter-agency coordination, and the availability of organizational resources. The results show that the effectiveness of patrol operations at the Bitung Class II PLP in preventing marine pollution by merchant vessels is not optimal. This is due to limited human resources, a lack of patrol fleets, budget constraints, and suboptimal coordination between related agencies. These conditions have resulted in uneven coverage of surveillance and the continued discovery of potential marine pollution violations in Bitung waters. In conclusion, the effectiveness of patrol operations is greatly influenced by institutional capacity and synergy between actors in the marine surveillance system. Therefore, it is necessary to strengthen resources, improve coordination, and optimize patrol strategies to support sustainable marine environmental protection.

Keywords: *effectiveness, marine patrol, PLP Bitung, marine pollution.*

INTRODUCTION

The sea is a national strategic asset with multidimensional value, both from an economic, ecological, and national security perspective. Economically, the sea serves as a major route for international trade, a source of fisheries resources, and a supporter of shipping and maritime industry activities. Ecologically, the sea serves as a life support through biodiversity and ecosystem balance. In the context of an archipelagic nation like Indonesia, the sea not only unifies the region but is also an integral part of sustainable national development, in line with the view of sustainable development theory which emphasizes the balance between economic growth, environmental protection, and social welfare (WCED, 1987). As a consequence of this strategic position, the state has a central role in ensuring the protection and sustainable management of the marine environment, which from a public administration perspective is realized through policy formulation, program implementation, and supervision and law enforcement against activities that have the potential to damage the environment. This study confirms that "Law Number 32 of 2009 concerning Environmental Protection and Management affirms that the government is responsible for preventing pollution and environmental damage, including in marine areas" (pages 7-8). In addition, the United Nations Convention on the Law of the Sea (UNCLOS 1982) which has been ratified by Indonesia mandates coastal states to protect and preserve the marine environment from pollution

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originating from ships, so that normatively this provision places the state as the main actor in controlling marine pollution by merchant ships. The function of supervision and law enforcement in waters is an important instrument in ensuring compliance with marine environmental regulations, and from a public administration perspective, maritime supervision is not only interpreted as a technical activity but also as part of the state administration accountability mechanism. According to the theory of public administration supervision (Siagian, 2014), supervision aims to ensure that policy implementation runs according to predetermined objectives and prevents deviations. Therefore, in the context of marine pollution, effective supervision will encourage compliance of shipping business actors with environmental standards while providing a deterrent effect through consistent law enforcement. Marine patrol operations are one concrete form of the implementation of these supervisory and law enforcement functions, and within the framework of public policy, marine patrols can be seen as an instrument of policy implementation aimed at achieving outcomes in the form of maintaining the quality of the marine environment.

This study cites that "according to the theory of policy implementation (Mazmanian & Sabatier), the effectiveness of a policy is largely determined by the ability of implementing officials to carry out tasks in the field, including clarity of authority and availability of resources" (page 8). Marine patrol operations function as a means of early detection of potential pollution, taking action against violations, and prevention through state presence in territorial waters, so that normatively marine patrols must be carried out routinely, in a planned manner, and based on pollution risks. The implementation of sea patrol operations in preventing marine environmental pollution has a strong legal basis in the national and international legal systems, because normatively marine environmental protection is part of the state mandate as stated in Article 28H paragraph (1) of the 1945 Constitution of the Republic of Indonesia which states that everyone has the right to a good and healthy environment. This constitutional provision is then derived in various sectoral laws and regulations, including Law Number 32 of 2009 concerning Environmental Protection and Management which is the main basis for environmental supervision as a preventive instrument, as well as Law Number 17 of 2008 concerning Shipping which provides a comprehensive legal basis regarding supervision of ships, shipping safety, and protection of the maritime environment. Indonesia is also bound by various international legal instruments such as UNCLOS 1982 and MARPOL which place coastal states as the parties responsible for supervising ship activities in their jurisdiction. In the context of public administration, the existence of the Sea and Coast Guard Base (PLP) is an extension of the government in carrying out guarding, monitoring, and law enforcement functions in the waters, and specifically the authority of the Bitung Class II PLP in carrying out sea patrol operations is part of the government's policy in the field of shipping safety and marine environmental protection. This study emphasizes that "in the context of public policy, this authority indicates the delegation of authority from the central government to technical implementing units in the regions, thus enabling closer supervision and responsiveness to local conditions" (pages 11-12), so that normatively the sea patrol operations carried out by the Bitung Class II PLP have clear legal and administrative legitimacy.

The Bitung waters are one of the strategic maritime areas in eastern Indonesia with a relatively high intensity of shipping and maritime trade activities. The presence of Bitung Port as an international port and gateway for exports and imports in the Pacific region makes the surrounding waters busy with commercial vessels, both national and foreign-flagged. From a public administration perspective, this high level of commercial vessel activity is an indicator of the increasing function of public services in the maritime transportation sector, but also poses complex oversight challenges because the higher the intensity of activity, the greater the potential risk of marine environmental pollution if not balanced by an effective and consistent oversight system. Empirically, commercial vessel activity in Bitung waters has the potential for significant marine pollution, particularly from oil waste and hazardous materials, whether from fuel spills, engine leaks, contaminated ballast water discharge, or tank cleaning activities. Various studies have stated that oil pollution from ships is one of the main sources of marine environmental degradation in port areas and busy shipping lanes (GESAMP, 2019), and in the Indonesian context, the Ministry of Environment and Forestry noted that most marine pollution in port areas is related to shipping and maritime activities. Although international regulations such as MARPOL have regulated the prohibition of dumping certain waste into the sea, in practice there are still indications of violations such as the unavailability of ship waste management documents, suboptimal use of port reception facilities, and non-compliance with environmental operational standards, which from the perspective of public oversight theory are often correlated with limited oversight capacity and low patrol intensity in the field. Although normatively, maritime patrol operations have a clear legal basis and policy framework, in practice, the implementation of patrols by PLP Class II Bitung still faces various problems that indicate the effectiveness of maritime surveillance is not optimal. This study identified that "one of the main problems is the limited available patrol fleet compared to the surveillance needs in the waters under the

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responsibility of PLP Class II Bitung" (page 17), and in the theory of public organization effectiveness, the match between resources and task load is a primary prerequisite for achieving optimal performance (Steers, 1985). This problem is exacerbated by the vast maritime surveillance area that must be covered by PLP Class II Bitung, which is not commensurate with its operational capacity. Therefore, from a public administration perspective, this condition reflects limitations in the policy input aspect that directly impacts program output and outcomes (Dunn, 2018). In addition to the limited fleet and surveillance area, another significant problem is the limited human resources, both in terms of the number and competence of patrol personnel, which in theory implementation capacity is very important in determining the success of government programs (Van Meter & Van Horn). Obstacles to coordination between agencies with authority in territorial waters also affect the effectiveness of maritime patrols, as in practice coordination often faces obstacles in the form of overlapping authority, differences in procedures, and limitations in communication and data exchange. The most obvious indication of these various problems is the continued occurrence of marine pollution by commercial vessels in territorial waters, whether in the form of oil waste, ship operational waste, or violations of environmental procedures, which indicates a gap between policy objectives and results achieved in the field. Studies on maritime patrols and water surveillance are generally dominated by technical and legal approaches, while public administration perspectives examining maritime patrols as public policy and government programs are still relatively limited. Research specifically analyzing the effectiveness of maritime patrols in the context of environmental pollution prevention is still relatively minimal, and the research gap is also evident in the lack of empirical studies that are region-specific, particularly in eastern Indonesia such as Bitung. This study asserts that "from a public administration perspective, the local context significantly influences the effectiveness of policy implementation (contextual policy implementation), so the lack of specific studies in the Bitung region indicates an important and relevant research space to be filled" (page 23).

Based on the description of the normative and empirical conditions, as well as implementation issues that have been presented, research on the effectiveness of patrol operations at the Class II Bitung Sea and Coast Guard Base (PLP) is highly urgent. From the government's perspective, this research is relevant as material for evaluating the performance of existing maritime surveillance policies and programs, and for the Class II Bitung Sea and Coast Guard Base, this research has practical relevance as a means of reflection and improvement of organizational performance. From the perspective of public policy development, this research provides academic contributions in enriching the study of the effectiveness of environmental and maritime policies, particularly those analyzed through a public administration approach using the input-process-output-outcome framework, so that it is expected to provide a comprehensive picture of the performance of marine patrol policies as an instrument for pollution prevention. Furthermore, the urgency of this research is also related to efforts to protect the marine environment as part of sustainable development, because polluted marine environments not only impact ecosystems and biodiversity, but also on the welfare of coastal communities and the sustainability of the maritime economy. Based on the background description above, this research aims to analyze, describe and explain the effectiveness of patrol operations of the Bitung Class II Sea and Coast Guard Base in preventing environmental pollution at sea by merchant vessels and to identify inhibiting factors that influence the effectiveness of patrol operations of the Bitung Class II PLP in preventing marine environmental pollution by merchant vessels.

METHOD

This study uses a descriptive qualitative approach, chosen because it is able to provide an objective, in-depth, and contextual picture of the effectiveness of patrol operations of the Bitung Class II Sea and Coast Guard Base (PLP) in preventing marine environmental pollution by merchant vessels. The qualitative approach allows researchers to explore the meaning behind the phenomena occurring in the field, as well as to holistically understand the factors that influence the effectiveness of maritime surveillance policies, from planning, implementation, coordination, to resource availability. This study does not focus on hypothesis testing or statistical generalization, but rather on an in-depth understanding of the reality of policy implementation at the operational level, by making researchers a key instrument in data collection and analysis. In accordance with the characteristics of qualitative research, data source sampling was carried out purposively and snowball, so that informants were selected based on certain criteria who had knowledge and direct involvement in maritime patrol operations in the Bitung area. This research focuses on the effectiveness of the Class II Bitung PLP patrol operations, which is then broken down into four interrelated sub-focuses or research indicators. The first indicator is patrol operation planning, which examines the extent to which the PLP carries out planning based on regulations, potential pollution risks, and resource conditions, with benchmarks such as the availability of standard operating procedures (SOPs), patrol schedules, and prioritization of pollution-prone areas. The second indicator is patrol

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operation implementation, which assesses implementation in the field through the frequency of routine and incidental patrols, the number of vessel inspections, and law enforcement actions against violations found. The third indicator is inter-agency coordination and synergy, which measures the effectiveness of cooperation between the PLP and other agencies such as the Harbormaster and Port Authority Office (KSOP), the Marine Police, the Ministry of Environment, and other stakeholders, with indicators such as coordination mechanisms, cross-agency forums, and the effectiveness of communication and report exchange. The fourth indicator is organizational resources and capacity, which assesses the influence of personnel (number and competence), patrol fleet (vessel condition), supporting infrastructure, and budget availability on patrol effectiveness. In addition to these four indicators, this study also identified inhibiting factors that emerged from the analysis of interview data and field observations.

The research location was determined at the Bitung Class II Coast Guard Base, considering that this work unit has operational responsibilities in strategic waters with dense shipping activity. The research data sources consist of three types, namely places and events (direct observation of the research object), informants (resource persons selected purposively), and research documents including laws and regulations, internal records, photographs, and voice recordings. Data collection techniques were carried out through three methods, namely documentation (reviewing supporting documents and taking photographs and voice recordings), observation (observing behavior, work processes, and symptoms in the field directly), and in-depth interviews with sources deemed competent. In this study, the informants interviewed included the Head of the Bitung Class II Coast Guard Base, Patrol Boat Captains, Head of the Engine Room, Pollution Control Personnel, Shipping Safety Administrators, and Pollution Control and SAR Disaster Supervisors, so that the collected data came from various different but complementary perspectives. The data analysis in this study uses an interactive model from Miles and Huberman (2017) which includes four main stages, namely data collection, data condensation (data selection and simplification), data presentation in the form of narrative text and tables, as well as drawing conclusions and verification. To ensure the validity of the data, this study applies four criteria, namely credibility (internal validity) through source triangulation, peer debriefing, and member checks; dependability (dependability) to test the consistency of the research results; transferability (transferability) so that the research results can be applied in other similar contexts; and confirmability (certainty) through audit trials to ensure that the findings truly correspond to the real situation in the field. With this systematic and comprehensive methodological approach, the study is expected to be able to produce valid, reliable, and beneficial findings both for the development of public administration science and for improving maritime surveillance policies in Indonesia, particularly in efforts to prevent environmental pollution by merchant vessels in the Bitung waters.

RESULTS AND DISCUSSION

1. Patrol Operation Planning

Patrol operation planning is the initial stage that determines the effectiveness of patrols carried out by the Bitung Class II Sea and Coast Guard Base (PLP) in efforts to prevent marine environmental pollution by commercial vessels. Based on field findings, patrol operation planning has basically been carried out through quite systematic stages, starting with situation analysis and mapping of water areas considered vulnerable to environmental pollution. As stated by informant JS, "the process of patrol operation planning at the Bitung Class II Sea and Coast Guard Base basically begins with situation analysis and mapping of water areas considered vulnerable to environmental pollution. In determining patrol areas, we usually refer to data on merchant vessel traffic, port areas, and points that are frequently used as entry and exit routes for ships" (page 94). However, this study found that the planning carried out was not fully based on a comprehensive risk analysis, so that the determination of patrol areas, times, and targets still tended to be general and not responsive to the dynamics of merchant vessel activity and pollution-prone points in Bitung waters. From the perspective of Siagian's (2014) administrative oversight theory, planning plays a strategic role as part of preventive oversight, aiming to prevent deviations before activities take place. Patrol planning is not simply the preparation of an operational schedule, but rather a systematic process to ensure that oversight activities are directed at potential marine pollution risks. This view is reinforced by Mardiasmo (2018), who positions planning as an integral part of the public management cycle. However, when compared to the reality on the ground, patrol planning at the Bitung Class II PLP has not fully accommodated a risk-based approach due to limited data and in-depth analysis. This results in patrols being less than targeted, thus suboptimal pollution prevention effectiveness.

This study also revealed that inter-agency coordination during the planning stage has not been optimally integrated. Although coordination has been carried out through regular meetings and communication, there are still limitations in the synchronization of data, information, and joint planning systems. Informant JS stated that "in the patrol operation planning stage, inter-agency coordination is usually carried out through coordination meetings involving the PLP Base, port authorities, and other relevant agencies such as the environmental agency and maritime law enforcement officers. This coordination is very helpful in developing patrol plans that are more focused and in accordance with field conditions" (page 95). However, informant FA added that "inter-agency coordination significantly influences the effectiveness of patrol operation planning, because without synchronization of data and information, the plans prepared can be less targeted" (pages 95-96). This condition indicates that unintegrated planning will lead to duplication or even a lack of supervision in certain areas. This is in line with the findings of Rahman (2019), which shows that the effectiveness of supervision is greatly influenced by the adequacy of input and the quality of the process, including how patrol activities are planned. Furthermore, limitations in human resources, infrastructure, and the use of technology and data are major obstacles in planning. Informant BS revealed that "in planning patrol operations, one of the main obstacles from a human resources perspective is the limited number of personnel who truly possess specific technical competencies in the field of marine environmental pollution monitoring. Not all personnel have a deep understanding of pollution indicators or appropriate action procedures" (page 96). In terms of facilities, informant KR stated that "a frequently encountered obstacle is the limited number of patrol vessels and adequate supporting equipment to detect marine pollution quickly and accurately" (page 96). Meanwhile, informant LT added that "from the aspect of data and technology utilization, the obstacle faced is the less than optimal integration of information systems that can provide real-time and accurate ship movement data. Some planning still relies on manual data or periodic reports" (page 97). Thus, patrol operation planning at the Bitung Class II PLP still requires strengthening of a risk-based approach, integrated coordination, and the use of data and technology to be more effective in supporting marine pollution prevention.

2. Implementation of Patrol Operations

Patrol operations are a core step in Bitung Class II PLP's efforts to prevent marine pollution by commercial vessels. Based on field findings, patrols have been carried out by deploying patrol boats into designated waters, both routinely and incidentally. Informant JS explained that "the patrol operations are carried out by deploying patrol boats into predetermined waters based on the operational plan. In the field, officers directly supervise the activities of commercial vessels passing through or operating in the port area. Our main focus is to ensure that there are no activities that have the potential to cause marine pollution, such as illegal waste disposal" (page 103). Informant FA added that "during field surveillance activities, we conduct visual monitoring of sea conditions and the movement of commercial vessels. In addition, we also approach certain vessels deemed suspicious or having potential violations" (page 103). However, this study found that patrols have not been able to optimally cover all waters due to limited infrastructure, particularly the number and condition of patrol boats, as well as the vastness and complexity of Bitung's waters, accompanied by unpredictable weather conditions.

From the perspective of administrative oversight theory, Siagian (2014) emphasized that oversight is a systematic process to ensure that activities are carried out according to plan. The uneven implementation of patrols and the persistence of oversight gaps indicate that the control function over merchant vessel activities is not yet fully optimized. This also relates to the concept of preventive and repressive oversight. Ideally, maritime patrols should be able to carry out a preventive function through a routine presence that provides a deterrent effect. However, the limited scope of patrols means that this preventive function is not optimal, so oversight tends to be reactive when violations have occurred. Informant KR stated that "another significant obstacle is the condition of Bitung's waters, which are quite extensive and have dynamic characteristics, including rapid weather changes and quite strong ocean currents. These conditions often affect the smooth running of patrol operations because in bad weather situations, patrol vessels must reduce speed or even postpone activities for the safety of personnel" (pages 104-105).

This study also revealed that the limited human resources with specialized competencies in marine pollution monitoring pose a serious obstacle to the implementation of patrols. Informant LT stated that "in terms of human resources, the obstacle faced is the limited number of personnel with specialized experience and technical skills in marine pollution monitoring. Not all members have the same ability to identify early signs of pollution or to make quick decisions in the field. In addition, the relatively high workload also poses a challenge because personnel must work in shifts with a tight patrol schedule" (page 105). From the perspective of Grindle's (1997) organizational capacity theory, the success

of policy implementation is largely determined by institutional capacity, including the quality of human resources. The uneven distribution of personnel competencies indicates that this capacity is not yet fully adequate, which results in slow responses and less than optimal handling of violations.

Furthermore, the use of technology and communication systems in patrol operations is not yet fully optimized and integrated. Informant JS acknowledged that "in the implementation of patrol operations, the use of technology and communication systems has begun, particularly through radio communication and basic monitoring devices to coordinate between patrol vessels and the command center. However, the existing system is still not fully integrated in real time, resulting in sometimes delays in data delivery" (page 105). Informant FA added that "the use of technology to support patrols is also evident in the use of available vessel tracking systems, although their coverage and accuracy are still limited" (page 106). The reliance on manual methods and the lack of integrated information systems indicate that patrol operations have not fully utilized modern, data-driven approaches, which hinders effective coordination and decision-making. This finding aligns with research by Siregar and Hidayat (2020) that the effectiveness of supervision is determined not only by regulations, but also by organizational capacity and inter-agency coordination.

3. Coordination and Synergy Between Agencies

Coordination and synergy between agencies are key elements in determining the effectiveness of maritime patrol operations, particularly in preventing environmental pollution by merchant vessels. Based on research findings, inter-agency coordination has essentially been carried out through formal mechanisms such as routine coordination meetings involving the PLP, port authorities, environmental agencies, and maritime law enforcement officials. Informant BS explained that "the form of coordination and synergy between agencies in supporting patrol operations is carried out through formal mechanisms such as routine coordination meetings involving various parties. The results of these meetings are then used as the basis for preparing plans and implementing patrol operations in the field so that they are more focused and in accordance with surveillance needs" (page 113). In addition, coordination is also carried out in the form of daily operational communications, both through telephone lines, radio communications, and special communication groups. However, this study found that inter-agency coordination has not been optimally integrated and remains partial.

From a governance theory perspective, Peters (2015) emphasized that coordination is a major challenge in cross-sector public sector governance, including the maritime sector. Lack of coordination results in weak control over merchant vessel activities, making it difficult to optimally prevent potential marine environmental pollution. This study revealed that the process of exchanging data and information between agencies still faces obstacles, both in terms of speed and integration. Informant JS stated that "the process of exchanging data and information between agencies to support patrol operations is generally carried out through official mechanisms such as electronic correspondence, daily reports, and the delivery of monitoring results from each agency. The data exchanged typically includes information on merchant vessel movements, arrival and departure schedules, and initial reports regarding suspected environmental violations. This process is quite helpful, but still requires time to deliver" (page 114). Informant BS added that "in addition to formal channels, data exchange is also carried out through direct communication between officers in the field, such as using radio communications, telephones, and rapid coordination groups. However, the accuracy and completeness of the data sometimes remain challenges in this rapid communication process" (page 115).

This study also identified that differences in work procedures, perceptions, and priorities between agencies pose serious obstacles to building effective synergy. Informant KR revealed that "in building coordination and synergy between agencies, the main obstacle we often face is the differences in work procedures and operational mechanisms of each agency. Each agency has different operational standards and bureaucratic processes, so in some situations it takes time to align perceptions before joint actions can be taken in the field. Furthermore, the limitations of information systems that are not yet fully integrated also pose a barrier" (pages 115-116). Informant AK added that "another quite prominent obstacle is the limitations of the communication system and information exchange between agencies, which are still not optimal. In some cases, important information related to merchant vessel activity or potential pollution cannot be immediately received simultaneously by all parties because it still relies on manual or non-integrated communication channels" (page 116). This indicates that the coordination system is not yet fully responsive and integrated, resulting in a slow response to potential pollution. These findings reinforce the findings of Siregar and Hidayat (2020) that overlapping authority and limited institutional capacity are major obstacles to marine environmental monitoring.

4. Organizational Resources and Capacity

Organizational resources and capacity are determining factors in determining the effectiveness of the Class II Bitung PLP patrol operations. Based on research findings, from a human resources perspective, the number of available personnel is not commensurate with the size of the waters to be monitored, resulting in shift work and suboptimal monitoring intensity. Informant JS stated that “in general, the human resources condition at the Class II Bitung Sea and Coast Guard Base still faces limitations in terms of the number of personnel available to support all patrol operations. With the vast waters to be monitored, the number of available personnel is sometimes not fully sufficient to carry out patrols optimally and continuously” (page 123). From a competency perspective, informant FA stated that “from a competency perspective, there have actually been efforts to improve capabilities through training and coaching, but not all personnel have sufficient specialized expertise in the field of marine pollution monitoring. Some personnel still need to improve their understanding regarding early pollution identification, field handling procedures, and the use of patrol support equipment” (page 123). This condition indicates that human resource capacity does not fully support the optimal implementation of the monitoring policy. From the perspective of institutional capacity theory, Grindle (1997) asserted that the success of public policy implementation is largely determined by an organization's ability to manage its resources. When human resource capacity is inadequate, policy effectiveness will be compromised. This aligns with Mardiasmo's (2018) findings that supervision is an integral part of the public management cycle, encompassing planning, implementation, and evaluation. Limited human resource numbers and competencies indicate that organizational input is not yet fully capable of optimally supporting the implementation and evaluation of supervision.

In terms of facilities and infrastructure, this study found that the availability of patrol boats was very limited and the condition of the equipment was not yet optimal. Informant BS stated that “in general, the availability of facilities and infrastructure for patrol operations at the Bitung Class II Coast Guard Base is still quite limited, especially when compared to the area of waters that must be monitored. The available patrol boats are not yet fully sufficient to reach all pollution-prone areas simultaneously. This condition requires patrols to be arranged in rotation and adjusted to prioritize areas considered most at risk” (page 124). Informant KR added that “in terms of condition, several facilities such as patrol boats and operational support equipment still require routine maintenance to be used optimally. Sometimes there are technical obstacles such as minor damage or limited pollution detection equipment that make the monitoring process in the field less effective” (page 124). Within the framework of public management, Dye (2017) emphasized that public policy does not stop at the formulation, but is largely determined by what the government actually does. The limitations of facilities and infrastructure reflect the existence of obstacles in the implementation stage of marine surveillance policies.

Furthermore, the utilization of technology and information systems to support organizational capacity is not yet optimal. Informant FA acknowledged that “the utilization of technology and information systems to support patrol operations has begun to be implemented, particularly in the form of radio communication systems, reporting applications, and monitoring of vessel movements through available systems. This technology helps speed up the process of conveying information between patrol vessels and the command center” (page 125). However, informant AK added that “in its implementation in the field, there are still obstacles in the form of incomplete integration of information systems between agencies and between work units. The data needed to support patrols is not always available in real time, so officers in the field still often rely on direct communication or manual reports. Furthermore, not all personnel have the same ability to operate the available technology” (page 125). Informant JS also highlighted that “another obstacle faced is limited technological infrastructure, such as unstable communication networks in some waters and supporting equipment that is not yet fully modern” (page 126). From the perspective of Denhardt and Denhardt (2015), public organizations must be able to utilize technology to improve responsiveness and service quality. Reliance on manual systems indicates that digital transformation in the organization has not been running optimally.

5. Factors that Inhibit the Effectiveness of Patrol Operations

The factors inhibiting the effectiveness of the Class II Bitung PLP patrol operations in preventing marine environmental pollution by merchant vessels are multidimensional, encompassing interrelated internal and external organizational aspects. Based on research findings, the main obstacle lies in limited human resources, both in terms of numbers and technical competence. Informant JS revealed that “the main factor inhibiting the effectiveness of Class II Bitung PLP patrol operations from a human resource perspective is the limited number of available personnel compared to the vast area of waters that must be monitored. In addition, the technical capabilities of personnel in detecting and handling potential pollution are also not evenly distributed, so that in some situations additional time is required for

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adjustments in the field" (page 131). This condition causes an unbalanced workload and affects the accuracy and speed of patrol operations. Furthermore, limited operational patrol facilities and infrastructure pose a significant structural obstacle. Informant FA stated that "in terms of infrastructure and operational conditions in the field, the obstacles frequently encountered are the limited number of patrol vessels and the suboptimal condition of equipment to support optimal surveillance. Furthermore, weather conditions and the vastness of Bitung's waters also pose challenges in carrying out patrols, as they can limit vessel mobility and slow down the surveillance process" (page 131). This study found that the combination of these factors has resulted in the suboptimal reach and effectiveness of patrol operations in preventing marine pollution by commercial vessels. From the perspective of administrative oversight theory, Siagian (2014) stated that oversight is a systematic process aimed at ensuring activities run according to plan, which requires adequate resource support. Limited personnel, uneven technical competency, and limited operational infrastructure indicate that the oversight function is not supported by optimal capacity.

As a result, oversight cannot be implemented comprehensively and sustainably, leaving gaps in controlling potential marine environmental pollution. This is in line with Rahman's (2019) findings that limited patrol facilities and low frequency of field oversight are the main causes of suboptimal shipping oversight. This study also revealed that operational constraints and supporting systems contribute to the barriers to effective maritime patrols. Informant BS explained that "the impact of these constraints on the implementation of patrol operations in the field is quite significant, particularly in terms of limited surveillance coverage and reduced effectiveness in early detection of potential marine pollution. Limited human resources and infrastructure mean that not all vulnerable areas can be monitored optimally at the same time. As a result, there is a possibility that some merchant vessel activities that have the potential to pollute the environment cannot be directly monitored" (page 132). Informant KR added that "in addition, constraints also impact the speed of response in handling suspected pollution cases, because the process of information gathering and coordination in the field is still hampered by technological and communication limitations" (page 132). Within the framework of adaptive policy implementation, Hill and Hupe (2014) emphasize that public policy implementation requires flexibility and the ability to adapt to environmental dynamics. The vastness of the waters, unpredictable weather conditions, and limitations in communication systems and technology utilization are external variables that must be anticipated through appropriate operational strategies. When organizational capacity is unable to keep up with these environmental challenges, the effectiveness of patrol implementation is disrupted.

Furthermore, these obstacles also impact the effectiveness of administrative law enforcement. Hadjon (2011) emphasized that law enforcement requires strong institutional support to operate consistently. Limited resources, operational conditions, and support systems result in suboptimal detection, verification, and enforcement of violations. This research reinforces Putri's (2022) findings that weak government oversight contributes to marine pollution, which impacts coastal ecosystems and communities. Thus, the inhibiting factors are not only technical but also structural and systemic, which collectively impact the effectiveness of supervision and the success of policies to prevent marine pollution by commercial vessels. Therefore, efforts to improve patrol effectiveness cannot be carried out in isolation but require a comprehensive approach through strengthening organizational capacity, modernizing facilities and technology, and adapting operational strategies to marine environmental conditions.

CONCLUSION

Based on the discussion above, the following conclusions can be drawn:

1. The effectiveness of patrol operations at the Bitung Class II Sea and Coast Guard Base (PLP) in preventing marine pollution by commercial vessels indicates that the overall implementation of the oversight function has been running smoothly, but not yet optimally. In terms of planning, efforts have been made to develop patrol strategies through routine and incidental methods, but these have not yet been fully based on comprehensive risk mapping. In terms of implementation, patrol operations still face limitations in their oversight reach due to the vastness of the waters and limited infrastructure. In terms of coordination and synergy between agencies, cooperation has been carried out, but it has not been optimally integrated and is still partial. Meanwhile, in terms of resources and organizational capacity, limitations in the number and competence of human resources, as well as the suboptimal use of technology, also affect the effectiveness of oversight. Thus, the patrol operations of the Bitung Class II PLP can be categorized as ineffective or not yet fully maximized in preventing marine pollution by commercial vessels.
2. The factors that hinder the effectiveness of the Class II Bitung PLP patrol operations in preventing marine environmental pollution by merchant vessels are multidimensional, encompassing both internal and external

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organizational aspects. The main obstacles lie in limited human resources that are not commensurate with the size of the patrol area, as well as uneven technical competency. In addition, limited operational facilities and infrastructure, such as the number of patrol vessels and the suboptimal condition of equipment, also limit the scope and frequency of surveillance. On the other hand, operational constraints in the form of the vastness of the water area and uncertain weather conditions, as well as the suboptimal communication system and integrated technology utilization, cause responses to potential pollution to be less than fully swift and effective. These factors collectively become the main obstacles in realizing the optimal effectiveness of patrol operations.

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