

Sustainable Management: An Institutional Inquiry for Common-Pool Resources (Case Study of Cirata Reservoir, West Java)

Andini Kusumawardhani

Diponegoro University, Semarang, Indonesia

ABSTRACT

(Cirata Reservoir area is one of the public water resources resulting from the damming of the Citarum River, which has the main function as a hydroelectric power plant (PLTA). The reservoir is also becoming a centre of economic activity for the surrounding community, which is for the floating net cage business and the distribution of floating cage products. The high level of economic activity that occurs in Cirata Reservoir has the consequence of causing various problems that threaten the sustainability of Cirata Reservoir. The conditions that occur in Cirata Reservoir indicate that there is institutional ineffectiveness in the management of reservoir resources. If this institutional ineffectiveness continues, it will threaten the existence of Cirata Reservoir, whose function is needed by many parties. This study aims to analyze the existing institutions in the management of Cirata Reservoir in West Java through in-depth interviews with resource persons and content analysis of existing regulations. The results show that regulations related to the management and utilization of Cirata Reservoir already exist, but their implementation is still not optimal. Institutions have been established based on existing regulations with the roles of each stakeholder and the relationships between them but have not been implemented effectively. Coordination, supervision, and law enforcement are important keys in implementing the institutional design of Cirata Reservoir management to realize sustainable reservoir management.

Keywords: *Collective action, Common-pool resources, Institutional economics, Sustainable management*

Corresponding author

Name: Andini Kusumawardhani

Email: andinikusumawardhani@lecturer.undip.ac.id

INTRODUCTION

Natural resources play a vital role in human life and economic development. Among the various types of natural resources, there is a category known as common-pool resources (CPRs) or shared resources. Common pool resources (CPRs) are natural or human-made systems that generate finite benefits, where excluding beneficiaries is costly, and exploitation by one user reduces availability for others (Suhardiman et al., 2017). Natural resources that fall under the category of common-pool resources (CPRs) such as forests, fisheries, and waters including river and reservoir have key characteristics of limited subtractability and the difficulty of excluding individuals from their use or non-excludability (Ostrom, 1990). These characteristics make CPRs highly vulnerable to overexploitation that

exceeds carrying capacity, causing ecological damage if not managed effectively. This raises a problem known as the “tragedy of the commons” based on research by Hardin (1968), which is when individuals act based on personal interests without regard to collective sustainability, resulting in the depletion of resources. In this context, institutions play an important role in regulating resource utilization and ensuring the sustainability of resource management.

Cirata Reservoir is located at an altitude of 200 meters above sea level with a reservoir surface area of 603,200 hectares and an average volume of approximately 2,165 million m³. Cirata Reservoir has an average depth of about 34.9 m and a maximum depth of up to 106 m. Cirata Reservoir was built with the main purpose of being the largest hydroelectric power plant supplying electricity to Java and Bali with an installed capacity of 1008 MW and generating 1426 GWH/year (Cirata Reservoir Management Board, 2024). Although its main purpose is as a hydropower plant, with such a large volume of water, Cirata Reservoir also has functions as a source of irrigation, fisheries, flood control, tourism, and water conservation. The river that irrigates Cirata Reservoir is the Citarum River as the main water source and several other sub-rivers as can be seen in Figure 1 and location map of Cirata Reservoir as the research object can be seen in Figures 2.

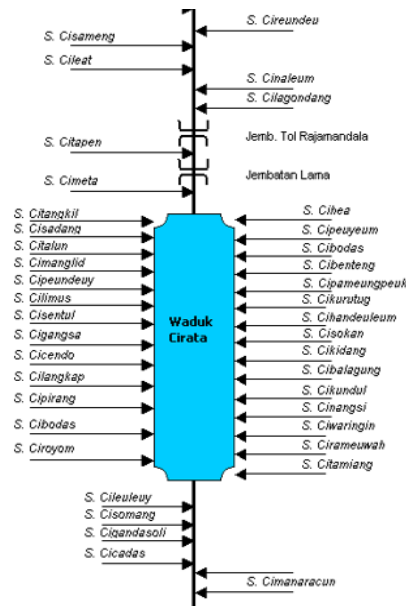


Figure 1. The river that irrigates Cirata Reservoir



Figure 2. Cascade Reservoir of West Java (Saguling, Cirata, and Jatiluhur)

Description:

- : Waduk Saguling
- : Waduk Cirata
- : Waduk Jatiluhur

Cirata Reservoir was first operated in 1988. Over time, the utilization of Cirata Reservoir is not only for hydropower but has involved many parties with various interests. Among them are the cultivation of floating net cages, utilization of tidal land and greenbelt areas for agricultural activities, and other related businesses. Cirata Reservoir has become a center of socioeconomic activity not only for the local community but also for migrants from outside the city, even outside Java. As a result of uncontrolled development, the Cirata Reservoir must bear a heavy burden of pollution. Kusumawardhani (2017) finds that siltation due to erosion, floating net cages populations that exceed required limits, industrial and domestic waste and water weeds (water hyacinth) are acute problems in Cirata Reservoir that require serious handling by various parties. Due to its function and benefits to the community and its cross-district location, Cirata Reservoir is under the supervision of the West Java Provincial Maritime Affairs and Fisheries Agency as well as also related agencies in Cianjur, West Bandung, and Purwakarta districts. Thus, the institutions that organize the management of Cirata Reservoir are multi-stakeholders, involving more than one authorized part (Cirata Reservoir Management Board, 2023).

Institutions are one of the important elements in analyzing social, economic and political dynamics in society. In context of social science and economics, institutions are defined as a set of rules, norms, and mechanisms that regulate interactions between individuals and groups in a common life (North, 1990). Institutions have a function as structures that provide certainty, reduce uncertainty, and direct individual behaviours towards social order and economic efficiency. Institutions not only include formal organizations such as governments, legal institutions, and markets, but also include unwritten rules such as social norms, culture, and values that develop in society. Therefore, understanding institutions is very important in various fields of study, especially in public

policy formulation, natural resource management, economic development, and governance. Institutions function as structures that provide certainty, reduce uncertainty, and direct individual behaviours towards social order and economic efficiency. Institutions not only include formal organizations such as governments, legal institutions, and markets, but also include unwritten rules such as social norms, culture, and values that develop in society (Ostrom, 2005). Therefore, understanding institutions is very important in various fields of study, especially in public policy formulation, natural resource management, economic development, and governance.

Ostrom (1990) research shows that successful management of CPRs often depends on locally appropriate institutional design, such as clear resource boundaries, mutually agreed rules of use, and internal monitoring and sanction mechanisms. Institutional analysis is therefore an important tool in understanding the dynamics of CPRs management and designing more contextualized and inclusive policy interventions. In development and resource governance studies, institutions are considered as the main instrument in determining the success or failure of a policy. Strong and adaptive institutions are able to respond to local challenges, foster community participation, and create sustainable management systems. On the other hand, institutions that are weak or inappropriate to the local context tend to cause failure in policy implementation as well as social conflict. Ostrom's Institutional Analysis and Development (IAD) framework and design principles are pivotal in CPR governance. These frameworks help analyze the robustness of CPRs and the evolution of institutional rules (Madani & Dinar, 2013). Ostrom's principles emphasize the importance of clearly defined boundaries, collective-choice arrangements, monitoring, graduated sanctions, conflict-resolution mechanisms, and minimal recognition of rights to organize (Bastakoti & Shivakoti, 2017) Various external regulatory institutions, such as quota-based, resource status-based, tax-based, and bankruptcy management, have different impacts on CPR sustainability. Quota-based and resource status-based management tends to be more effective in prolonging CPR life and preventing the "tragedy of the commons" compared to tax-based management (Ostrom, 2009).

Institutional Strengthening is needed as one of the efforts to increase the capacity and coordination of institutions in order to realize sustainable resource management (Basupi et al., 2019) with ensuring compliance with sustainability policies through effective monitoring (Ali et al., 2025). Then, the author has made the research model as shown below in Figure 3:

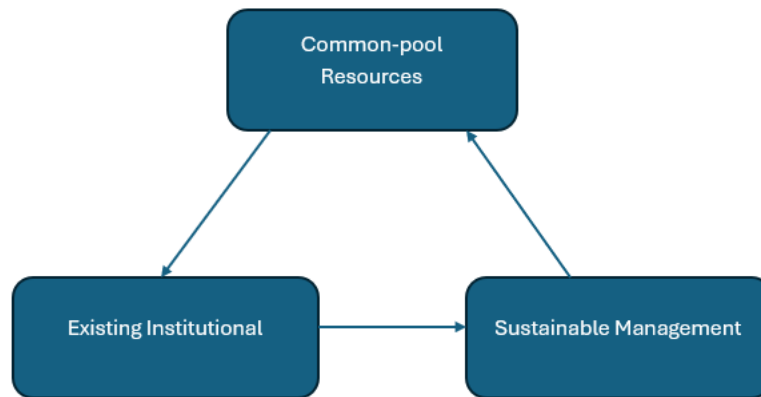


Figure 3. Research Model

METHOD

This study was conducted in Cirata Reservoir area, which covers 3 districts: Cianjur, Purwakarta, and West Bandung. The location was determined purposively with the consideration that Cirata Reservoir has experienced severe sedimentation and water pollution due to the excessive number of floating net cages, which has caused economic losses for its users. The method used was qualitative research. The data used in this study consisted of primary data and secondary data. Primary data was obtained through in-depth interviews with selected respondents using structured questions in the form of questionnaires and Focus Group Discussions (FGDs) to analyze the existing institutional management of Cirata Reservoir. Secondary data was obtained from literature studies and statistical data from relevant agencies such as the Cirata Reservoir Management Agency (BPWC), the Central Bureau of Statistics (BPS), PT PJB, the West Java Provincial Fisheries and Maritime Affairs Office, the Cianjur Regency Fisheries and Maritime Affairs Office, the West Bandung Regency Fisheries and Maritime Affairs Office, the Purwakarta Regency Livestock and Fisheries Office, and the Public Aquatic Fisheries and Ornamental Fish Research Center (BP3UIH).

Sample selection carried out randomly from each stakeholder group with a proportional sample size. The determination of the number of respondents in each group will be done proportionally and the selection of respondents in each group will be done deliberately by considering the representation of each group. In addition to conducting interviews, FGDs with the community and key people who play a role in the management of Cirata Reservoir will also be conducted to further discuss the results of the previously conducted questionnaires. The list of target groups for interview and FGD respondents is presented in Table 1.

Table 1. List of Target Respondent Groups for Interviews and FGDs

| No. | Target Group | Target Respondents (People) |
|-----|---|-----------------------------|
| 1. | Department of Marine and Fisheries, West Java Province | 3 |
| 2. | Department of Livestock and Fisheries, Bandung Regency | 3 |
| 3. | Department of Livestock and Fisheries, Purwakarta Regency | 3 |
| 4. | Department of Livestock, Fisheries, and Marine Affairs, Cianjur Regency | 3 |
| 5. | Research Institute for Public Waters Ornamental Fish (BP3UIH) | 3 |
| 6. | Cirata Dam Management Agency (BPWC) | 3 |
| 7. | Fish Feed Sellers Group | 3 |
| 8. | Fish Collectors Group | 3 |
| 9. | Fish Processing Group | 3 |
| 10. | Fish Farmers Group (Floating Net Cage Fish Farmers) | 30 |

The institutional study will refer to Dolsak and Ostrom's (2003) framework. How resources can be utilized depends on interrelated factors. The relationship between these factors and their relation to the characteristics of the resource users and the characteristics of the resource itself will greatly influence the type, structure, and infrastructure of institutions in resource management. In this study, the institutional audit will focus on the rules of the game that apply to the management of Cirata Reservoir. The rules of the game here are formal regulations related to Cirata Reservoir that should be used as a reference in the management of Cirata Reservoir. These formal regulations will be analyzed using content analysis to see how they are connected and how they relate to who has the authority to implement these regulations and to what extent this authority has been implemented. The formal regulations identified using content analysis come from government documents in the form of laws and regulations related to Cirata Reservoir. The regulations to be analyzed are presented in Table 2 as follows.

Table 2. Regulations Related to Cirata Reservoir

| No. | Regulation |
|-----|---|
| 1. | Decree of the Director General of Water Resources No. 21/KTPS/D/2014 concerning the Establishment of the Coordination Team for the Operation of the Cascade Dams of Saguling, Cirata, and Djuanda/Jatiluhur |
| 2. | Regional Regulation of West Java Province No. 7 of 2011 concerning Fisheries Management |
| 3. | Decree of the Governor of West Java No. 41 of 2002 concerning the Development of Utilization of Public Waters, Agricultural Land, and the Cirata Reservoir Area |

4. Decree of the Director of PT. Jawa-Bali Power Generation No. 023.K/020/DIR/2014 concerning the Organizational Improvement of the Cirata Reservoir Management Agency under PT. Jawa-Bali Power Generation
5. Regulation of West Java Governor No. 37 of 2021 concerning Amendment to Regulation of West Java Governor No. 28 of 2019 Concerning Action Plan to Control Pollution and Damage to Citarum River Basin In 2019-2025
6. Regulation of Governor of West Java No. 96 of 2022 concerning the Management of Net Floating Cages in Cirata, Saguling, and Jatiluhur Reservoir Area
7. Regulation Of Minister of Public Works and Public Housing Republic of Indonesia Number 7 Of 2023 Concerning the Second Amendment to Regulation of Minister of Public Works and Public Housing Number 27/PRT/M/2015 Concerning Reservoir

Sustainable development refers to the establishment of institutionalized, standardized, and systematic stabilization measures and procedures based on scientific principles. Refers to Zhang et al. (2019) the formulation of regional policy should focus on the operability of policies, improve the structure of policy targets, and lead to sustainable development. Content analysis of formal regulations related to Cirata Reservoir will be analyzed using the categories and parameters in Table 3 about unit analysis, categories, and content analysis's parameters as follows adopted from Nurrochmat et al. (2012):

Table 3. Unit Analysis, Categories, and Content Analysis Parameters

| Unit of Analysis | Category | Parameter |
|----------------------|-------------------------|---|
| Article | Formal Information | Type of Regulation |
| | | Title of Regulation |
| | | Description (publication date and year) |
| Statement | Stakeholder Involvement | Stakeholders involved |
| | | Roles of each stakeholder |
| | | Coordination among stakeholder |
| | Reservoir Management | Utilization/Exploitation |
| | | Protection |
| | | Rehabilitation |
| | Reservoir Accessibility | Parties with Access |
| | | Maximum Capacity |
| | | Zoning (restrictions) |
| | Reservoir Usage Permits | Type of Permit |
| | | Issuing Authority |
| | | Permit Validity Period |
| Reservoir Monitoring | Monitoring Authority | |
| | Monitored Activities | |
| Violations | Enforcement Mechanism | |

| | |
|-------------------------------|--|
| | Sanctioning Authority |
| | Sanctions Imposed |
| Key Aspects of the Regulation | Aspects that are the focus of the regulation |
| Link to Sustainability | Relationship between regulation aspects and sustainability |

Source: Adapted from Nurrochmat (2012) with modifications

A qualitative analysis of existing institutions was conducted with reference to Ostrom (2000) institutional indicators. By conducting this analysis, it can be seen how existing institutions operate in the field (de facto). The institutional indicators can be seen in Table 4. In addition, an analysis of institutions according to the applicable legal basis (de jure) was also conducted to see legally how the existing institutional structure is according to the rules. Qualitative analysis of institutions according to the applicable legal basis was carried out to find out whether the institution is running or not in the field. Respondents in this institutional redesign analysis were stakeholders involved in the management of Cirata Reservoir. Stakeholder responses to existing institutions (de facto) and institutions based on applicable regulations (de jure) were studied as input for the design of new institutions that fit the needs.

Table 4. Institutional Indicators

| No. | Indicator | Explanation |
|-----|--|--|
| 1. | Clearly Defined Boundaries | Identifies individuals who have the right to access and utilize the resources, and the extent to which the resources may be accessed and used. |
| 2. | Fit Between Rules and Local Conditions | The operational rules are adapted to local conditions, where the rules reflect specific attributes of the resource. |
| 3. | Collective Action | Joint actions carried out by the community, in which many individuals agree with the rules and participate in enforcing them. |
| 4. | Monitoring | Monitoring carried out on users; it may be conducted either by the users themselves or by external parties. |
| 5. | Sanctions | Sanctions imposed on parties who violate the established rules. |
| 6. | Conflict Resolution Mechanism | Conflict resolution mechanisms in place among users and between users and managers. |
| 7. | Recognition | Recognition of the operational rules that apply in the utilization of the resource. |
| 8. | Complementary Institutions | Other institutions that support and complement each other. |

Source: Ostrom (1990)

FINDING AND DISCUSSION

RESEARCH RESULT

Institutional rules of the game in the management and utilization of Cirata Reservoir, especially for the designation of freshwater fisheries cultivation sites with net floating cages, refers to existing regulations. The regulations in question are formal regulations that have been approved by the central and local governments, as well as other related parties such as PT PJB (PJB) as the owner of the reservoir and the Cirata Reservoir Management Agency (BPWC) as the reservoir manager. Dams/reservoirs are assets associated with the Ministry of Public Works. Dams or reservoirs are CPRs whose utilization often causes many problems due to their characteristics. This is especially true for Cirata Reservoir, which is primarily used for hydropower and is located across districts. In addition to the main hydropower use, Cirata Reservoir also has other uses such as capture fisheries, aquaculture, and tourism. The Minister of Public Works and Housing issued a relatively new regulation that is a refinement of the previous regulation. This regulation discusses the stakeholders involved, the roles of the stakeholders, coordination among stakeholders, permitted uses in dams/reservoirs, zoning (restrictions), licensing, prohibitions, and supervised activities. In fact, there are still many violations in the field, especially related to waste and environmental pollution of reservoir waters. This is due to a lack of socialization and minimal supervision.

In addition to regulations from the Ministry of Public Works, the management and utilization of Cirata Reservoir is also related to other formal regulations. Some of the regulations related to Cirata Reservoir that will be analyzed are: 1) Decree of the Director General of Water Resources Number 21/KTPS/D/2014 on the Establishment of a Coordination Team for the Operation of Saguling, Cirata, and Djuanda/Jatiluhur Cascade Dams; 2) Regional Regulation of West Java Province Number 7 of 2011; 3) Decree of the Governor of West Java Number 41 of 2002 on the Development of Utilization of Public Waters, Agricultural Land, and Cirata Reservoir Area; 4) Decree of the Board of Directors of PT Pembangkitan Jawa-Bali Number 023.K/020/DIR/2014 on the Improvement of the Cirata Reservoir Management Agency Organization at PT Jawa-Bali Power Generation; 5) Regulation of West Java Governor No. 37 of 2021 concerning Amendment to Regulation of West Java Governor No. 28 of 2019 Concerning Action Plan to Control Pollution and Damage to Citarum River Basin In 2019-2025; 6) Regulation of Governor of West Java No. 96 of 2022 concerning the Management of Net Floating Cages in Cirata, Saguling, and Jatiluhur Reservoir Area; and 7) Regulation of Minister of Public Works and Public Housing Republic of Indonesia Number 7 Of 2023 Concerning the Second Amendment to Regulation of Minister of Public Works And Public Housing Number 27/Prt/M/2015 Concerning Reservoir. The results of content analysis on several regulations related to the management and utilization of Cirata Reservoir are presented in Table 5.

Table 5. Results of Content Analysis of Several Regulations Related to the Management and Utilization of Cirata Reservoir

| <i>Category</i> | <i>Parameter</i> | <i>Decree of the Director General of Water Resources No. 21/KTPS/D/2014 concerning the Establishment of the Coordination Team for the Operation of the Cascade Reservoirs of Saguling, Cirata, and Djuanda/Jatiluhur</i> | <i>Regional Regulation of West Java Province No. 7 of 2011 concerning Fisheries Management</i> | <i>Decree of the Governor of West Java No. 41 of 2002 concerning the Development of Utilization of Public Waters, Agricultural Land, and the Cirata Reservoir Area</i> | <i>Decree of the Director of PT. Jawa-Bali Power Generation No. 023.K/020/DIR/2014 concerning the Organizational Improvement of the Cirata Reservoir Management Agency under PT. Jawa-Bali Power Generation</i> | <i>Regulation of West Java Governor No. 37 of 2021 concerning the Amendment to Regulation of West Java Governor No. 28 of 2019 Concerning Action Plan to Control Pollution and Damage to Citarum River Basin In 2019-2025</i> | <i>Regulation of Governor of West Java No. 96 of 2022 concerning the Management of Net Floating Cages in Cirata, Saguling, and Jatiluhur Reservoir Area</i> | <i>Regulation Of Minister of Public Works and Public Housing Republic of Indonesia Number 7 Of 2023 Concerning the Second Amendment to Regulation of Minister of Public Works and Public Housing Number 27/PRT/M/2015 Concerning Reservoir</i> |
|--------------------------------|--------------------------------|--|--|--|---|---|---|--|
| Stakeholder Involvement | Stakeholders involved | Steering Committee. Implementation Committee, Technical Committee | Pasal 1 | Pasal 1 | Pasal 1 Pasal 2 | | Pasal 1 | |
| | Roles of each stakeholder | Steering Committee. Implementation Committee, Technical Committee | Pasal 7 Pasal 26 | - | Pasal 2 | | Pasal 1 | |
| | Coordination among stakeholder | - | Pasal 9 Pasal 78 | - | Pasal 2 | | - | |
| Reservoir Management | Utilization/Exploitation | - | Pasal 37 Pasal 49 Pasal 54 Pasal 61 Pasal 62 | Pasal 5 Pasal 6 | Pasal 3 Pasal 4 Pasal 5 | | Pasal 105 | |
| | Protection | - | Pasal 10 Pasal 46 | Pasal 39 | Pasal 2 | | Pasal 101 | |
| | Pencatatan dan Pelaporan | - | Pasal 47 | Pasal 50 | - | | - | |
| Reservoir Accessibility | Parties with Access | - | - | - | - | | - | |
| | Maximum Capacity | - | - | Pasal 11, Pasal 15 | - | | - | |
| | Zoning (restrictions) | - | Pasal 67 | Pasal 9 | - | | Pasal 106 | |
| | Violations | - | Pasal 80 | Pasal 40 | - | | Pasal 111 | |
| Reservoir Usage Permits | Type of Permit | - | Pasal 65 | Pasal 25 | - | | Pasal 9 | |
| | Issuing Authority | - | Pasal 65 Pasal 67 | Pasal 38 | - | | Pasal 10 | |
| | Permit Validity Period | - | - | Pasal 25 | - | | - | |
| Reservoir Monitoring | Monitoring Authority | - | Pasal 35 Pasal 48 Pasal 53 | Pasal 41 Pasal 43 Pasal 46 | Pasal 3 Pasal 4 Pasal 5 | | Pasal 105 Pasal 110 Pasal 160 | |
| | Monitored Activities | - | Pasal 35 Pasal 48 Pasal 52 | Pasal 42 Pasal 46 | Pasal 3 Pasal 4 Pasal 5 | | Pasal 105 Pasal 110 Pasal 160 | |
| Violations | Enforcement Mechanism | - | Pasal 79 | Pasal 44 Pasal 47 | - | | - | |
| | Sanctioning Authority | - | Pasal 83 Pasal 84 | Pasal 43 | - | | - | |
| | Sanctions Imposed | - | Pasal 81 Pasal 82 | Pasal 44 | - | | - | |

Source: Author's observation

DISCUSSION

Cirata Reservoir is a part of cascades reservoirs in West Java that are dammed from the Citarum River, which is one of the strategic rivers in West Java. This unique cascade reservoir involves multiple stakeholders in its operation, management and utilization. Thus, a special regulation was issued to form a coordination team for the operation and management of the three cascade reservoirs. The regulation is Decree of the Director General of Water Resources Number 21/KTPS/D/2014 on the Establishment of the Coordination Team for the Operation of Saguling, Cirata, and Djuanda/Jatiluhur Cascade Dams. The regulation discusses the stakeholders involved in the operation of cascade dams in West Java, including Cirata Reservoir. The West Java Regional Regulation on fisheries management is one of the important regulations related to the management of Cirata Reservoir because Cirata Reservoir is located in West Java and has fisheries activities in it.

The Regional Regulation of West Java Province No. 7/2011 on Fisheries Management has become the basis for fisheries management in West Java, including in Cirata Reservoir. In this regulation, various matters concerning fisheries, especially net floating cage aquaculture, have been regulated quite clearly. Some of the things that are regulated in this regulation are the stakeholders involved, the role of each stakeholder, coordination between stakeholders, net floating cage business licensing, recording and reporting, regional retribution, maximum number of net floating cages, prohibition, supervision, sanctions, and law enforcement.

The real condition in Cirata Reservoir is that there are still many fisheries users who do not have a license, especially permits for fish farming. Based on field research, some farmers admitted that they did not know that they needed to apply for a permit to conduct fish farming. Some other farmers do not know how to obtain a permit for fish farming. In addition, making a permit is considered quite complicated so that farmers are reluctant to take care of it. The average size of net floating cage plots owned by farmers is in accordance with the specified criteria of 7x7 m, but there are still many net floating cage holdings that exceed the maximum limit of 20 plots. There are many fish farmers who make net floating cages not with the required materials and materials and even some net floating cages that are not feasible and have been damaged are just left 'stalled' in the middle of the reservoir so that it disturbs other net floating cages.

Existing institutions in the Cirata reservoir can be seen in Figure 3.

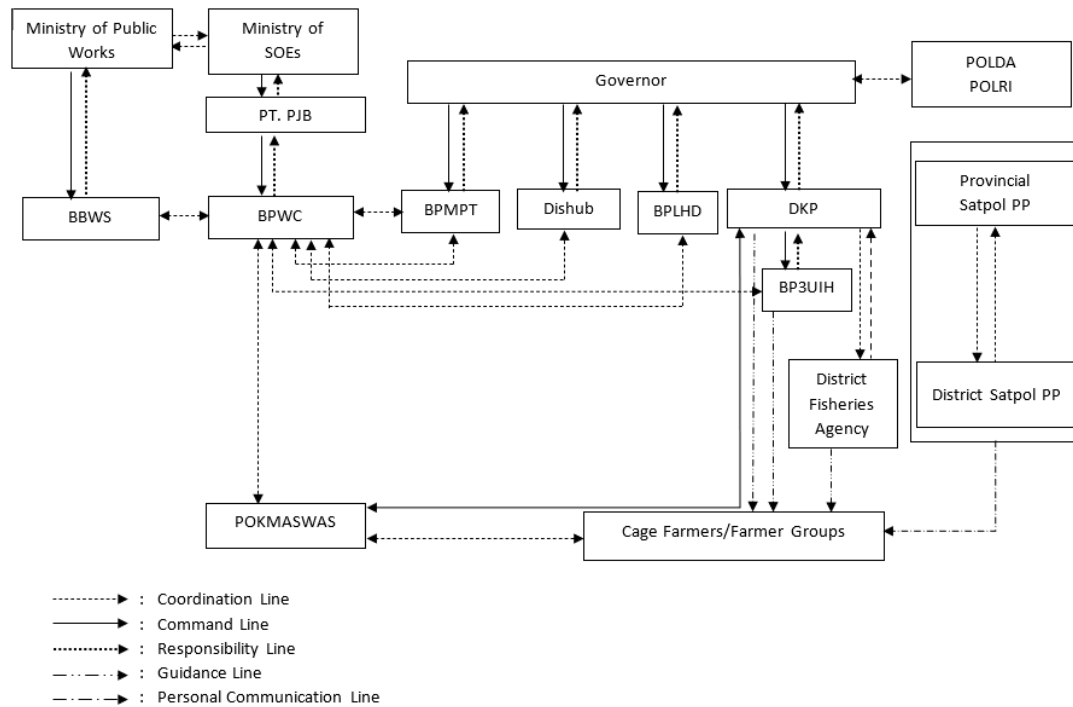


Figure 4. Existing institutions in the Cirata reservoir

Regulations regarding the development and utilization of the Cirata Reservoir are specifically regulated in West Java Governor Decree No. 41 of 2002 concerning Development of Utilization of Public Waters, Public Agricultural Land, Agricultural Land and

Cirata Reservoir Area. This regulation was issued by the Governor in the exercise of his Regional Government authority. In accordance with the Cirata Reservoir, whose administrative area is located across districts, the regulation that governs is a regulation with a provincial regional scale. This regulation discusses the development of Cirata Reservoir utilization, including net floating cage aquaculture in it. Some of the things regulated in this regulation are the types of activities that can be carried out in the public waters of the reservoir, reservoir utilization requirements (size of net floating cage plots, maximum number of net floating cage, placement of net floating cage), net floating cage ownership, net floating cage licensing, and waste treatment used in net floating cage construction. Conditions that occur in the field, the average net floating cage size is in accordance with the rules, but the number of net floating cages is very excessive, very far exceeding the maximum limit.

Many net floating cage owners are not from the community around the reservoir and do not have a fish farming license. In addition, there are many violations of the location of cultivation that have been regulated, many net floating cages construction waste is left in the middle of the lake because they do not have the cost to transport it to land or to the

edge. These problems occur due to lack of socialization, supervision, and enforcement of sanctions by related parties.

In addition to regulations from the government, regulations from related agencies were also analyzed. This is because the management and utilization of Cirata Reservoir involves multi-stakeholders (not only the government). Cirata Reservoir, which is owned by PT. Pembangkitan Jawa-Bali (PT. PJB/PT Jawa-Bali Power Generation), makes PT PJB also have authority in its management, so the Cirata Reservoir Management Agency (BPWC) was formed as an extension of PT PJB to manage Cirata Reservoir, especially in maintaining electricity supply and addressing environmental issues. The regulation is the Decree of the Board of Directors of PT Pembangkitan Jawa-Bali No. 023.K/020/DIR/2014 concerning the Improvement of the Cirata Reservoir Management Agency Organization at PT Jawa-Bali Power Generation.

BPWC is a management body that has a clear legal umbrella and has been recognized by the local government and other stakeholders. In its implementation, BPWC coordinates and cooperates with other stakeholders. Facts in the field, coordination has not been running optimally. Stakeholders do not have a unified vision, so programs related to Cirata Reservoir that should be integrated are carried out separately because they are not well coordinated. In addition, communication between BPWC and related stakeholders is still very minimal, resulting in frequent misunderstandings among stakeholders.

CONCLUSION

Based all data obtained from all respondents, Regulations related to the management and utilization of Cirata Reservoir already exist, but their implementation is still not optimal. Various matters related to the management and utilization of Cirata Reservoir have been outlined in the existing regulations, such as the stakeholders involved, the role of each stakeholder, coordination between stakeholders, utilization permits, area preservation, prohibitions, supervision, sanctions, and law enforcement. Lack of socialization is an obstacle to the realization of these regulations in the field. Minimal supervision and lax enforcement have led to many violations of these regulations.

An analysis of data obtained from all respondents reveals that a regulatory framework governing the management and utilization of the Cirata Reservoir is indeed already established. These regulations encompass a broad range of critical aspects, including the delineation of stakeholder roles and responsibilities, inter-agency coordination mechanisms, procedures for obtaining utilization permits, environmental conservation mandates, zoning restrictions, monitoring protocols, sanctioning mechanisms, and law enforcement provisions. Despite the comprehensiveness of these regulations, their practical implementation remains considerably limited and inconsistent.

One of the primary barriers identified is the insufficient dissemination and socialization of the regulatory content to key stakeholders, including local communities, private actors, and implementing agencies. This lack of awareness significantly hampers stakeholders' understanding of their duties and rights, as well as the broader governance

objectives of the reservoir. As a result, the intended cooperative and sustainable management approach is weakened.

Moreover, the lack of robust institutional oversight and the ineffectiveness of enforcement mechanisms have contributed to a high incidence of non-compliance. Minimal surveillance and the absence of deterrent sanctions have allowed unauthorized and ecologically harmful activities—such as over-exploitation, illegal waste disposal, and encroachment—to persist. These challenges underscore a critical gap between regulatory formulation and field-level execution, highlighting the urgent need for improved governance structures, stakeholder engagement strategies, and accountability systems to ensure the sustainable management of the Cirata Reservoir.

REFERENCES

- Ali, P. F., Gan, G. G. G., & Asmawi, A. (2025). Strategies for Achieving Sustainable Management of Offshore Sand Mining in Malaysia. *Sustainability (Switzerland)*, 17(4). <https://doi.org/10.3390/su17041679>
- Bastakoti, R. C., & Shivakoti, G. P. (2017). Governing the Commons Through Understanding of Institutional Diversity: An Agenda for Application of Ostrom's Framework in Managing Natural Resources in Asia. In *Redefining Diversity and Dynamics of Natural Resources Management in Asia* (Vol. 1). <https://doi.org/10.1016/B978-0-12-805454-3.00003-7>
- Basupi, L. V., Dougill, A. J., & Quinn, C. H. (2019). Institutional challenges in pastoral landscape management: Towards sustainable land management in Ngamiland, Botswana. *Land Degradation and Development*, 30(7). <https://doi.org/10.1002/ldr.3271>
- Cirata Reservoir Management Board. (2023). *Annual Report of Cirata Dam Management Board 2022*.
- Cirata Reservoir Management Board. (2024). *Annual Report of Cirata Dam Management Board 2023*.
- Hardin, G. (1968). The Tragedy of the Commons. *Science*, 162, 1243–1248.
- Kusumawardhani, A. (2017). *Analisis biaya dan manfaat kelembagaan pengelolaan waduk Cirata Provinsi Jawa Barat*. Bogor Agricultural University.
- Madani, K., & Dinar, A. (2013). Exogenous regulatory institutions for sustainable common pool resource management: Application to groundwater. *Water Resources and Economics*, 2–3. <https://doi.org/10.1016/j.wre.2013.08.001>
- North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.
- Nurrochmat, D. R., Hasan, M. F., Suharjito, D., Hadianto, A., Ekayani, M., Purwawangsa, H., Ryandi, E. D., & Budiman, A. (2012). *Ekonomi politik kehutanan: Mengurai mitos dan fakta pengelolaan hutan*.
- Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.

- Ostrom, E. (2000). *Governing the commons: The evolution of institutions for collective acti*. Cambridge University Press.
- Ostrom, E. (2005). *Understanding Institutional Diversity*. Princeton University Press.
- Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science*, 325(5939), 419–422.
- Suhardiman, D., Lebel, L., Nicol, A., & Wong, T. (2017). Power and politics in water governance: Revisiting the role of collective action in the commons. In *Water Governance and Collective Action: Multi-Scale Challenges*. <https://doi.org/10.4324/9781315174938>
- Zhang, H., Deng, T., Wang, M., & Chen, X. (2019). Content Analysis of Talent Policy on Promoting Sustainable Development of Talent: Taking Sichuan Province as an Example. *Sustainability*, 11(9). <https://doi.org/10.3390/su11092508>