

Strategies for Ensuring the Performance Sustainability of Cirata Reservoir Using Soft System Methodology (SSM)

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Abstract. Cirata reservoir has a huge role in the economic development in Indonesia, with its main function as a hydroelectric power plant (HEPP) to meet the electricity needs of Java and Bali. The performance sustainability of Cirata Reservoir as a hydroelectric power plant is determined by human activities within and outside of the reservoir. This paper will discuss the performance sustainability of Cirata Reservoir using Soft Systems Methodology (SSM). The analysis results showed that the weak of licensing system is a major caused of land use change in Citarum Watershed and out of control of floating net cage (KJA) growth. Consequently increased of sedimentation and declines of reservoir water quality, that affect to the turbine performance of power plant. To ensure the sustainability of the main function of reservoir, the licensing system should be integrated in one door, and increase public participation and use of technology in the control and supervision of the reservoir.

Keywords: Cirata Reservoir, reservoir performance, sedimentation, sustainability, Soft Systems Methodology.

1. Introduction

Cirata reservoir is one of the 570 reservoirs in Indonesia, which has a huge role for economic development. Its main function is hydroelectric power plant (hydroelectric power) with 1008 megawatt, and fish farming for local community. The estimate of economic value equivalent to US\$ 4 bilyun per [1] .

The main source of the water of Cirata reservoir comes from Citarum river that flows along nearly 300 miles, goes through residential areas, industrial zones, Agriculture and livestock areas. Due to the increase of population the number of industries, plantations and farms, settlement increased more than 10 % in the last 10 years [2]; which tend to the uncontrolled growth [3],[4].

The most serious problems currently faced by Cirata reservoir is high sedimentation and decreased of reservoir water quality [5], caused by uncontrol growth of KJA [6] and land use change in the up stream of Citarum watershed [7], so performance sustainability of reservoir threated [8]. Reservoir performance can be seen form several aspects. The most important performance indicator of reservoir is the capacity of water volume [9], and the water quality [10], that affected by human activities and watershed management [11], [12]. One of the most influential aspect is land use change in the upstream [13].

This study aimed to design appropriate strategy to ensure the performance sustainability of the reservoir by using Soft System Methodology (SSM). This method was chosen because performance sustainability of reservoir is the complex, dynamic and stochastic problem [14], and strongly associated with human activities [15], and public role [16].

2. Methodology

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Based on the CATWOE, RP and RD formulations, then the PAM (Purposefull Activity Model) diagram can be formulated as shown in Fig. 2. This Fig. showed that there are four dominant activites which determine performance sustainability of the reservoir : tightening of licensing, land use restriction, KJA restriction and law enforcement. Those four main activities are interrelated, require community support and commitment of the officers concerned, especially from the local government. This result relevant to the previous studies which stated and Suwarno et al (2011) that public participation is the key of watershed management [21],[22], and besides law enforcement [23].

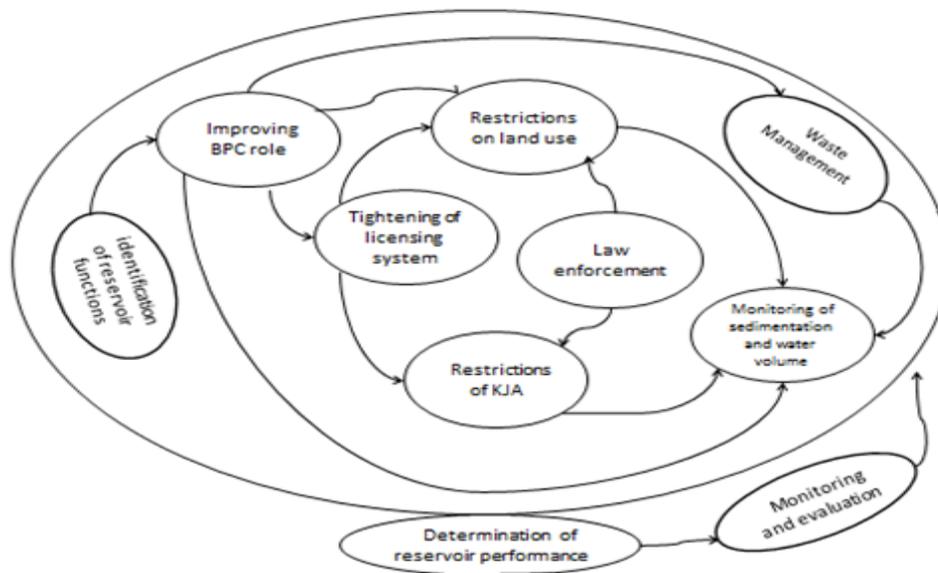


Fig. 2: the PAM Structure of Cirata Reservoir

3.2. Deductive process

Based on the results of the discussion with experts and the needs analysis (needs assessment) of the stakeholders, the linkages among factors to ensure performance sustainability of Cirata reservoir is shown in Fig. 3.

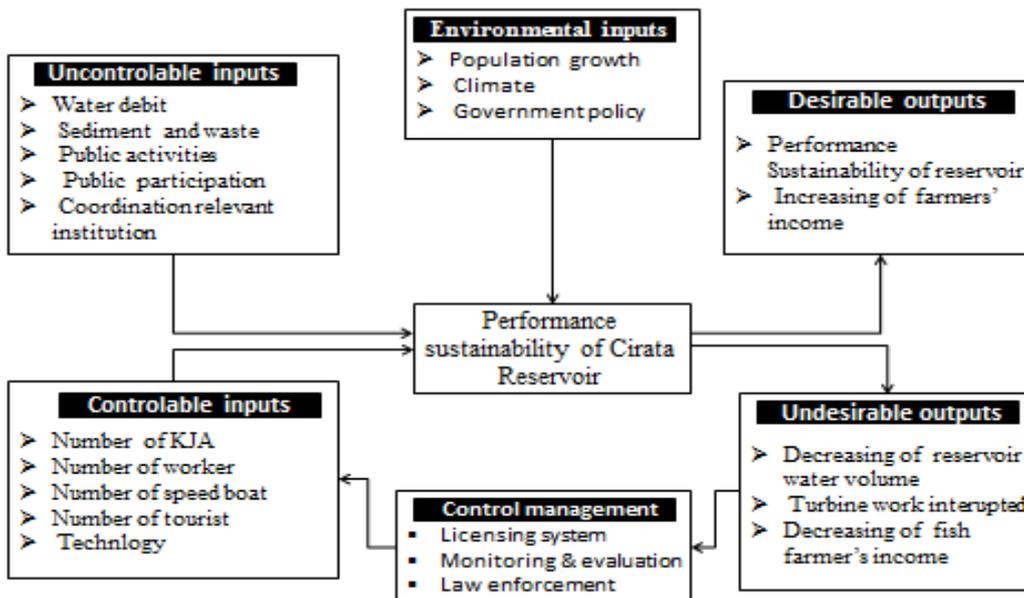


Fig. 3: The Black box diagram of the performance of Cirata reservoir

The results of the AHP analysis shows that the rate of sedimentation is the main criteria and indicator that determine the performance sustainability of the reservoir. The result support to the previous studies that

sedimentation is the main factor of reservoir sustainability [24]. While improving public participation is the best strategy (0.296), as shown in Table 1.

Table 1: Hierarchical structure based on the weighted values

Criteria	Alternative strategy					Model
	S1	S2	S3	S4	S5	
Rate of sedimentation	0.151	0.364	0.274	0.106	0.106	0.501
Productivity of KJA	0.104	0.091	0.189	0.128	0.489	0.106
Cooperation amongst KJA farmers	0.185	0.085	0.461	0.179	0.090	0.142
Coordination amongst the related institution	0.189	0.186	0.381	0.156	0.089	0.168
Technologies for water pollution detection	0.115	0.129	0.115	0.115	0.525	0.082
Result	0.154	0.246	0.296	0.128	0.176	1.00

Description :

S1 : Institutional strenghtening ; S2 : Integration of licensing system; S3 : Increasing of public participation; S4 : Increasing of surveillance and control, and S5 : Strengthening of technology

3.3. Convergence

Tightening of licensing system would be effective under one-gate licensing system (licensing integration) between the local government and the management of reservoirs (BPWC). It is important to build mutually beneficial linkages between BPWC, local government and KJA farmers to ensure performance sustainability of reservoir as shown in Fig. 4.

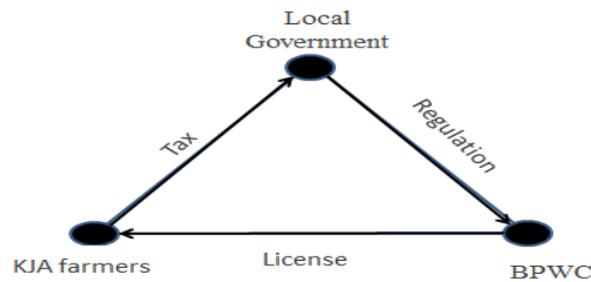


Fig. 4: Linkage local government, BPWC and KJA farmer

The policy strategy should be taken as the convergence of regulatory and acceleration strategies which can be formulated as shown in Fig. 5. The one-gate licensing integration should be under a different unit with supervision and control units, but under the same management board. Based on the primary function of the reservoir as a water supply for hydroelectric plant, the one-gate licensing and control systems of the reservoir should be under BPWC which daily manages the hydroelectric plant.

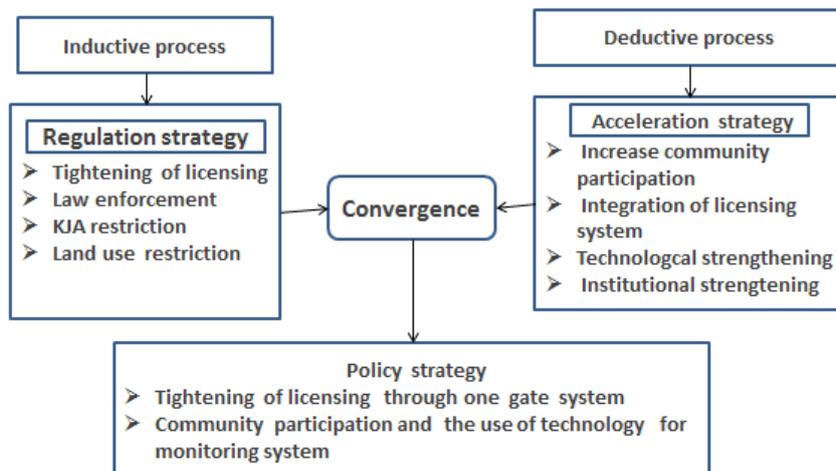


Fig. 5: The convergence of the Inductive and Deductive Processes

4. Conclusion

One gate licensing system and community involvement is the best strategy to control the growth of KJA and land use change on the upstream Citarum watershed. It is strongly associated with the effort for reducing the rate of sedimentation, and to prevent constantly of water volume and water quality. So that the performance of reservoir can be sustainable in accordance with the age designed.

5. Acknowledgement

Our deep gratitude goes to the ministry of national education, which has supported the financing of this study. Likewise, the Head BPWC and Local Government (Cianjur, Bandung and Purwakarta) for the permission to the author.

6. References

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