

Budget Efficiency Analysis Through Collaboration of Infrastructure Development, Human Resource Management, Ecosystem and Risk Management (Study in the Cimanuk Cisanggarung River Area)

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Abstract

The potential for flooding in the Cimanuk Cisanggarung River is triggered by climate change, watershed degradation, land conversion, and imbalance in infrastructure development using conventional approaches such as raising river embankments, constructing retention ponds, and concreting. It is true that development can protect the sustainability of the ecosystem and at the same time budget efficiency. Ironically, although the issue of budget efficiency is increasingly prominent, many users and implementers of the budget are actually reducing the volume of work as part of finding creative solutions, whereas by involving the community through mutual cooperation and self-management schemes, efficiency can be increased without sacrificing effectiveness; therefore, a more strategic approach is collaboration in infrastructure development with ecosystem-based human resource management and risk management through Nature-Based Solutions (NBS), risk-based spatial planning, adaptive infrastructure, and Community-Based Disaster Risk Management (CBDRM), which not only increase the effectiveness of flood control but also optimize budget efficiency with a community participation-based approach. Budget efficiency in flood control is not only about cutting costs, but also about optimizing resources with a more creative approach, including community involvement, mutual cooperation, and self-management.

Keywords: *Efficiency, Collaboration; Infrastructure Development; Human Resource Management; Ecosystem and Risk Management.*

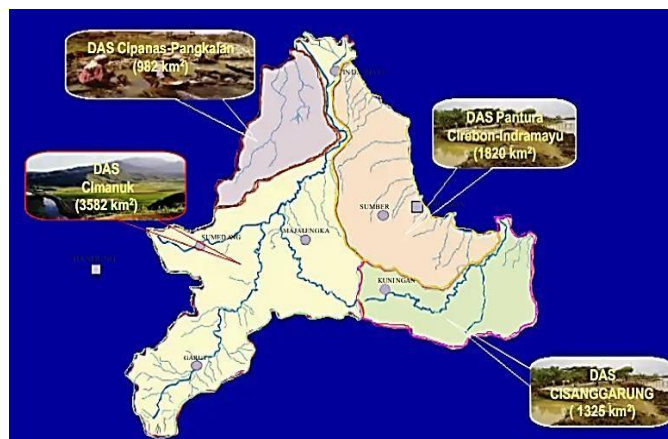
Introduction

The Department of Economic and Social Affairs, United Nations New York, (2022) emphasized that Indonesia is the 14th largest country and the largest archipelagic country in the world with an area of 1,904,569 km². Indonesia is the country with the 6th largest number of islands in the world, with a total of 17,504 islands. The Indonesian archipelago is called Nusantara (Justus M. van der Kroef (1951). Indonesia is the 4th most populous country in the world. In Semester I of 2024, Indonesian population data recorded a total population of 282,477,584 people. Of that number, 142,569,663 people were male, while 139,907,921. (DUKCAPIL, 2024).

Most of Indonesia's territory is at high risk of natural disasters (BNPB Disaster Risk Index, 2021). From the perspective of Geography, Geology, Climatology, and Demography, Indonesia is in 7th position as the country most vulnerable to natural disaster risk (UNESCO). This is because the territory of Indonesia is crossed by the Pacific Circum or Pacific Ring of Fire, passed by the Alpide belt, and its area is in the tropics (equator). So it has the potential to experience natural disasters, such as earthquakes, volcanoes, tsunamis, landslides, floods, and others. Even though it is in 7th position, of course, vigilance must continue to be carried out, as well as preventive measures.

It is understood that many cases of natural disasters, especially floods, have resulted in many losses, such as loss of life, damage to facilities and infrastructure, loss of valuables, damage to the environment, as well as the psychology of disaster victims. Direct and indirect impacts are interrelated. (Razikin et al., 2017). It is further emphasized that flood disasters can be caused by at least 2 factors, namely: (1) Natural factors such as rainfall, erosion and sedimentation, river topography and geophysics, inadequate river capacity and drainage, land subsidence, damage to flood control structures; and (2) Human factors such as changes in land use, waste disposal, slum areas along rivers, and inappropriate flood control system planning.

Learning about this flood disaster on the island of Java there are two large rivers that cross West Java and Central Java which often experience flooding, namely the Cimanuk and Cisanggarung Rivers. The Cimanuk-Cisanggarung River Area covers an area of approximately 7,711 km².



Administratively, the Cimanuk Cisanggarung River Area is located in the provinces of West Java and Central Java. Geographically, the Cimanuk Cisanggarung River Area is located at 107 10"-109 00" East Longitude and 6 00" -7 30" South Latitude, to the north it borders the Java Sea, to the east it borders the Pemali Juana River Area, to the west with the Citarum River Area and to the south with the Citanduy River Area and the Ciwulan Cilaki River Area.

Cimanuk-Cisanggarung is the name of the River Area that crosses 8 Regencies/Cities. 7 Regencies/Cities in West Java, namely: Garut, Sumedang, Majalengka, Cirebon, Indramayu, Kuningan

and Cirebon City; and 1 in Central Java Province, namely Brebes Regency. The order from upstream to downstream of the Cimanuk River is: Garut, Sumedang, Majalengka and Indramayu. For the order from upstream to downstream of the Cisanggarung River is Kuningan, Cirebon and Brebes.

The development of flood control infrastructure in the Cimanuk-Cisanggarung river area is still very much needed, but not just physical development, but must be collaborated with human resource management, ecosystem-based approaches and risk management. Analysis of the importance of infrastructure development for many reasons including climate change, increased flood intensity, degradation of river basins, land conversion, old infrastructure burden, and maintenance imbalance. While the analysis of collaboration with a human resource approach, ecosystem-based approach, and risk management for budget efficiency purposes.

Methodology

The analysis method uses a qualitative approach. Creswell (2009) emphasized that qualitative research analysis is one way to analyze and understand the meaning of social problems from individuals or groups of people. Qualitative research is also research that focuses on oral and written data from research informants.

The technique or method of data collection used in the qualitative approach is the literature study method. Studies sourced from journals, books, and other documents that describe theories and information related to the past and present and organize the literature into the topics and documents needed.

Results and Discussion Results and Discussion

Conceptually, a disaster is an event or series of events that threaten and disrupt people's lives and livelihoods, caused by natural factors, non-natural factors and human factors, resulting in human and animal casualties, environmental damage, property losses, and psychological impacts (Agus Taryana, 2022). Meanwhile, a natural disaster is a condition caused by an event or series of events caused by nature such as earthquakes, tsunamis, volcanic eruptions, floods, droughts, hurricanes, and landslides. Specifically, a flood disaster is defined as an event or condition in which an area or land is submerged due to increased water volume.

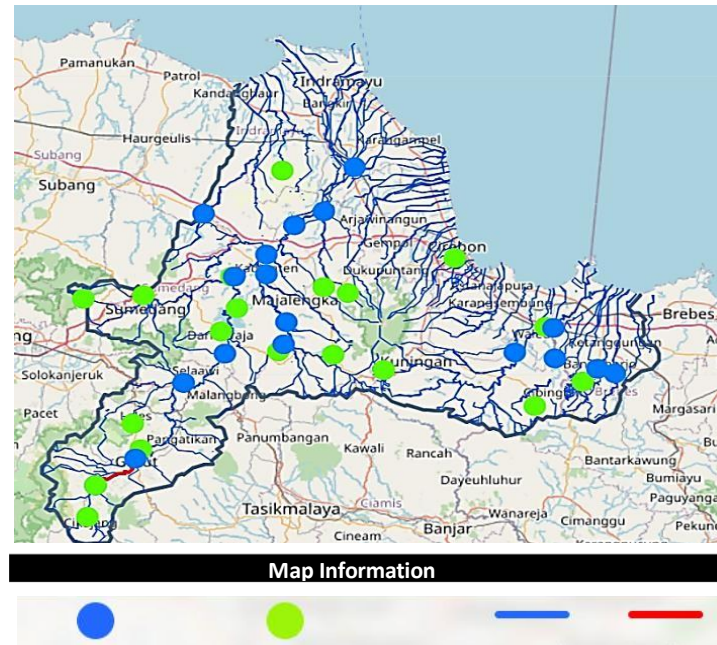
Indonesia already has regulations. Article 3 of Law Number 24 of 2007 concerning disaster management emphasizes that disaster management must be based on the main principles/principles: humanity, justice, equality in law and government, balance, harmony and harmony, order and legal certainty, togetherness, environmental sustainability, science and technology.

Floods are part of natural disasters that must be continuously monitored. Floods are a relatively larger river water discharge, including due to rain that falls upstream or in a certain place continuously, so that it cannot be accommodated by the existing river channel, so the water overflows and inundates the surrounding area. (Ginting and Ningrum, 2020). Conceptually, flood mitigation can be done through two approaches. First, reducing the river flow discharge to match the capacity of the river body.

Reducing the river flow discharge coming from upstream areas (and other areas) can be done by improving land cover and implementing soil and water conservation techniques in river basin areas. Second, managing river flow so that it does not cause flooding. This strategy can be done by: (a) building a retention reservoir to temporarily hold and store river flow coming from upstream areas; (b) building flood canals and diversions to channel peak flow discharge directly into the sea; (c) pumping stagnant water so that flood water recedes quickly; d) building temporary water parking tanks in basin areas; and (e) building river embankments and sea embankments equipped with water gates to prevent river flooding and tidal flooding from the sea. (Yayat Hidayat, 2022).

Solutions to overcome and control floods and landslides in rivers are still very much needed, including in the Cimanuk-Cisanggarung river area. This is related to the possibility of climate change and an increase in flood intensity that is very likely to occur. Extreme rainfall around the Cimanuk and Cisanggarung river areas tends to occur more frequently due to climate change.

The water discharge in the Cimanuk-Cisanggarung River will experience a greater increase compared to previous conditions. If proper and adequate infrastructure is not built, the risk of flooding tends to increase. Pay attention to the map from the Cimanuk Cisanggarung River Basin Center which depicts the water estimation post (blue circle image), rainfall post (green circle image), river (blue line image), and flood (red line image).



The threat of watershed degradation and land conversion is still possible. Deforestation, rapid urbanization, and land conversion will worsen the water capacity in the River Basin Area. This directly impacts the decreasing capacity of the river due to sedimentation, narrowing, and even waste pollution. Flood control infrastructure such as retention ponds, reservoirs, embankments, and polders are still very much needed to manage water more effectively.



Drainage Detention Basin FMNJP in Padakaton Village, Cisanggarung River area, Brebes Regency, Central Java Province



**River Bank Protection Development Process in
Pabedilan Village, Cisanggarung River Area, Cirebon
Regency, West Java Province**

It must be understood that other threats will come from the burden of old infrastructure and imbalanced maintenance. Many flood control infrastructures built decades ago are no longer able to accommodate the current water discharge. Infrastructure maintenance is often neglected, so that its effectiveness decreases.

The strategic step forward, especially with budget or cost efficiency, is to shift the old pattern that only focuses on physical infrastructure development, namely by collaborating infrastructure with HR management, ecosystem approaches and risk management. The old pattern that is only oriented towards physical infrastructure development such as raising embankments, apparently ignores the natural retention capacity in the River Basin Area. River concreting, apparently accelerates the flow without solving the problem upstream. Likewise, building pumps without a local community adaptation strategy. It is true that infrastructure development is a strategic solution, but will it be sustainable? Is it true that the root of the problem is in river basin management and spatial planning?

Operational forms of infrastructure collaboration with human resource management, ecosystem approaches and risk management. First, through Nature- Based Solutions (NBS) and green infrastructure. Reforest upstream of river basins to increase soil absorption. Build ecologically based reservoirs and retention ponds to increase water storage capacity. Second, spatial planning collaboration based on flood risk. Rearrange settlements on riverbanks with an incentive-based relocation concept; and implement a technology-based early warning system. Third, build resilient and adaptive infrastructure. Build flexible embankments and green embankments that can absorb water, not just drain it. Renewable energy-based pumps and polders. Bio- engineering-based drainage systems to reduce water runoff. Fourth, community participation and community-based risk management or Community-Based Disaster Risk Management (CBDRM), namely a community-based approach to reducing disaster risk. In the context of flood management, CBDRM can be carried out by involving the community in identifying, analyzing, and handling flood risks. Communities or communities need to be strengthened so that they can handle flood risks. Increasing community capacity for ecosystem-based adaptation, such as water retention-based urban farming.

Collaboration must be in accordance with its principles. The principle of collaboration from Emily R. Lai (Pearson, 2011) is "Collaboration is the mutual engagement of participants in a coordinated effort to solve a problem together. Collaborative interactions are characterized by shared goals, symmetry of structure, and a high degree of negotiation, interaction, and interdependence. Collaboration and active participation of all parties, especially the community, are absolute requirements at the program management stage. (Agus Suryono, 2001).

Collaboration of infrastructure development with NBS approach, spatial planning, risk management and human resource management is a superior strategy in managing cost efficiency-

oriented programs. The key to the aspect of human resource management is "the right people in the right place at the right time" (Anatan & Ellitan, 2007:30). Implementation in flood management and control is that humans as stakeholders must play an active role in every activity, starting from planning, implementation, utilization and maintenance, monitoring and program development.

Human resource management is the main instrument in managing program assets, both infrastructure (structural) and non-infrastructure (non-structural). Human resource management has a positive influence on the sustainability of asset management. This is in accordance with the results of the study by Omega Gratia Anita Karisoh, Riane Johnly Pio and Sandra Ingried Asaloei (2017) that sustainability is influenced by human resource management practices by 70.2%.

The principle of human resource management is oriented towards empowerment because in the process there is optimization of community participation, capacity building (knowledge, skills and attitudes), education, transformation, optimization of contribution, self-reliance, based on local wisdom, collaborative and prioritizing justice (Owin, 2004).



The principle of empowerment in flood management includes increasing community knowledge, skills and responsibilities, playing an active role in reducing flood risks, protecting themselves and contributing to mitigation efforts. Furthermore, in his study (Owin et al., 2023) formulated that the relationship between human resource management and empowerment is statistically significant at a significance level of 0.05. The implication is that program management that requires sustainability requires empowerment-based human resource management.

There is a very strong relevance between the development of flood control infrastructure and human resource management. Both support each other to ensure that the infrastructure built is not only technically effective, but also well managed to provide long-term positive impacts for society and the environment. Infrastructure development requires competent human resources to be able to prepare appropriate infrastructure planning and design. Human resource management is very important in the planning and design stages of infrastructure. Professionals in the fields of civil engineering, environment, and planning will design the right system based on data, rainfall trends, and the geographical characteristics of an area. Likewise, risk analysis skills and predictive abilities are needed to estimate the impact of future floods and ensure that infrastructure designs are able to deal with them.

Infrastructure development requires competent human resources to be able to implement quality activity programs. Construction workers, technicians, and project managers must have adequate technical skills to ensure that flood control infrastructure development is carried out according to established standards. Good human resource management in the field will prevent technical errors and decreased quality of work that can have fatal consequences for the sustainability of the flood control system.

Flood control infrastructure management requires skilled human resources in infrastructure maintenance and repair. Flood control infrastructure requires ongoing maintenance, such as cleaning drainage channels, maintaining embankments, and monitoring polders and pumps. A workforce with skills in these areas must be available in sufficient numbers and trained to carry out these tasks effectively. Flood control infrastructure management requires managerial skills for efficient maintenance. Human resource management includes skills in arranging maintenance schedules, managing operational budgets, and ensuring coordination between various parties involved in maintenance, such as local governments, communities, and the private sector.

The government has a strategic role in managing human resources for Flood Infrastructure. Managerial and technical skills in government institutions are essential for the purpose of having the ability to plan, implement, and supervise flood control projects comprehensively. National policies need to support training, certification, and continuing education programs for human resources working in the infrastructure sector, especially those related to utilization and maintenance.

Community participation in flood management and control is very important. Community empowerment includes watershed management, waste management, and ecosystem-based flood prevention. Flood mitigation and adaptation training for the community can be carried out together with local residents or volunteers who have expertise. In his study around infrastructure development on the Citarum River in West Java, Owin Jamasy (2018) emphasized that the main principle of development, especially in the restoration of the Citarum River in West Java Province, can be carried out at low cost through building awareness of the community who are daily users of the river. Building awareness is directed so that the community is able to maintain the quality of the river. Building awareness is directed so that the river returns to its original function as an ecosystem for living things around it.

Cooperation between the Government, Private Sector, and Community is very important. Development and management of flood control infrastructure requires collaboration between various elements, namely the central government, local government, private sector, and community. The right collaboration can reduce the budget (budget efficiency) and have an impact on sustainable development.

Collaboration of infrastructure with proper human resource management can have an impact on: (1) efficiency and budget optimization. Skilled and well-capacity human resources can increase efficiency in project planning and implementation. Wasteful costs due to poor planning, corruption, or project inefficiency can also be reduced; (2) integration of sustainable development. Infrastructure development is not only about physical, but also sustainability. Human resources who understand economic, social, and environmental aspects can ensure that infrastructure projects are in line with sustainable principles, for example by adopting Nature-Based Solutions (NBS), Green Infrastructure, or energy-efficient technology; (3) participatory approach and local empowerment. River infrastructure programs require the involvement of local workers who are trained according to project needs. This helps create a multiplier effect in the local economy and increases the community's sense of ownership of the project; and (4) strengthening the capacity of planners and implementers. Infrastructure planning is often weak in the aspects of risk evaluation and mitigation. Human resources who have competence in risk management, environmental studies, and project monitoring and evaluation can prevent projects from stalling or having negative impacts in the future.

Good and appropriate human resource management can be the key to keep infrastructure development running despite limited budgets, while ensuring long-term positive impacts on society and the environment. Some indicators of good human resource management in infrastructure development include: (1) efficiency and productivity of human resources. This means that there must be criteria that have technical and managerial competence; (2) governance and managerial capacity. This means that an analysis of the need for quality workers is needed; (3) innovation and adaptation to challenges. This means that workers must be ready to adopt technology and be ready to respond to crises and risks such

as readiness to face extreme weather, logistical delays or other technical constraints; (4) community participation and social sustainability. This means that there needs to be a mechanism to involve the community in development. Ensure that infrastructure projects do not become a burden on society in the future. But there are sustainable economic effects after the project is completed; and (5) environmental impact and infrastructure resilience. In the context of implementing NBS. How much of the workforce has been trained in environmentally friendly practices? In the context of energy and material efficiency in development. Does the project reduce its carbon footprint by using energy-efficient technology? In the context of infrastructure resilience to climate change. Is the workforce equipped with disaster risk mitigation skills in design and construction?

Working steps so that increasing community participation can be non-commercially oriented (based on volunteer spirit and self-reliance) requires a strategic approach that strengthens collective awareness, sense of ownership, and mutual cooperation values. The approaches taken include: First, conduct socialization based on values and long-term benefits. Focus on how the project will improve community welfare, not just as a government obligation. Use language that is close to the community (avoid technical terms that are too bureaucratic). Utilize local media, discussion forums, and door-to-door approaches. Provide an understanding that infrastructure is not just a physical project but part of sustainable development. Example: Workshop on the impact of infrastructure on the village economy, clean water management training, etc. With several strategic approaches, it is hoped that the community will understand that their contribution is not just voluntary work, but a long-term social investment.

Second, strengthen the sense of ownership. Involve the community in planning and decision-making. Use a participatory planning approach, for example through village deliberations or focus group discussions. Encourage the community to provide ideas and input on the project, so that they feel part of the solution. Example: If you want to build a village road, ask the community where the best location is and how they can contribute. The expected result is increased community participation because they feel they own the project, not just freelance workers without any attachment.

Third, encourage mutual cooperation and self-reliance through revitalizing the culture of mutual cooperation in infrastructure. Take advantage of local traditions, such as "work service" or "energy gathering" in working on simple infrastructure projects. Give appreciation to the most active groups, for example in the form of community awards or symbols such as plaques. Use an approach based on small contributions that are carried out in stages so as not to be burdensome. Example: Each family contributes labor for 1-2 days per month or provides materials voluntarily. The expected result is that community participation occurs voluntarily without a heavy financial burden.

Fourth, create social incentives and moral rewards by providing social recognition for volunteers. Provide symbolic rewards, such as certificates for volunteers or documentation of their role in the project. Example: Their names are listed on the project plaque as a form of respect. Another strategy is to strengthen social identity in contributing. Involve community leaders and informal leaders to provide motivation. Use social proof strategies (example: "The neighboring village has built a bridge with self-help, we can too!"). The expected result is that the community feels appreciated and encouraged to continue participating in other social projects.

Fifth, ensure the sustainability of participation by forming community groups or forums. Form a local volunteer group that is responsible for maintaining infrastructure after the project is completed. Example: If building a village reservoir or embankment, then form a disaster preparedness community group to supervise and maintain it. Another strategy is to build an aderization chain. Ensure there is regeneration in participation, for example by involving village youth so that they continue the spirit of self-reliance. Hold regular activities that maintain community involvement, such as environmental cleanliness competitions or village festivals. The expected result is that community participation does not stop after the project is completed, but continues in the form of further maintenance and development.

The key to the success of non-commercial community participation in relation to efficiency is building a sense of ownership, mutual cooperation, and social incentives that are not always in the form of money. Participation can be increased through socialization strategies, role empowerment, light self-reliance mechanisms, and moral appreciation. Sustainable participation needs to be facilitated by forming local groups that are responsible for the infrastructure that has been built.

Formulation and Recommendations

1. Development of flood control infrastructure in the Cimanuk-Cisanggarung river area is still very much needed, but cannot stand alone. A hybrid approach (a combination of physical infrastructure and ecosystem-based solutions) is more effective and sustainable. Maintenance and optimization of old infrastructure must be a priority, not just building new ones. Community participation in risk management is very important, because floods cannot be controlled only with a technical approach.
2. Development of flood control infrastructure requires not only the right technology, but also skilled, competent, and sustainable human resource management. Community involvement and local government capacity must be strengthened so that flood control is not only effective at the physical level, but also at the level of infrastructure management and maintenance. Continuous training for human resources involved in this sector will ensure the sustainability of flood control infrastructure, as well as strengthen community resilience to the threat of flooding in the future.
3. Good human resource management can be the key to ensuring that infrastructure development continues despite a limited budget, while ensuring long-term positive impacts on the community and the environment.
4. Human resource management in infrastructure development planning can be one solution, especially in facing budget constraints and demands for sustainable development.
5. If human resources are managed well based on the right indicators, then: infrastructure projects can run on a limited budget without sacrificing quality. Development is not only physical but also increases the capacity of human resources for local economic sustainability. The environment and social are still considered so that infrastructure does not damage the ecosystem or trigger social conflict.
6. For the management and control of floods and landslides in the Cimanuk- Cisanggarung river area, it is necessary to strengthen cross-sector collaboration (government, academics, private sector, and community). Use a collaboration- based model, where communities, academics, and the private sector are involved in the development process. The use of digital technology in project planning and monitoring is essential.
7. The efficiency of the development budget must be answered by efforts to find creative solutions based on community participation. Self-reliance or mutual cooperation must be used as a development scheme.
8. The government needs to adopt Hybrid Financing (a combination of the APBN, CSR, and community participation). Encourage regulations that accommodate self-reliance as part of official planning (not just additional initiatives). And
9. The mindset change from “complete development” to “sustainable development” must be included in policy and continuously socialized, included in performance indicators and the national budget planning system

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