

Dissecting the complexity of Cidanau watershed governance through payment environment services and non-payment environment services

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Abstract: The objective of this study is to examine the implementation of a combined scheme involving payment environment services (PES) and non-payment environment services (non-PES) in the management of the Cidanau River Basin. This study used exploratory research to analyse the structure and mechanism of PES and non-PES schemes for the governance system. The Cidanau Watershed governance is a pioneer in sustainable integrated water resources management in Indonesia and has persisted until the present time. The governance of the Cidanau Watershed is dynamic, resilient, and evolving in response to various changes in social and ecological systems. A bridging organisation like the Cidanau Watershed Communication Forum (Ind.: Forum Komunikasi DAS Cidanau – FKDC) requires legal standing to be visible and gain the trust of the public, especially when implementing a PES approach like the Cidanau River Basin, where service buyers utilise non-direct payment mechanisms. The challenging aspect of developing a PES scheme is empowering knowledge regarding the importance of soil and water preservation among upstream communities, particularly in developing countries like Indonesia, where upstream communities are predominantly composed of low-income farmers whose livelihoods depend on nature. The non-PES scheme represents the government's mandatory responsibility, whereas the PES scheme presents public participation in active collaboration through the FKDC as an ad hoc institution. A combination of the non-PES and PES scheme approach can serve as a model and reference for similar river basin governance frameworks. Further research is needed regarding social networks and institutional development of sustainable watershed governance in the Cidanau River Basin.

Keywords: Cidanau Watershed, Indonesia, non-PES scheme, PES, watershed governance

INTRODUCTION

The demand for water and land is amplified by factors such as population growth, urbanisation, intensive agricultural development, industrial expansion, and environmental needs (Gleick, 1998; Atisa, Bhat and McClain, 2014; Song *et al.*, 2018; Ren *et al.*, 2020; Widianingsih *et al.*, 2021). Simultaneously, there is a growing human pressure on water resources, accompanied by

the amplification of climate change impacts within the water environment (Gleick, 1998; UN Environment, 2018; Widianingsih *et al.*, 2021). Manmade objects are more likely to generate numerous adverse consequences of an unbalanced environment, including water quality degradation, floods, droughts, ground-water depletion, land subsidence, erosion, sedimentation, and seawater intrusion (Fulazzaky, 2014; Koebele, 2015; McIntyre-Mills *et al.*, 2022). The Integrated Water Resources Management

(IWRM) paradigm emphasises the necessity for government involvement and stakeholder engagement at all levels of water management (Hooper, 2003).

The challenges associated with enhancing the capacity building of IWRM, particularly concerning the enabling environment, institutional frameworks, and management instruments, have been identified as significant factors influencing future directions toward enhancing problem-solving abilities (Fulazzaky, 2014; UN Environment, 2018). The engagement of stakeholders in the restoration and maintenance of the natural stream flow regime of a river is essential for establishing sustainable water management initiatives. Participation (Sulistyaningsih *et al.*, 2021), collaboration and interaction (Brisbois and Loë de, 2016), and partnership (Ferreya and Beard, 2007) are the most common words used to illustrate the key success of watershed management; however, every river basin is unique, different, and practised from one to another.

The traditional top-down regulatory approach, controlled by the government, has been replaced by a multi-actor collaborative governance approach or still combines both sides (Loë de, Murray, and Simpson 2015; Brisbois and Loë de, 2016). The development of the governance paradigm is an approach for solving public problems by prioritising bottom-up and horizontal processes, conceptualised as a joint and collective endeavour of diverse entities, encompassing the government, private enterprises, civil organisations, local government officials, political parties, universities, and members of the public, which is vital in achieving common goals (Warriner *et al.*, 1996; Minnes, 2019; Siagian *et al.*, 2019; Sururi *et al.*, 2022).

Presently, alongside top-down “command-and-control” approaches, market-based instruments like payments for watershed services (PWS) have gained considerable global prominence (Brauman, 2015; Salzman *et al.*, 2018; Bösch, Elsassser and Wunder, 2019; Wu *et al.*, 2019; Okiria, Zaki and Noda, 2021; Zeng *et al.*, 2021). PWS refers to the compensation provided for environmental services (Atisa, Bhat and McClain, 2014), or watershed eco-compensation (Engel, Pagiola and Wunder, 2008; Deng *et al.*, 2022) in reference to water (watershed) is a market-based incentive scheme that operates under the principle that individuals or entities (managers or sellers) who contribute to the conservation of natural ecosystems and provide valuable ecosystem services related to water (watershed) should be financially compensated by those who benefit from these services (buyers) (Silva and Ribeiro, 2013; Calvet-Mir *et al.*, 2015; Nyongesa *et al.*, 2016; Wu *et al.*, 2019; Sharma *et al.*, 2021). In general practice, financial compensation is provided by downstream water users, such as municipal water supply and hydropower companies, to upstream actors, including industry, farmers, or landowners, as a means of incentivising water protection actions aimed at ensuring the provision of watershed services (Engel, Pagiola and Wunder, 2008; Zeng *et al.*, 2021).

Watershed management is a dynamic, and complex process that requires consistent long-term improvements over a long period (Budiarto *et al.*, 2022). There are two notes regarding research publications on the sustainability of watershed management. First, few research results discuss how the stage and dynamics of the role and mechanism of governance structure make the management of a watershed sustainable. Second, most scholars analyse watershed management on an administrative scale rather than by practising or combining payment for

environment services (PES) and non-PES approaches. Brownson *et al.* (2020) have studied PES schemes at both the national and local levels. In relation to the two issues mentioned above, this research uses PES and non-PES approaches to analyse the patterns and mechanisms of the Cidanau Watershed governance structure based on a time trajectory study.

Despite the growing momentum in promoting payments for watershed protection in recent years, limited attention has been given to evaluating the effectiveness of these programs (Silva and Ribeiro, 2013). In practice, PES programs differ in the type and scale of environment services demand, payment source, type of activity paid, performance measure used, and payment mode and amount (Engel, Pagiola and Wunder, 2008). This research paper applies the aforementioned concepts related to the evaluation of governance processes to a comprehensive combination of PES and non-PES schemes, currently being implemented at the state level in the Cidanau River Basin, Indonesia. Its primary objective is to investigate the role and mechanisms of governance within this context. This research does not seek to evaluate another case outside the Cidanau Watershed; however, it is used to compare or benchmark the dynamic governance structure and mechanism in another river basin to enrich the developed model.

MATERIALS AND METHODS

DATA COLLECTION AND PROCESSING

The dynamic function and mechanism of the Cidanau River Basin governance were investigated in this study using an exploratory case study methodology (Yin, 2018). To capture both the uniqueness and a shared set of norms and procedures, the focus-limited group discussion process acts as the larger case study's unit of analysis. A series of in-depth interviews were conducted with participants representing various stakeholder groups, accompanied by comprehensive observations of the Cidanau Watershed Communication Forum (Ind.: Forum Komunikasi DAS Cidanau – FKDC), aiming to gain a comprehensive understanding of the underlying mechanisms supporting it (Jennings, 2012; Putera *et al.*, 2022). The interview subjects were chosen based on the stakeholder group (to guarantee a range of viewpoints) and their responsibilities as significant contributors to the process, either noticed by the researcher or acknowledged by other interview subjects.

Notably, interviewees do not necessarily represent the opinions of other participants even though they represent a wide range of viewpoints on the process. Nonetheless, preserving anonymity and choosing a broad sample of interviewees helps lessen interviewer response bias when discussing the process's accomplishments and difficulties. Documents received through the public process, such as the payment for environment services (PES) contract between the farmer and PT Krakatau Industries, financial statements, the current legal opinion of FKDC, and other information, were used to complement the information gained through interviews. The interviews were recorded verbatim, transcribable, and significant themes from the pertinent collaborative governance literature were emphasised to highlight the study's findings. To better understand the outcomes, interviewees were questioned about their activities and successes, the development of rapport among participants, and suggested

policy and managerial options. In addition to addressing the objectives, community outreach, and associations with other stakeholder groups, the interviewees also highlighted a diverse range of outcomes, achievements, or results pertaining to various aspects of the process during the course of the interviews.

Primary and secondary data were analysed using a trajectory study based on the developmental period of management of the Cidanau River Basin. Furthermore, trajectory studies have been undertaken to ascertain the sustainability of governance patterns and mechanisms within the Cidanau River Basin.

LOCUS OF STUDY

The Cidanau Watershed holds significant importance as one of the foremost river basins in Indonesia, especially for the province of Banten because it serves water for more than 113 industries and nearly five hundred thousand residents of Cilegon City. The Cidanau River Basin covers an area of 22,620 ha (FKDC, 2018), which includes 999.29 ha in Pandeglang Regency and 21,620.71 ha in Serang Regency (Khairiah *et al.*, 2016). Administratively, the Cidanau River Basin was located in the regencies of Serang and Pandeglang. Serang Regency includes 5 districts, namely Padarincang, Cinangka, Ciomas, Mancak, and Gunungsari, while Pandeglang Regency is located in the Mandalawangi District (Fig. 1). There are 40 villages within the Cidanau Watershed, 35 of which are located in the Serang Regency and 5 in the Pandeglang Regency (Lapeyre, Pirard and Leimona, 2015; Amaruzaman, Rahadian and Leimona, 2017). The Cidanau Watershed has witnessed a rapid transformation of its land cover over a span of nearly two decades.

The surge in population growth, combined with a heavy reliance on agriculture, has resulted in the conversion of forested areas into agricultural lands. Furthermore, the Rawa Danau Reserve has faced substantial encroachment, reaching up to 20% by the year 2000 (Darmawan, Tsuyuki and Budi, 2005), which has consequently led to a decline in the diversity of flora and fauna

(Mbak, 2010). Water consumers in the Cidanau Watershed encounter several prominent challenges, including the degradation of water quality caused by pollution, significant sedimentation, and substantial fluctuations in water flow. The Cidanau Watershed has experienced rapid land cover change for almost two decades. Population increases, coupled with dependence on farming, have led to the conversion of forests to agriculture (Darmawan, Tsuyuki and Budi, 2005; Munawir and Vermeulen, 2007).

RESULTS AND DISCUSSION

DYNAMIC CIDANAU WATERSHED GOVERNANCE

In the early 2000s, the issue of the proliferation of administrative regions was a significant political concern in Indonesia. The proliferation involved the creation of new administrative boundaries, the establishment of new local governments, and the allocation of specific functions and responsibilities to these newly formed regions. This undertaking aimed to tackle the challenges of managing vast and diverse territories, enhance service delivery, and promote regional autonomy.

An illustrative example of administrative region proliferation during that time was the establishment of Banten Province, which separated from West Java Province. This change resulted in various administrative governance modifications, including the management of river basin areas such as the Cidanau River Basin (Ind.: Daerah Aliran Sungai Cidanau – DAS Cidanau). Since its establishment in the year 2000, the management of DAS Cidanau has fallen under the jurisdiction of Banten Province. The management dynamics of the Cidanau River Basin (DAS Cidanau) represent a prime example of a collaborative watershed management approach involving all stakeholders to ensure the sustainability of the social and ecological aspects of the basin. The dynamics of changes in watershed management, as identified in this research, will be further elaborated.

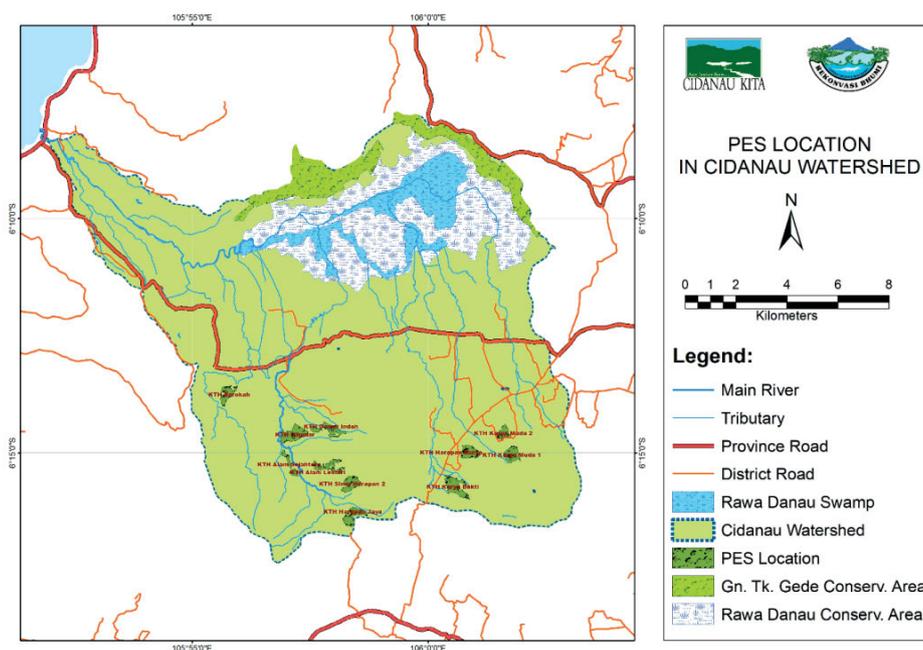


Fig. 1. Current situation map of the Cidanau River Basin; source: FKDC (2018)

TOP-DOWN BASED POLICY OF CIDANAU WATERSHED MANAGEMENT (BEFORE THE YEAR 2002)

Before Forestry Law No. 41 of 1999 was enacted in Indonesia, watershed management was conducted through a top-down approach, which means that the government controlled the management of the watershed. The central and regional governments allocated programs, activities, and budgets for the management of the Cidanau Watershed. Central government institutions, such as the Watershed Management Agency (Ind.: Balai Pengelolaan Daerah Aliran Sungai – BP DAS), River Basin Management Agency C3 (Ind.: Balai Besar Wilayah Sungai Cidanau Ciujung Cidurian – BBWS C3), and the Natural Resource Conservation Agency (Ind.: Balai Konservasi Sumber Daya Alam – BKSDA), together with provincial and regency governments, developed a strategy for managing the Cidanau Watershed. However, policies between ministries were sometimes not synchronised, resulting in an unintegrated watershed management system that followed the policies of each ministry (Fulazzaky, 2014). According to Fulazzaky (2014), the paradigm of watershed management in Indonesia before 1988 was still carried out through a top-down approach, with strong leadership, a focus on national administration, decisions based on administrative interests, funding from the government and international donors, risks to the environment being balanced against regional economic development interests, and risks of corruption due to authority.

In the case of DAS Cidanau before 2002, the central government still controlled and dominated the management of the Cidanau River Basin through central and regional institutions, such as the Natural Resource Management Agency (Ind.: Balai Konservasi Sumber Daya Alam – BKSDA), River Basin Management Agency, and River Management Agency (Ministry of Public Works) (Ind.: Balai Besar Wilayah Sungai – BBWS). This approach has many weaknesses, as watersheds are considered dominant from the ecological system perspective, leading to a tendency to neglect watersheds as social systems in the development approach. The Cidanau River Basin is still viewed as a development object, as various watershed management policies still rely on programs and budgets from central and local governments. The public had limited access to participation in the Cidanau River Basin management.

BOTTOM-UP AND TOP-DOWN COMBINED BASE POLICY OF CIDANAU WATERSHED MANAGEMENT (PERIOD OF 2002–2005)

The Cidanau Watershed holds significant importance as one of the foremost river basins in Indonesia, especially for the province of Banten because it serves water for more than 113 industries and nearly five hundred thousand residents of Cilegon City. The establishment of Banten Province, which was separated from West Java Province in 2001, had an administrative impact on government policies, including the management of the Cidanau River Basin. In 2002, there was a change in administrative management and approach to the Cidanau River Basin from top-down to mixed policy (integration of both top-down and bottom-up approaches is being employed to achieve a comprehensive solution). The dominant role of the government in managing the Cidanau River Basin shifted to a collective role among

stakeholders, including the government, NGOs, industries, and communities, with the common goal of ensuring watershed sustainability. Public participation has become an integral component of sound in the management of the Cidanau River Basin. The inclusion of public input has become an essential aspect of effective watershed management due to the public's desire to participate and the conflicts that frequently arise between public and private interests during the development and execution of water resource protection and remediation policies (Warriner *et al.*, 1996; Gunawan *et al.*, 2004; Parikesit *et al.*, 2005; Widianingsih, Riswanda and Paskarina, 2020).

The initiation of the Cidanau Watershed Communication Forum (Ind.: Forum Komunikasi DAS Cidanau – FKDC) was carried out during the period of the West Java Provincial Government and continued after the formation of the Banten Province government as a milestone in the management of Cidanau River Basin. The implementation of FKDC was initially introduced in Indonesia as part of a participatory approach to watershed management, providing an opportunity for public engagement in the governance of the Cidanau River Basin. With the formation of FKDC, there was a paradigm shift in policy from top-down to bottom-up, and the government's dominance shifted to FKDC as a collective institution in managing the Cidanau River Basin for sustainable water sources and conservation functions. Watershed management organisations possess the capacity to play a crucial role in facilitating multi-loop social learning; however, there are several challenges that must be addressed in order to fully realise this potential (Gunawan *et al.*, 2004; Parikesit *et al.*, 2005; Medema *et al.*, 2015).

In accordance with the Governor of Banten Province Decree No. 124.3/Kep.64-Huk/2002 issued on May 24, 2002 (Amaruzaman, Rahadian and Leimona, 2017). FKDC was granted legal recognition by the Banten Provincial Government as a multi-stakeholder organisation responsible for the management of the Cidanau Watershed. The Governor's decision changed the role and mechanism of the Cidanau Watershed governance, which was previously fully controlled by the government, to be shifted to FKDC (see Fig. 2).

According to Figure 3, the Cidanau Watershed Management has transitioned from a predominantly government-driven top-down approach to a more inclusive approach that combines both top-down and bottom-up strategies, with the FKDC assuming a more prominent position. The FKDC functions as a multi-stakeholder collective forum and a platform for public participation in the management of the Cidanau River Basin, using the principle of "one river, one planning and one participation management" to ensure the sustainability and

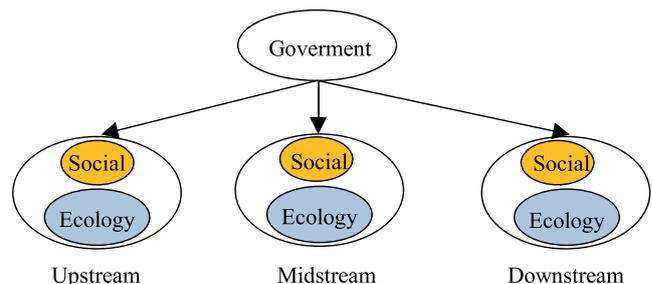


Fig. 2. Top-down mechanism of Cidanau Watershed Management (before the year of 2002); source: own study

balance of the social and ecological systems. In this period, the management of the Cidanau River Basin was not only focused on ecological aspects but also on social aspects (the community is also a priority in watershed management). The watershed is a social-ecological system; therefore, its management must consider both social and ecological aspects (Gunawan *et al.*, 2004; Parikesit *et al.*, 2005; Martin *et al.*, 2014; Montenegro and Hack, 2020).

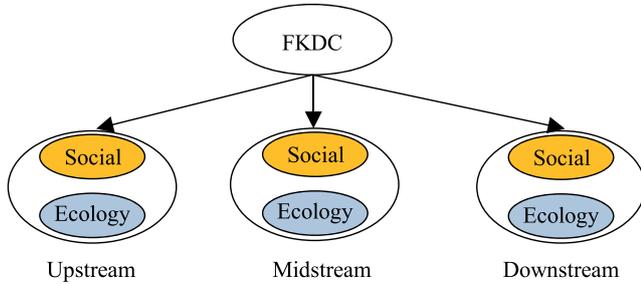


Fig. 3. Top-down and bottom-up mixed policy by the Cidanau Watershed Communication Forum (Ind.: Forum Komunikasi DAS Cidanau – FKDC) period year of 2002–2005; source: own study

A MIXTURE OF PAYMENT FOR ENVIRONMENT SERVICES AND NON-PAYMENT ENVIRONMENT SERVICES APPROACHES FOR THE 2005–2019 PERIOD

The increasing water demand for industry, households, and tourism prompted PT Krakatau Industry and Cidanau Watershed Communication Forum (Ind.: Forum Komunikasi DAS Cidanau – FKDC) to develop the payment for environmental services (PES) scheme in 2005. During that period, PT Krakatau Industry assumed the role of the purchaser, while farmers, organised in a farmer group, played the role of vendors for the environmental services associated with water production. Concurrently, the Banten provincial government made contributions to the PES initiative established by FKDC by allocating a predetermined budget and remunerating the providers of environmental services.

According to Brownson *et al.* (2020), payment for environmental services (PES) employs diverse governance structures that span from centralised national programs to community-led initiatives managed at the local level. The government of Banten Province contributed to the PES scheme for the Cidanau River Basin. This finding is similar to that of Pan *et al.* (2017), who stated that the Chinese government allocated PES schemes through government budgets via top-to-bottom payments. However, the Banten Provincial government’s participation in the PES funding scheme faces many problems because of the lack of Central Government rules and legal standing regarding the transparency of government allocation of PES budgets. The absence of rules and regulations has caused various problems in the government’s participation in the PES program, and until now, there has been no related regulatory initiative. A suitable policy mechanism will provide enhanced assurance for the community in supporting this PES mechanism (Sharma *et al.*, 2021). The PES scheme for the Cidanau River Basin was formed to bridge the gap between industry as water users and farmer/ farmer groups who own land in the upstream area of the

watershed. The funding sources for the industries were coordinated by PT Krakatau Tirta Industries (PT KTI). Active participation from both buyers and sellers is crucial when formulating a policy, as they are the primary stakeholders in the implementation of PES schemes. It should be acknowledged that the sustainability of watershed management is not solely the responsibility of the local government (Wulandari *et al.*, 2015).

Currently, central and local governments provide schemes for the development of upstream and downstream watershed areas through budget allocation, programs, and activities (non-PES) that are coordinated with FKDC. The government still plays an important role in the management of the watershed, although FKDC plays a central role in the management of the Cidanau River Basin.

Figure 4 depicts the stages of the governance structure and mechanism development for the management, which evolved with the emergence of the PES scheme. At this stage, FKDC is the watershed organisation as a bridging entity between water suppliers (farmers and farmer groups) and buyers (Krakatau Tirta Industries). FKDC is responsible for the PES program (supplier-buyer participation) and non-PES programs (central and local governments) for the sustainability of the Cidanau River Basin management. The PES scheme is expected to bring about a cultural shift from deforestation habit to ecosystem conservation and improve farmers’ understanding of the common interests importance. Incentives of PES schemes are intended to bring about behavioural changes in land use and resource utilisation decisions to reduce ecosystem service losses or increase their provision.

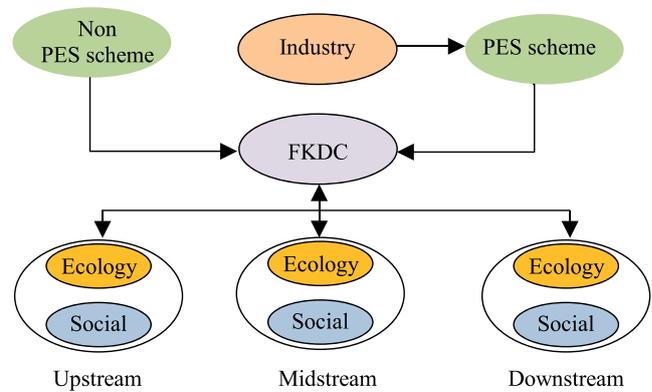


Fig. 4. Integrated payment for environment services (PES) and non-payment environment services (non-PES) schemes by Cidanau Watershed Communication Forum (Ind.: Forum Komunikasi DAS Cidanau – FKDC) for 2005–2019 period; source: own study

INTEGRATION OF PAYMENT FOR ENVIRONMENT SERVICES AND NON-PAYMENT ENVIRONMENT SERVICES APPROACHES BY CIDANAU ENVIRONMENTAL SERVICE MANAGEMENT AGENCY FOR THE 2019–PRESENT PERIOD

This period signifies the progression of the payment for environment services (PES) scheme in response to the progressively intricate necessitating adjustments in governance patterns and mechanisms. Several underlying factors of the dynamics are the increasing demand for water by industries due to the entry of new industries in Cilegon City and the expansion of production

capacity, increasing demand for household water, and the development of PES schemes in other PES projects.

The development of patterns and mechanisms of Cidanau River Basin governance requires the establishment of an ad hoc institution for managing PES schemes in implementing the upstream–downstream relationship mechanism. Furthermore, FKDC formed and established the Cidanau Environmental Service Management Agency (Ind.: Lembaga Pengelola Jasa Lingkungan – LPJL) as an ad hoc institution. The establishment of the LPJL and the mechanisms built to realise payment transactions and supporting rules to establish accountability, transparency, and credibility for the public become key factors that can foster buyer trust to engage in various conservation efforts through environmental service payment mechanisms. LPJL is responsible for managing the finances, administration and operation of the establishment of the PES scheme. Currently, the PES scheme has expanded not only in the management of the Cidanau River Basin but also in the development of upstream biodiversity parks. LPJL must coordinate with FKDC to implement PES programs. The non-PES schemes remain in the FKDC domain task.

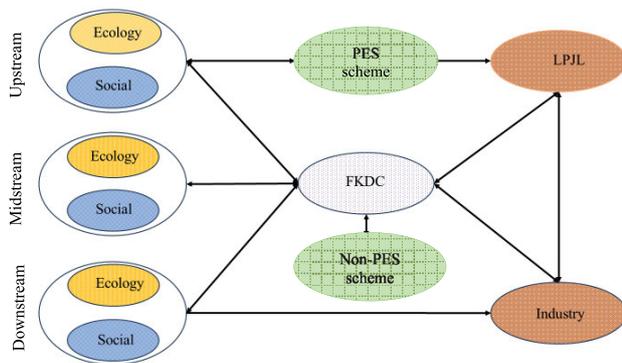


Fig. 5. Payment for environment services (PES) and non-payment environment services (non-PES) scheme and mechanism by Cidanau Environmental Service Management Agency (Ind.: Lembaga Pengelola Jasa Lingkungan – LPJL) for period year of 2020–now; FKDC = Cidanau Watershed Communication Forum (Ind.: Forum Komunikasi DAS Cidanau); source: own study

According to Silva and Ribeiro (2013), in developing countries, the absence of suitable forms of property rights and/or insecure land tenure can give rise to conflicts when determining the responsibilities related to soil use, which are essential for ensuring the provision of services. In this case, PES is primarily driven by the willingness to sell and willingness to pay, rather than issues of land and land conflicts in the upstream area. The primary concerns revolve around comprehending the actions undertaken by these programs and their impact on water quality and quantity. This necessitates the evaluation of uncertainties and the long-term benefits associated with them. PES discussion pertains to the interests of sellers and buyers. Discussion of non-PES schemes involves the mandatory role of top-down government in the management of the Cidanau River Basin. Figure 5, shows a combination of non-PES and PES schemes indicates a suitable approach for sustainable Cidanau Watershed management. PES will only be effective if supported by top-down government policies.

The primary challenges in implementing payment for environment services (PES) involve the establishment of concrete

policies and a comprehensive legislative framework at the national, subnational, and institutional levels (Bhatta *et al.*, 2014). Various obstacles arise when PES schemes are not supported by non-PES policies. The presence of the Cidanau River Basin’s joint institution, FKDC, which is recognised as a reliable and responsible entity for all stakeholders, contributes as a reinforcing and leveraging factor in the integration of PES and non-PES schemes. According to Wangdale (2022), the strong motivation of the stakeholders to participate in the PES scheme was primarily influenced by their keen aspiration for a consistent water supply, as well as their commitment to enhancing and safeguarding the watershed that serves as the source of their water. Insufficient vertical and horizontal coordination among governmental departments and agencies frequently gives rise to implementation issues (Bhatta *et al.*, 2014).

According to Wunder (2006), payment for ecosystem services (PES) constitutes voluntary exchanges between service users and providers, contingent upon mutually agreed-upon rules for natural resource management, aimed at generating offsite services. However, Wunder (2006) did not mention how the rules and mechanisms of PES were implemented. A comprehensive analysis of numerous case studies reveals that the successful implementation of PES primarily relies on active involvement and commitment from either the state, the local community, or both (Vatn, 2010). According to Perevochtchikova *et al.* (2021), PES schemes predominantly receive funding from public sources and are implemented on a national scale over five-year durations. These schemes primarily prioritise conservation objectives and hydrological aspects.

According to Figure 6, the relationship between upstream and downstream in relation to payment mechanism for environmental services developed in the Cidanau River Basin was an indirect relationship (indirect payment) and set on a local scale/province scale. It was proved because PT Krakatau Tirta Industries (KTI), as the buyer, is not willing to make direct payments for environmental services to the seller due to various reasons and considerations. Instead, they request FKDC and LPJL as an intermediary to facilitate the alignment of interests between KTI (buyer) and the upstream community (seller or provider of environmental services), within the Cidanau River Basin.

The government’s role in the development of environmental services in the Cidanau River Basin is crucial. Governments persist in playing a vital role in initiating collaboration, providing institutional support, and overseeing the approval and implementation of policies and decisions (Brisbois and Loë de, 2016; Widianingsih, Riswanda and Paskarina, 2020). The government’s willingness to change and shift the development paradigm has been practised thus far, particularly for land conservation and rehabilitation activities in Cidanau. Implementing mechanisms for payment of environmental services, will not only serve as an example of utilising environmental services from the Cidanau River Basin but also promote the establishment of new development mechanisms considered as alternatives to existing and previous development concepts. These new mechanisms will provide broader accessibility for the public and communities to determine the planning and implementation in their respective areas by striking a balance among ecological, social, and economic interests.

Furthermore, the development of institutional frameworks through accountability, transparency, clear mechanisms, and

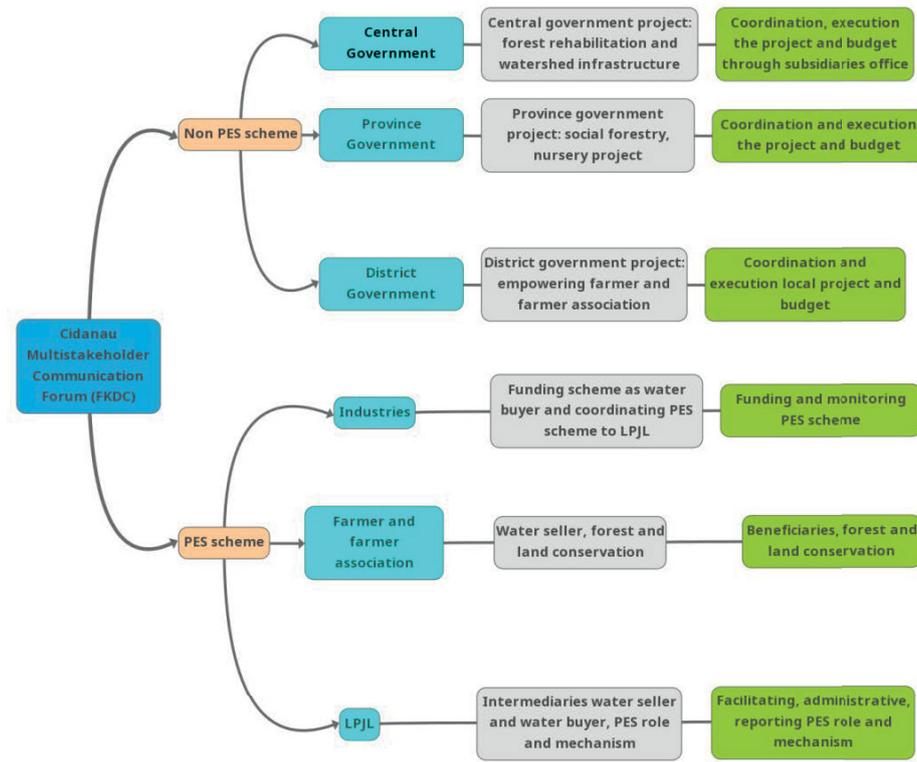


Fig. 6. The exiting role and mechanism of payment for environment services (PES) and non-payment environment services (non-PES) scheme for sustainable Cidanau River Basin management; FKDC = Cidanau Watershed (Multistakeholder) Communication Forum (Ind.: Forum Komunikasi DAS Cidanau), LPJL = Cidanau Environmental Service Management Agency (Ind.: Lembaga Pengelola Jasa Lingkungan); source: own study

tangible activities resulting from the payment for environmental services, not only build trust among buyers and seller, but also draw international attention to the potential to engage in carbon transactions (carbon trade) in line with the spirit emerging from the clean development mechanism (CDM) concept. This research finding contradicts the findings of Salzman *et al.* (2018) who highlighted the challenges of obtaining comprehensive and reliable data for PES, which is a relatively new environmental policy instrument characterised by diverse practices at the local, regional, and national levels. The implementation of PES and non-PES schemes, through the establishment of FKDC and LPJL, plays an important role and is a mechanism to provide upstream-to-downstream mutualism benefits.

CONCLUSIONS

The Cidanau Watershed governance is a pioneer in sustainable watershed management in Indonesia and has successfully persisted until the present time. The governance of the Cidanau Watershed is dynamic and resilient in the face of various changes in social and ecological systems. There has been a shift in the approach to managing the Cidanau River Basin (Ind.: Daerah Aliran Sungai Cidanau – DAS Cidanau) from a top-down approach (control and command) to a combined top-down and bottom-up approach after 2002, following the issuance of Governor of Banten Province, Decree No. 124.3/Kep.64-Huk/2002 regarding the Formation of the Cidanau Watershed

Communication Forum (Ind.: Forum Komunikasi DAS Cidanau – FKDC). A bridging watershed institution like FKDC requires legal standing to be visible and gain the trust of the public, especially when implementing a payment for environment services (PES), where service buyers utilise non-direct payment mechanisms. The most challenging aspect of developing a PES scheme is educating and empowering knowledge regarding the importance of soil and water conservation among upstream communities in the watershed, particularly in developing countries like Indonesia, where upstream communities are predominantly composed of low-income farmers whose livelihoods depend on nature. The non-PES scheme represents the government’s responsibility in managing the river basin, while the PES scheme actualises the joint responsibility of the public participation in Cidanau River Basin management. The establishment of FKDC and Cidanau Environmental Service Management Agency (Ind.: Lembaga Pengelola Jasa Lingkungan – LPJL) as ad hoc institutions for the PES scheme is a response to the demand for transparency and accountability to the public and reports to FKDC as a collaborative institution in the management of the Cidanau River Basin. FKDC’s and LPJL’s key success in managing the Cidanau River Basin lies in how FKDC can transform the dynamics of change into roles and mechanisms through PES and non-PES schemes and must be able to intermediate the common goal for the sustainability of Cidanau Watershed management. The non-PES and PES approaches strengthen the sustainable governance of the river basin and can serve as a model and reference for similar river basin governance elsewhere. Further

research addressing the question of social network and institutional development analysis regarding the identification of another key success factor in Cidanau Watershed governance for future direction in social ecological perspectives.

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CONFLICT OF INTERESTS

The authors declare no competing financial interests or personal relationships that could have influenced the work reported in this study.

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