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Effective Government Strategies to Deal With Climate Change Impacts in the West Papua Region

Budget Optimization for Mitigation and Adaptation

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Abstract: Climate change is a global challenge that significantly impacts various environmental, economic, and social sectors. In the West Papua region, the effects of climate change are increasingly being felt, especially in the agriculture, fisheries, and local ecosystem sustainability sectors. Local governments play an important role in developing effective mitigation and adaptation strategies to face this challenge. This research aims to analyze the budget optimization strategies used by local governments to address the impacts of climate change in the region. This research uses a qualitative approach with a case study method to examine local government policies on climate change. Data were obtained through focus group discussions with government officials, analysis of policy documents, and analysis of budget data. The Miles and Huberman interactive model was used in the analysis, which involved data collection, reduction, presentation, and conclusion drawing. The results showed significant budget allocations for climate change mitigation and adaptation changes between 2023 and 2024. The budget for mitigation decreased by 39.70%, while the budget for adaptation increased by 62.86%. The decrease in the mitigation budget reflects efficiencies that have been achieved or changes in priorities. In contrast, the increase in the adaptation budget indicates an increased focus on community and infrastructure resilience to climate change impacts. Priority action plans identified in this study include strengthening climate-resilient infrastructure, water and waste management, renewable energy development, increasing community capacity and participation, diversifying funding sources, and technology development and application. Recommendations for local governments emphasize the importance of continuous evaluation, inclusive policy development, collaboration with the private sector, and increased public awareness and participation in dealing with climate change.

Keywords: Climate Change; Mitigation; Adaptation; Government Policy; Budget; Climate Resilient Infrastructure.

1. Introduction

Climate change is a global challenge that significantly impacts various environmental, economic, and social sectors. This phenomenon not only affects the physical condition of the earth but also has broad implications for human welfare and ecosystems. In the West Papua region, which includes the provinces of West Papua and Southwest Papua, the impacts of climate change are increasingly being felt, especially in the agricultural sector, fisheries, and the sustainability of local ecosystems. Changing weather patterns, increasing temperatures, and rising sea levels threaten the sustainability of natural resources in this area (IPCC, 2023).

West Papua's and Southwest Papua's agricultural sectors highly depend on stable climatic conditions. Changes in rainfall and temperature can result in crop failure, decreased land productivity, and loss of local climate-adapted crop varieties (Cradock-Henry et al., 2020). The fisheries sector also faces similar challenges with declining fish stocks due to changes in seawater temperature and damage to marine habitats such as coral reefs that serve as breeding grounds for fish (Monticini, 2019).

In addition, climate change threatens the sustainability of local ecosystems. Tropical rainforests in West Papua and Southwest Papua, one of the world's most biodiverse regions, are under pressure from deforestation accelerated by climate change and human activities. This decline in environmental quality threatens endemic flora and fauna and affects indigenous communities that depend on forests daily (WWF, 2020).

Local governments must develop effective mitigation and adaptation strategies to face these challenges. Through appropriate policies and adequate budget allocations, governments can help reduce the negative impacts of climate change and increase the resilience of communities and ecosystems. Controlling climate change through various national and international policies began in 1994 when Indonesia ratified various vital agreements such as the Conference of the Parties 23 United Nations Framework Convention on Climate Change (COP 23 UNFCCC), the Kyoto Protocol, and the Paris Agreement, as well as submitting nationally determined contributions (NDC) to the UNFCCC. The government has also integrated low-carbon development planning in the RPJMN 2020-2024 and established a climate change agenda that includes addressing climate change within the Sustainable Development Goal (SDG) 13 framework.

In responding to climate change issues, fiscal policy has been strengthened with various initiatives such as a climate change mitigation fiscal framework, tax incentives for developing new renewable energy (EBT) and clean technology, and revoking fuel subsidies. In addition, measures such as strengthening Ministry and Agency (K/L) spending through budget tagging and strengthening ecology-based fiscal transfers have also been implemented. Furthermore, the government will prepare fiscal instruments related to levies on carbon (carbon tax), develop an updated climate change budgetary framework, and integrate national climate change planning, budgeting, and Monitoring, Reporting, and Measurement (MRV) systems.

Indonesia's fiscal strategy in tackling climate change. Through the NDC submitted to the UNFCCC, Indonesia is committed to reducing greenhouse gas (GHG) emissions from Business as Usual (BaU) levels by 2030, 29% with national efforts and 41% with international support. The estimated cost of climate change mitigation until 2030 reaches Rp3,461 trillion, with the accumulative cost of 2020-2030 reaching Rp3,779 trillion divided into sectors such as forestry, energy and transportation, IPPU, waste, and agriculture. The government identified domestic funding sources such as the state budget (APBN), Transfer to Regions and Village Fund (TKDD) spending, carbon tax/ excise, and financing through Green Sukuk and SDGs Bond to fund these mitigation

efforts. In addition, non-APBN funding involves private enterprises, carbon trading, APBD, financial service institutions, capital markets, state-owned enterprises, and philanthropy. International funding sources include bilateral cooperation with other governments and the private sector and multilateral funding through the Green Climate Fund, Global Environment Facility, Adaptation Fund, and MDBs/IFIs. These measures demonstrate the Indonesian government's comprehensive efforts in addressing climate change challenges through an integrated and collaborative fiscal strategy (Akita et al., 2021). The Climate Change Budget Tagging concept involves identifying budget allocations specifically for climate change, including mitigation and adaptation sectors. In 2024, there is a budget block for Climate Change Mitigation of Rp1,052 million and a budget for Climate Change Adaptation of Rp14,071 million.

Ebi, Boyer, et al. (2018) highlighted that climate change can impact public health through increased temperature, humidity, and precipitation, risk factors for airborne, waterborne, and vector-borne infectious diseases. This suggests the need for appropriate interventions from local governments to allocate budgets for the health system to deal with the possible health impacts of climate change. In addition, in agriculture, Hatfield et al. (2011) emphasized that climate change affects the decline in agricultural production, especially food crops, with production decline ranging from 5-20%. Adaptation strategies in the agricultural sector need to be supported by adequate budget allocations to ensure that food security in the region is maintained. As explained by Aisya (2019), the multilevel governance approach in the politics of climate change adaptation shows that local policies and budget allocations can be affected by resource shortages due to climate change. To address climate change impacts, the governments of West Papua and Southwest Papua should consider collaborative strategies across levels of government to optimize budget use.

A big question that has been looked at from different angles in the new study is the link between economic growth and emissions. Ade et al. (2023) discussed how new technologies can help the economy grow while lowering pollution. They said that the Industrial Revolution 4.0 and globalization can work together to encourage people to start their businesses and lessen their adverse effects on the environment. Wurarah et al. (2021) looked at eco-industrial development in West Papua and suggested a way to achieve long-term economic growth while causing the least environmental damage. Ramandey et al. (2023) talked about how economic activities in West Papua hurt mangrove ecosystems, which shows how important it is to have a balanced development plan. Wehantouw et al. (2021) look into low-carbon energy methods in West Papua and push for renewable energy to help the economy grow sustainably. These studies stress how important it is for economic strategies to include new technologies and environmentally friendly methods to balance growth with protecting the environment.

Another critical focus is community participation in climate change adaptation efforts. The study by Wang and Zhao (2021) shows that rural communities in developing countries face problems due to climate change and its variability. Therefore, local governments should fund participatory programs such as the Climate Village Program (PROKLIM) to increase community participation in adaptation. Education is also very important in climate change mitigation and adaptation. Zukmadini et al. (2024) highlighted that climate change impacts many things, such as rainfall patterns, frequency of extreme weather, and sea level rise. Therefore, spending money on education about climate change mitigation and adaptation, such as watching documentaries, can help improve people's understanding of the issue and prepare them to deal with the impacts of climate change. In addition, Suwarto and Nasrullah (2011) pointed out that climate change can affect tourists' choices for

specific destinations. Therefore, local governments should consider allocating the necessary budget to develop adaptation strategies in the tourism industry so that tourist destinations in West Papua and Southwest Papua remain attractive amidst climate change.

Strategies to adapt coastal communities to the impacts of climate change are essential for the sustainability of local ecosystems. According to Ramadhan et al. (2024), the activities of coastal communities, such as anglers, can be affected by unpredictable weather changes. As a result, budgets allocated to adaptation programs for coastal communities, such as establishing early warning systems and disaster preparedness training, can help reduce their vulnerability to climate change. Farmer participation is essential in facing the challenges of climate change. According to Cilas and Bastide (2020), climate change can cause an increase in cocoa plant pests and diseases, reducing cocoa production in the country. Therefore, budget sharing for climate change adaptation training and education programs for cocoa farmers in West Papua and Southwest Papua can help increase farmers' resilience to climate change impacts.

As a result of various studies, it can be concluded that climate change significantly impacts many things in West Papua and Southwest Papua, such as tourism, agriculture, and the sustainability of local ecosystems. Local governments need to optimize budgets to develop effective mitigation and adaptation strategies, engage community participation, and improve education on climate change. Although many studies have examined the impacts of climate change in West Papua and Southwest Papua, there are still gaps in understanding the effectiveness of mitigation and adaptation strategies implemented by local governments. Research has focused on specific aspects, such as environmental or social impacts in isolation, while comprehensive analysis of budget optimization and cross-sector policy integration is limited. In addition, little research has explored the role and challenges local governments face in effectively implementing these strategies on the ground.

In order to fill this research gap by analyzing the budget optimization strategies used by the government to address climate change impacts in the region, it is necessary to explore the initiatives undertaken, the challenges faced, and the potential for future improvements to achieve greater sustainability. For this reason, this research is intended to analyze the budget optimization strategies used by the government to address the impacts of climate change in the region and explore the various initiatives that have been carried out to achieve better sustainability. These research questions are expected to provide a comprehensive understanding of the strategies and policies implemented and their effectiveness in mitigating the impacts of climate change in West Papua and Southwest Papua.

2. Methods

This research uses a qualitative approach with a case study method to examine local government policies dealing with climate change in West Papua and Southwest Papua (Bird's Head region of Papua). These two regions were chosen because funding from the state budget is still under the coordination of the West Papua Provincial Treasury Office and is a newly enlarged region. A qualitative approach was chosen to provide an in-depth understanding of these regions' specific contexts and the complexities of climate policy. The case study method examined local government policies in detail to comprehensively understand the mitigation and adaptation strategies implemented.

Data in this study were obtained through various data collection techniques, including in-depth discussions with local government officials who are directly involved

in the formulation and implementation of climate change policies and analysis of policy and budget documents. Interviews were semi-structured to allow for a more flexible exploration of officials' views and experiences. Documents analyzed included local action plans, policy implementation reports, and relevant laws and regulations.

The data analysis process was conducted using the Miles and Huberman interactive model, which consists of four main stages: data collection, data reduction, data presentation, and conclusion drawing/verification. Information was collected continuously through interviews and documents in the data collection stage. Each interview was recorded (with the respondent's permission) and transcribed for further analysis. The data reduction stage involved selecting, focusing, simplifying, and transforming raw data into a more organized and meaningful form. Coding was used to identify key themes or categories from the data. Irrelevant or repetitive data was eliminated to capture the essence of the information collected. Furthermore, the reduced data was presented as narratives, tables, and diagrams to facilitate interpretation. Good data presentation allows researchers to see patterns, relationships, and trends in the data, making it easier to draw informative conclusions.

Conclusion involves interpreting the data presented to identify meanings, patterns, and major themes. Initial conclusions were verified to ensure their validity and reliability. Verification was done through data triangulation, rechecking with sources of information (member check), and discussion with fellow researchers.

In order to ensure the validity and reliability of the research, several additional steps were taken, including data triangulation by using multiple data sources, member check by involving respondents in the process of verifying interview results, audit trail by keeping detailed notes regarding the data collection and analysis process, and peer debriefing by discussing findings with peers to gain additional input and perspectives.

3. Results and Discussion

The budget allocation for climate change mitigation and adaptation in West Papua experienced significant changes from 2023 to 2024. In 2023, the budget for climate change mitigation amounted to Rp79,051,495,000, down 39.70% to Rp47,667,224,000 in 2024. In contrast, the budget for climate change adaptation increased from Rp1,334,377,000 in 2023 to Rp2,173,202,000 in 2024, representing an increase of 62.86%. This shift decreased the total climate change budget from Rp80,385,872,000 in 2023 to Rp49,840,426,000 in 2024, or a decrease of 38.00%. Despite an increase in the adaptation budget, a substantial decrease in the mitigation budget led to a decrease in the overall climate change budget in 2024.

Different vulnerabilities to environmental hazards, such as climate change, are influenced by various social, economic, historical, and political factors acting at different scales. These factors play an essential role in determining how communities and regions respond to and cope with the impacts of climate change. Understanding these different vulnerabilities is critical to designing effective mitigation and adaptation strategies tailored to specific contexts, such as the recent changes to budget allocations for climate change initiatives in West Papua (Ameray et al., 2023). In addition, carbon exchange between vegetation and the atmosphere is critical in determining regional climate patterns and the global carbon budget. Changes in forest composition, as highlighted in studies focusing on boreal forests, can impact carbon sequestration and climate change mitigation efforts. Therefore, shifting budget allocations towards adaptation, as seen in West Papua, may impact ecosystem dynamics and carbon cycle processes, thus affecting the effectiveness of climate change initiatives in the region (Nurhasan et al., 2021).

In West Papua, efforts towards sustainable food systems and agroforestry practices are critical to improving food security, resilience, and climate change adaptation among indigenous communities. Initiatives such as modified agroforestry practices increase local incomes and food security and support environmental conservation and low-carbon development strategies. These approaches align with the broader goals of climate change mitigation and adaptation, emphasizing the linkages between socio-economic and environmental factors in addressing climate challenges (Tuturop et al., 2022). Furthermore, the need for a low-carbon development strategy in the forestry sector in West Papua underscores the importance of integrating climate-friendly practices into land use and resource management. Sustainable forestry practices contribute to reducing greenhouse gas emissions and support biodiversity conservation and ecosystem resilience. By promoting sustainable forestry practices, regions like West Papua can improve climate resilience and contribute to global efforts to combat climate change (Indouw et al., 2022).

Global climate change indicators highlight the alarming trend of greenhouse gas emissions and their impact on the climate system. High greenhouse gas emissions and declining aerosol cooling contribute to rapid planetary warming. These trends underscore the urgency of implementing effective mitigation measures and transitioning to a low-carbon development pathway to address the worsening climate crisis. Findings from global climate indicators emphasize the need for urgent action to reduce emissions and limit the adverse impacts of climate change (Bustamante et al., 2023).

In urban areas with Mediterranean climates, the intersection of climate change and health poses significant challenges that require holistic and equity-oriented approaches. Understanding the complex relationships between climate change drivers, environmental impacts, health outcomes, and policy responses is critical to developing comprehensive mitigation and adaptation strategies. By adopting a social and climate justice framework, policymakers can address inequities exacerbated by climate change and promote resilient and healthy urban environments. This approach is particularly relevant in regions such as West Papua, where climate-related hazards disproportionately affect vulnerable communities (Marí-Dell'Olmo et al., 2022).

The change in budget allocation for climate change mitigation and adaptation in West Papua from 2023 to 2024 reflects a shift in focus towards increased adaptation efforts, while there is a decrease in mitigation funding. This change underscores the need for a balanced approach considering mitigation and adaptation strategies to effectively address climate change impacts. By integrating sustainable practices, promoting low-carbon development, and prioritizing community resilience, regions like West Papua can increase their capacity to address climate challenges and contribute to global climate action.

3.1. Climate Change Budget Allocation

Comparison of budget allocations for climate change mitigation and adaptation in West Papua and Southwest Papua in 2023 and 2024. In 2023, the budget for climate change mitigation reached around Rp79.05 trillion but decreased significantly to around Rp47.67 trillion in 2024. This 39.70% decrease can be caused by several factors, such as the completion of large mitigation projects, increased efficiency of program implementation, or a shift in budget priorities to areas of greater need, as shown in Figure 1.

On the other hand, the budget for climate change adaptation in 2023 amounted to Rp1.33 trillion and increased significantly to around Rp2.17 trillion in 2024. This

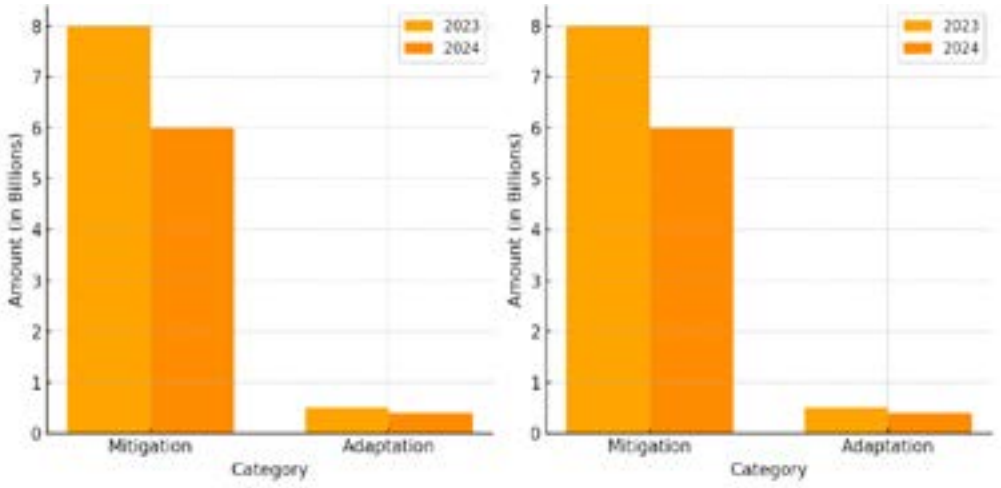

Figure 1. Budget Allocation for Climate Change Mitigation and Adaptation

62.86% increase reflects the local government's awareness of the importance of building resilience to climate change impacts. More significant investment in adaptation includes strengthening infrastructure, increasing community capacity, and developing climate risk management systems. This change in budget allocation indicates that local governments are thoroughly evaluating the effectiveness of existing programs. The decrease in the mitigation budget may result from higher efficiency or completion of previous projects. In contrast, the increase in the adaptation budget indicates a more significant shift in focus towards preparedness and resilience to climate change impacts.

Changes in local governments' budget allocations, notably for climate change mitigation and adaptation, show an in-depth assessment of the performance of existing initiatives. A decrease in the mitigation budget could be due to improved efficiency or the completion of prior projects. According to Suparman et al. (2021), effective and measurable budget execution is critical for ensuring that capital expenditure aligns with development goals and priorities. The increased budget for adaptation programs also indicates a shift in focus toward community resilience and preparedness in the face of climate change impacts, as highlighted by Sulista (2019), who emphasized the importance of sustaining community livelihoods in vulnerable areas, such as villages near tin mines in the Bangka Islands.

Additionally, transparency and accountability in budget management must be improved to ensure proper utilization. Wargadinata et al. (2022) stated the necessity of building e-government platforms to increase openness and accountability, which can help budget management in the climate change adaptation sector. Kartika (2017) also emphasized local governments' readiness to develop the Regional Innovation System (SIDa) plan, which can help create innovation and climate change adaptation readiness in diverse regions. Furthermore, Rahayu et al. (2022) emphasized the necessity of SWOT analysis-based methods for improving public services and government preparedness to tackle climate change problems, including more strategic budget management.

Furthermore, Wirawan et al. (2018) emphasizes the need for ongoing budget spending evaluation, stating that constant evaluation of the sustainability of local budget expenditure would ensure that fiscal policy stays effective and efficient in the long run. This evaluative strategy can ensure that budget allocations for climate change adaptation and mitigation stay relevant and on track while also reducing waste and increasing community resilience to climate change.

Studies show that an adaptive approach to climate policy allows local governments to respond more to changing climate conditions and dynamic local needs (Inderberg et al., 2015). In West Papua and Southwest Papua, continuous evaluation allows for identifying areas that require adjustments to strategies so that budget allocations can be directed more effectively (Smith, 2014). Balanced investment between mitigation and adaptation is essential. Mitigation reduces greenhouse gas emissions to mitigate the impacts of climate change, while adaptation increases the ability of communities to deal with these impacts. Research by Adger et al. (2005) shows that combining mitigation and adaptation strategies is the most effective approach to ensure long-term resilience. In West Papua and Southwest Papua, this combination can help reduce the risk of climate-related disasters and increase local capacity to deal with future climate challenges.

3.2. Climate Change Mitigation Programs

Climate change mitigation programs are a series of initiatives to reduce greenhouse gas emissions and increase carbon sequestration to combat global warming. The Mitigation Work Program (MWP), established at COP26 and further developed at COP27, aims to increase mitigation ambition through worldwide dialogue and investment-focused events. The program emphasizes coordination with existing initiatives to avoid duplication (Ellis et al., 2020).

Mitigation remains critical to addressing climate change, driven by scientific, economic, and moral imperatives (Gardiner, 2004). Mitigation programs often leverage multiprogram economies of scope and production to optimize mitigation and adaptation efforts, recognizing their nature as public goods and the need for government intervention (Lilford et al., 2021). Sub-national initiatives, such as the Covenant of Mayors, require comprehensive greenhouse gas emissions inventories to monitor and scale up local mitigation efforts effectively (Sporchia et al., 2023).

In regions such as the Democratic Republic of Congo and South Africa, strategies in the forestry and energy sectors are critical, given the role of forests in carbon sequestration and the need for low-carbon energy sources (Akanwa & Joe-Ikechebelu, 2019). Innovative models, including photosynthetic biomass density and direct air capture technologies, promise to reduce atmospheric carbon dioxide levels (Achimugwu et al., 2023). Machine learning is increasingly recognized for its potential to predict environmental events and optimize mitigation strategies, contributing to achieving sustainable development goals (Zennaro et al., 2021). Programs such as REDD+ encourage forest conservation in developing countries by creating financial value for stored carbon, thereby reducing deforestation and forest degradation (Conway, 2022; Martin, 2020). Overall, effective climate change mitigation requires a blend of international cooperation, innovative technologies, and comprehensive policy frameworks to address the complex and global nature of the problem.

In West Papua and Southwest Papua in Fig 2, several climate change mitigation programs such as Navigational Aids, Ecosystem Restoration in Conservation Areas, Marine Vessels, Wastewater and Waste Management Systems, and Land and Forest Fire Prevention have varying budget allocations. For example, the budget for Aids to Navigation increased from Rp12,604,906,000 in 2023 to Rp20,559,352,000 in 2024. In contrast, the budget for Ecosystem Restoration in Conservation Areas decreased from Rp9,091,550,000 in 2023 to Rp5,342,205,000 in 2024. In other regions, such as West Java, budget allocations for climate change mitigation also show similar variations. For example, the reforestation and afforestation program in West Java received a 15% increase in budget from the previous year, while the program to reduce

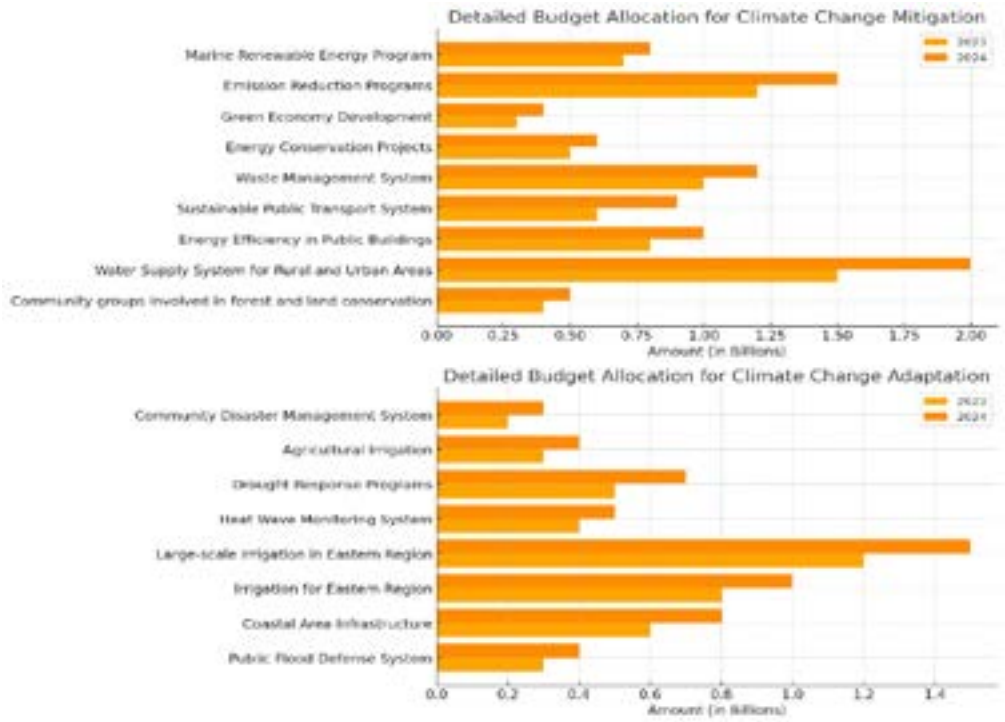

Figure 2. Climate Mitigation and Adaptation Program

emissions from industry decreased by 10% because it had reached specific efficiency targets (Barnett & O'Neill, 2010).

For climate change adaptation programs in Figure 2, West Papua and Southwest Papua have several programs such as Piped Irrigation, Applied Climate Information Services in the Region, Large Pump Irrigation Eastern Region, Community for Climate, and Capacity Improved Watershed Care Forum. The budget for Piped Irrigation was removed in 2024 after receiving Rp510,695,000 in 2023, while the Eastern Region Large Pump Irrigation saw an increase in funding from Rp201,000,000 in 2023 to Rp961,529,000 in 2024.

Bali's budget allocation for climate change adaptation focuses on coastal protection and clean water management programs. Bali's coastal protection program received a 20% increase in budget to build more wave protection infrastructure. At the same time, the clean water management program also saw an increase in funding to ensure that the water supply remains secure amidst changing rainfall patterns due to climate change. This shows that the focus of budget allocation in Bali is more on protection against the direct impacts of climate change felt by coastal communities.

Overall, budget allocations for climate change mitigation and adaptation in West Papua and Southwest Papua and other regions in Indonesia, such as West Java and Bali, show that each region adjusts budget priorities based on local needs and program evaluation. West Papua and Southwest Papua focus more on shipping navigation, ecosystem restoration, and water management. In contrast, regions such as West Java and Bali focus more on reforestation, industrial emission reduction, coastal protection, and clean water management. This budget adjustment is essential to ensure the program's effectiveness in dealing with climate change impacts according to the characteristics and needs of each region.

Budget allocations for climate change mitigation and adaptation in regions like West Papua, Southwest Papua, West Java, and Bali reflect tailored approaches based on local needs and program evaluations. West Papua and Southwest Papua prioritize maritime navigation, ecosystem restoration, and water management, while

West Java and Bali focus more on reforestation, industrial emission reduction, coastal protection, and clean water management. This budget adaptation is critical to ensure program effectiveness in addressing climate change impacts specific to each region (Ebi, Hasegawa, et al., 2018). Addressing climate change requires a multifaceted approach, including assessing vulnerability and exposure to climate-related hazards, understanding current impacts and projected risks, and improving adaptation processes and health system resilience (Zennaro et al., 2021). By considering these aspects, regions can customize their strategies to combat the impacts of climate change effectively.

In the Indonesian context, particularly in West Java and Bali, the emphasis on reforestation, emission reduction, coastal protection, and water management aligns with the need to mitigate climate change impacts and enhance resilience (Ebi, Hasegawa, et al., 2018). These strategies are critical for conserving ecosystems, ensuring sustainable resource management, and protecting communities from the adverse impacts of climate change. Furthermore, community engagement is crucial in climate change initiatives, as evidenced by the importance of well-planned and implemented engagement strategies in effective climate mitigation and adaptation programs (Serrao-Neumann et al., 2015). Engaging local communities can foster ownership of initiatives, encourage sustainable practices, and increase the overall success of climate-related projects.

Integrating energy efficiency, renewable energy, demand response, and climate change considerations signal a paradigm shift in energy policy-making towards a more climate-conscious approach (Mersmann et al., 2014). This holistic view recognizes the linkages between energy systems and climate change and underscores the importance of aligning energy policy with emissions reduction goals. In evaluating climate change adaptation programs, it is crucial to consider factors such as local adaptive capacity, health impacts, and effectiveness of implemented strategies (Kowalcyk & Dorevitch, 2024). By assessing these elements, regions can measure the success of their initiatives and make informed decisions to improve their resilience to climate change. In addition, implementing programs such as the Climate Village Program (ProKlim) shows the importance of community empowerment in climate change mitigation efforts (Gunawati & Rejekiningsih, 2020). Empowering local communities to take action builds resilience and fosters a sense of ownership and responsibility for environmental sustainability.

Incorporating environmental education into curricula and awareness programs can significantly influence knowledge, attitudes, and practices related to climate change (Ghazy & Fathy, 2023; Torres-Bejarano et al., 2020). By educating students and communities about environmental issues, sustainable practices, and the importance of climate action, communities can develop a culture of environmental stewardship and encourage positive behavior change. A case study in Vietnam highlights the complexity of considering climate change and its interactions with other risks in the evaluation process (Lam et al., 2023). Understanding these linkages is critical to developing comprehensive strategies that simultaneously address multiple challenges and build resilience to increasing risks.

Budget allocations for climate change mitigation and adaptation in regions like West Papua, Southwest Papua, West Java, and Bali reflect a nuanced approach tailored to local needs and program evaluation. By focusing on specific priorities such as maritime navigation, ecosystem restoration, reforestation, and emission reduction, these regions aim to address climate change impacts effectively. Community engagement, integration of energy efficiency, and community empowerment are critical components

in successful climate change initiatives, emphasizing the importance of a holistic approach to combat climate change.

West Papua and Southwest Papua governments have implemented various policies and programs to mitigate and adapt to climate change. The policies include sustainable natural resource management, which involves sustainable forest and land management to prevent deforestation and land degradation. The program involves local communities in forest conservation and agroforestry development. In addition, the government also focuses on strengthening infrastructure by developing green infrastructure resilient to natural disasters, such as flood retaining walls and efficient irrigation systems. The development of sustainable agriculture is also a priority, with the application of climate change-adaptive agricultural technologies, including drought-resistant crop varieties and conservation farming techniques. Emission monitoring and reduction are also implemented through greenhouse gas emission monitoring programs and emission reduction using renewable energy.

Budget optimization in climate change mitigation and adaptation initiatives is achieved through smart and effective resource allocation. Integrating climate change budgets into local development budgets is crucial to ensuring financing sustainability and spending efficiency. Partnerships with foreign agencies, non-governmental organizations, and the commercial sector give additional money and technological support, allowing environmental programs to be sustainable (Nurfindarti, 2019). Furthermore, as Koeswara (2016) suggests, careful supervision and periodic evaluation of ongoing initiatives are critical to ensuring budget efficiency and preventing corruption.

Transparency and accountability in climate change fund management are further enhanced, in line with Dwijatenaya and Dewi's (2016) research on the role of social capital in the Adipura environmental program, which emphasizes the importance of community participation in maintaining clean fund management. On the other hand, the increased budget for climate change adaptation programs emphasizes the importance of community readiness and resilience, as highlighted by Herdiansyah et al. (2018) in their study on Bajo fishermen's adaption tactics to climate change. As a result, successful management of climate change and sustainable development requires an integrated, efficient, and transparent financial plan.

The strategies implemented by the governments of West Papua and Southwest Papua demonstrate a strong commitment to dealing with the impacts of climate change. Budget optimization through integration, partnership, spending efficiency, and transparency has positively impacted mitigation and adaptation efforts. The success of this strategy can serve as a model for other regions facing similar challenges. This government strategy certainly requires support from the private sector to accelerate the implementation of climate programs such as renewable energy and green infrastructure with additional investment, technological innovation, and private sector collaboration; even the private sector can encourage transparency and increase environmental awareness through their social responsibility. This will ultimately strengthen the region's positive impact of climate change plans.

4. Conclusion

The government has implemented policies and initiatives prioritizing mitigation and adaptation to address climate change effectively. Implementing policies focused on sustainable natural resource management, the enhancement of green infrastructure, the promotion of sustainable agriculture, and the diligent monitoring and reduction of greenhouse gas emissions exemplify a firm dedication to safeguarding the environment

and enhancing resilience against climate change. One way to optimize the budget is by incorporating the climate change budget into the regional development budget. This may be achieved by establishing stakeholder partnerships, ensuring efficient spending, and enhancing openness and accountability. These strategic measures are anticipated to guarantee the optimal utilization of resources to accomplish climate change mitigation and adaptation objectives while promoting local populations' well-being in confronting the challenges posed by climate change.

The allocation of funds towards climate change mitigation and adaptation in West Papua and Southwest Papua demonstrates commendable endeavors in addressing intricate environmental obstacles. The money allocated for mitigation projects, such as sustainable natural resource management, enhancing green infrastructure, promoting sustainable agriculture, and monitoring and lowering greenhouse gas emissions, has been streamlined to ensure effective and efficient outcomes. The budget optimization is achieved by incorporating the climate change budget into the regional development budget, fostering collaboration with diverse organizations and sectors, enhancing expenditure efficiency, and ensuring transparency and accountability in fund administration. While budget allocation may vary depending on local goals and program evaluation, these strategic approaches aim to enhance regional resilience to climate change impacts and promote environmental sustainability and community welfare.

Numerous strategic initiatives must be implemented to ensure the long-term viability and effectiveness of climate change mitigation and adaptation programs in West and Southwest Papua. First, it is critical to enhance local institutional capacity by providing ongoing training and education to government officials and local people on the most recent mitigation and adaptation strategies. Second, there is a need to improve data integration and climate change monitoring, which can be accomplished by creating an integrated geographic information system to monitor and evaluate the success of ongoing projects. Furthermore, local governments should continue to form and strengthen partnerships with the business sector, non-governmental organizations, and international institutions to mobilize additional resources and innovative technology to support mitigation and adaptation efforts.

Furthermore, budget efficiency should be maintained by regular audits and independent evaluations to ensure that funds are used optimally and by defined goals. Transparency and accountability in fund management can also be increased by making budget allocations and using information available to the public. Furthermore, there is a need to diversify funding sources by looking into innovative financing methods, including payment for ecosystem services (PES) schemes and green bonds, which can provide long-term funding streams for environmental projects.

Reliance on external funding sources through mechanisms such as payments for ecosystem services and green bonds can be risky if support is inconsistent. On the other hand, local community empowerment programs such as sustainable agriculture and small-scale renewable energy require ongoing assistance to maintain sustainability. Future research should focus on analyzing the capacity of local institutions in budget oversight, studying technological solutions for information access in remote areas, assessing the effectiveness of innovative financing schemes such as PES and green bonds, and evaluating the long-term impact of community empowerment programs on the resilience and economic well-being of local communities.

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