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GREEN PUBLIC FINANCIAL MANAGEMENT: INTEGRATING ENVIRONMENTAL METRICS INTO GOVERNMENT BUDGET REPORTING

Rita J D Atarwaman*[1]
Universitas Hasanuddin, Indonesia
Email: rita.atarwaman72@gmail.com

Nirwana
Universitas Hasanuddin, Indonesia

Aini Indirajawati
Universitas Hasanuddin, Indonesia

Abstract

Green Public Financial Management (PPM) is a strategic approach to public financial management that integrates environmental considerations into the entire fiscal policy cycle, particularly in the budgeting and government financial reporting processes. This study aims to systematically examine the concept, framework, and practice of integrating environmental metrics into government budget reporting through a literature review. This study analyzes various scientific publications, international agency reports, and policy documents relevant to the implementation of Green PFM in various countries. The results indicate that integrating environmental metrics, such as carbon emissions, energy efficiency, and natural resource management indicators, into government budget reporting has the potential to improve fiscal transparency, public accountability, and policy consistency between economic development goals and environmental sustainability. However, the implementation of Green PFM still faces several challenges, including limited institutional capacity, the lack of environmental measurement standards integrated with public accounting systems, and the complexity of cross-sector coordination. This study concludes that strengthening the regulatory framework, developing adaptive financial information systems, and improving human resource competencies are essential prerequisites for the successful integration of environmental metrics into government budget reporting. This study is expected to provide a conceptual contribution to the development of public finance policies oriented towards sustainable development.

Keywords: Green Public Financial Management, government budget reporting, environmental metrics, sustainable public finance

[1] Correspondence author

INTRODUCTION

The research background for Green Public Financial Management: Integrating Environmental Metrics into Government Budget Reporting stems from growing global awareness of the limitations of natural resources and the serious impacts of climate change on the economic, social, and fiscal stability of countries. In recent decades, governments around the world have faced increasing pressure not only to achieve economic development targets but also to ensure that the development process is sustainable and environmentally friendly. This challenge has driven a paradigm shift in public financial management, from one solely focused on fiscal efficiency and budget compliance to one that integrates environmental dimensions as an integral part of budget decision-making. It is in this context that the concept of Green Public Financial Management (GPFM) becomes relevant as a framework that seeks to link environmental policies with government financial planning, budgeting, implementation, and reporting systems.

Traditionally, public financial management systems have been designed to ensure budget discipline, accountability in the use of public funds, and the achievement of short-term economic and social goals. However, this approach often ignores the environmental costs of development activities, such as ecosystem degradation, pollution, and overexploitation of natural resources. These costs are not explicitly reflected in government budget reports and financial statements, creating an information gap between fiscal performance and the environmental impact of public policies. As a result, budget decisions have the potential to create the illusion of fiscal efficiency, while in the long run creating a greater environmental and fiscal burden for future generations. Integrating environmental metrics into government budget reporting is seen as one solution to close this gap by providing more comprehensive and relevant information to policymakers (Petrie, 2025a).

The push to adopt GPFM is also inseparable from international commitments to the sustainable development agenda, particularly the Sustainable Development Goals (SDGs) (Göksu, 2022a). International organizations such as the Organisation for Economic Co-operation and Development and the United Nations actively encourage member states to integrate environmental and climate considerations into national budgeting processes. Initiatives such as green budgeting, climate budget tagging, and environmental fiscal reform demonstrate a global shift toward greener and more long-term-oriented public financial management (Nurfadila, 2024a). However, the level of adoption and depth of implementation of these practices

still vary widely across countries, particularly between developed and developing countries, which face limitations in institutional capacity, data, and human resources.

In practice, integrating environmental metrics into government budget reporting is not a simple process. Environmental metrics encompass a wide range of indicators, from greenhouse gas emissions and energy and water use to the impact of policies on biodiversity. The main challenge lies in translating these indicators into fiscal language that can be understood and used effectively in the budget decision-making process. Without a clear methodology and consistent reporting standards, integration efforts risk becoming merely an administrative formality with no substantive impact on the quality of public policy (Isi et al., 2022a). Therefore, research that explores the conceptual framework and practices of integrating environmental metrics into budget reporting is crucial to identify the most effective and contextual approaches.

In developing countries, including Indonesia, the urgency of implementing GPFM is increasing due to high dependence on natural resources and vulnerability to the impacts of climate change. Natural disasters, environmental degradation, and pressure on ecosystems not only impact public welfare but also pose significant fiscal risks to governments. Without a budgeting and reporting system capable of capturing these environmental risks, fiscal policy has the potential to be reactive and less adaptive to long-term challenges. Integrating environmental metrics into budget reporting is expected to help governments identify environmental-related fiscal risks earlier, design more effective mitigation policies, and increase transparency and accountability to the public (Manes Rossi et al., 2025).

Furthermore, from a governance perspective, GPFM plays a crucial role in strengthening the link between policies, budgets, and sustainable development outcomes. Budget reporting that incorporates environmental information allows stakeholders, including parliaments, oversight bodies, and civil society, to assess the extent to which the government's environmental commitments are reflected in budget allocations and realization (Zapata & Daniela, 2024). This has the potential to improve the quality of public oversight and encourage the government to be more consistent in implementing sustainable development principles (Moser-Plautz & Korac, 2025). However, without an adequate understanding of the concepts, mechanisms, and challenges of GPFM implementation, this potential is difficult to realize optimally.

Based on this description, it can be concluded that research on Green Public Financial Management, focusing on the integration of environmental metrics into government budget reporting, has high academic and practical relevance. Academically, this research contributes to the development of literature in the fields of public sector accounting and sustainable public finance by offering a deeper understanding of the relationship between the fiscal system and environmental performance. Practically, the research findings are expected to serve as a reference for policymakers in designing and implementing budgeting and reporting systems that are more responsive to environmental challenges. Thus, this research not only addresses theoretical needs but also supports the government's concrete efforts to realize sustainable, transparent, and fiscally and ecologically responsible development.

RESEARCH METHOD

This research uses a literature review method with a qualitative approach to analyze the concept and practice of Green Public Financial Management (GPFM), particularly in the context of integrating environmental metrics into government reporting and budgeting. The literature review was conducted by exploring various relevant scientific sources, including reputable international journal articles, academic books, international organization reports, and public policy documents discussing public financial management, public sector accounting, fiscal sustainability, and green budgeting. The literature search process was conducted through scientific databases such as Scopus, Web of Science, and Google Scholar using keywords related to green budgeting, environmental fiscal policy, sustainability reporting in the public sector, and environmental performance indicators. The selected literature was limited to publications directly relevant to the research objectives and published within a timeframe reflecting the latest developments in sustainable public finance policy.

The analytical stages in this research include identifying, classifying, and synthesizing key findings from the selected literature. Each source was critically analyzed to assess the conceptual framework, methodological approach, and empirical results related to the application of environmental metrics in government budgeting and reporting systems. Next, a thematic synthesis was conducted to integrate various perspectives and previous research findings to build a comprehensive understanding of the mechanisms, benefits, and challenges of implementing Green Public Financial Management. Through this

approach, the research is expected to produce a systematic conceptual framework and provide a strong theoretical foundation for developing public financial management policies that are more oriented towards environmental sustainability.

RESULT AND DISCUSSION

Green Budgeting and Climate Budgeting in International Practice

Over the past two decades, various countries have begun to recognize that environmental and climate policies are not simply outlined in strategic documents or political commitments but must be effectively integrated into public budgeting frameworks. Green Budgeting and Climate Budgeting have emerged as innovative approaches to public financial management that aim to align fiscal policy with sustainable development goals, environmental protection, and climate change mitigation and adaptation (Petrie, 2021). In international practice, these two approaches have developed alongside encouragement from multilateral institutions and international organizations, such as the Organisation for Economic Co-operation and Development, which actively promote environmentally-based budgeting reforms as part of modern fiscal governance.

Green Budgeting, in the international context, is generally understood as a systematic process for identifying, measuring, and evaluating the environmental impacts of fiscal policies and government budget allocations. Developed countries such as France, Germany, and the Nordic countries have adopted relatively comprehensive Green Budgeting frameworks that integrate environmental impact assessments into the annual budget cycle. In France, for example, the government has implemented green budget tagging, which classifies each budget item based on its contribution to environmental goals, whether positive, neutral, or negative. This practice allows policymakers and the public to transparently assess the extent to which the state budget supports the transition to a green economy. At the regional level, the European Union also plays a significant role through the implementation of climate mainstreaming in the EU budget, where a certain percentage of the total budget is required to be allocated to climate and environmental objectives (Kete, 2022).

Meanwhile, climate budgeting is a more specific approach focused on climate change issues, both in terms of mitigating greenhouse gas emissions and adapting to climate impacts (Marinheiro et al., 2024). Internationally, climate budgeting is often linked to a country's commitment to the Paris

Agreement and its Nationally Determined Contributions (NDC) targets. Countries such as Mexico, Nepal, and Bangladesh have developed climate budget tagging to track government spending relevant to climate action. This approach helps governments identify climate finance gaps, improve the effectiveness of public spending, and strengthen accountability to the public and the international community. In many cases, climate budgeting is also supported by collaboration with international institutions such as the United Nations Development Programme, which provides technical assistance in developing methodologies and institutional capacity.

Green budgeting and climate budgeting practices across countries show significant variation, depending on the fiscal capacity, institutional structure, and level of political commitment of each government (Astorg, 2021). In countries with established and transparent budget systems, integrating environmental aspects into budgeting is relatively easy. Conversely, in developing countries, the main challenges often lie in limited data, human resource capacity, and inter-agency coordination. Nevertheless, international experience shows that even a simple approach such as climate-based budget labeling can be an effective first step in increasing awareness and consistency of fiscal policy on environmental issues (Azzahra et al., 2022).

From a public governance perspective, the implementation of Green Budgeting and Climate Budgeting also has important implications for the fiscal decision-making process. With clearer information on the environmental and climate impacts of public spending, the government is expected to prioritize budgets more rationally and sustainably. Furthermore, this practice strengthens transparency and public participation, as citizens and stakeholders can assess the extent to which the government's commitment to the green agenda is translated into actual budget allocations. In some countries, Green Budgeting reports are even published alongside state budget documents, thus becoming an integral part of the fiscal accountability process (Aydin et al., 2023).

Overall, international practices of Green Budgeting and Climate Budgeting demonstrate that public budgeting can be a strategic instrument in addressing environmental challenges and climate change. While approaches, methodologies, and levels of implementation vary, a common thread is the effort to align fiscal policy with long-term sustainable development goals. The experiences of countries around the world provide an important lesson: the success of Green Budgeting and Climate Budgeting depends not only on the technical framework but also on political commitment, institutional capacity,

and a governance culture that supports transparency and sustainability. This international learning provides a valuable reference for other countries, including Indonesia, in developing a public budgeting system that is more responsive to global environmental challenges.

The Role of Environmental Tagging and Budget Classification in Harmonizing Green Public Financial Management

Green Public Financial Management essentially requires not only environmentally friendly budget allocations but also a budgeting system capable of identifying, tracking, and evaluating the environmental impacts of each fiscal policy. In this context, environmental tagging and budget classification serve as key instruments bridging environmental policy objectives with technical budgeting practices, thus harmonizing green-oriented public financial planning, budgeting, implementation, and reporting (Petrie, 2025b).

Environmental tagging is a mechanism for marking or labeling government activities and expenditures based on their relevance to environmental and climate goals. Through this approach, each program and activity in the budget can be categorized as having a positive, neutral, or even negative impact on the environment. The primary role of environmental tagging in Green Public Financial Management lies in its ability to increase the visibility of green spending in the government budget (Pizarro et al., 2021a). Without a clear tagging system, environmental spending is often scattered across various ministries and sectors, making it difficult to identify in aggregate. With environmental tagging, the government can obtain a comprehensive overview of the extent to which the state budget supports the transition to low-carbon development and environmental protection.

Furthermore, environmental tagging serves as a strategic tool to align fiscal policy with national and international environmental commitments, such as greenhouse gas emission reduction targets and climate change adaptation. Internationally, many countries have developed climate budget tagging as part of their environmental tagging program to ensure that budget policies align with global climate commitments, which are also promoted by international institutions such as the OECD and the World Bank. Through consistent tagging, the government can monitor the budget's contribution to climate targets and evaluate the effectiveness of such spending over time. This demonstrates that environmental tagging is not merely an administrative instrument but also a policy tool that strengthens fiscal accountability and transparency (Guariso et al., 2023).

However, the effectiveness of environmental tagging depends heavily on the budget classification system used. Budget classification is a basic structure that groups government revenue and expenditure based on function, organization, program, and economic type. A sound budget classification allows fiscal data to be presented in a consistent, standardized, and easily analyzed manner (Göksu, 2022b). In the context of Green Public Financial Management, budget classification plays a crucial role in ensuring that environmental tagging information can be systematically integrated into the national budgeting framework. Without adequate classification, environmental tagging risks becoming isolated, supplementary information that is difficult to use in fiscal decision-making.

The role of budget classification in harmonizing Green Public Financial Management is evident in its ability to link environmental objectives with existing budget structures. By integrating environmental dimensions into budget classification, the government can ensure that green spending does not stand alone but becomes an integral part of the overall public financial management system. For example, when the functional classification of the budget reflects sectors such as energy, transportation, and the environment, environmental tagging can be applied consistently to each of these functions. This enables cross-sectoral analysis of the environmental impacts of fiscal policy and supports inter-ministerial coordination in implementing the green agenda (Hurriyati et al., 2024).

Harmonization between environmental tagging and budget classification also contributes to improving the quality of medium-term planning and budgeting. Within the medium-term expenditure framework, tagging information integrated into the budget classification can be used to assess the fiscal sustainability of environmental policies. The government can identify green spending trends, assess funding gaps, and design budget priorities that are more consistent with sustainable development goals. Thus, this harmonization not only impacts transparency but also the effectiveness of public resource allocation.

Furthermore, the role of environmental tagging and budget classification in Green Public Financial Management is also evident in the reporting and performance evaluation stages. Standardized budget classification allows tagging data to be presented systematically in government financial reports and can be compared across periods. This supports strengthened public accountability, as stakeholders, including parliament and the public, can assess the extent to which the government is meeting its environmental commitments

through its budget policies. Environmental tagging integrated with budget classification also facilitates performance audits and impact evaluations, enabling the government to make evidence-based policy improvements.

Internationally, the harmonization of environmental tagging and budget classification is often seen as a crucial foundation for the success of Green Public Financial Management. Countries that successfully integrate these two instruments generally have a strong budgetary framework, adequate institutional capacity, and a clear political commitment to the environmental agenda. This harmonization enables the creation of a common language among policy planners, budget managers, and program implementers, enabling environmental objectives to be effectively translated into day-to-day fiscal decisions.

Harmonization of Green Public Financial Management with International Public Sector Accounting Standards (IPSAS)

Harmonization of Green Public Financial Management (GPFM) with International Public Sector Accounting Standards (IPSAS) is a strategic step in strengthening accountability, transparency, and sustainability in public financial management amidst increasing global pressure on climate change and environmental degradation. GPFM developed as an approach that integrates environmental and climate considerations into the entire state financial management cycle, from planning and budgeting to implementation, to fiscal reporting and evaluation (Schmidthuber et al., 2022). On the other hand, IPSAS, as an international public sector accounting standard, provides an accrual-based reporting framework aimed at improving the quality of government financial information, making it more reliable, comparable, and relevant for decision-making. Harmonization of these two frameworks is crucial because the success of GPFM depends heavily on accounting and reporting systems that capture, measure, and disclose fiscal and environmental impacts in an integrated manner (Thomas et al., 2017).

Conceptually, GPFM and IPSAS share strong common ground in the principles of transparency and public accountability. IPSAS, developed by the International Public Sector Accounting Standards Board under the auspices of the International Federation of Accountants, emphasizes the fair, complete, and bias-free presentation of financial information, enabling stakeholders to comprehensively assess the financial position, performance, and cash flows of public sector entities. This principle aligns with the objectives of the Public Sector Accounting Standards Board (GPFM), which seeks to ensure that the

allocation and use of public resources is not only economically efficient but also environmentally responsible. Through harmonization, accounting standards are no longer understood solely as financial record-keeping tools, but rather as strategic instruments to support green policies and the transition to sustainable development (Almagtome & Mohammed, 2024).

The harmonization of GPFM with IPSAS is also reflected in the approach to recognizing and measuring environmental assets, liabilities, and costs. The accrual-based IPSAS allows governments to recognize certain environmental assets, rehabilitation obligations, and provisions for liabilities arising from environmental damage or long-term climate commitments (Giosi, 2020). This framework provides a critical accounting foundation for GPFM to incorporate previously implicit or hidden environmental costs into government financial statements. Thus, fiscal decision-making can consider the full costs of a policy or project, including its long-term environmental impacts, thereby encouraging more sustainable and responsible policies.

Furthermore, this harmonization plays a crucial role in improving the quality of government environmental performance reporting. IPSAS encourages the disclosure of non-financial information relevant to the performance of public sector entities, particularly when such information has significant implications for their financial condition and fiscal sustainability. Within the GPFM framework, this disclosure can be expanded to include information on green spending, the effectiveness of climate change mitigation and adaptation policies, and fiscal risks arising from environmental disasters. Integrating financial and environmental reporting within a consistent framework will strengthen the credibility of government reports and increase public and investor confidence in the country's commitment to the sustainable development agenda (Brusca & Martínez, 2016).

The harmonization of GPFM and IPSAS also has significant institutional and governance implications. The implementation of IPSAS often requires accounting system reform, human resource capacity building, and strengthening of government financial information systems. When these reforms are aligned with the GPFM agenda, governments have the opportunity to build a more integrated public financial management system, where fiscal, environmental, and performance data are interconnected. This enables stronger, evidence-based policy formulation, particularly in responding to the cross-sectoral and long-term challenges of climate change. Furthermore, this harmonization also strengthens coordination between ministries and agencies,

as environmental issues are no longer viewed solely as a sectoral responsibility but as an integral part of national fiscal policy (Slama, 2024).

However, the harmonization of GPFM with IPSAS also faces several conceptual and practical challenges. One key challenge is the limitations of accounting standards in capturing the economic value of non-market environmental assets and services. Although IPSAS provides a relatively advanced recognition and measurement framework, many environmental aspects are still difficult to measure reliably in monetary terms. This situation requires the development of complementary methodologies and the use of credible non-financial information to achieve GPFM objectives without compromising the quality and reliability of reporting. Furthermore, differences in institutional readiness across countries also impact the effectiveness of harmonization, particularly in developing countries that are still in the early stages of IPSAS adoption.

Overall, the harmonization of Green Public Financial Management with International Public Sector Accounting Standards is a crucial foundation for transforming public financial management toward a more sustainable, transparent, and accountable direction. By integrating IPSAS principles and practices into the GPFM agenda, governments can strengthen their fiscal capacity to address environmental and climate risks while improving the quality of information for public decision-making. This harmonization is not only technical and accounting in nature, but also strategic, as it reflects the government's commitment to making environmental sustainability an integral part of modern public financial governance.

Technical Challenges of Integrating Environmental Metrics into the Government Budget System

For decades, the government budget system has been built on a focus on monetary-measured economic inputs, outputs, and outcomes. When environmental dimensions such as carbon emissions, ecosystem degradation, natural resource use, or air and water quality were introduced as part of budget performance indicators, fundamental challenges emerged related to paradigm alignment. Environmental metrics are multidimensional, long-term, and often lack a direct monetary value, making them difficult to align with the logic of annual budgeting, which emphasizes spending efficiency and fiscal discipline. This mismatch creates technical challenges in indicator design, baseline determination, and integration of environmental measurement results into established planning and budgeting cycles (Isi et al., 2022b).

The most fundamental technical challenge lies in the availability and quality of environmental data. Environmental data is generally scattered across various ministries, technical agencies, and local governments, with varying measurement standards. Government budget information systems are typically designed solely to manage financial data, thus lacking a database structure capable of accommodating spatial, temporal, and scientific environmental variables. When integrating data on greenhouse gas emissions, deforestation rates, or water quality into the budget system, differences in measurement methodologies between agencies, limited data update frequency, and low data reliability and verification are often encountered. This complicates the national environmental data consolidation process and hinders efforts to directly link budget allocations to measurable environmental outcomes (Lulaj et al., 2022).

In addition to data issues, technical challenges also arise in developing budget-relevant environmental performance indicators. Environmental metrics are often end-products influenced by many factors beyond government budget interventions, such as public behavior, natural conditions, and global economic dynamics. Consequently, it is difficult to design indicators that clearly reflect the contribution of public spending to environmental improvement or protection (Nurfadila, 2024b). In a performance-based budget system, indicators that lack a strong causal link to programs and activities weaken accountability. The government faces a technical dilemma: choosing scientifically sound and comprehensive environmental indicators that are difficult to link to the budget, or simpler and easier-to-integrate indicators that are less reflective of the true environmental situation.

The next technical challenge relates to budget classification and tagging of environmental spending. Integrating environmental metrics requires a consistent environmental tagging mechanism across ministries and agencies. However, existing budget classification systems are generally structured based on function, organization, and expenditure type, without an explicit environmental dimension. The addition of this new dimension requires structural changes to the chart of accounts, adjustments to financial application systems, and technical training for budget management officials. This process is not only technically complex but also risks inconsistencies if not supported by clear operational guidelines and uniform national standards (Gunarathne et al., 2022).

The integration of environmental metrics also faces technical challenges in terms of harmonization with public sector accounting and reporting standards. Government budget systems are closely linked to accrual-based

accounting systems that adhere to specific standards, such as those developed by the International Public Sector Accounting Standards Board. Environmental metrics, on the other hand, are often developed based on sustainability reporting frameworks or environmental statistics that do not fully align with financial accounting standards. This lack of synchronization complicates efforts to integrate environmental information into government financial reports in a consistent and auditable manner. From a technical perspective, conceptual reconciliation between non-monetary environmental measures and accounting principles that emphasize reliable recognition, measurement, and presentation is required (Pizarro et al., 2021b).

From an information technology perspective, the technical challenges of integrating environmental metrics are further complicated by limited system interoperability. Many governments still use fragmented budgeting and accounting systems, both across levels of government and across sectors. Environmental data integration requires information systems capable of linking financial data with environmental data in real time or periodically, including cross-sectoral and regional analysis capabilities. Limited technological infrastructure, low analytical capacity, and data security and integrity issues pose serious obstacles to building an integrated green budget system. Without adequate technological support, environmental metrics risk becoming merely supplementary information that does not meaningfully influence budget decision-making.

Another technical challenge relates to the methodological aspects of assessing the environmental impact of public spending. Linking budget amounts to changes in environmental indicators requires complex evaluation methods, such as impact assessment and environmentally based cost-benefit analysis. These methods require assumptions, models, and data that are often not widely understood by budget planners and administrators. Consequently, there is a risk of using overly simplistic or inconsistent approaches, leading to biased environmental impact measurement results and less reliable basis for fiscal decision-making (Kurrohman et al., 2025).

Internationally, various organizations, such as the Organization for Economic Co-operation and Development, have promoted the integration of environmental metrics through the concept of green budgeting. However, implementation at the national level demonstrates that technical challenges often outweigh normative challenges. Differences in technical capacity across countries, variations in budget systems, and the maturity of environmental data mean that the implementation of environmental metrics is gradual and uneven.

For many developing countries, this challenge is compounded by the need to implement it concurrently with ongoing public financial system reforms.

CONCLUSION

The conclusion of this study confirms that Green Public Financial Management (GPFM) is a relevant and increasingly necessary strategic approach in the context of modern public financial management, particularly in addressing the challenges of climate change and environmental degradation. Integrating environmental metrics into government budget reporting enables the budgeting process to be oriented not only toward fiscal efficiency but also toward environmental sustainability and the achievement of sustainable development goals. A literature review found that implementing GPFM can improve transparency, accountability, and the quality of fiscal decision-making by providing a more comprehensive picture of the environmental impacts of public policies and spending.

Furthermore, this study concludes that the successful integration of environmental metrics into budget reporting is highly dependent on institutional readiness, human resource capacity, the availability of reliable environmental data, and strong political commitment. While challenges remain, such as limitations in measurement methodologies and inter-agency coordination, GPFM still offers significant opportunities to strengthen sustainable public financial governance. Therefore, developing a clear policy framework, enhancing technical capacity, and harmonizing financial and environmental systems are crucial steps to ensure that public financial management can significantly contribute to environmental protection and long-term development.

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