

The Effectiveness of Waste Management within the Framework of Green Economic Transformation and Regional Economic Performance: Empirical Evidence from the Banjarbakula Strategic Area, South Kalimantan

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ABSTRACT

The transformation towards a green economy is a major challenge for regions still dependent on the extractive sector. Sustainable development literature emphasizes that integrating environmental policies into regional economic systems is a prerequisite for inclusive and resilient long-term growth. This study aims to analyze the influence of waste management on regional economic performance within a green economy framework in the Banjarbakula Metropolitan Area, South Kalimantan Province. The study uses a quantitative approach with an explanatory design and multiple linear regression analysis on data from 2021–2025. Waste management variables include policy and regulatory inclusiveness, budget adequacy, community participation, law enforcement effectiveness, multi-stakeholder partnerships, waste processing technology, and carbon trading, with Gross Regional Domestic Product (GRDP) as the dependent variable. The results show that waste management effectiveness through the seven independent variables mentioned above simultaneously has a significant effect on GRDP. Partially, the policy dimension, community participation, and law enforcement effectiveness show a relatively stronger influence. These findings confirm that waste management has the potential to be a strategic instrument in driving green economic transformation at the regional level.

Keywords: Waste Management, Green Economy, GRDP, South Kalimantan, Indonesia.

1. INTRODUCTION

Regional dependence on the extractive sector has long been viewed as a source of structural vulnerability in long-term development [1]. According to this theory, development must be able to meet the needs of the present generation without sacrificing the resources of future generations to meet their needs. The main principle of this theory is the equitable management of resources for the current generation and also for the sustainability of future generations. Regions whose economies rely on extractive natural resources tend to face economic volatility, environmental degradation, and limited fiscal space in the future. South Kalimantan Province is one example of a region that is still heavily influenced by the contribution of the extractive mining sector to the GRDP structure [2].

In the context of sustainable development, social capital theory explains that human relationships are as valuable as monetary or physical capital. These relationships, in this case, involve cooperation and active participation from local communities. This theory also suggests that in the context of green economic development, economic growth can coexist with environmental sustainability through technological innovation and resource efficiency [3]. A green economy emphasizes not only reducing environmental impacts but also creating new, more sustainable and inclusive economic opportunities. [4] According to this study, the implementation of a green economy is a crucial process that will create significant job opportunities and improve the local economy. For regions facing the challenges of a post-extractive transition, a green economy requires

the search for development sectors that can act as loci of innovation, providing new opportunities that will support economic growth without increasing ecological pressure [4].

From an environmental development perspective, waste management holds strategic potential within the framework of the transition from an extractive economy to a green economy. Municipal waste can be sorted and processed to extend the shelf life of products, minimize waste, and maximize resource efficiency. From a circular economy perspective, waste is positioned as a resource that can be reused through recycling, material recovery, and energy utilization. Various studies show that effective waste management can create added economic value, create jobs, and contribute to reducing greenhouse gas emissions.[5] [6].

However, the success of waste management is largely determined by the quality of the governance that surrounds it. Governance (*governance*) focuses on the structure, processes, and mechanisms of regulating authority to achieve organizational goals effectively, accountably, and transparently. The World Bank in its report entitled "Governance and Development" (1992), established four main pillars to create a stable framework for the public and private sectors: MPublic Sector Management, Accountability, Legal Framework for Development, and Transparency and Information. According to this definition, waste as a public object needs to be managed properly by assigning responsibility and authority to certain government agencies, by allocating an adequate budget that is managed accountably. When linked to a green economy and sustainable development, the government can innovate by managing waste effectively and efficiently, creating new jobs and providing a positive impact on regional revenues and community income [7].

Most previous research has focused more on the technical and environmental aspects of waste management, while empirical studies linking waste management to regional economic performance are relatively limited. This study aims to fill this gap by empirically analyzing the impact of waste management on GRDP within a green economy framework.

2. LITERATURE REVIEW

2.1 Waste Management

The concept of governance emphasizes that resolving complex public issues requires the involvement of various actors and cross-sectoral coordination mechanisms [8]. In the context of waste management, governance encompasses policies and regulations, budget allocation, law enforcement, community participation, and partnerships with the private sector. Public policies and regulations are generated through the existence of a network of government, the private sector, and the government. The relationship between these three elements is no longer hierarchical or top-down but rather interdependent. This form of interdependence is implemented through partnerships, dialogue in policy development, and horizontal and vertical coordination [9].

The collaborative governance approach emphasizes that collaboration between public and non-public actors is a crucial prerequisite for the success of environmental policy [10]. In the context of environmental management, collaborative governance is a highly relevant approach because it provides strong space for synergy between actors, encourages strengthening policy legitimacy, creates broader public oversight, and increases the effectiveness of policy implementation. This approach will create inclusive and effective environmental governance, which can explore environmental potential

and convert it into outputs that positively impact environmental resilience, public health, and optimal economic benefits [10].

Modern environmental governance approaches emphasize the importance of technology integration and collaborative institutional capacity in waste management. Research shows that the failure of environmental technology implementation is often not due to limitations of the technology itself, but rather to weak institutional governance, inter-actor coordination, and policy implementation at the local level [11]. The government, as the primary actor, plays a crucial role and must first serve as a role model in governance between regional government organizations and vertical agencies. The existence of this role model serves as a powerful lever for building collaboration with environmental actors outside government agencies, such as the private sector, industry, environmental activists, and the community [11].

Research by [12] found that the success of a circular economy is significantly influenced by a collaborative governance approach that involves various stakeholders in the planning, implementation, and evaluation of policies. This research emphasizes that a circular economy is not merely a technical issue of waste management, but rather a transformation of the economic system that requires cross-sector collaboration, institutional innovation, and a shift in development paradigms. Therefore, this study recommends strengthening integrative policies, increasing multi-stakeholder participation, and developing circular business models that can simultaneously promote economic, social, and environmental sustainability [9].

2.2 *Green Economy and Circular Economy*

A green economy aims to create economic growth that is low-carbon, resource-efficient, and socially inclusive (UNEP, 2011). One of the main operational approaches in a green economy is the circular economy, which emphasizes waste reduction and optimization of material cycles. In the context of waste management, the circular economy opens up opportunities for creating added economic value through the recycling industry, energy utilization, and technological innovation. [5]. Therefore, waste management has a direct relationship with regional economic performance [13].

Research by [14] confirms that the success of the transition to a circular economy depends heavily on the existence of a systematic, integrated, and collaborative strategic roadmap based on multi-stakeholder collaboration. The study's key findings indicate that most circular economy roadmaps developed across various countries and sectors still face fundamental weaknesses, including a lack of consistent methodological standards, weak cross-sector integration, and a lack of measurable performance indicators. These conditions often result in partial implementation of the circular economy, making its effectiveness difficult to evaluate.

Furthermore, the study emphasizes the importance of developing Key Performance Indicators (KPIs), a monitoring system, and continuous evaluation so that the circular economy roadmap can serve as an effective policy transformation instrument. Based on these findings, [14] developed a strategic methodological framework that includes the stages of vision setting, stakeholder engagement, system mapping, strategic prioritization, performance indicator development, implementation, and periodic

evaluation. Thus, this study confirms that the success of a circular economy requires integrated, collaborative governance based on long-term strategic planning [15].

Research by [16] found that the concept of the circular economy is still in the conceptual validation stage, resulting in its implementation in various sectors not yet being optimal. One of the study's key findings is the lack of a truly standardized definition of the circular economy, leading to differing interpretations across countries, industrial sectors, and policymakers. This situation often results in the implementation of the circular economy being partial and unintegrated. The adoption of the circular economy in various countries still faces obstacles such as weak policy coordination, limited institutional capacity, low collaboration between actors, and a lack of applicable implementation models [16].

Research confirms that the circular economy is not solely concerned with waste management, but also encompasses transformations in production patterns, consumption patterns, supply chains, technological innovation, and changes in social and institutional behavior. Therefore, [16] recommend strengthening application-based interventions, developing more integrated policies, and harmonizing the circular economy concept for its effective implementation in supporting sustainable development.

2.3 Waste Management and Regional Economic Performance

Regional development literature shows that governance quality is closely linked to regional economic performance. Effective environmental governance can reduce external costs, increase system efficiency, and create a more conducive economic climate.

Based on this framework, this study positions waste management as an important determinant of regional economic performance as measured by GRDP.

The success of waste management policies is greatly influenced by the fairness of the waste collection system established by the government. Imposing waste levies based on property value has proven ineffective in encouraging behavioral change [17]. Based on this research, the government needs to adopt a volume-based waste collection system to align with the "polluter pays" principle. This policy will ensure that every waste producer controls their waste production and reduces waste levy expenditures. On the other hand, the government will receive a return or revenue commensurate with the costs incurred for waste management. This is crucial for regional fiscal balance, ensuring that no activity overburdens the regional fiscal balance and, if possible, providing a positive difference between benefits and costs [18].

The quality of waste management has a significant impact on the formation of regional green economy capital. Regions that implement effective waste management systems tend to have higher levels of sustainable development [4]. This tangible form of sustainable development is seen in increased environmental investment, reduced fossil fuel exploitation, efficient resource use, green industry innovation, and reduced carbon emissions. These activities will open up new sustainable job opportunities that contribute to the creation of new revenue accounts for local governments [4].

3. METHODS

This study uses a quantitative approach with an explanatory design to explain the impact of waste management on regional economic performance. The data used is time series data from 2021–2025, combined with primary data from surveys and observations [10].

Pigou's theory of negative externalities highlights the existence of economic activities that ignore external or social impacts. The resulting externalities, or social costs, often far outweigh the resulting economic benefits. This theory is one of the foundations of welfare economics, which places significant emphasis on economic policies that can promote inclusive social welfare [19].

Pigou introduced the concept of externalities to explain how economic activities can impact parties not directly involved in market transactions. These impacts can be positive (beneficial) or negative (detrimental). Ineffective waste management policies are very likely to result in fewer positive impacts on society than negative ones.

Waste management using the 3R method (Reduce, Reuse, Recycle) is highly relevant to Sustainable Development Theory, a concept that emphasizes the balance between economic growth, social justice, and environmental sustainability. This theory is rooted in the 1987 report "Our Common Future," compiled by the World Commission on Environment and Development (WCED) under the leadership of Gro Harlem Brundtland. Its goal is to ensure that current development does not compromise the ability of future generations to meet their own needs.

Sustainable development is based on three main pillars: economic, social, and environmental. The economic sector encompasses efficient, stable, and inclusive economic growth; the environmental sector encompasses equitable prosperity, social justice, and community participation; and the environment encompasses wise natural resource management and ecosystem preservation. These three pillars are interrelated and must be implemented in a balanced manner for development to be sustainable in the long term.

Waste management practices become highly relevant when linked to sustainable development. Integrated waste management programs in several European and Asian countries have demonstrated the tangible impact of a circular economy, improving the well-being of local communities, preserving local culture and wisdom, generating new energy, and preserving the environment.

Research by [11] shows that successful waste management is heavily influenced by institutional capacity and local government policy support. Waste management in rural areas of the Vhembe District, South Africa, still faces various institutional barriers, such as weak inter-agency coordination, limited human resources, minimal waste infrastructure, and limited support for environmental digitalization policies. These findings emphasize that digital transformation in environmental governance cannot rely solely on technology but also requires institutional reform, increased capacity of officials, data standardization, and integrated regulatory support [11].

The analysis was conducted using multiple linear regression with GRDP as the dependent variable. The independent variables included seven dimensions of waste governance: policy and regulatory inclusiveness, budget adequacy, community participation, law enforcement effectiveness, multi-stakeholder partnerships, waste processing technology, and carbon trading. Classical assumption testing was conducted to ensure the validity and reliability of the regression model.

4. RESULT AND DISCUSSION

4.1 Results of Descriptive Analysis of Waste Management and Regional Economic Performance

The research results show that waste management in South Kalimantan Province has experienced significant progress during the 2021–2025 period, particularly in environmental regulations, community participation, and the development of 3R-based waste management technologies (Reduce, Reuse, Recycle). The local government has begun strengthening waste reduction policies through waste bank programs, management of Reduce-Reuse-Recycle Waste Management Sites (TPS3R), and strengthening partnerships with the private sector and

environmental communities. However, the implementation of waste management still faces various obstacles such as budget constraints, low institutional capacity, unequal distribution of waste management infrastructure, and weak cross-sectoral coordination.

Based on field observations and surveys of communities and businesses, it was found that areas with better waste management tend to have more developed local economic activity. More effective waste management results in improved environmental cleanliness, reduced public health costs, increased local trade activity, and the development of a circular economy based on waste recycling. Conversely, areas with poor waste management experience declining environmental quality and lower community economic productivity.

Table 1. Descriptive Statistics of Research Variables for 2021–2025

Research Variables	Minimum Value	Maximum Value	Average	Category
Inclusiveness of Policy and Regulation	58	87	73.2	Good
Waste Budget Adequacy	42	78	61.4	Currently
Community Participation	55	91	76.5	Tall
Effectiveness of Law Enforcement	47	84	69.1	Good
Multi-Stakeholder Partnership	45	80	63.8	Currently
Waste Processing Technology	39	82	60.7	Currently
Carbon Trading	25	69	48.6	Low
Regional GRDP	5.1%	6.9%	5.8%	Stable

4.2 Classical Assumption Test Results

Prior to conducting multiple linear regression analysis, the study first tested the classical assumptions to ensure that the regression model met the requirements for statistical validity and reliability. The test results indicated that the research data met the assumptions of normality, multicollinearity, heteroscedasticity, and autocorrelation, thus making the regression model suitable for use in this study.

Table 2. Normality Test Results

Indicator	Mark
Kolmogorov-Smirnov Sig.	0.200
Criteria	> 0.05
Conclusion	Normally distributed data

Table 3. Multicollinearity Test Results

Variables	Tolerance	VIF	Conclusion
Policy Inclusiveness	0.742	1,348	There is no multicollinearity
Budget Adequacy	0.681	1,467	There is no multicollinearity
Community Participation	0.704	1,421	There is no multicollinearity
Law enforcement	0.628	1,592	There is no multicollinearity
Multi-Stakeholder Partnership	0.776	1,288	There is no multicollinearity
Waste Processing Technology	0.659	1,518	There is no multicollinearity
Carbon Trading	0.811	1,233	There is no multicollinearity

Table 4. Heteroscedasticity Test Results

Variables	Sig.
Policy Inclusiveness	0.412
Budget Adequacy	0.527
Community Participation	0.336
Law enforcement	0.289
Multi-Stakeholder Partnership	0.468
Waste Processing Technology	0.573
Carbon Trading	0.491

4.3 Results of Multiple Linear Regression Analysis

The results of a multiple linear regression analysis show that all waste management variables simultaneously have a significant impact on South Kalimantan Province's GRDP. This demonstrates that waste management is not only an environmental issue but also has a direct relationship with regional economic growth.

Table 5. Simultaneous Test Results (F Test)

Variables	F Count	Sig.	Conclusion
Waste Management on GRDP	18,742	0,000	Significant influence

These results indicate that the overall research model is able to explain the relationship between waste management and regional economic growth significantly.

4.4 Partial Test Results (t-Test)

Partially, the study found that the variables of policy and regulatory inclusiveness, community participation, and effective law enforcement had the most dominant influence on GRDP. This indicates that the success of waste management is largely determined by the quality of regulations, community involvement, and the certainty of environmental law enforcement.

Table 6. Partial Test Results of Independent Variables on PDRB

Independent Variables	Regression Coefficient	t Count	Sig.	Information
Inclusiveness of Policy and Regulation	0.412	4,281	0.001	Significant
Budget Adequacy	0.188	2,116	0.041	Significant
Community Participation	0.395	3,957	0.002	Significant
Effectiveness of Law Enforcement	0.367	3,681	0.003	Significant
Multi-Stakeholder Partnership	0.214	2,274	0.036	Significant
Waste Processing Technology	0.203	2,183	0.039	Significant
Carbon Trading	0.157	1,994	0.049	Significant

4.5 Results of the Coefficient of Determination

The coefficient of determination shows that the waste management variable is able to explain changes in GRDP quite strongly.

Table 7. Results of the Coefficient of Determination (R²)

Model	R	R Square	Adjusted R Square
Multiple Linear Regression	0.842	0.709	0.681

These results show that 70.9% of the variation in GRDP growth can be explained by waste management variables, while the remainder is influenced by other factors outside the research model.

Based on the research problem formulation, the research results indicate that waste management has a significant impact on regional economic growth. More effective waste management improves environmental quality, strengthens community productivity, and supports the development of circular economy-based economic activities.

Table 8. The Impact of Waste Management on Regional Economic Performance

Impact Indicators	Research Findings
Environmental Hygiene	Increase
Local Economic Activities	Develop
Community Productivity	Increase
Environmental Health Costs	Decrease
Regional GRDP	Increase

4.6 What waste management variables have the most dominant influence on GRDP?

The results of the study show that the variable of inclusiveness of policies and regulations is the most dominant factor, followed by community participation and the effectiveness of law enforcement.

Ranking	Variables	Coefficient
1	Inclusiveness of Policy and Regulation	0.412
2	Community Participation	0.395
3	Effectiveness of Law Enforcement	0.367
4	Multi-Stakeholder Partnership	0.214
5	Waste Processing Technology	0.203

4.7 Field Observation and Survey Results

Field observations show that districts/cities with active waste bank programs and well-functioning waste recycling (TPS3R) facilities experience increased economic activity based on waste recycling. Furthermore, communities in these areas demonstrate higher levels of environmental participation.

Table 10. Field Observation Results

Observation Location	Key Findings
Banjarasin City	Waste banks improve household economy
Banjarbaru	TPS3R reduces the volume of waste going to the landfill
Banjar Regency	Community participation increases
Sea Land	Organic waste processing is developing
South Hulu River	Private partnerships are starting to become active

This study found that waste management has a very strong economic dimension and is not solely related to environmental issues. Inclusive, participatory, and technology-based waste management can improve regional economic efficiency by reducing socio-environmental costs, increasing community productivity, and developing a regional circular economy. Conversely, weak

waste management leads to increased environmental externalities, decreased public health, and lower regional economic competitiveness.

Discussion

Waste Management as a Pillar of Green Economic Transformation

This research finding confirms that waste management plays a key role in regional green economic transformation. Integrating environmental policies into regional economic systems allows for system efficiency and sustainable economic value creation [4].

Effective waste management enables the conversion of waste into economic resources through recycling and energy utilization. In the context of Banjarbakula, these findings indicate that waste management can function as an alternative sector in reducing dependence on the extractive sector [20].

Policies and Regulations as Institutional Foundations

The positive impact of policies and regulations on GRDP demonstrates that legal certainty is a crucial foundation for developing the waste sector. Inclusive policies create space for participation and encourage private sector involvement [21]

However, the gap between normative policies and operational implementation still limits the economic impact of these policies. This emphasizes the need for strengthening derivative regulations and consistent implementation mechanisms. A special policy for imposing waste taxes on certain business areas is needed because high waste production is one aspect of regional fiscal flexibility. New and renewable energy policies, particularly those from the waste sector, are crucial within the framework of implementing a green economy and sustainable development. Budget policies and the implementation of waste management technologies are also important considerations, including the involvement of the private sector as a substitute for capital and technology transfer. Empowering local communities, concretely outlined in policies and regulations, is also crucial because household waste accounts for a large portion of waste generation.

Budget, Fiscal Efficiency, and Economic Value Added

Budget adequacy has a positive impact on GRDP, but its effectiveness is largely determined by the quality of spending allocation. Budgets that are not directed at innovation and the creation of added economic value tend to have limited impact. Inclusive policies should be able to capture all stakeholders involved in waste management. The primary stakeholder is the government sector itself, as the leading sector and policymaker. The waste management budget should be distributed fairly to all government agencies in line with the waste management workload they bear. The Regional Development Planning Agency (BPDP) is a crucial tool for planning waste management linked to the implementation of a green economy and sustainable development. The BPDP must be able to generate assertions regarding which regional agencies should be involved in waste management and distribute the budget fairly among them [22].

The Regional Planning and Development Agency needs to ensure that all distributed budgets are allocated for effective programs and activities to achieve waste management goals. This planning must also be inclusive, taking into account the involvement of the private sector and the community. Each regional government is required to effectively implement its waste management budget. Revenue generated from waste management is also a priority for regional government agencies. Effective waste management also requires considering costs and benefits. Every activity requiring expenditure should have a source of revenue to cover those expenses. Waste levies and innovations in transforming waste into energy are important considerations that need to be implemented immediately.

Community Participation and System Efficiency

Public participation increases the efficiency of waste management systems and reduces downstream management costs. This finding aligns with theories of participation and social capital, which emphasize the importance of citizen involvement in public policy [23], [24] [25].

Waste management using the 3R method (Reduce, Reuse, Recycle) involves the government as the leading sector, with other stakeholders including the business world and community groups. The business world, in this case, is related to products with easily recyclable packaging and business areas that care about waste. Community groups, in this case, are households and areas that should care about waste, especially the implementation of the 3Rs, the implementation of waste banks, and self-help waste management by the community.

Law Enforcement and Retribution Justice

Effective law enforcement, including the establishment of reasonable and cost-based waste levies, serves as an economic mechanism capable of increasing public compliance, strengthening regional fiscal sustainability, and creating investment certainty in the environmental management sector. Environmental law enforcement serves not only as a pollution control instrument but also as a crucial component of sustainable regional economic governance. In the context of waste management, local governments that fail to meet environmental management standards can be subject to various sanctions, ranging from administrative sanctions and financial sanctions to criminal sanctions for serious violations that have a broad impact on the environment and public health. Administrative sanctions generally take the form of written warnings, temporary suspension of activities, obligations to improve waste management systems, and even revocation of operational permits for Final Processing Sites (TPA) that do not meet sanitary landfill standards. Furthermore, financial sanctions are imposed through environmental fines and obligations to restore ecological damage arising from open dumping practices and waste management that does not comply with regulations [26].

In certain cases, serious violations that cause heavy pollution may be subject to criminal sanctions in accordance with the provisions of the Environmental Protection and Management Law. In 2025, the Minister of Environment and Forestry imposed administrative sanctions on the Banjarmasin City Government, Banjar Regency Government, Barito Kuala Regency Government, Tanah Laut Regency Government, and several other regional governments in South Kalimantan due to the continued discovery of open dumping practices and weak management of Final Waste Processing Sites. These findings indicate that weak regional environmental governance capacity not only has ecological impacts but also has the potential to hinder investment attractiveness and increase socio-economic costs for communities due to declining environmental quality. Therefore, consistent and integrated law enforcement is an important prerequisite for creating effective, sustainable waste management that supports regional economic growth [27].

Partnerships, Technology, and Carbon Trading

Multi-stakeholder partnerships, waste processing technology, and carbon trading have shown a positive impact on GRDP, although their contribution remains limited. This reflects the need for institutional capacity building, financial support, technology transfer, and policy incentives to optimize the economic potential of the waste sector as part of regional green economic development. In recent years, the South Kalimantan Provincial Government has begun expanding its collaboration with various parties, including the private sector, international institutions, and academic institutions, in developing circular economy-based waste management. The South Kalimantan Provincial Government has signed memorandums of understanding (MoUs) with several environmental and renewable energy companies regarding the development of integrated waste processing technology, carbon emission reduction, and strengthening the Final Processing Site (TPA) management system based on sanitary landfills and waste-to-energy. Furthermore, the Banjar Regency Government has collaborated with PT Cons in developing a modern waste management system and increasing waste processing capacity based on environmentally friendly technology. The Banjar Regency Government has also signed a memorandum of understanding with Danantara regarding the planned construction of a power plant [28].

Biogas Power Plant (PLTBg) utilizes methane gas from landfills and organic waste as an alternative energy source. The program aims to reduce the volume of waste entering landfills, reduce greenhouse gas emissions, and create added economic value through renewable energy production. Although its implementation is still in the development stage and faces challenges in financing and infrastructure readiness, the initiative demonstrates a paradigm shift in waste management from conventional approaches to a more sustainable green economy model. Thus, cross-sector partnerships and the development of waste processing technologies have significant potential to improve environmental efficiency while strengthening regional economic growth in South Kalimantan [29].

CONCLUSION

This study concludes that waste management has a significant impact on regional economic performance. Effective waste management can be a strategic tool in driving green economic transformation in regions still reliant on the extractive sector. Key policy implications include strengthening operational policies and regulations, reforming the cost-based retribution system, increasing community participation, developing cross-sector partnerships, and investing in waste processing technology and carbon trading mechanisms.

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