

Trashure as an ESG-Based Digital Innovation to Improve Community Welfare and Green Environment Sustainability

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ABSTRACT

Waste management in Indonesia remains a critical challenge for sustainable development, exacerbated by population growth and changing consumption patterns. Data from the Ministry of Environment and Forestry (KLHK) in 2024 shows that only 59.94% of 33.7 million tons of annual waste is properly managed, with the rest polluting rivers or being burned. Jember Regency, for instance, faces low public awareness, inadequate infrastructure, and limited economic value from domestic waste. This Study aims to address these issues by developing TRASHURE, an ESG-based digital platform managed by Badan Usaha Milik Desa (BUMDes), to transform waste into sustainable investments. Using the prototype method, the research iteratively designed a web application through rapid feedback cycles with BUMDes and rural communities. Key features include waste collection tracking, an educational module, a marketplace for recycled products, and sustainability accounting. The prototype process involved three iterations, refining usability and functionality based on user input. Results demonstrate that TRASHURE enhances community participation, reduces environmental pollution, and supports Sustainable Development Goals (SDGs), particularly Goals 12 (Responsible Consumption) and 13 (Climate Action).

Keywords: Waste management, ESG, BUMDes, prototyping, SDGs

INTRODUCTION

The growing population and changing consumption patterns have contributed to the increasing volume of waste in Indonesia, posing a serious challenge to achieving sustainable development. According to data from the Ministry of Environment and Forestry (KLHK, 2024), out of the total 33,791,154 tons of waste annually generated from 311 regencies/cities, approximately 59.94% (20,253,033 tons) was properly managed, while the rest was dumped into rivers, burned, or disposed of haphazardly. Ineffective waste management will lead to serious environmental issues. Improperly disposed waste can pollute the air through open burning, releasing harmful pollutants such as dioxins and methane gas, which contribute to global warming. Additionally, poorly managed waste also causes soil pollution, disrupting ecosystem balance and endangering health due to the accumulation of microplastics in the soil. It further contaminates water sources, particularly drinking water supplies (Erika Erika & Eva Gusmira, 2024).

Unfortunately, this situation is also reflected in Jember Regency, where waste is dominated by paper/cardboard waste (79,084,653.98 kg) and plastic waste (38,570,328.88 kg). Yet, the amounts that can be managed remain limited—only 3,638,506.03 kg and 2,588,563.02 kg, respectively. This condition directly contradicts SDG 12 (Responsible Consumption and Production) and SDG 13



(Climate Action). Such imbalance highlights the urgent need for multi-stakeholder collaboration to improve waste management, particularly by addressing public awareness, adequate infrastructure, and enhancing the economic value of domestic waste as a contribution to environmental sustainability. (Prayoga et al., 2023).

Jember Regency faces significant challenges in addressing waste management issues, particularly in its rural areas. According to data from the Jember Environmental Agency (2023), only 45% of villages in the regency have adequate and proper waste management systems. The primary issue lies in severely limited infrastructure: just 12% of villages are equipped with sufficient temporary waste disposal sites (TPS), while the average distance to the nearest final disposal site (TPA) reaches 15-20 km resulting in high transportation costs. Moreover, 68% of households still burn their domestic waste, posing high risks to respiratory health, while 23% discard waste directly into rivers, polluting the Bedadung and Mayang River watersheds. Without effective solutions at the village level, these practices will continue to exacerbate serious waste-related environmental and public health crises.

On the other hand, the Environmental, Social, and Governance (ESG) framework is increasingly becoming a benchmark for sustainable development. ESG goes beyond environmental aspects by empowering communities (social) and ensuring transparent governance (Oktaviani et al., 2024). Implementing ESG at the village level can mitigate environmental impacts through integrated waste management, improve welfare by creating green jobs, and strengthen accountability via measurable impact reporting. However, ESG implementation in rural areas faces critical challenges, including low community awareness of environmental stewardship, limited environmental literacy, and a digital divide that restricts access to reliable internet. This study presents novelty through the development of TRASHURE as a digital system that combines ESG principles, sustainability reporting, and data-based incentives for village waste management. This kind of study is still very rare in the context of strengthening village institutions in Indonesia.

LITERATURE STUDY

Socio-Ecological System Theory

The socio-ecological systems theory emphasizes the reciprocal relationship between humans and their environment. Effective household waste management requires a profound understanding of how human activities influence the environment and vice versa. In this context, village waste should not be viewed merely as a byproduct of human activity, but as a critical factor shaping environmental quality and livelihoods, particularly in rural settings. This reciprocity manifests as a cyclical loop: human activities generate waste, waste alters environmental conditions, the degraded environment impacts living standards and ecological health, and these diminished conditions ultimately feed back into human activities creating a self-perpetuating cycle.

Sustainable Resource Management Theory

The above theory aligns with the sustainable resource management theory, which focuses on the efficient and sustainable use of natural resources to maintain ecosystem balance. Effective village waste management involves practices such as waste sorting, recycling, and composting to minimize waste sent to landfills (TPA). The sustainable resource management framework outlines a systematic process: First, village waste is generated, then sorted into distinct categories (organic, inorganic, and recyclable materials). Recyclable waste is processed into new products, while organic waste is composted for use as fertilizer. This approach significantly reduces landfill-bound waste through recycling and composting. The result is a balanced and sustainable ecosystem enabled by effective waste management. The cycle works as follows: Human-generated waste is sorted by type; recyclables are reprocessed into raw materials, and organic waste becomes compost. Together, these processes reduce landfill dependency. With less waste in landfills, ecosystems maintain their equilibrium and long-term sustainability.

Pro-Environmental Behavior Theory

Pro-Environmental Behavior Theory is also relevant, as it posits that environmentally friendly actions are influenced by factors such as environmental knowledge, awareness, and attitudes. Environmental education and awareness campaigns play a crucial role in encouraging community participation in proper waste management. The theory suggests that information and understanding of environmental issues and their impacts can enhance environmental awareness. This awareness, in turn, shapes environmental attitudes defined as an individual's positive or negative disposition toward actions affecting the environment. These attitudes then drive pro-environmental behavior, which manifests as concrete actions taken to protect and sustain the environment. These theories can be directly applied to rural communities to gradually foster greater environmental stewardship, particularly in village settings.

Research by Fitriana et al. (2022) demonstrates that waste possesses significant economic value when managed innovatively through the reduce, reuse, recycle (3R) approach, which not only promotes environmental conservation but also generates social benefits for communities. The growing interest in and awareness of waste processing is becoming a focal point for sustainable development (Björnberg et al., 2022).

Therefore, sustainable innovation is required to address this issue by optimizing the role of rural communities as the foundational social unit. Village-Owned Enterprises (BUMDes) present a viable mechanism to stimulate the local economy while strategically transforming waste challenges into sustainable investment opportunities. BUMDes' contribution to waste management aligns with the Indonesian government's commitment to achieving Sustainable Development Goals (SDGs) by 2030. By developing village-level waste collection and recycling systems, BUMDes helps alleviate landfill (TPA) burdens while fostering cleaner environments.

Several studies have developed web-based systems for waste banks, as exemplified by (Prayoga et al., 2023), who created 'E-Trash' - a system implemented at the Environmental Agency of Ponggok Subdistrict, Blitar Regency to locate nearby waste banks. Similarly, (Riyadh et al., 2023) implemented an e-Trash Bank program to support SDG 12 (Responsible Consumption and Production). However, these waste bank initiatives primarily focus on digital systems/web platforms rather than environmental sustainability education for achieving zero-waste communities.

Based on the aforementioned challenges, the research question is formulated as follows: "What strategies can Village-Owned Enterprises (BUMDes) in Jember Regency adopt for waste management to simultaneously enhance community welfare and green environmental sustainability?". And his study aims to: "Develop actionable strategies for BUMDes in Jember Regency's villages to implement effective waste management systems that promote both socioeconomic benefits and long-term ecological sustainability."

METHOD

3.1 Data Type

This study employs a descriptive qualitative approach. As an interpretive methodology, it seeks to explore the meanings individuals or groups attribute to social problems through detailed narratives, without imposing predetermined categories (Creswell & Poth, 2023). In this research, a descriptive qualitative approach is used to analyze the context of ESG (environmental, social, and governance) and sustainability accounting in the web-based digital platform innovation, TRASHURE.

This study utilizes secondary data, where researchers aim to develop an understanding of the research subject and themes through literature review. A literature review is defined as the systematic examination of data derived from various references and prior studies relevant to the research theme. This approach is also referred to as library research or desk research (Nasution, 2019).

3.2 Data Processing Method

The method used in developing the TRASHURE web is the prototyping method. The prototyping

method addresses critical questions regarding usability and preferences by simulating key interactions between users and the technology (Houde & Hill, 2020). Prototyping method process:

1. Requirements Identification
Conduct needs assessment by mapping existing problems and system requirements and then performing literature review of similar studies
2. Flowchart Development
Create preliminary website workflow diagrams based on identified problems and documented user requirements
3. Web Development
Implement website prototype using prior analysis results and by established workflows. Development platform by: Google Sites
4. User Testing
Can conduct evaluation through user feedback collection and usability and effectiveness assessment.
5. Finalization & Maintenance
Perform continuous improvement through user feedback integration and periodic updates and feature enhancements.

RESULT

Waste is a pressing issue that has become a significant global concern today. The waste generated in communities can be categorized into organic and inorganic waste. This waste contributes to environmental pollution and can even lead to disasters such as flooding. These conditions directly conflict with SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action). This problem must be addressed appropriately and wisely. One effective step that can be taken is empowering Village-Owned Enterprises (BUMDes) to manage waste (through waste banks) and transform it into high-value products. This initiative also creates a multiplier effect by boosting the local economy. Therefore, this research aims to integrate waste management into valuable products, a marketplace for recycled goods, incentives for communities (waste bank customers), education, and waste bank financial reporting through the TRASHURE website.

This aligns with socio-ecological systems theory, which posits a reciprocal relationship between human activity and environmental systems. (Erika Erika & Eva Gusmira, 2024). Waste, which is a byproduct of household activities, can significantly affect environmental conditions. These environmental changes, in turn, impact the quality of life and public health. Ultimately, this creates a cyclical effect, as degraded environmental conditions will again negatively influence human activities.

Strategies BUMDes Can Employ to Enhance Community Welfare and Green Environmental Sustainability

BUMDes (Village-Owned Enterprises) in Jember Regency hold a strategic position in implementing ESG (Environmental, Social, and Governance) principles for sustainable waste management. From the environmental aspect, BUMDes play a crucial role in reducing the still-prevalent practice of open waste burning in villages. On the social dimension, BUMDes create tangible impacts by absorbing local labor in the waste management sector.

Through an ESG (Environmental, Social, and Governance)-based approach, BUMDes can reduce waste by establishing recycling-oriented businesses while engaging local communities to create employment opportunities. However, proper planning remains essential to fully integrate ESG principles and achieve long-term sustainability (DINARJITO, 2024).

In this case, customers who are members of the village community need to be educated about the importance of waste management so that they can contribute waste as part of efforts to reduce village waste. Transparent reporting of waste management will enhance customer trust in the BUMDes (Village-Owned Enterprises) initiatives; therefore, sustainability accounting is necessary in this context. Sustainability accounting integrates environmental and social aspects into business

financial reporting. According to (Hörisch et al., 2020), sustainability accounting is relevant to the needs of customers or investors because it relates to the creation of environmental and social value. Therefore, a web-based system was developed for the Waste Bank business unit under the Village-Owned Enterprises (BUMDes).

TRASHURE is a system that transforms waste into a new source of income through innovative and sustainable management. This initiative also supports the achievement of the Sustainable Development Goals (SDGs), particularly Goal 12 (Responsible Consumption and Production) and Goal 13 (Climate Action). Through TRASHURE, Village-Owned Enterprises (BUMDes) are able not only to record financial gains but also to measure the ecological and social impacts of their waste management activities.

TRASHURE as a Strategic Approach to Enhance Community Welfare and Green Environmental Sustainability

This website functions as a digital waste management platform based on ESG (Environmental, Social, and Governance) principles, operated by Village-Owned Enterprises (BUMDes), and accessible to village residents, BUMDes managers, as well as partners and government entities. The focus of this website is on education, community participation, sustainability reporting, and the integration of a data-driven incentive system. Below is the content of the TRASHURE website (Flowchart from the beginning to the financial reporting at the end):

A. Flowchart

The following is the implementation flow of the waste bank under the TRASHURE system:

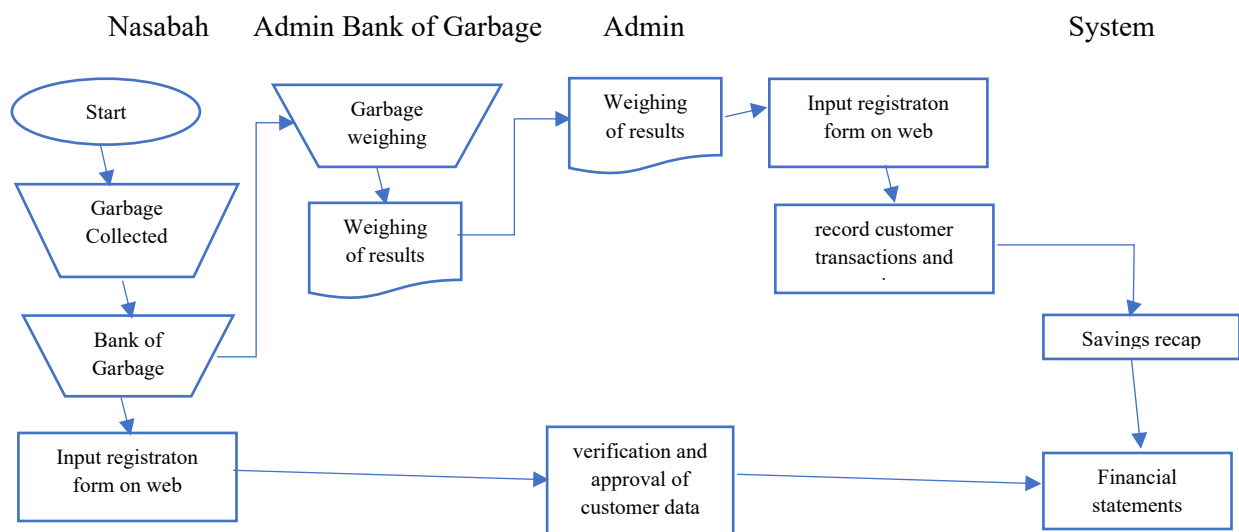


Figure 1. Flowchart

The process begins with customers collecting and sorting their waste. Once the waste is gathered, customers visit the waste bank to make a deposit. Prior to this, they are required to complete a registration form through the provided website. Upon arrival at the waste bank, the staff will weigh the waste brought in by the customer. The weighing results are recorded and forwarded to the administrator. The administrator then inputs the weighing data into the system. The system automatically records the transaction and updates the customer's savings balance based on the value of the deposited waste. Additionally, the registration data submitted by the customer will go through a verification and approval process by the administrator. Once verified, the customer is officially registered in the system. All recorded transactions and savings data are summarized by the system in the form of a savings recap. This recap is then used to compile the overall financial report of the waste bank.

B. TRASHURE

TRASHURE is a digital waste management platform based on ESG (Environmental, Social, and Governance) principles, operated by Village-Owned Enterprises (BUMDes), and accessible to village residents, BUMDes managers, partners, and government entities. The platform focuses on education, community participation, sustainability reporting, and the integration of a data-driven incentive system. A prototype of TRASHURE can be accessed via the following link:
<https://sites.google.com/view/trashure-sdgsbumdes/home>

1. Homepage

TRASHURE is a web-based digital innovation developed to support a sustainable and transparent waste management system for Village-Owned Enterprises (BUMDes), integrated with the principles of Environmental, Social, and Governance (ESG) and the Village Sustainable Development Goals (SDGs). This platform aims to empower rural communities to manage waste productively, enhance economic value, and strengthen social and environmental accountability through the use of technology. It encourages active community participation in transforming waste into marketable resources. This prototype is expected to serve as a model for waste management that supports inclusive, competitive, and environmentally conscious village development.



Figure 2. Home

The initial data display on the homepage clearly reflects the primary objective of developing the prototype as a medium for communication and delivery of the digital platform—namely, environmental transformation through waste management that leads to improved community welfare, green environment development, and sustainable investment. SDG Point 12 on Responsible Consumption and Production in Environmentally Aware Villages, as well as SDG Point 13 on Climate-Responsive Villages, are also featured on the main page of the TRASHURE platform.

2. Education Page

The Education Page aims to raise public awareness and understanding of the importance of sustainable waste management. The educational content focuses on ESG principles, Village SDGs, and sustainability accounting practices, with the goal of encouraging behavioral change toward more responsible and economically valuable environmental management. This educational initiative serves as a foundation for fostering an environmentally conscious rural community. It aligns with pro-environmental behavior theory, as education promotes pro-environmental actions—positive behaviors that reflect individuals' concrete efforts to support and protect the environment.



Image 3. Education page

Based on the education page, the community is expected to gain the perspective that waste sorting is a form of awareness regarding the importance of a sustainable green environment. The practice of sorting waste—ranging from organic waste, inorganic waste, to hazardous and toxic materials (B3)—is expected to become an ingrained habit within the mindset of rural communities.

3. Marketplace and Incentives

Community interest is encouraged through participation in waste reduction by exchanging or depositing recycled waste products in return for incentives or rewards, such as shopping vouchers or specific discounts related to BUMDes services. The Marketplace section features products made from recycled waste, including crafts and other goods. Products on this platform are categorized into three sections: Recycled plastic-based products, Recycled fabric scrap products, Recycled household organic waste products

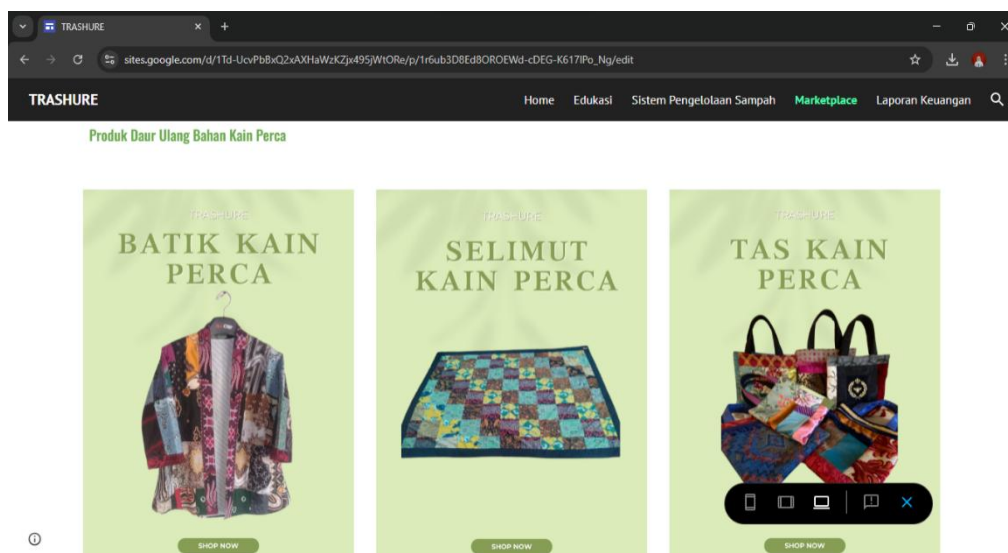


Image 4. Marketplace

The processing of waste into high-value products—such as fertilizer, as well as batik, blankets, and bags made from fabric scraps—is in line with the theory of Sustainable Resource Management, which aims to ensure the balance of the ecosystem (Erika Erika & Eva Gusmira, 2024). According to this theory, the waste produced is sorted into categories of organic and inorganic waste, which are then recycled into new products. Subsequently, organic waste is processed into compost or fertilizer. This processing significantly reduces the amount of waste sent to the Final Disposal Site (TPA), thereby contributing to the creation of a sustainable ecosystem.

These products serve as a means to improve community welfare by encouraging contributions to the creation of employment opportunities in the village. The Village-Owned Enterprises (BUMDes) can continue to operate sustainably through a marketing platform based on the website prototype. Its impact is expected to be tangibly felt by the rural community.

4. Financial Reporting Page (Sustainability Report)

The Financial Reporting Page in TRASHURE showcases financial transparency in waste management based on sustainability principles. This report not only records financial aspects but also considers social and environmental impacts, in line with sustainability accounting practices. Through this approach, BUMDes can demonstrate accountability and its contribution to sustainable development at the village level



Image 5. Financial Reporting Page

Based on the website prototype platform, it can be analyzed that there is data on community members who have made payments for their waste collection services. Once the data regarding the number of payers, outstanding balances, and delinquencies is recorded, it can then be analyzed in the financial reports as a form of transparency and accountability in financial reporting.

DISCUSSION

TRASHURE, as an ESG based digital waste management platform, represents an innovative approach to addressing the persistent challenges of waste management in rural areas. The system is designed not only to record waste transactions and provide community incentives but also to build environmental awareness through education and sustainability based financial reporting. The concept aligns with the socio ecological systems theory, which emphasizes the reciprocal relationship between human activities and environmental conditions. By adopting this perspective, TRASHURE attempts to integrate waste management with social welfare and ecological balance at the village level.

Financial applications as an effort to improve business finances have been carried out at the BUMDES Kecamatan Cimaung, Kabupaten Bandung and Sumber Kembang Coffee Farmers Group (Zulbetti et al., 2019; Wijayanti, 2022). Coffee Farmers Group as a part of community groups in village. Implementation of e-commerce also carried out in the Rukun Makmur Farmers Group (Ardhiarisca et al., 2021).

The development of TRASHURE can be compared with earlier digital waste management systems such as e-Trash (Prayoga et al., 2023) and the e-Trash Bank (Riyadh et al., 2023). Both systems utilize digital platforms to streamline waste tracking and collection processes, yet they primarily focus on the functional aspects of waste transactions. In contrast, TRASHURE offers additional value by incorporating ESG based education, sustainability accounting modules, and

marketplace for recycled products. These features position TRASHURE not merely as a digital tool, but as a holistic governance platform that supports long term environmental and socioeconomic goals.

Apart from these advantages, TRASHURE still faces several critical challenges in its implementation. One of the primary limitations lies in the low level of digital literacy among both community members and BUMDes administrators. Many rural villages in Jember lack access to adequate infrastructure, including reliable internet connections and necessary hardware. This digital divide undermines the effectiveness of TRASHURE, which relies heavily on consistent and accurate digital engagement for data input, user interaction, and reporting.

Another weakness of the system is its currently limited incentive mechanism, which remains focused on simple waste to savings conversions. While this model encourages initial participation, it has not yet evolved into a more complex and rewarding economic framework. For example, TRASHURE does not currently measure carbon offsets, ecosystem service values, or environmental burdens, which are key metrics in ESG and sustainability reporting. As a result, the accounting functions remain normative and do not provide actionable insights for decision making or policy evaluation.

Initial prototype testing revealed the community participation tends to spike during the early stages of implementation but declines without consistent reinforcement mechanisms. This indicates a need for deeper community ownership and empowerment strategies. The lack of long term engagement models, such as community based cooperatives or microenterprises led by local stakeholders, suggests that the current system has not yet achieved sustainable social integration. Without such models, TRASHURE may struggle to maintain momentum beyond the pilot phase.

The current TRASHURE system also falls short in leveraging cross-sectoral collaborations, which are essential for scaling up ESG-based innovations. Partnerships with academic institutions, private sector actors, and supravillage government agencies remain largely untapped. The absence of such partnerships limits TRASHURE's access to funding, technological upgrades, and expertise in sustainability innovation. As a result, the platform continues to operate within a localized scope, hindering its potential for broader impact.

TRASHURE holds significant potential to be developed into a more integrated platform that includes carbon reporting tools, household ecological footprint calculators, and blockchain based incentive mechanisms. These additions would allow for more transparent, verifiable, and tamper resistant tracking of environment contributions, aligning the platform more closely with global sustainability standards. By incorporating such advanced features, TRASHURE could evolve from a village level initiative into a nationally scalable environmental management solution.

To ensure long term development, TRASHURE could be integrated with the existing Village Information System (SID) used in many Indonesian villages. This integration would allow TRASHURE to contribute to official village data records, enhancing its role in local governance, performance evaluation, and development planning. As part of the SID ecosystem, TRASHURE could support data driven policy formulation while reinforcing the institutional role of BUMDes as agents of sustainable digital transformation.

Another long term strategy involves positioning TRASHURE as software as a service (SaaS) solution that can be replicated in other regions. Under this model, subscribing BUMDes would gain access to digital tools, online training modules, and regular technical support. This model would foster the creation of an entrepreneurial ecosystem around environmental services, empowering rural institutions to become self-sustaining actors in the green economy. It would also create incentives for continued innovation and performance improvements.

CONCLUSION

Based on the research findings, TRASHURE is an innovative web-based digital platform developed to support village waste management through an Environmental, Social, and Governance (ESG) approach and sustainability accounting. TRASHURE is designed with various features that support sustainable waste management at the village level, including. Education, as a

means to raise awareness and drive behavioral change within the community regarding the importance of waste management based on ESG principles and SDGs. Marketplace and Incentives, to optimize the economic value of waste through recycling into creative products, while providing incentives that encourage active community participation. Sustainability Financial Reporting, which strengthens transparency and accountability in the performance of BUMDes in waste management based on sustainability principles. Through TRASHURE, BUMDes not only plays a role in reducing the burden on the Final Disposal Site (TPA) and mitigating environmental pollution, but also empowers rural communities economically, socially, and environmentally. This innovation supports the achievement of SDGs, particularly Goal 12 (Responsible Consumption and Production) and Goal 13 (Climate Action). TRASHURE offers high value because it can serve as a digital solution to address the challenges of village waste management while also strengthening the local sustainable economy. For future development, it is recommended that the platform expand its digital service features, increase community engagement more widely, and strengthen collaboration with the private sector and government to optimize its contribution to sustainable village development.

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