T20 INDONESIA 2022 THINK

Policy Brief

INTEGRATED SUSTAINABLE WASTE MANAGEMENT AND FINANCING FRAMEWORK: A CALL FOR COLLABORATION AMONG LOCAL GOVERNMENTS, CENTRAL GOVERNMENTS, MULTILATERAL AGENCIES AND PRIVATE INSTITUTIONS

Task Force 8
Inclusive, Resilient, and Greener Infrastructure Investment and Financing

Eko Nur Surachman (State Finance Polytechnic, Indonesia)

Dian Handayani (State Finance Polytechnic, Indonesia)

Maman Suhendra (State Finance Polytechnic, Indonesia)

Sakti Prabowo (State Finance Polytechnic, Indonesia)

Lestari Kurniawati (State Finance Polytechnic, Indonesia)

Agung Dinarjito (State Finance Polytechnic, Indonesia)

Ricky PH (Supreme Court, Indonesia)

Abstract

Waste management has become an unprecedented global challenge, and it requires a global effort to improve and move towards a circular-economy model. This policy brief will discuss the need for an integrated sustainable waste-management system as part of the circular-economy model, how it relates to project financing, and policy recommendations for effective implementation. From experience, it has been confirmed that efficient resource allocation in the circular economy is not market driven. This model requires central government leadership, stakeholder collaboration and significant financing. Government action will trigger the participation of other parties to finance waste management.

Challenges

Waste management has become a worldwide concern. A report by the World Bank (2021) predicted that by 2050 waste production will be 73 percent higher than in 2020. This appears to be inevitable due to growing populations, urbanisation, economic development and consumption. The escalation of waste will mostly be driven by middle-income countries, in which waste generation will increase fivefold over the next three decades. According to the data, only 71 percent of global solid waste is collected and 29 percent is openly dumped.

Poorly managed waste poses threats to the environment and hinders national and local governments' goals of providing a welfare society. It is happening in developed countries (Shooshtarian, Maqsood, Caldera, and Ryley, 2022) and developing countries (David, John, and Hussain, 2020). The main stakeholders are municipal governments, which usually collaborate with central authorities and private entities (Guerrero, Maas, and Hogland, 2013). The involvement of stakeholders, along with a supportive environment, is critical to waste management (Guerrero et al., 2013; Naveen, 2021). A case in Bangalore, India showed that the waste-management system failed because the institution under the local authority suffered from a lack of adequate finances, technical knowledge, waste data, policies and law enforcement (Naveen, 2021). Most of these factors are inherently dependent on the central government. Thus, central authority intervention is necessary, which can integrate the waste-management system, and then direct local problems to find solutions (Shooshtarian et al., 2022). Nevertheless, municipalities and their residents are still the main actors. They should use a variety of methodologies, regulations and practices for waste treatment, such as controlling consumption behaviour and recycling valuable waste, as well as transforming waste into other sources including energy.

The traditional waste-management system, which is mostly associated with incineration (Tsui and Wong, 2019), collects and blends all the waste from upstream sources until it is accumulated in the final collection center downstream. Thus, it is difficult to apply appropriate technologies to manage the waste properly in terms of economic, social and environmental perspectives, which eventually leads to high project costs (Shekdar, 2009). Therefore, an intervention in the comprehensive system must bring stakeholders together to solve problems (Mani and Singh, 2016; Shekdar, 2009; Wilson et al., 2015). The use of information and communication technology is crucial for conducting sustainable waste treatment, using the Internet of Things as the integrator (Fatimah et al., 2020).

From the finance perspective, an integrated system would allow for more effective financing of waste-management practices and reduce the environmental impact (Khan et al., 2022). The World Bank (2018) emphasised that waste management is not an economic activity for generating income but a public service that involves external financing and cost recovery. Thus, external funding will be the backbone of sustainable waste management.

Proposals for G20

The increasing urgency to address the adverse effects of climate change has driven international awareness of the circular-economy model. A circular economy suggests retaining materials instead of disposing of them, which will reduce energy demand and wasted resources by cutting off unnecessary materials from the product lifecycle. Therefore, applying a circular economy leads to sustainable development. Nonetheless, it requires disruptive changes because national development will no longer be achieved solely by producing more goods and replacing them, but by maintaining and reusing them. To achieve that, integration between sustainability and business development is essential (Ritzén and Sandström, 2017). The processes used to transform waste into energy, fuels and other value-added products are crucial to a circular economy (Moustakas, Rehan, Loizidou, Nizami, and Naqvi, 2020). Hina et al., (2022) introduced a circular-economy conceptual framework that suggests the necessity of collaborative work and social inclusion.

The application of the circular economy leads to integrated sustainable waste management (ISWM). Financing is a critical factor for building ISWM because the initial formulation of the project is technology driven. The more unmanaged waste in a household, the more technology is needed to manage it. This also applies to the environmental impact, where more state-of-the-art machines are required to manage the waste. This problem leads to high project costs. Thus, technology involvement should be considered not only when it is technically feasible (considering the waste composition and volume) and sufficient technical capacity exists but also when people are ready to pay higher costs for waste services (World Bank, 2018).

Moreover, the available ISWM revenue to recover the investment is limited. Tipping fees are usually low, and the sale of electricity is restricted since the tariff is higher than fossil fuel-based electricity (i.e., coal), and the other by-products (i.e., refuse derived fuel [RDF] and compost) are difficult to sell. This situation makes ISWM projects less attractive for private investment, and at the same time, too big to be handled alone by the government. Waste management becomes a vicious cycle and more difficult to solve. Hence, waste-management service delivery models should be aligned with the local context (such as financial, operational and administrative requirements), need and policy objectives (World Bank, 2021).

This policy brief proposes a circular-economy concept with an integrated financing framework consisting of three actionable policy recommendations for stakeholders to set up a sustainable, resilient and inclusive business model based on waste management.

First, the circular economy implementation is backed by the regulatory role of the central government.

A circular economy needs an integrated approach, from households to higher levels of government, from upstream to downstream processes. To succeed, the circular economy relies on changing behaviour in a society – this is the part where the government plays a crucial role. Changing behaviour can either be coercive, such as by applying the polluter-pays principle, or voluntary through optional incentives.

The central government plays a major role in formulating the regulations on waste management (Calvo, Varela-Candamio, and Novo-Corti, 2014). The government should supervise stakeholders in the implementation of the regulation because stakeholders tend to be less concerned about the implementation of the circular economy, where there are no incentives for doing so or penalties for failing to do so. In addition, local government should define the coverage of waste collection and ensure it can be captured by the solid-waste management and recycling system (Wilson et al., 2015). All the waste data should be managed to inform the later stages of the circular economy.

While in midstream, manufacturers also have an important role in the recycling process. Government regulation and its enforcement can raise the producer's awareness of the urgency. However, the applied regulations also need to address the sustainability of the business processes – the supply chain starting from sourcing the raw materials, to the production of new goods by original equipment manufacturers (OEMs), to the waste that will be managed by waste management firms (WMFs) (Geda, Ghosh, Karamemis, and Vakharia, 2020). As a form of penalty, environmental taxes can be levied on OEMs to internalise the management of waste from the production of goods, while WMFs can get subsidised incentives for carrying out proper waste-recycling management processes. However, the sustainability efforts will be complicated because new products for recycling may experience changing levels of community demand. Therefore, the government needs to consider every complexity of product design involved in the recycling cycle – but still provide optimal product-market sustainability.

Lastly, downstream, waste data collected by a government body in the upstream process might be used by the WMF to choose the appropriate technology to manage the waste properly in terms of the recycled products and environmental impact. Moreover, the waste management performance can be measured by the recycling rate, disposal control and monitoring (Wilson et al., 2015).

Second, the central government takes control of the national strategy, while local governments play a role in providing data, implementing public education and adjusting strategies by considering their regional social capital.

India's evolution in its municipal solid-waste management is a good example of the central government's role and stakeholder collaboration among municipalities and the private and informal sectors. Not only is the central government in charge of forming solid-waste management laws and rules, framing policies and preparing guidelines and manuals, but it also helps the local government. It assists the local government in advancing solid-waste management practices and execution in terms of administration, financial management, technical systems and environmental safeguards (Priti and Mandal, 2019).

The central government oversees the national strategy through the establishment of regulations, mapping and strengthening regional capacities and creating markets. The central government, which has a national target, must have a comprehensive strategy to realise the target goals. A top-down approach needs to be implemented where the central government has the regulatory instruments to support efforts to reduce waste creation, either by imposing taxes or providing incentives and fiscal support. Applying the polluter-pays principle (i.e., carbon tax, environmental tax), imposing a penalty for companies and households that produce excessive waste, providing proper incentives (i.e., recycled product tax incentives), government monitoring of legal waste disposal and delivering fiscal support to the local government (i.e., tipping fee subsidies) should be designed to shift people's behaviour.

The experience of the European Commission shows that landfill taxes can reduce the use of landfills (Andretta, D'Addato, Serrano-Bernardo, Zamorano and Bonoli, 2018). Through environmental taxes, Italy managed to reduce landfill disposal and increase recycling and composting waste due to a relatively high landfill gate fee. Nevertheless, a common awareness in society of the urgency of waste management is difficult to achieve. Therefore, the government can impose environmental taxes on producers of goods and charge fees for removing waste from households. However, the government needs to pay attention to the possibility of illegal dumping of waste, and thus, monitoring is required. The monitoring will be more

effective if the community is involved. The government also needs to enforce the monitoring rules against violators (Choe and Fraser, 1999). Lax regulations and enforcement can be the major causes of failure in reducing the level of illegal waste disposal (Calvo et al., 2014).

The central government should also map the potential and capacity of each region so that it can allocate the appropriate resources and connect the useful assets between regions. The waste prevention and minimisation approach needs to be adjusted to the social capital of the local population. In Bali, Indonesia, local culture (*tri hita karana*) directs people towards more responsible behaviour regarding waste management (Surachman, Handayani, Suhendra, Zaki and Proboretno, 2021). Sharing resources can also be applied to infrastructure needs such as landfills, solid-waste transportation and information systems. Moreover, the involvement of the community can be optimised. Therefore, the major role of the local government is to fully understand the character of the local community.

Likewise, concerning the waste-treatment approach, the results of waste transformation need to be adjusted to the existing needs. For example, waste-to-energy operations should be built in areas that still have electricity needs. Waste to RDF converters should be built in areas that have RDF demand and are close to industries that need it, such as cement plants. By mapping the potential of the area, the central government can create an effective market for waste-management output, which should efficiently maintain supply according to the needs and demand. The sustainability of the waste-management industry is ensured by producing sustainable resources from waste processing.

Both the central and local governments also have access to digital technology start-ups in their areas. In Indonesia, several digital technology start-ups have emerged and offered solutions to address environmental problems (Good News From Indonesia, 2021). They contribute to various fields, including waste collection and treatment services, monitoring waste management, and information systems regarding the nearest waste bank. The central government can involve them in mapping the potential and problems, as well as in creating information systems and technology that can be used on a national scale.

Third, on the financing side, there is an urgency to improve stakeholder engagement in structuring waste-management projects to lower costs.

ISWM projects require collaboration among stakeholders, especially regarding the financing aspects (Asefi and Lim, 2017). According to Jabeen et al. (2022), in Pakistan it is necessary to convert solid waste into energy, but without the government's support it will not be financially feasible.

The central government needs to provide direct support, such as the Viability Gap Fund (VGF), from the state budget. The VGF reduces investment costs for the private-sector party.

In addition, the central government is recommended to apply green budget tagging in its budget mechanism, such as green bonds or social impact bonds (SIBs), to support green project financing. Green bonds are attractive to investors, financial institutions and governments because they can respond to the growing awareness of systemic climate damage (Deschryver and de Mariz, 2020). However, the major concerns involve standardisation of the issuance process and whether the green bonds do represent the required environmental transformation (Verma and Agarwal, 2020). Hence, the government should prepare the road map and identify its critical path before it is launched on the market. On the other hand, recent reporting suggests that the global investment needs cannot be met by current trends in proceeds allocation (Tolliver et al., 2019). Thus, an opportunity to expand the issuance of green bonds combined with other mechanisms of environmental finance is available to help meet the targets of local United Nations Sustainable Development Goals (SDGs) and the worldwide Paris Agreement.

Another instrument to mobilise resources is the SIB, or sustainable development bond (SDB). The SDB extends the issuer's explicit commitments to sustainability impact projects that are measurable and auditable (Bilotta and Brookings, 2021). SDBs differ from traditional bonds since they provide added value related to the final use of the sources. Not only do the SDBs answer the need to meet investment targets linked to environmental, social and corporate governance, but they also can be associated with the better financial condition of the issuer. From a local perspective, SDBs can be more attractive by pooling small bond issuances, thus reducing transaction costs and attracting private investors. (Bilotta and Brookings, 2021). However, to make the project attractive for the private-sector party, the central government needs to provide indirect support (i.e., government guarantees). The local government, as the main stakeholder in waste management, can also raise funding by issuing municipal SIBs. However, this concept is still undeveloped, especially in developing countries.

After all the above government actions have been taken, the private-sector parties can participate in the projects more easily. Their involvement is important because the project will gain efficiency and achieve sustainability. To lower the cost of funds, multilateral institutions (i.e., the World Bank, ADB, JICA, AIIB) and other development banks can also be invited. Beirne (2021) states that multilateral institutions should fulfill their role to support climate-vulnerable developing countries. In this case, the institutions are needed to cover technical and financial support for waste-management projects.

Some international initiatives have been implemented such as the Global Climate Fund and the SDGs. These initiatives should be enhanced in terms of technical project assistance coverage and project financing.

Although questions continue to arise regarding the stable operation of global philanthropy, and with every nation still financially struggling due to the recent pandemic, it is worth exploring the use of local social capital. Bilotta and Brookings (2021) proposed local infrastructure financing by looking for innovative solutions that support investment requirements and the environment. Small businesses and small-scale entrepreneurs tend to invest their earnings in the local economy. In this sense, they could contribute further by investing in the SDBs. Meanwhile, Muslim-majority countries can utilise Islamic social funds (i.e., *waqf*) and endowments for a good purpose and sanctioned by Islamic law (Abdullah, 2018; T. Khan, 2019). Ari and Koc (2021) propose a *waqf*-owned financial intermediary as an alternative equity-based financing model. The study demonstrates that, by considering long-term social implications, economic growth and environment-friendly projects, *waqf*-based institutions have significant potential for aiding the achievement of SDGs.

All the above collaborative financing resources can be strategically used to form a blended finance scheme and mobilise additional external private commercial finance. However, the scheme needs to be designed systematically based on the project life cycle to achieve the optimal result. Indonesia has the experience of arranging a local waste-management project involving the participation of central government, local governments, multilateral agencies, and the private sector. However, the involvement of multilateral agencies in the project was not by design but was later realised during project structuring. Thus, it is difficult to replicate. Hence, the central government needs to establish a framework of a blended financing scheme to realise an ISWM system by implementing a pilot project.

Conclusion

To conclude, this policy brief explains the challenges that governments are facing in financing sustainable waste management. The ISWM system and its prerequisite condition for achieving optimal financing are discussed as the entry point and manifestation of a circular economy. The circular economy is a disruptive model for the mainstream open economic development, and Group of 20 (G20) nations have a strategic role in supporting the establishment of such an ecosystem. The major challenges come from the coercive role of central authorities and financial structuring. To address these challenges, this policy brief suggests three integrated approaches to creating an inclusive and resilient waste-management infrastructure. Central governments should 1) direct the proper regulatory instruments that are necessary for manifesting circular-economy behaviour; 2) take charge of the national strategy through the establishment of supporting regulations, mapping and strengthening of regional capacities, and creating markets; 3) structure projects to achieve sustainable financing and lower costs.

References

Abdullah, M. (2018). Waqf, Sustainable Development Goals (SDGs) and maqasid al-shariah. International Journal of Social Economics, 45(1), 158–172. Emerald Group Publishing Ltd.

Andretta, A., D'Addato, F., Serrano-Bernardo, F., Zamorano, M., and Bonoli, A. (2018). ENVIRONMENTAL TAXES TO PROMOTE THE EU CIRCULAR ECONOMY'S STRATEGY: SPAIN vs. ITALY. Environmental Engineering and Management Journal, 17(10), 2307–2311.

Ari, I., and Koc, M. (2021). Towards sustainable financing models: A proof-of-concept for a waqf-based alternative financing model for renewable energy investments. Borsa Istanbul Review, 21, S46–S56. Borsa Istanbul Anonim Sirketi.

Asefi, H., and Lim, S. (2017). A novel multi-dimensional modeling approach to integrated municipal solid waste management. Journal of Cleaner Production, 166, 1131–1143.

Beirne, J. (2021). Policy brief Mitigating and Managing the Effects of Climate Change on Macrofinancial Stability and Sovereign Risk.

Bilotta, N., and Brookings, M. B. (2021). Local Governance of Infrastructure Financing to Financing to Promote Sustainable and Inclusive Cities.

Calvo, N., Varela-Candamio, L., and Novo-Corti, I. (2014). A Dynamic Model for Construction and Demolition (Candamp;D) Waste Management in Spain: Driving Policies Based on Economic Incentives and Tax Penalties. Sustainability, 6(1), 416–435.

Choe, C., and Fraser, I. (1999). An Economic Analysis of Household Waste Management. Journal of Environmental Economics and Management, 38(2), 234–246.

David, V. E., John, Y., and Hussain, S. (2020). Rethinking sustainability: a review of Liberia's municipal solid waste management systems, status, and challenges. Journal of Material Cycles and Waste Management, 22(5), 1299–1317. Springer.

Deschryver, P., and de Mariz, F. (2020). What Future for the Green Bond Market? How Can Policymakers, Companies, and Investors Unlock the Potential of the Green Bond Market? Journal of Risk and Financial Management, 13(3), 61. MDPI AG.

Fatimah, Y. A., Govindan, K., Murniningsih, R., and Setiawan, A. (2020). Industry 4.0 based sustainable circular economy approach for smart waste management system to achieve sustainable development goals: A case study of Indonesia. Journal of Cleaner Production, 269. Elsevier Ltd.

Geda, A., Ghosh, V., Karamemis, G., and Vakharia, A. (2020). Coordination strategies and analysis of waste management supply chain. Journal of Cleaner Production, 256, 120298.

Good News From Indonesia. (2021, April). Selamat Hari Bumi! Yuk, Cari Tahu 6 Startup Indonesia yang Peduli Lingkungan. Good News From Indonesia.

Guerrero, L. A., Maas, G., and Hogland, W. (2013). Solid waste management challenges for cities in developing countries. Waste Management, 33(1), 220–232.

Hina, M., Chauhan, C., Kaur, P., Kraus, S., and Dhir, A. (2022). Drivers and barriers of circular economy business models: Where we are now, and where we are heading. Journal of Cleaner Production, 333. Elsevier Ltd.

Jabeen, F., Adrees, M., Ibrahim, M., Mahmood, A., Khalid, S., Sipra, H. F. K., Bokhari, A., et al. (2022). Trash to Energy: A Measure for the Energy Potential of Combustible content of Domestic solid waste generated from an industrialized city of Pakistan. Journal of the Taiwan Institute of Chemical Engineers. Taiwan Institute of Chemical Engineers.

Khan, S., Anjum, R., Raza, S. T., Ahmed Bazai, N., and Ihtisham, M. (2022). Technologies for municipal solid waste management: Current status, challenges, and future perspectives. Chemosphere, 288. Elsevier Ltd.

Mani, S., and Singh, S. (2016). Sustainable Municipal Solid Waste Management in India: A Policy Agenda. Procedia Environmental Sciences, 35, 150–157. Elsevier BV.

Moustakas, K., Rehan, M., Loizidou, M., Nizami, A. S., and Naqvi, M. (2020, March 1). Energy and resource recovery through integrated sustainable waste management. Applied Energy. Elsevier Ltd.

Naveen, B. P. (2021). Scenarios of waste management nexus in Bangalore. Energy Nexus, 1, 100004. Elsevier BV.

NAVEEN, B. P. (2021). Scenarios of waste management nexus in Bangalore. Energy Nexus, 1, 100004. Elsevier.

Priti, and Mandal, K. (2019, November 1). Review on evolution of municipal solid waste management in India: practices, challenges and policy implications. Journal of Material Cycles and Waste Management. Springer Tokyo.

Ritzén, S., and Sandström, G. Ö. (2017). Barriers to the Circular Economy - Integration of Perspectives and Domains. Procedia CIRP (Vol. 64, pp. 7–12). Elsevier B.V.

Shekdar, A. v. (2009). Sustainable solid waste management: An integrated approach for Asian countries. Waste Management, 29(4), 1438–1448.

Shooshtarian, S., Maqsood, T., Caldera, S., and Ryley, T. (2022, March 1). Transformation towards a circular economy in the Australian construction and demolition waste management system. Sustainable Production and Consumption. Elsevier B.V.

Surachman, E. N., Handayani, D., Suhendra, M., Zaki, K., and Proboretno, N. (2021). ANALISIS KELAYAKAN KEUANGAN PROYEK DALAM RANGKA PEMBIAYAAN INFRASTRUKTUR PENGELOLAAN SAMPAH PERKOTAAN PLTSA DI INDONESIA. Jakarta.

Tolliver, C., Keeley, A. R., and Managi, S. (2019). Green bonds for the Paris agreement and sustainable development goals. Environmental Research Letters, 14(6). Institute of Physics Publishing.

Tsui, T.-H., and Wong, J. W. C. (2019). A critical review: emerging bioeconomy and waste-to-energy technologies for sustainable municipal solid waste management. Waste Disposal and Sustainable Energy, 1(3), 151–167.

Verma, A., and Agarwal, R. (2020). A Study of Green Bond Market in India: A Critical Review. IOP Conference Series: Materials Science and Engineering, 804(1). Institute of Physics Publishing.

Wilson, D. C., Rodic, L., Cowing, M. J., Velis, C. A., Whiteman, A. D., Scheinberg, A., Vilches, R., et al. (2015). “Wasteaware” benchmark indicators for integrated sustainable waste management in cities. Waste Management, 35, 329–342. Elsevier Ltd.

World Bank. (2018). Municipal Soild Waste Management: A Roadmap for Reform for Policy Makers, 1–162.

World Bank. (2021). Bridging the Gap in Solid Waste Management: Governance Requirements for Results, 1–206.