© IJARW | ISSN (O) - 2582-1008
September 2025 | Vol. 1 Issue. 1
www.ijarw.com

SOLUTIONS TO ENHANCE THE EFFECTIVENESS OF MUNICIPAL SOLID WASTE MANAGEMENT IN VIETNAM IN THE COMING PERIOD

Nguyen Thanh Hien

Hanoi University of Natural Resources and Environment, Vietnam

ABSTRACT

This paper addresses the current practices of municipal solid waste (MSW) management in Vietnam. It identifies difficulties, obstacles and limitations in the present system, as well as their underlying causes. On this basis, the paper proposes solutions to improve the effectiveness of MSW management in Vietnam in the near future.

Keyword: Solid waste; municipal solid waste; environmental protection; management.

1. INTRODUCTION

Urbanization and economic development have resulted in a rapid increase in municipal solid waste (MSW) generation, exceeding the current system's capacity for treatment. Waste composition has become increasingly complex, particularly with the rise of plastic waste, creating major challenges for treatment. Vietnam remains heavily dependent on landfilling, which accounts for more than 70% of the total waste volume. Most of these landfills fail to meet sanitary standards, causing soil, water and air pollution, as well as inefficient land use. Although regulations are in place, waste separation at source has hardly been implemented in a serious manner. This reduces the effectiveness of advanced treatment technologies and results in the loss of recyclable resources. The Law on Environmental Protection (2020) stipulates that December 31, 2024, is the latest deadline for nationwide implementation of household MSW separation at source. This paper focuses on clarifying several concepts such as MSW, source separation of MSW in Vietnam and the status of MSW management under the 2020 Environmental Protection Law. It highlights the existing limitations and proposes recommendations for MSW source separation.

This study is derived from the institutional-level scientific research project "Research on legal regulations on municipal solid waste management from the practical perspective of Phu Tho province" at Hanoi University of Natural Resources and Environment, project code HUNRE.2025.07.10. The results presented in this paper form an important part of the project.

2. RESEARCH CONTENT

2.1. Current status of municipal solid waste management in Vietnam

2.1.1. Issuance of guiding documents for implementation

The Law on Environmental Protection 2020 (effective from January 1, 2022) was promptly followed by a series of detailed guiding documents issued by the authorities. Immediately thereafter, the Government promulgated Decree No. 08/2022/NĐ-CP (January 10, 2022), guiding several provisions of the Law and Decree No. 45/2022/NĐ-CP (July 7, 2022; effective August 25, 2022), which prescribes administrative penalties in the environmental field (including fines of VND 0.5–1 million for households or individuals failing to separate household waste).

The Ministry of Natural Resources and Environment (MONRE) promptly issued Circular No. 02/2022/TT-BTNMT (January 10, 2022), specifying technical requirements for collection points, transport vehicles, treatment technology criteria and the pricing mechanism for MSW collection–transport–treatment services. Subsequently, MONRE issued Circular No. 07/2025/TT-BTNMT (February 28, 2025) amending and supplementing several provisions of Circular No. 02/2022/TT-BTNMT. The Ministry has also issued numerous official documents and technical guidelines (e.g., Official Letter No.

9368/BTNMT-KSONMT dated November 2, 2023, on MSW source separation) and is finalizing additional legal instruments: in June 2024, Circulars were promulgated on technical procedures for collection and transport of source-separated MSW and on economic–technical norms for landfill and biomass treatment; in September 2024, a Circular was issued on treatment norms for other MSW technologies. By the end of 2024, additional National Technical Regulations on MSW incinerators and landfills are expected.

At the local level, many provinces and cities have taken proactive action. For instance, Ho Chi Minh City promulgated Decision No. 63/2024/QĐ-UBND (September 20, 2024; effective October 1, 2024) regulating MSW management in the city.

In practice, implementation is being actively promoted but remains in its early stages. By mid-2025, only 32 out of 63 provinces/cities had piloted MSW source separation; most remain at small-scale levels with many households still managing waste by themselves (using it as animal feed, burying or burning at home) rather than complying with general regulations. On the other hand, the waste collection and treatment system has shown marked improvements: the total MSW generated is approximately 69,400 tons/day, of which about 91% is collected and treated (97% in urban areas, 80.5% in rural areas); the landfill rate in rural areas is now about 59% (a 30% reduction compared with 2012). These figures demonstrate that the network of disposal sites and treatment facilities (notably in Hanoi and Ho Chi Minh City, which together account for ~23% of the nation's waste volume) has been upgraded, though not yet comprehensively.

However, significant shortcomings remain. Many localities are "almost unprepared" for mandatory waste separation before the 2024 deadline. Post-separation infrastructure for collection, transport and recycling is still lacking and fragmented. Investment capital, economic–technical norms and service pricing mechanisms are incomplete, failing to incentivize private sector participation. Awareness and engagement of local authorities, enterprises and citizens in source separation remain limited with public communication yet to establish habitual practices.

In summary, after more than two years of implementing the 2020 Law, the legal framework has been issued in a timely manner, awareness campaigns and workshops have been actively conducted and the overall national MSW treatment rate has improved. Nevertheless, at the local level, source separation and management continue to face major challenges in terms of resources and infrastructure, requiring urgent completion of technical procedures, pricing mechanisms and investments to achieve the objectives set out in the Law.

2.2.2. Situation of Generation, Source Separation, Collection and Transportation of Municipal Solid Waste

a. MSW Generation

According to survey and assessment results, the current nationwide generation of municipal solid waste (MSW) is estimated at more than 61,000 tons/day, of which urban areas account for over 37,000 tons/day, while rural areas generate more than 24,000 tons/day. Statistics by province/centrally administered city show significant variation in waste generation volumes. Localities with high generation rates include Ho Chi Minh City (9,100 tons/day), Hanoi (6,500 tons/day), Thanh Hoa (2,246 tons/day), Binh Duong (1,764 tons/day) and Dong Nai (1,838 tons/day). Provinces with lower volumes include Bac Kan (190 tons/day), Kon Tum (212 tons/day), Lai Chau (260 tons/day) and Ha Nam (265 tons/day).

The data indicate that more than one-quarter of localities generate over 1,000 tons/day. This suggests that most provinces and cities in Vietnam are technically capable of applying waste-to-energy (WtE) incineration technology, since the minimum feedstock requirement for this technology is approximately 200–300 tons/day. However, attention must be paid to the specific characteristics of mountainous, remote and sparsely populated regions, where waste streams often have low calorific value, making them unsuitable for WtE incineration.

b. Source Separation of MSW

At present, source separation of MSW is only implemented in certain localities and remains largely voluntary without strong enforcement mechanisms. Many provinces/cities are conducting pilot programs in selected areas, while Ho Chi Minh City, Da Nang and Can Tho have implemented large-scale programs. Waste is generally separated into categories such as

combustible waste, recyclable waste and other types of waste. However, source separation practices largely depend on the waste treatment technologies being applied locally.

Overall evaluation shows that source separation has not yielded significant results. In practice, recyclable waste is often collected and sold by households, informal collectors and scrap buyers before being recovered by formal collection and transport units. In addition, localities currently lack dedicated equipment and vehicles for each separated waste stream; as a result, waste is often transported together in the same collection system, reducing the effectiveness of source separation. Furthermore, in many cases, waste is separated at source but treatment facilities still apply a single undifferentiated treatment method, undermining the benefits of separation. Moreover, certain MSW treatment technologies do not require pre-separation; thus, the necessity of source separation should be reconsidered in such cases (except for the purpose of separating recyclable materials and other special waste types).

c. Collection and Transportation of MSW

Collection of MSW

Currently, collection and transport practices vary between urban and rural areas, across provinces and even among regions within the same locality.

In urban areas, household waste is usually collected by service providers at fixed hours. Informal collectors typically use handcarts to transfer waste to designated collection points, from which it is loaded onto trucks for transport to treatment facilities or intermediate transfer stations before reaching treatment sites. The MSW collection rate in urban areas ranges from 62% to over 90%, indicating that current collection targets are being met.

In rural areas, many localities rely on self-managed community groups or women's associations to collect waste at regular intervals and transfer it to collection points, from which urban environment companies transport it to treatment facilities. However, in many cases waste is not collected, leading to the formation of temporary dumpsites that cause environmental pollution in rural regions.

Statistics show that 22 provinces/cities currently use transfer stations. Selecting sites for waste collection and transfer stations is often challenging and faces public opposition due to odor, leachate and insect attraction, all of which negatively impact the environment. Many transfer points lack roofing, so during rainfall waste becomes soaked, generating additional leachate and causing environmental concerns.

Transportation of MSW

Waste transportation still faces significant challenges. Landfills are often located far from residential areas, increasing transportation costs. Meanwhile, environmental sanitation fees (or waste collection–transport service charges) collected from households currently cover only part of collection expenses and are insufficient to sustain transportation activities.

Transport capacity in some localities remains limited and transport vehicles often cause leakage and spillage of waste during transit. Waste collection and transportation from islands is particularly difficult, as shipping waste to the mainland is costly, while investing in large-capacity incinerators locally is not economically viable.

Another challenge is that many localities have proactively modified collection and transport vehicles to suit local topographical conditions. However, these modifications often encounter regulatory barriers during vehicle registration and inspection under transport sector regulations. Therefore, there is a need for specific technical guidelines on waste collection and transport vehicles, ensuring compliance with sectoral standards while also addressing operational efficiency and enabling registration/inspection in accordance with transportation regulations.

2.3. Assessment of Municipal Solid Waste Management in Vietnam at Present

2.3.1. Achievements

The system of regulatory documents has been increasingly consolidated, providing an important legal foundation for unified waste management under the new orientation. This constitutes a significant step toward promoting waste reuse and recycling, preventing the application of outdated treatment technologies such as uncontrolled landfilling and improving the

effectiveness of environmental protection. Since the Environmental Protection Law (EPL) 2020 came into effect on January 1, 2022 with the requirement that source separation of MSW must be implemented nationwide starting in 2025, the management of municipal solid waste in Vietnam has made notable progress.

According to the Ministry of Natural Resources and Environment (MONRE), in 2023 the national MSW collection and transportation rate reached approximately 88.34% (96.60% in urban areas and 77.69% in rural areas). The MSW treatment system has also expanded: as of now, there are 1,548 treatment facilities nationwide, including 340 MSW incineration plants (21.96%), 30 composting facilities (1.94%) and 1,178 sanitary and non-sanitary landfills (76.10%). Source separation models have been increasingly piloted: by mid-2025, about 34 out of 63 provinces/cities had initiated pilot programs in residential areas.

Several localities have reported positive results. For instance, Hanoi (with pilot implementation in six districts) collected an additional over 3 tons of recyclables per day, saving 2.5 billion VND in treatment costs and 500 million VND in bulky waste collection costs during the pilot phase. In Hai Duong (Nam Sach district), 100% of households were mobilized to participate in waste separation with households allowed to compost organic waste into fertilizer at home. At the same time, many localities are investing in dedicated separation bins, dual-compartment collection trucks and recycling material processing plants to improve efficiency.

In general, pilot initiatives and communication campaigns on source separation have begun to yield initial success. Beyond cost savings, MSW separation significantly reduces the volume of waste requiring landfilling, gradually increases recycling rates and contributes to the transition toward a circular economy in waste management.

2.3.2. Limitations, Weaknesses and Underlying Causes

a. Limitations and Weaknesses

MSW management has not yet been implemented under an integrated management approach with limited emphasis on waste minimization in daily life. Cleaner production practices and waste audits in industry remain underdeveloped. Most waste is not yet separated at source; local pilot programs remain experimental, fragmented and not institutionalized.

Collection of MSW in rural areas remains low with little improvement. Recycling activities are still small-scale, informal and largely carried out by the unregulated sector in traditional craft villages, which generate secondary pollution. Environmental protection authorities at the local level lack adequate oversight and control. Most recycling facilities are small in scale, technologically outdated with low levels of investment and obsolete equipment, leading to further environmental pollution.

The dominant treatment method is still unsanitary landfilling, which consumes large areas of land, while the proportion of waste treated with energy recovery remains very low. Many MSW treatment facilities constructed and operated in recent years fail to meet environmental protection requirements, causing contamination of water, soil and air.

The implementation of source separation following the enactment of EPL 2020 (effective January 1, 2022) reveals many weaknesses. Specifically:

Collection and transport infrastructure is not synchronized; in many places, separated waste streams are mixed together during collection, negating separation efforts.

Post-separation treatment and recycling infrastructure is lacking, especially large-scale systems (currently dominated by household-level operations, manual technologies and low capacity). As a result, most recyclables are still landfilled or crudely processed.

Public awareness and practice of waste separation remain limited due to insufficient outreach and incentives, resulting in very low separation rates (below 20% in urban areas).

Institutional frameworks, policies and regulations are incomplete. Many localities are still at small pilot stages and have not scaled up nationwide. There is a lack of regulations on pay-as-you-throw schemes (waste collection service fees by weight/volume). As of now, only 32 out of 63 provinces have piloted separation; only 5 provinces have issued service fees; and 4 provinces have enacted technical norms.

Local government leadership and oversight remain weak and inconsistent. Many areas are piloting at only a small scale, while ongoing government restructuring has fragmented resources, preventing systematic implementation at the commune and district levels.

b. Underlying Causes

The limitations in MSW management in Vietnam arise from both subjective and objective factors. First, although the legal and policy framework has been promulgated, it remains fragmented, overlapping and in some cases impractical, creating difficulties in implementation. Financial resources and infrastructure investment are insufficient; treatment technologies are outdated with heavy reliance on landfilling, while modern approaches such as waste-to-energy and recycling have not been widely applied.

Source separation is ineffective due to household habits, lack of consistent guidance and weak supervision. Intersectoral management capacity and coordination remain low with a shortage of qualified technical personnel. Oversight, inspection and enforcement of violations are inadequate.

Furthermore, public awareness and sense of responsibility for environmental protection remain limited; waste separation and minimization are not yet perceived as a shared social responsibility. Collectively, these factors explain why MSW management in Vietnam has not achieved the expected effectiveness.

2.4 Some Solutions to Strengthen Municipal Solid Waste Management in the Coming Period

2.4.1. Solutions on Improving the Legal Framework, Mechanisms, Policies and Institutional Organization

It is necessary to concretize regulations on segregation, collection, transportation and treatment according to different waste categories and local scales. Regulations on financial mechanisms and service charges for waste collection and treatment should be completed based on the principle of "polluter pays." The system of legal documents, technical standards and regulations on municipal solid waste (MSW) management must be further developed and refined. A revised Decree amending and supplementing existing Decrees related to state management of solid waste should be drafted and submitted to the Government for promulgation to ensure a unified and coherent state management system from central to local levels.

Regulations on financial mechanisms and service charges for waste collection and treatment should be finalized in accordance with the "polluter pays" principle. Local authorities must strictly comply with environmental criteria under the National Target Program on New Rural Development, particularly by refraining from investing in small-scale incinerators that fail to meet environmental technical standards. Training and capacity-building programs for staff and operators of incineration facilities should be prioritized to ensure compliance with environmental and technical requirements.

Furthermore, the development and enforcement of guiding documents for the implementation of the 2020 Law on Environmental Protection regarding the segregation and collection of MSW must be accelerated. Specifically, from January 1, 2025, households and individuals will be required to separate waste into three categories: recyclable waste, food waste and other waste. At the same time, strict enforcement of the "polluter pays" principle should be applied with a gradual but rational increase in service fees for waste management, coupled with mandatory waste insurance for production and business facilities.

2.4.2. Solutions on Investment and Finance

In the coming period, to enhance the effectiveness of municipal solid waste management, investment and financial solutions should be prioritized along sustainable pathways. The State should allocate sufficient budget resources while simultaneously promoting socialization, encouraging enterprises and communities to participate through public–private partnership (PPP) models.

In addition, implementing a fee system for waste collection, transportation and treatment based on the "polluter pays" principle will create a stable financial resource, reducing the burden on the state budget. Alongside this, preferential tax and credit policies, together with the efficient use of environmental funds, should be adopted to support investment projects in advanced treatment technologies, progressively phasing out landfilling and promoting recycling and energy recovery.

Expanding international cooperation, accessing concessional loans, green finance and carbon credit mechanisms will further diversify resources and drive MSW management towards modern, efficient and environmentally friendly practices. It is also essential to ensure balanced budgeting for MSW management, strengthen socialization in waste collection, transportation and facility operation and gradually increase sanitation fee revenues while reducing direct subsidies from the state budget for MSW collection and transportation.

Moreover, the State should formulate supportive policies for communities living near waste treatment facilities to encourage public acceptance of treatment plant construction and consent for land allocation. Policy mechanisms offering reduced service charges for individuals and households that effectively implement waste segregation at source in accordance with regulations should also be studied and applied.

2.4.3. Solutions on Monitoring, Inspection and Supervision

In the coming period, to strengthen municipal solid waste (MSW) management, it is essential to focus on solutions related to monitoring, inspection and supervision in a systematic, transparent and regular manner. First, the system of legal documents, standards and technical regulations serving as the basis for monitoring activities must be completed. Competent authorities should intensify both periodic and ad hoc inspections of collection, transportation and treatment of MSW, while applying digital technologies and online monitoring systems to track waste volumes, collection routes and treatment methods.

Inspection must be closely linked with strict enforcement against violations, ranging from improper disposal to fraudulent reporting of waste volumes or treatment quality, thereby ensuring deterrence and fairness. In addition, community-based monitoring and the involvement of socio-political organizations should be promoted, combined with the disclosure of information to create social pressure and enhance transparency. The consistent implementation of these measures will help prevent management negligence, strengthen accountability and improve the effectiveness and efficiency of MSW management in the coming period. Furthermore, inspection and supervision of collection, transportation and treatment activities must be reinforced to prevent, detect and promptly address violations; responsibility of local state management agencies must also be examined, particularly in cases where environmental pollution caused by MSW occurs.

2.4.4. Solutions on Technical Support and Research and Development of Technology

In the coming years, strengthening MSW management requires advancing technical support solutions and promoting research and development (R&D) of technologies. The State and local authorities should invest in improving the technical capacity of collection, transportation and treatment systems with an emphasis on modern, synchronized and regionally appropriate equipment. At the same time, research and application of advanced technologies should be encouraged, such as automated sorting, recycling of waste into raw materials, production of refuse-derived fuel (RDF), waste-to-energy incineration and biological treatment, thereby reducing the proportion of landfilled waste.

Universities, research institutes and enterprises should be encouraged to collaborate in R&D and technology transfer, supported by state policies on funding and tax incentives to promote innovation. Additionally, strengthening training for high-quality technical personnel and building a digital database on MSW are crucial measures to improve management and monitoring, advancing MSW treatment toward modernity and sustainability.

Research should focus on developing environmentally friendly, state-of-the-art treatment technologies that minimize landfilling, increase recycling and reuse rates and enhance energy recovery from waste. Efforts should also be made to transfer and apply best available techniques (BAT) and environmentally sound technologies. Pilot models on waste segregation at source, collection, transportation, recycling, reuse and energy recovery should be established to select suitable approaches for nationwide replication. Furthermore, programs should be developed and implemented to remediate pollution and improve the environment at unsanitary MSW landfill sites currently in operation.

2.4.5. Solutions on Communication, Awareness-Raising and Human Resource Development

Effective waste management cannot be achieved by technical measures alone; it also requires strong communication, a well-informed public and competent human resources to ensure that policies are understood, accepted and implemented in practice. Raising awareness, engaging communities and businesses, sharing knowledge and strengthening institutional capacity are therefore essential elements of a sustainable approach. To this end, several solutions can be proposed.

First, education and communication on the principles of Reduce, Reuse and Recycle must be prioritized through broad campaigns in schools, residential areas and mass media. These campaigns should emphasize the benefits of waste segregation at source, including protecting the environment, lowering treatment costs and generating recyclable products with the ultimate goal of changing public attitudes and behaviors. Lessons from Korea show that pilot implementation combined with extensive outreach can gradually foster acceptance of pay-as-you-throw policies. At the same time, communication on the provisions of the Law on Environmental Protection 2020 and related regulations on waste management should be strengthened at all levels of society to ensure widespread awareness and compliance.

Second, the active participation of communities and businesses should be encouraged. Green neighborhood and sustainable street models, where households segregate waste, compost organic matter and use recycled products, should be expanded. Environmental volunteer clubs and networks can provide support, reminders and monitoring, thereby creating social pressure for compliance. Mobilizing public consensus and participation in both policy development and implementation will increase effectiveness. Enterprises, particularly private waste management companies, should be engaged in dialogue and consultation to improve service delivery. Training and workshops for businesses on cleaner production, waste minimization and legal compliance in collection, transportation, treatment and recycling of municipal solid waste will also help build capacity in the private sector.

Third, experience sharing and mutual learning among localities should be promoted. Exchange programs, study visits and collaborative learning activities on waste management should focus on the feasibility and adaptability of treatment models to local conditions, ensuring that solutions are both practical and sustainable.

Fourth, transparency and communication of data must be ensured. Regular publication of reports on collected waste volumes, treatment rates, infrastructure investment and key environmental indicators such as air and water quality should be made available to the public. Providing communities with accurate and reliable data on both challenges and achievements will motivate changes in daily habits. At the same time, staff and specialists in waste management need to be trained in communication skills to effectively guide and support communities.

Finally, human resource development and capacity building should be strengthened. This involves developing sufficient and qualified human resources to meet growing management requirements, upgrading infrastructure and equipment, applying science and technology more effectively and mobilizing resources from across society for waste reduction, segregation, collection, transportation and treatment. By investing in people, systems and technology together, it is possible to build a comprehensive and resilient waste management framework that supports both environmental sustainability and social well-being.

3. CONCLUSION

The importance of waste segregation at source: The segregation of municipal solid waste (MSW) at source plays a pivotal role in modern waste management. It constitutes the foundation of an efficient and sustainable waste treatment system. When waste is separated from the outset organic waste, recyclable waste and other residual waste can be collected and treated individually. This practice not only reduces the volume of waste requiring landfill disposal but also transforms waste into resources, thereby contributing to the development of a circular economy. Although policies and initial efforts have been introduced, waste segregation at source in Vietnam still faces numerous challenges. Public awareness remains limited; collection and treatment systems are not yet synchronized and there is a lack of concrete incentive mechanisms. The 2020 Law on Environmental Protection explicitly stipulates the responsibility of households and individuals to separate waste at source, moving beyond the

previous approach of merely encouraging segregation. Waste segregation at source is not only an environmental solution but also a critical socio-economic issue. Effective implementation of this practice will generate significant benefits: reducing waste treatment costs, conserving resources, creating income from recycling and most importantly, protecting the living environment. Success requires close coordination among regulatory authorities, enterprises and the broader community.

NOTES: This study is derived from the institutional-level scientific research project "Research on legal regulations on municipal solid waste management from the practical perspective of Phu Tho province" at Hanoi University of Natural Resources and Environment, project code HUNRE.2025.07.10. Author's information: Nguyen Thanh Hien, Hanoi University of Natural Resources and Environment, Vietnam; Email: nthien.hcth@hunre.edu.vn.

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