# Challenges on creation of sustainable municipal waste and wastewater management in Indonesia using experience of Hungary

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**Selly Ayu Janetasari**[1,2]*, **Ljudmilla Bokányi**[1]

[1] Institute of Raw Material Preparation and Environmental Processing, Department of Bioprocessing and Reaction Techniques, University of Miskolc, Hungary
[2] Research Unit for Clean Technology, National Research and Innovation Agency, Bandung, Indonesia

*E-mail: janetasari.selly.ayu@student.uni-miskolc.hu

**Abstract.** Hungary is a country in Central Europe with the population of 10 million people. In the second half of the last century, it belonged to the so-called communist block with the typically poor municipal waste and wastewater treatments. After the change of the political regime in 1989 and joining the European Union in 2004, there has been a huge development in these areas. The management of municipal solid waste now-a-days implements effective, countrywide separative collection, sorting plants for separately collected packaging materials, composting and biogas plants for biowaste, as well as facilities on the mechanical-biological treatment of residual fraction. As a result, the recycling rate of materials and energy is rather high. The municipal wastewater treatment system has been developing since, the wastewater sewerage system covers now over 80% of the population. The wastewater treatment in all treatment plants incorporates three stages: mechanical, biological and advanced chemical one. Nevertheless, there are newer and newer targets and challenges. One of the most important tasks is to develop a sustainable sewage sludge treatment system aiming at the converting of this by-product into agricultural or energetic values. In Indonesia with 270 million people, according to the Indonesian Ministry of Environment and Forestry, 66.4% of municipal solid waste generated is simply landfilled, with 57% of landfills operating as open dumpsites, and 19.62% of waste is unregulated. Centralised wastewater treatment operates only in big cities and consists of only two stages. There are a huge number of targets to be met both in research and development, as well as in legislative and engineering fields. To create the sustainable municipal waste and wastewater treatment system in Indonesia, the Hungarian example and experience can be highly motivating and useful.

**Keywords:** recycling; sewage sludge problems; solid waste management; wastewater treatment.

## 1. Introduction

The rapid growth of the urban population in Indonesia has had a significant impact on the rate of water consumption and the increase in wastewater generation. Some of the negative issues caused by wastewater include eutrophication, health risks to humans and livestock, oxygen loss, and undesirable changes in the aquatic ecosystem. Solid waste and wastewater treatment is a kind of indicator of community waste management development. The lack of expertise and the limited budget available are

two classic issues that force local governments to struggle to provide even minimal waste management. Typically, solid waste generated in residential areas is not collected and transported to a disposal site. In dense urban areas, effective sanitation and wastewater management is becoming increasingly difficult. Rapid urbanization and rising settlement densities in low-income urban and peri-urban areas highlight the need for robust and affordable waste technologies and management systems.

In Hungary landfilling was the dominant treatment of municipal solid waste for decades. Prior to 1989, municipal waste management was not subject to extensive regulations and focused solely on hazardous wastes and household waste collection. Hungary joined the European Union (EU) in 2004, and since the late 1990s, the national waste management policy priorities have been primarily driven by EU waste legislation. The legal basis for preparing National Waste Management Plans (NWMP) was introduced in the Hungarian legislation in year 2000 with the Act on Waste Management. Furthermore, in line with the overall goals of the first NWMP, two relevant strategy papers have been prepared: the Strategy for the Management of Biodegradable Waste in Municipal Solid Waste Management 2004-2016, and the Development Strategy for Municipal Solid Waste Management, 2007-2016. These documents served as the foundation for future developments in municipal solid waste treatment (MSW) [1].

Indonesia still faces numerous sanitation problems, particularly in the field of municipal solid waste and wastewater. With almost half of the 270 million population in urban areas and a population growth rate of 3.3%, the need for waste and wastewater management is crucial and rising. The Indonesia has yet to fully implement the requirements of the government regulation (Law No. 18/2008) on Solid Waste Management and Government Regulation No. 81 of 2012 regarding The Management of Domestic Waste and Domestic Waste Equivalents. The waste treatment paradigm shifts from waste dumping to waste recycling under the Law No. 18/2008. MSW should be handled through reduction and treatment, according to the Law No. 18/2008. Reduction includes reducing the amount of MSW generated, as well as the reuse. Waste handling entails waste source separation, collection, transportation, treatment, recycling and disposal [2]. According to the Governmental Regulation No. 81/2012, every person is required to reduce and manage the volume of his/her waste, which includes waste reduction, reuse, and recycling.

Local government investment in sanitation services or infrastructure, including wastewater treatment remains low. The majority of communities continue to dispose off their wastewater in inappropriate conditions. In most cases, wastewater is discharged into open channels, rivers, or ponds untreated or only partially treated. In another case, there is no distinction between grey and black wastewater. In fact, many households, particularly in poor/slum areas, have toilets but lack proper septic tanks and drainage system.

Though, the creating the sustainable waste and wastewater management in Indonesia is necessary. This paper focuses on the development of waste and wastewater management in Hungary to be utilised to solve waste management problems in Indonesia.

## 2. Evolution of Municipal Waste, Water and Wastewater Management in Hungary

The Hungarian waste management regime has been evolving continuously, particularly since the start of the EU accession procedure in the late 1990s. The Waste Management Act No. 53 of 2000 established the framework legislation in accordance with the EU Directive 2006/12/EC on waste.

Hungary has recently implemented significant waste sector reforms. Since 2016, a state-owned company known as the National Waste Management Coordination and Asset Management Company (*Nemzeti Hulladékgazdálkodási Koordináló és Vagyonkezelő* (NHKV)) has been coordinating and overseeing the delivery of waste services at the local level. NHKV is in charge of collecting waste fees and distributing them to the appropriate operators, as well as selling recyclable materials and supervising infrastructure. Municipalities are still in charge of public waste management services such as waste collection, transportation, and treatment, as well as the operation and maintenance of waste management facilities. There were approximately 130 public service operators in 2016 [3].

Hungary collected 3,203,367 t residual MSW and separately 236,673.619 tons of MSW in 2019. From 2008 to 2015, total waste generation decreased by 17%, while GDP increased by 3%, which is a good achievement. Municipal solid waste generation decreased by around 19% between 2001 and 2015. In 2015, Hungary generated annually 379 kg/capita of municipal solid waste, which contains plastic, paper, cardboard, glass and metals representing approximately 45%, while bioorganic waste represents about 23% [4]. The separately collected waste, i.e., packaging materials, undergoes the sorting plant technology to recycle materials. Biowaste is also separately collected and further treated in composting- or biogas plants. The residual fraction is also treated in mechanical-biological plants for the sake of energy- and material recycling.

Figure 1 illustrates that the landfilling remains the most frequent treatment option for municipal waste eventhough the rates decreased from 2,838 tons in 2010 to 1,919 tons in 2019, while the material recovery increased from 789 tons in 2010 to 1,300 tons in 2019. By 2009 Hungary had succesfully closed old former landfill sites not complying with EU standards. Seventy advanced landfills are now operating with licence. Between 2007 and 2013, 23 former landfill sites were remediated, while in the same time 89 abandoned landfill sites were re-cultivated [4].

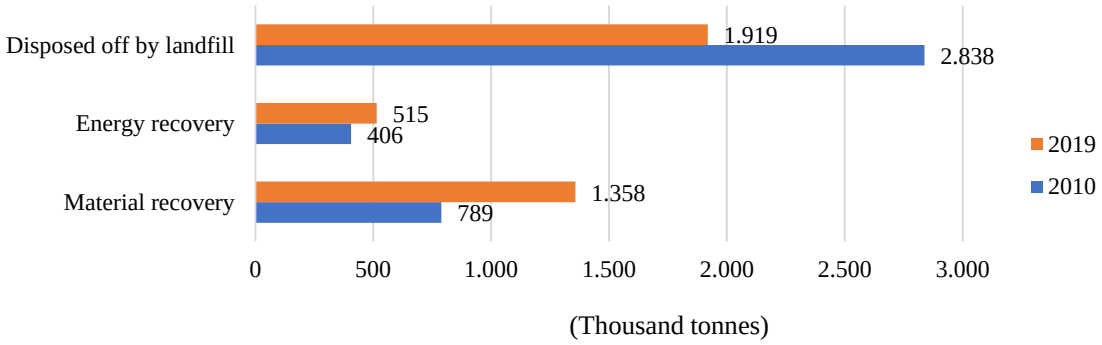


**Figure 1.** Trends in municipal waste treatment in Hungary [5].

The way of collecting the municipal solid waste in Hungary showed a better improvement in decade from 2010 to 2019 as it is shown in Figure 2. In 2010, almost 3,500 thousand tons of municipal solid waste was collected by traditional way, this number decreased down to 2,500 thousand tons in 2019. Meanwhile, the waste separative collection increased from 750 thousand tons in 2010 up to 1,250 thousand tons in 2019. The amount of municipal solid waste recycled, as it can be seen in Figure 3, has been raised in a decade. The amounts of recycling and reuse of solid municipal waste in 2009 was 267,190 tonnes and increased up to 954,442 tonnes in 2019 or by 350% in ten years.

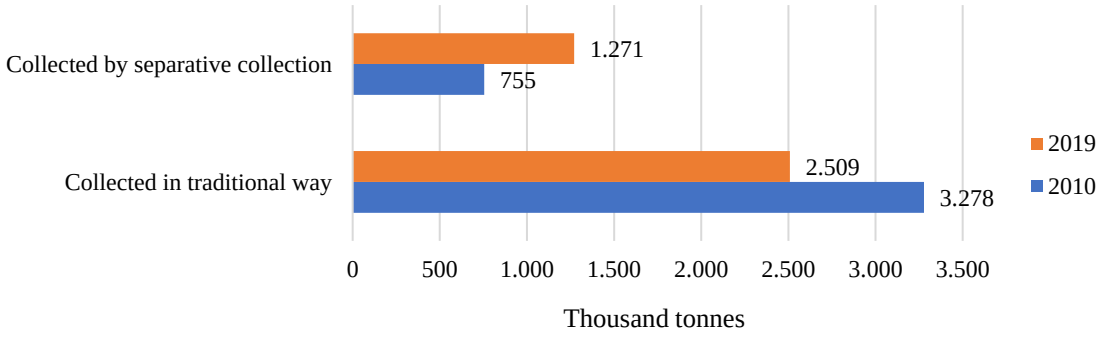


**Figure 2.** Collecting municipal solid waste in Hungary by way [5].

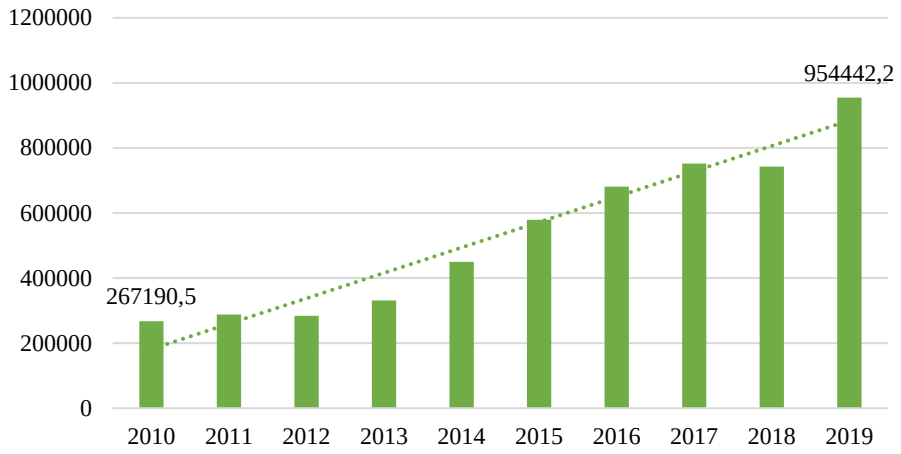


**Figure 3.** Amount of recycled and reused municipal solid waste (tonnes) in Hungary over the time [6].

According to the Waste Framework Directive (2008/98/EC) [1], the waste hierarchy shall be applied as a priority order in integrated waste management systems, where, in addition to prevention, the implementation of reuse, recycling, and other recovery activities should be prioritized. The main priorities were declared by the Hungarian Act, (2012), Act CLXXXV 2012. Hungary is in favor of the implementation of regional waste management systems. These preferred systems are similar to Austrian ones. EU funds are made available the planning and construction of Mechanical-Biological Treatment plants (MBT) as well. One of the mechanical- biological treatment plant with the regional landfill is situated in Királyszentistván, the main goals of this MBT plant are to increase the recycling rates and activities and to produce energy as Refuse Derived Fuel/Solid Recovered Fuel (RDF), as well as secondary raw materials from the waste. Refuse Derived Fuel or Solid Recovered Fuel (SRF) are becoming an important “green” energy source in Hungary. By mechanical-biological treatment the RDF/SRF can be produced in relatively large quantities. The requirements of the end-users of RDF/SRF in Hungary also had been taken into consideration in the planning phase. Regarding the technology the key criteria was to devise a flexible technology for all possible emerging requirements, as shown in Figure 4.

The National Waste Prevention Programme (NWMP) 2014-2020 identified needs related to recycling and recovery in nine aspects, namely municipal waste, non-hazardous production waste, non-hazardous agricultural and food industrial waste, sewage sludge, hazardous waste, particularly high priority hazardous waste stream, packaging waste, biodegradable waste, waste tyres and construction waste [1]. To assist in bridging the implementation gap in Hungary, the Commission Representative of Hungary and the Environmental Implementation Recycling and Landfill Roadmap was created. Preventing and reducing waste generation, as well as increasing reuse and recycling, could help the country become more resource-efficient and further expand business opportunities [4].

On May 21, 1991, the Council Directive 91/271/EEC on urban wastewater treatment was adopted to protect the water environment from the harmful effects of urban wastewater discharges and certain industrial discharges. To meet the requirements of the European Union's Urban Wastewater Directive, a National Sewerage and Wastewater Treatment Program was established. One of the aim for this program is to increase the volume of discharge water to be treated in wastewater treatment plant (WWTP) as seen in Figure 5. The wastewater treatment plant is use three-stage technology to enhance municipal wastewater treatment. The primary mechanical treatment is followed by a biological stage to degrade organic substances. Tertiary treatment aims at phosphorous removal, it was planned in settlements with more than 10,000 population equivalents [7].

Many factors contribute to the long-term development of wastewater treatment plants, including technology, financial resources, institutional support, community involvement, and environmental

concerns. For the financial side, The Wastewater Programme tasks involving agglomerations of more than 2,000 population equivalent (PE) are carried out with EU funds, local government contributions and state assistance as showed in Figure 6. These investments are funded through a competition within the framework of the Environment and Energy Operational Programme (EEOP), which was launched in 2007 [8].

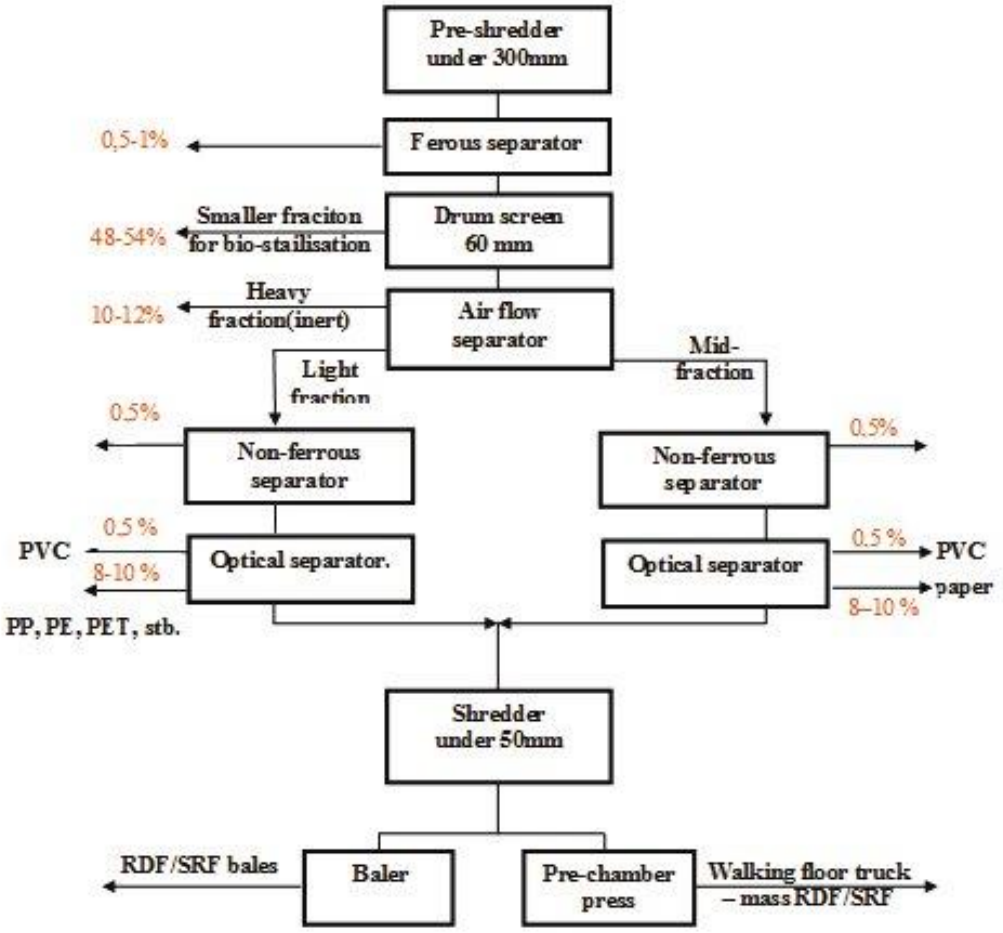


**Figure 4.** Technology for North-Balaton regional waste management system (recycling, RDF/SRF production [9].

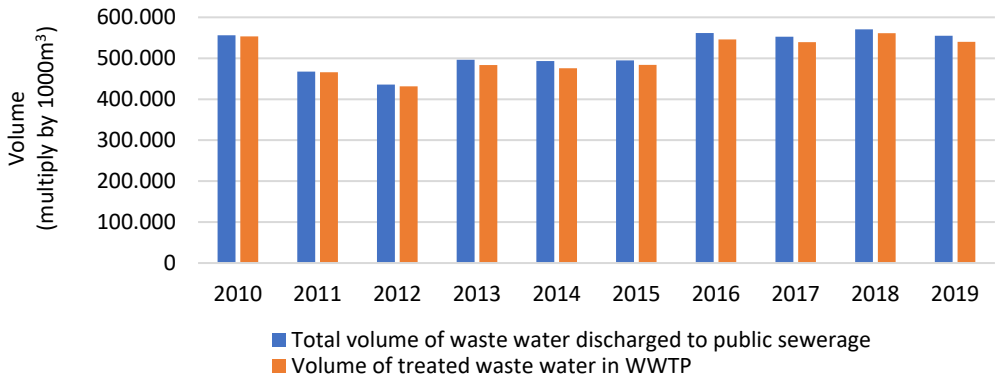


**Figure 5.** Total volume of discharged and treated wastewater in Hungary between 2010-2019 [5].

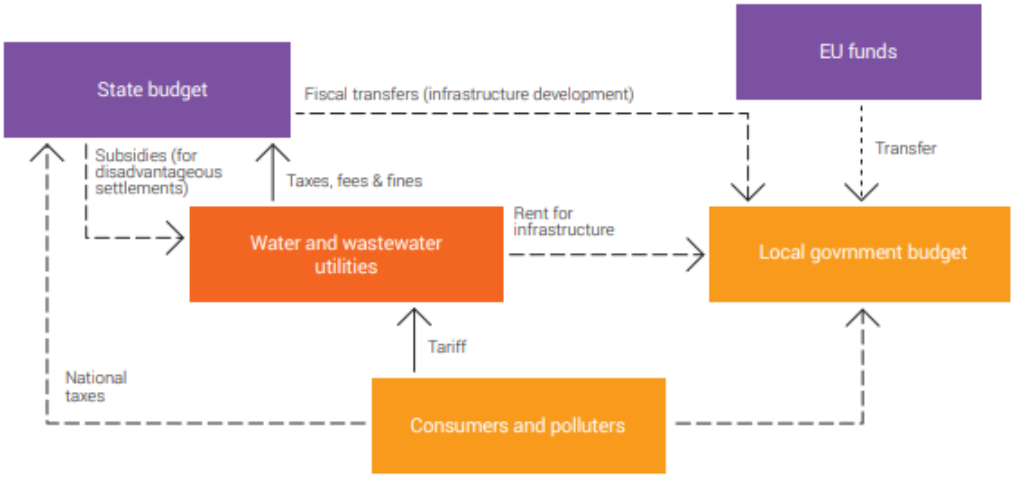


**Figure 6.** Water and wastewater fund scheme in Hungary [8].

## 3. Municipal Solid Waste, Water and Wastewater Management Problems in Indonesia

Indonesia has implemented some international waste legal frameworks, such as the Basel Convention in 1993 and the Kyoto Protocol in June 2004, indicating that the government is concerned about the potentially negative environmental impact of waste. Meanwhile, the Government of Indonesia recently issued the Waste Management Law No. 18/2008, a new national waste management regulation. Based on the statistical data, in 2019, 54.99% of Indonesian total population lived in urban area and cities, and 45.01% in rural area [10] .

In Indonesia, there are currently limited data on MSW disposal. Municipalities and districts all lack adequate data, except for general information, such as number of trucks, personnel, etc. To predict greenhouse gas emissions from the waste sector, the National Development Planning of Indonesia [11] assumed that in 2005, MSW generation in urban areas was 0.6 kg/capita/day, and in rural areas 0.3 kg/capita/day. Along with economic growth, the rise is expected up to 1.2 kg/capita/day in urban area and 0.55 kg/capita/day in rural area by 2030.

According to the Ministry of Environment and Forestry, 66.39% of waste generated in Indonesia is landfilled (57% of landfills operate as open dumpsites), 19.62% is unmanaged (i.e., burned in open areas or leaked into the environment), and only 2.2% is recycled or processed into resources such as fuel, biogas, etc. (Figure 7). The majority of waste transported to final disposal sites is dumped in open areas (Figure 8), and it is estimated that only about 10% of it was handled using better systems, such as controlled landfills. In many sites, these facilities are nothing more than uncontrolled open dumping [10].

Incineration is another method used to treat MSW in some Indonesian cities. There are several small-scale incinerators operating in various cities, each with a capacity of 100-200 kg/h and an operating time of 8 hours. Therefore, this system can only handle a small portion of the total MSW generated. Organic waste composting has also been introduced as a part of biowaste treatment. Plastics, glass, paper, and metals are well collected in Indonesia, either by the informal sector or by municipalities, and these materials are recycled. These waste types would be considered as used objects with economic value, to the point where they would rarely be found in municipal waste management chains, because these items are actually can be sold or could be donated to other people with lower income [12].

The Ministry of Environment and Forestry Regulation No.68 of 2016 concerning the quality standards of domestic wastewater refers to the obligation to conduct domestic wastewater management on a national scale in Indonesia. According to the Ministerial Regulation, the type of domestic wastewater management system to be installed in a specific area must consider some factors such as population density, groundwater level, slope, soil permeability, and financial capability.


**Figure 7.** Distribution of municipal solid waste handling in Indonesia [10].

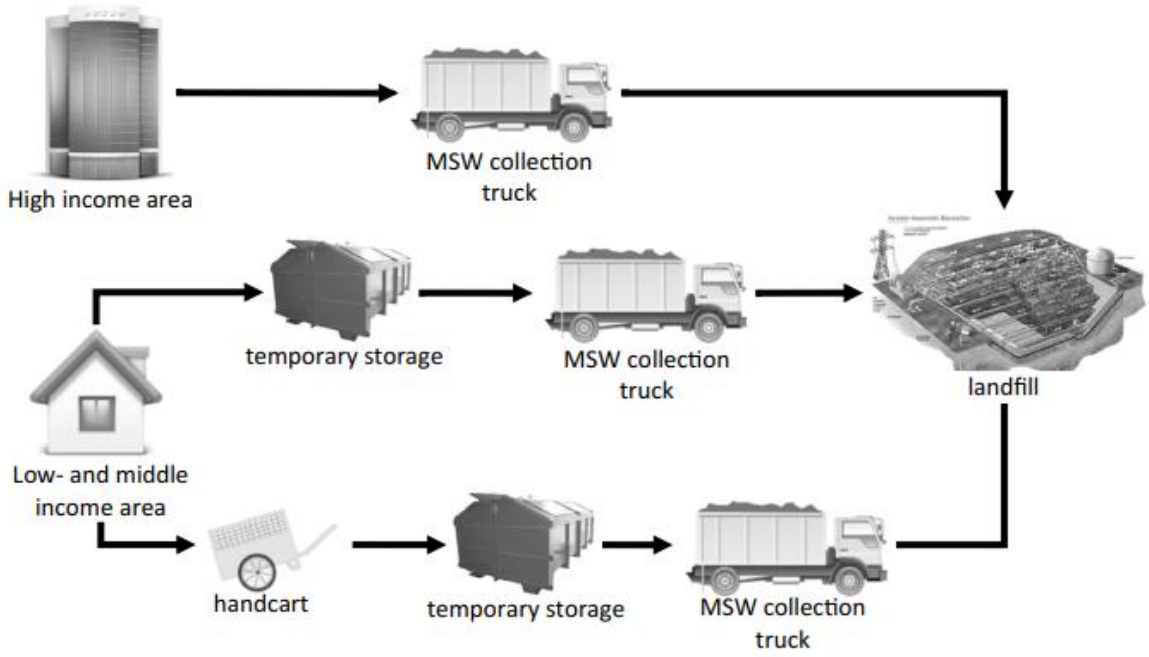


**Figure 8.** Municipal solid waste collection scheme in most of Indonesia cities [10].

In Indonesia, domestic wastewater management is divided into two categories: on-site sanitation systems, which include septic tanks, the community-based decentralized wastewater treatment systems, and centralized sewerage systems (with or without treatment). Despite initiatives to improve sanitation, urban sanitation continues to underperform and faces critical issues that must be solved as soon as possible.

According to the wastewater scheme described in Figure 9, the total wastewater treated in urban Indonesia accounts for approximately 1% of total wastewater produced. The practice of open defecation free (ODF) is still practiced by 14 % and contributes to 95 % of wastewater being disposed off in an unsafe way. There are 12 major cities in Indonesia with dense population that have centralized

wastewater treatment systems. Nevertheless, only 5% of the population has access to these treatment facilities through the sewerage system. An anaerobic baffled reactor (ABR) is a treatment unit that is commonly used for communal domestic wastewater treatment. ABR is a type of series up-flow anaerobic sludge blanket (UASB) with a simple design and low operation and maintenance costs [12].

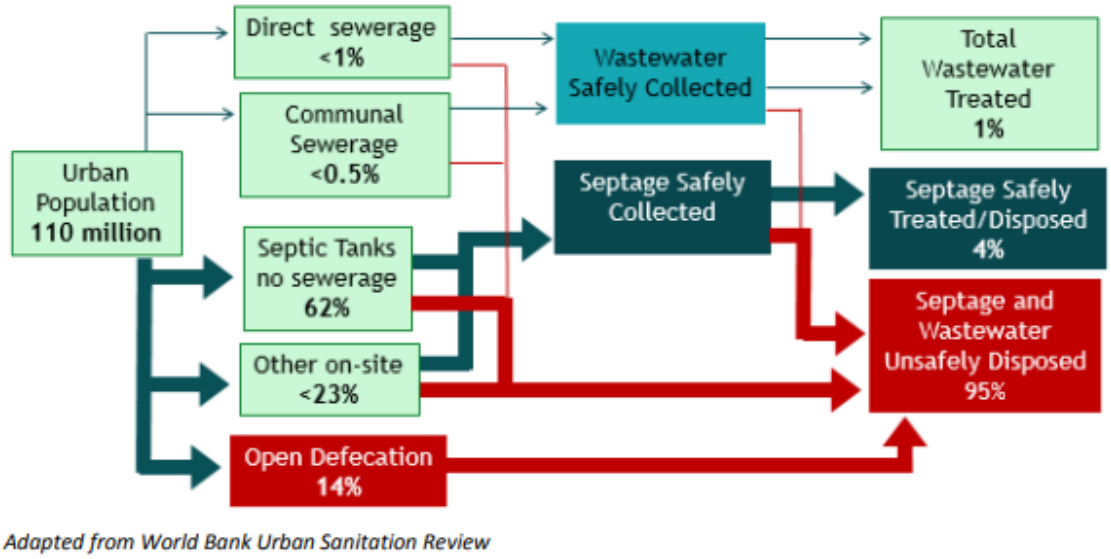


**Figure 9.** Wastewater and septic tank flow in Indonesia [13].

In Indonesia, the responsibility has been formally stipulated in the Regional Government Act 23/2014. In terms of funding sources for government responsibilities, the Regional Government Act 23/2014 (Article 282) states that the implementation of government affairs under local government authority is funded by and at the expense of the local government budget (APBD). Meanwhile, the state budget funds the implementation of government affairs at the regions that come under the framework of the central government (APBN) (Figure 10). However, according to a World Bank analysis, the average budget for waste management in Indonesia, particularly in metropolitan and large cities, is only 2.5%. This figure is significantly lower than the suggested budget for waste management, namely at least 5%, which is usually required to provide adequate services [14].

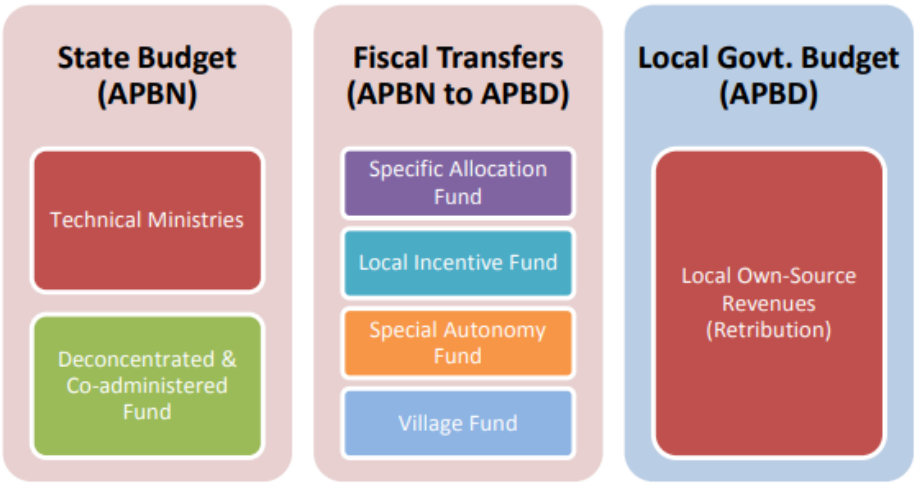


**Figure 10.** Public financing of waste sector in Indonesia [9].

## 4. Creation of Sustainable Municipal Solid Waste, Water and Wastewater Management

Municipal solid waste, as defined by the Waste Act 18/2008, is all waste generated by human activities and natural processes in the form of solid waste. This waste should be managed systematically, holistically, and sustainably through processes such as reduce, reuse, and recycling, as well as mechanical and biological treatment prior to landfilling at the final disposal site.

**Table 1.** Comparison of municipal solid waste management and wastewater treatment in Hungary and Indonesia

| Summary | Hungary | Indonesia |
|---|---|---|
| Municipal Solid Waste Management | • Source separation<br>• Recycling rates increase continuously than waste disposal<br>• There are sorting, MBT, composting and biogas plants in several cities in Hungary<br>• Waste data is update and accessible<br>• Clear and adequate funding scheme | • Source separation only apply in several households<br>• Landfill still to be the main disposal method to treat municipal solid waste<br>• No record about sorting, composting or MBT plants in Indonesia<br>• Lack of adequate data<br>• Low funding |
| Wastewater Treatment | • Three-stage treatment (primary/physical, secondary/biological & tertiary/ advanced chemical treatment)<br>• Centralized wastewater treatment plant countrywide | • Two stages treatment (primary/physical and secondary/biological) if exists<br>• Decentralized wastewater treatment (minor, around 1%)<br>• Inadequate wastewater system is a dominant one |

### *4.1. Municipal solid waste management*

Learned from the municipal solid waste management system in Hungary as be seen in Table 1, beside the clear regulations, the essential point is the source separation protocol. Moreover, to make a decision about the suitable municipal solid waste treatment in some area, the economic issues and education of the society at all levels must be considered, because the success of waste management is highly influenced by the active participation of all members of the society. The education status of the Indonesian people is also important, the educational status is related to acceptance of society for a new technology or change in their environment. Krook *et al.*[15] reported that the success of household recycling programs is highly reliant on citizens participation in the source separation process. It was the Hungarian experience too.

One of the possible scenarios for solid waste management started with source separation process is shown in Figure 11. The solid waste from households would be separated into three categories (1) Clean paper, plastic, and metals; (2) Wet garbage or biodegradable waste and (3) Residual waste like contaminated paper, plastics, textile, wood, baby napkins, etc. or other uncategorized waste. Batteries, lamps, spent cooking oil, drugs are all hazardous waste and should be collected and then treated in other way. Although waste source separation is a normally utilized method for separating recyclable fractions, the willingness of residents to maintain source sorting of recyclable materials and food waste is highly needed [16]. Furthermore, providing equipment for source waste separation only is not enough, the programs to improve the public knowledge, attitude, and behavior towards waste sorting must be also developed. Society counseling is a process that raises awareness to change people’s or group's attitudes and behaviors.

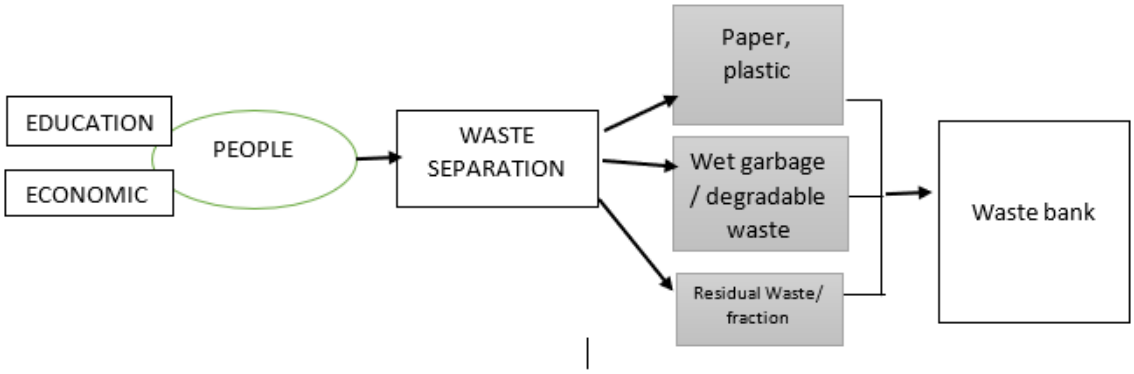


**Figure 11.** Source separating scenario.

Sorting plant technology can be considered as a next step of separately collected municipal solid waste treatment process. Sorting has purposes to separate recyclable materials into mono-material products, to ensure that recovered or recycled product is not mixed with undesirable elements, and to maximize the waste recycling rate while reduce the landfilling disposal. Hand sorting, or the manual removal of selected grades of material from a flow of solid waste, is the simplest, most direct, and sometimes most effective method. Manual sorting operation including (a) unloading the waste, (b) spreading on belt conveyor with complete safety gears, and (c) hand picking of visually identifiable waste objects for recycling.

The biodegradable waste from households and sorting plants would be processed by biological treatment. Biological treatment is divided into two processes, namely aerobic one, which produces compost as the final product, and the anaerobic which produces biogas as the final product. Composting has some benefits for the environment, such as reduced $CO_2$ and methane emission in landfills, furthermore, compost can reduce the need for chemical soil fertilizers, it promotes higher yields of agricultural crops, enhances water retention in soil and can be used to remediate soils contaminated by hazardous waste. It gives the advantage from an economic point of view as well.

Sorting plants and biological treatment facilities can be organized in Indonesia under the waste bank organization. The Ministry of Environment issued regulation *PermenLH No. 13/2012*, which governs the guidelines for reduce, reuse, and recycle using solid waste bank. This regulation recognizes that current MSW management has yet to implement the reduce, reuse, recycle (3R) concept and requires a comprehensive and also integrated application, one of the scenario concepts of source separation, sorting plants and biological process can be seen in Figure 12. As a result, it would provide economic benefits, improve public health, save the environment, and enhance community wellbeing [17].

One of problem to create a proper solid waste management system in Indonesia is the shortage in funds. Before the decentralization, the local government had received solid waste program financed by the state budget and some financial assistances. Another concernes to improve the municipal solid waste management is the community participation, doing waste source separation, willingness to pay for waste treatment, as well as the participation in sorting and composting plants. Other ways to involve the community into waste management includs implementing the neighborhood waste treatment, presenting waste management in schools, implementing community-based management and planning, and establishing waste separation close to the point of source.

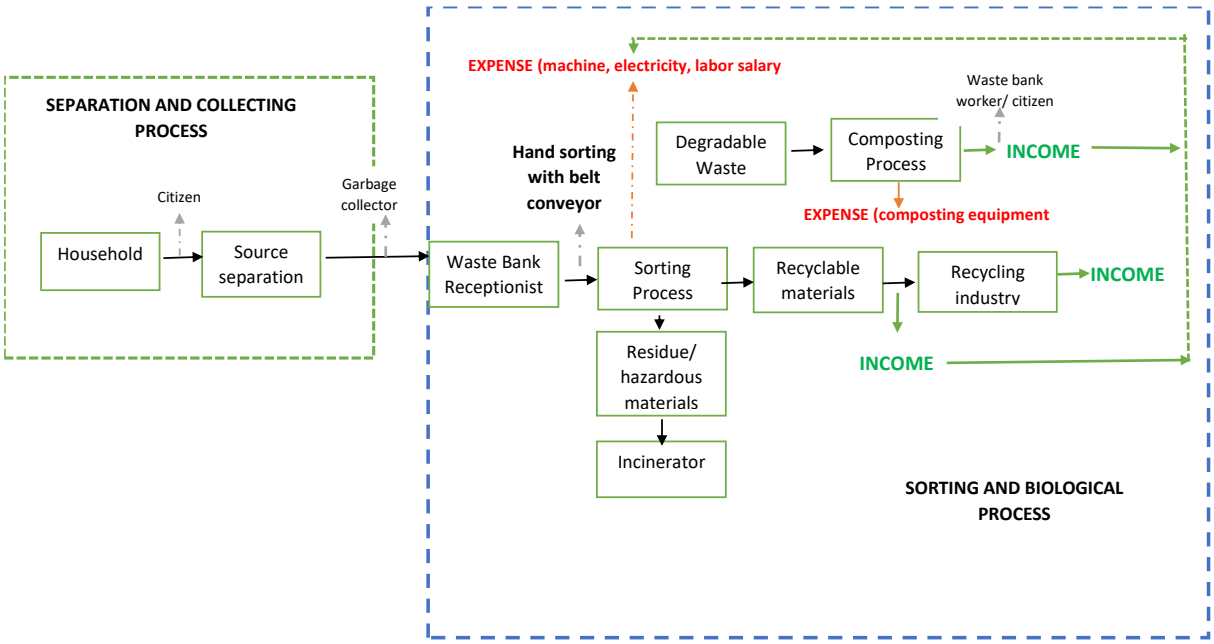


**Figure 12.** Scenario of source separation, sorting plant and biological processing.

*4.2. Wastewater treatment management*

One of the success factors of wastewater treatment management in Hungary is the substantial access to the wastewater network. Based on the data, wastewater network in Hungary now is over 80% and still expanding, all the wastewater treatment plants are using three-stage technology to remove all the three nutrients. An intensive R&D work and implementation is going on to remove xeno-metabolites, as well as to find advance approaches for the sewage sludge treatment for its recycling and utilisation in agriculture or energetic industry [18].

In Indonesia, only 5% of population has access to centralized wastewater treatment plants. Decentralized wastewater treatment systems (DEWATS), which are linked to simplified sewer systems or communal sanitation centres, might have some potential to bridge the gap between on-site and centralized systems. DEWATS managed by communities offer the possibility of rapid sanitation improvements in high-priority neighbourhoods where local government does not yet provide a full sanitation service, as showed in Figure 13. It might provide benefits when used in a densely populated urban area with a limited access to toilets and washing facilities [13].

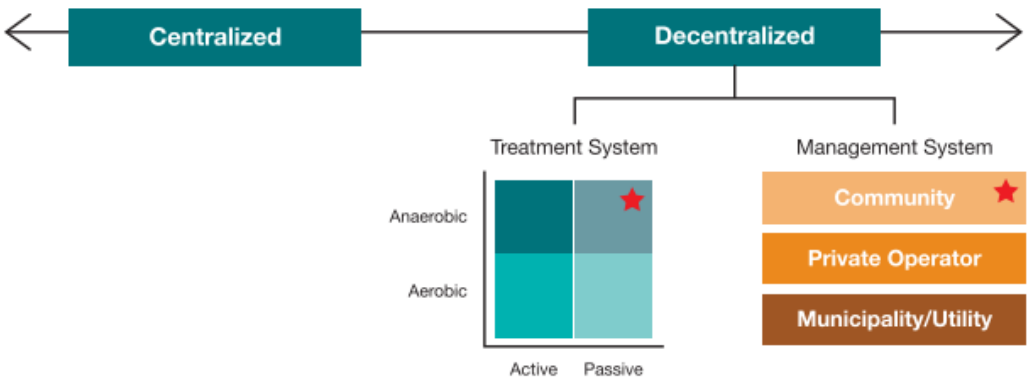


**Figure 13.** Community-managed DEWATS as a revolution of decentralized wastewater management systems [17].

This system is characterized by several advantages, including a strategy, not just a technical equipment package, i.e, technical and engineering aspects, the specific local economic and social conditions are properly considered, as well as the DEWATS could be an essential component of comprehensive wastewater schemes. The first step in decentralized wastewater treatment systems is the primary treatment in sedimentation ponds, settlers, septic tanks, or bio digesters, followed by the secondary treatment in anaerobic baffled reactors, anaerobic filters, or anaerobic and facultative pond systems, and finally secondary aerobic/ facultative treatment. And at last, post-treatment in aerobic polishing ponds is used [19].

One of the city in Indonesia implementing this system is Alam Jaya, Tangerang, Java with its community based sanitation (CBS) Programme. Alam Jaya is a slum in the heart of Jakarta's industrial zone. The majority of the residents are employed in the nearby factories. Social structures are frail as a result of the high rate of migration. The infrastructure development level is rather low. Housing is of substandard, and there is insufficient water supply. In terms of both quality and quantity, the settlement's sanitation facilities are completely inadequate. Wastewater is discharged into the environment untreated, causing a long-term threat to human health. The facilities provided in CBS system include toilets, bathrooms, a laundry area, and “water points”. A DEWATS treats the entire wastewater flow (Figure 14). Until 2008, 33 Community Sanitation Centres were established in Tangerang and Surabaya, serving 14,800 people and treating 1,197 $m^3$ of wastewater a day. Another cities which apply this system are Jogjakarta and Bali. In Denpasar – Bali Province, the communal wastewater treatment unit was designed to accommodate up to 165 households or equal to 40 $m^3$/day wastewater, while in Yogyakarta to facilitate blackwater from 15 households and greywater from 51 households [20].

If designed and managed properly, an on-site/decentralized system can provide a clean and comfortable sewerage service. R. Rochmadi [20] analysed the effectiveness of four Indonesian provinces' decentralized wastewater treatment plants. The results showed that the Chemical Oxygen Demand (COD) degradation of this system could reach 85%, hence there were several constraints or problems associated with system performance. The survey data indicated that the biodigester was handling the blackwater from only 15 households. In addition, the families who could take advantage of biogas was only 13% of users and the treated wastewater did not meet the effluent standards for discharge into the environment. Since the first operation, the biodigester and its anaerobic baffled reactor had never been cleaned to remove accumulated solids (more than 3 years). As a result, it is possible to conclude that the accumulated solids inside of the biodigester and anaerobic baffled reactor reduced the overall performance of the wastewater treatment unit.

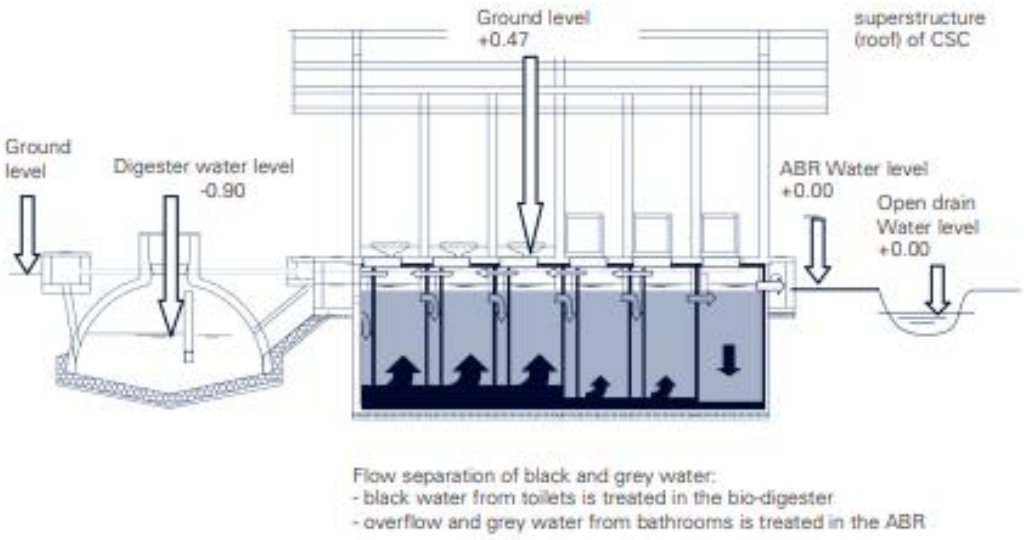


**Figure 14.** DEWATS scheme in Tangerang, Indonesia [16].

Harahap J [21] stated in his study that the challenges of this system are incapability of producing standard-quality effluent due to a lack of technical capacity and community support; DEWATS are frequently stopped during the planning and implementation stages of development. The management system on a communal scale on-site system must pay attention to the willingness and ability of the users to operate their own system, in order to comply with the existing regulations. The experience gained from various efforts to develop efficient and cost-effective sanitation and wastewater-treatment strategies clearly indicates that, in the absence of comprehensive legal frameworks and efficient law enforcement, relevant financial resources, institutional capacities within public and private services, and household or enterprise-level awareness, the hoped-for health and environmental benefits will not be realized.

## 5. Conclusions

Hungary was successful to develop a proper municipal solid waste and wastewater management due to clear regulations, substantial financial support, integrated separative collection, building of sorting plants, mechanical-biological and biological (composting, biogas facilities) ones for the treatment of municipal solid waste. It established an advanced wastewater network and treatment to remove all the three nutrients (carbon, nitrogen and phosphorus). To create a sustainable waste and wastewater management system like the Hungarian, Indonesia has to solve many problems, such as implementing governmental regulations on waste management, gain an efficient fund system, increasing community participation, expanding the wastewater network and make annual evaluation of decentralized wastewater treatment plants, while properly considering about a whole issue including technical and engineering aspects, the specific local economic and social conditions.

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*Author contribution*

All authors contributed equally as the main contributor of this paper. All authors read and approved the final paper.

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