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SUSTAINABLE STRATEGIES IN ORGANIC WASTE MANAGEMENT: A SYSTEMATIC LITERATURE REVIEW STUDY

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ABSTRACT

Introduction: Particularly in Indonesia, waste management—especially organic waste—remains a major worldwide concern. A substantial contributor to greenhouse gas emissions (7.29% yearly) and economic losses of IDR 213–551 trillion, food waste will make up 39.78% of all garbage in 2023.
Methods: This study employs a systematic literature review to analyze organic waste management practices and their environmental implications, utilizing secondary data from national and global sources.
Results: The findings show that Indonesia has problems with such low public knowledge, reliance on subpar dumps, and limited technology. Locally, creative methods such as using Black Soldier Fly larvae to convert organic waste show promise. Around the world, modern technologies like Malaysian and Thai anaerobic digestion and programs like the European Green Deal show greater efficiency. Successful programs frequently incorporate government incentives, trash segregation regulations, and public education.
Conclusion and suggestion: SAccording to the study's findings, managing organic waste sustainably can lower greenhouse gas emissions and help achieve several UN SDGs, such as those related to health, clean water, and climate change. Promoting trash separation at the source, using composting methods, implementing contemporary technologies, and encouraging cooperation between public, corporate, and community sectors are some of the main proposals. Long-term solutions in Indonesia and elsewhere depend on addressing shortages in funding, infrastructure, and public awareness.

INTRODUCTION

Waste is an issue that is still a major problem globally, especially in Indonesia. With the increase in population, the amount of waste also continues to increase. In connection with this, many academics and environmentalists realize that the accumulation of waste will have a negative impact on the environment.

According to data from the Ministry of Environment and Forestry, food waste accounts for 39.78% of Indonesia's waste composition (KLHK RI, 2023). Based on the Food Loss and Waste (FLW) study conducted by Bapanas in 2000-2019, each individual contributes to food waste of around 115-184 kg/year. Over 20 years, this waste has contributed 1,702.9 Mt CO2 equivalent, with an average annual contribution equivalent to 7.29% of greenhouse gas (GHG) emissions in Indonesia. In addition, from an economic perspective, there is a loss of Rp213-551 trillion/year. Meanwhile, the potential of FLW can be channeled into food assistance for 61-125 million people, or around 29-47% of the population in Indonesia (Kementerian PPN/Bappenas, 2021). Meanwhile, as of 2023, there are still 63 districts/cities with food insecurity status. Furthermore, given climate change and population growth, Indonesia faces a food crisis for the next 50 years (Lasminingrat & Efriza, 2020).

Table 1. Waste Composition in Indonesia

Waste Category	2019 (%)	2020 (%)	2021 (%)	2022 (%)	2023 (%)
Food Waste	40.8	40.3	38.79	39.77	39.78
Wood Waste	15.98	13.73	13.19	13.1	12.03
Paper Waste	11.7	12.12	11.81	11.31	10.8
Plastic Waste	15.88	17.39	17.75	18.34	19.19
Metal Waste	3.39	3.12	3.37	3.17	3.23
Fabric Waste	2.3	2.63	2.72	2.51	2.9
Waste	1.75	1.97	1.95	2.21	2.53
Glass Waste	2.13	2.13	2.52	2.23	2.47
Others	6.07	6.88	7.9	7.36	7.07

Source: Ministry of Environment processed by the researcher.

In Indonesia, the government's awareness to manage waste began in 2008 through the regulation of Law Number 18 of 2008 concerning waste management at the household level. (Ambina, 2019) then it issued Government Regulation Number 81 of 2012 concerning the management of household waste and similar household waste, as well as Government Regulation Number 27 of 2020 concerning specific waste management. Based on the United Nations Environment Programme (UNEP) report in 2021, the total food waste in Indonesia reached 20.93 million tons per year, making Indonesia the largest food waste producer in Southeast Asia and the fourth largest after China, India, and Nigeria (UNEP, 2021).

Food waste is a contributor to GHGs; therefore, there needs to be a mechanism to reduce it (Nafi'ah & Dinarjito, 2024). In fact, food waste is a fertile ground for the formation of greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4), and nitrogen oxides (N_2O) (Galford et al., 2020). Methane (CH_4) is known to be a dangerous gas because it can damage the ozone layer and is 21 times more dangerous than carbon dioxide (Lutviyani, Farkha, & Firdausi, 2022). When methane gas and air come together, they can make a potentially explosive mixture. Explosions from methane gas and air can damage infrastructure and kill people if they are mixed with things that cause explosions, like temperature (Álvarez-Fernández et al., 2022).

The accumulation of food waste has caused a major disaster for Indonesia. This happened on February 21, 2005, at the Leuwigajah Landfill, Cimahi City, West Java, where an explosion from a pile of garbage led to a landslide. In addition to infrastructure damage, the incident also caused the death of 157 people. We refer to this phenomenon as the "Dark Story of Bandung Lautan Sampah" (MC Kota Bandung, 2021). The landslide hit two villages in Cimahi City, namely Cilimus Village and Pojok Village. It is known that the Leuwigajah landfill uses an open dumping system, which at that time was drenched with heavy rain at 02.00 WIB, which caused the concentration of methane gas released by organic waste in the garbage pile to increase, causing an explosion. As a result, the 200 m long and 60 m high mountain of waste collapsed (Mahendra & Luthfiana, 2023).

On August 19, 2023, there was a fire at the Sarimukti landfill in Ciputat, West Bandung, covering an area of 1 ha with a height of 50 meters. However, the fire at Sarimukti landfill was difficult to extinguish and resulted in its resurgence. This was due to the high content of methane gas in the pile of garbage and the increase in temperature during the dry season (detikJabar, 2023).

On September 16, 2023, a fire broke out at the Putri Cempo landfill in Solo, Central Java, reaching 2 ha. The fire was located in Block B, or the northeast side adjacent to the Fecal Sludge Treatment Plant (IPLT). The fire at the Putri Cempo landfill is suspected to have been caused by high temperatures, so the methane gas that had accumulated over a lengthy period triggered sparks, which then caused a fire (News.detik.com, 2023). The impact of extinguishing the fire, which lasted for five days, caused smoke clouds and caused residents to experience shortness of breath and hampered their activities, considering that the location of the fire was only 100 m from residential areas. As a result of the smoke from the fire, 27 residents received special treatment from the medical team (CNN Indonesia, 2023b).

On September 18, 2024, there was a fire at Jati Barang landfill in Semarang that also consumed 2 ha of land out of a total of 46 ha. Methane gas from organic waste piles also caused the fire at Jati Barang landfill, according to officials (CNN Indonesia, 2023a). Meanwhile, the high moisture content of food waste can cause odors and attract disease vectors, such as flies and rats, potentially endangering public health (Fadhullah, 2022).

Solid waste management can be linked to 12 of the 17 Sustainable Development Goals (UN-SDGs). For example, poor waste management can lead to significant health and environmental impacts, which relate to SDG 3 (Good Health and Well-Being), SDG 6 (Clean Water and Sanitation), and SDG 13 (Climate Change) (Sharma et al., 2021).

LITERATURE REVIEW

Waste Management in Indonesia

In Indonesia, waste, or what is known as Municipal Solid Waste (MSW), is a complex problem due to various reasons, such as the increasing quantity that is linear with the increase in population, lack of public awareness, and the complexity of city administration policies in various cities (Chaerul, 2007). Indonesia's waste management system uses the 3P technique: collection, transportation, and disposal. Community members collect waste in temporary shelters, with the City Cleaning Service transporting it periodically. High-income areas store waste in temporary bins, which are then collected by private companies for immediate disposal. Workers in low- and middle-income areas use hand or motorized carts to collect waste, but no waste processing occurs at the landfill (Munawar et al., 2018).

Disposal is carried out with an open-dumping approach (waste is collected at temporary disposal sites and then piled up without management in the landfill) (Prihatin, 2020). Open dumping is the most popular and oldest waste management technique (Mavropoulos et al., 2016). Open dumping is a simple disposal method by dumping all types of waste at a location and leaving it open (Sukarmawati et al., 2023). As of 2023, there are around 450 landfills scattered in big cities with an open dumping/landfilling system, only a small part of which has been developed into controlled landfills (Defitri, 2020). Paul et al.'s research in several countries shows that open dumping can cause soil pollution, affecting soil quality and commodity growth, such as in Islamabad. In Nepal, open dumping causes the spread of infectious diseases (Paul et al., 2019). Meanwhile, Indonesia also faces problems related to waste management, such as the low quality of waste management, limited landfills, and waste financing issues (Kardono, 2007).

Organic Waste and Methane Gas

Methane gas, a potent greenhouse gas, is produced during the anaerobic degradation of organic matter in waste, a common condition in landfills, making it crucial for waste management and environmental protection (Förstner et al., 2005). Methane gas is highly flammable and explosive (Vardhan & Singh, 2022). When methane gas accumulates below the ground surface, an increase in gas pressure can cause an explosion, resulting in the formation of a gas emission crater (GEC) (Zolkos et al., 2021). Organic waste has a high potential to produce methane gas (CH_4) through anaerobic processes. In a biochemical methane potential (BMP) test, food waste produced 0.26 m^3 CH_4/kg.

Landfills contribute to methane emissions, a greenhouse gas with higher global warming potential than CO2. Poor management increases emissions, causing climate change. Food waste is biodegradable, but landfills can pollute air, soil, water, and groundwater. Exposure to waste and emissions can cause respiratory and infectious diseases, especially in underprivileged communities (Yong et al., 2015). Household composting can reduce greenhouse gas emissions and offer economic benefits, but its success relies on local citizens' social responsibility, ethical awareness, and proper training to avoid safety issues and ensure proper compost bin operation (Khan et al., 2022). Nath et al. (2023) emphasized the significance of transforming food waste into safe, nutritious animal feed, reducing waste and providing an alternative protein source, thus reducing reliance on costly and environmentally harmful traditional feeds. Organic recycling converts food waste into fertilizer or energy, reducing landfill volume and greenhouse gas emissions. Policies supporting sustainable waste management and effective recycling practices are crucial (Mak, 2020).

Waste Management in General

Anaerobic digestion technology can reduce GHG emissions by avoiding landfill methane, replacing nutrients, and recovering energy from organic waste. However, it requires modifications in collection practices and transportation fleets. (Yoshida et al., 2012). Reducing organic waste to landfills is a significant global policy measure, but it's not the only mitigation measure. Alternative disposal options may be unaffordable for many (Scharff et al., 2023).

RESEARCH METHODS

This research uses the systematic literature review (SLR) method. SLR is a method that transparently synthesizes previous scientific evidence to answer research questions (Wang, 2020). SLR is a research process that identifies, interprets, reviews, and evaluates research to identify strategies, perspectives, and relevant theories for a specific study area (van Dinter et al., 2021).

First, defining the problem, the main problem in this study is related to the management of food waste in Indonesia, which has not been running properly, which has an impact on material losses and even fatalities. Therefore, the researcher designed this study to answer the following research questions:

RQ1: How does Indonesia's current organic waste management compare to internationally recognized best practices proven to lower GHG emissions?

RQ2: To what extent can community-based approaches improve the effectiveness of organic waste reduction and management at the household level in Indonesia?

Scopus, a reputable data source, was used to gather credible information from numerous publishers, thereby serving as the primary index for quality scientific papers and articles from various countries (Jabeen et al., 2021). The data collection process on Scopus was carried out on 17 November, 2024, with restrictions for data from 2019-2024 (5 years), and obtained data from as many as 526 documents. Then, the researcher filtered through various aspects, such as the subject area, keywords, language, document type, and publication stage.

VOSViewer was used to analyze data from Scopus and Google Scholar search results to determine the novelty or gaps of collected keywords, focusing on its ability to analyze large amounts of data (Bukar et al., 2023). The VOS concept has evolved into a bibliometric analysis program, utilized in bibliometric and citation studies to visualize bibliometric networks involving journals, researchers, and publications (van Eck & Waltman, 2010).

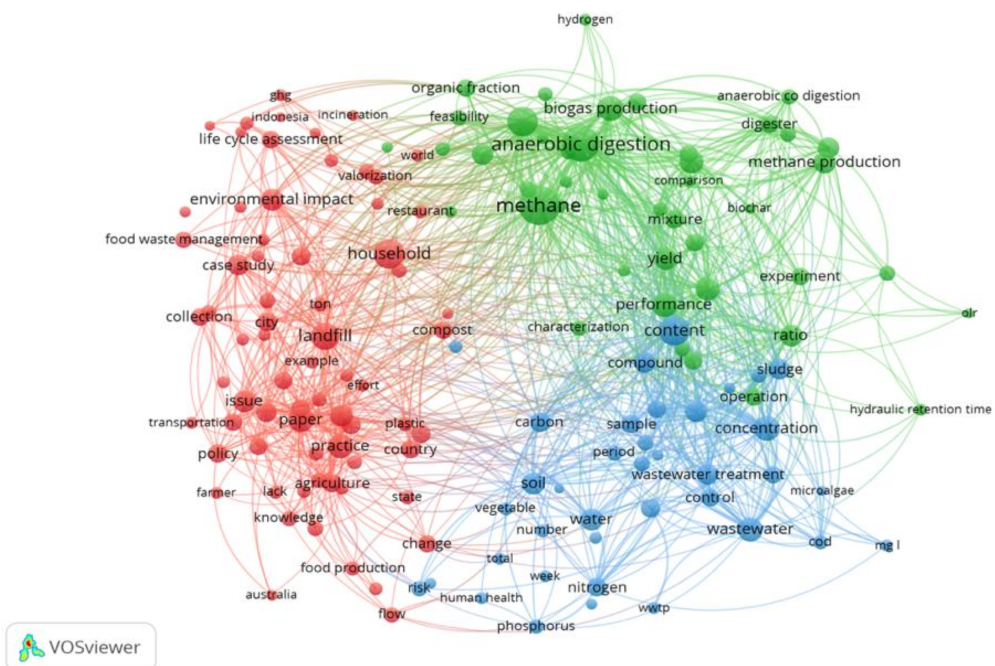

Figure 1. Network visualization mapping. ***Source:*** **VOSViewer Analysis**

The data analysis from Scopus and Google Scholar produced four clusters, as illustrated in Figure 1. When viewed from a network visualization perspective, it can be concluded that there is quite a lot of research discussing "methane;" this is indicated by the size of the circle with the keyword "methane," which is more significant than other keywords. Although, in the data search process, the keywords "waste management system," “household waste management”, and “organic food waste were included, the analysis results do not show the relationship between "methane" and "waste management system," “household waste management”, and “organic food waste.” Therefore, research using "methane" and "waste management systems," "household waste management," and "organic food waste" has intriguing novelty and originality. Furthermore, the research question anticipates the existence of government regulations that guarantee food safety.

At this stage, the researcher must search for literature suitable for the research topic. In some studies, this process is called determining eligibility criteria. The researcher provides limitations based on the inclusion and exclusion criteria. T from Craven et al. recommend that choices about search limitations should be recorded by using a story to show the choices that were made as the literature search was being planned (Craven & Levay, 2011). Table 2 lists the eligibility criteria.

Table 2. Eligibility criteria for Scopus search result

Item	Inclusion	Exclusion	Rationality
Year	2020-2024	Before 2020	Researchers prioritize recent research
Language	English	Other than English	Research that uses English (an international language) is more eligible.
Paper Access	Open Access	Paper needs subscription	Open Access makes it easier for researchers to obtain articles
Type Paper	Article	Book & Proceeding	-
Keyword on Article	“Organic Food Waste”; “Waste Management System”; ”Household Waste Management”; “Methane Gas”	Other than those keywords	Eliminate less relevant keywords to obtain research with a focus on the topic.
Journal Quartile	Q1	Other than Q1	Q1 is considered a journal that has good credibility

Source: Data processing by researchers

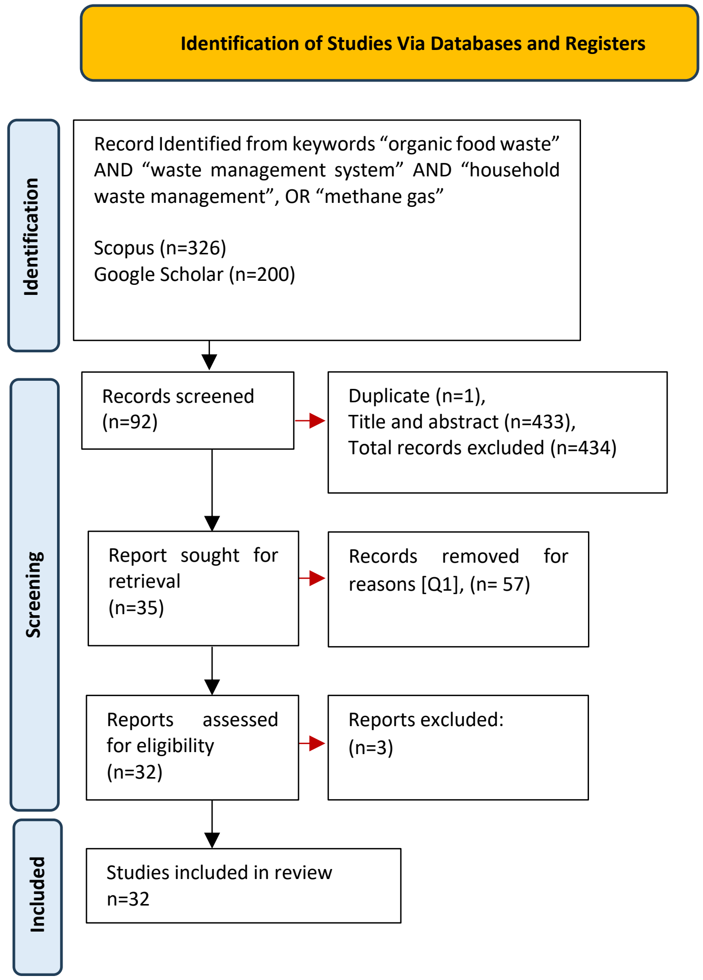

Figure 2. PRISMA chart flow. ***Source:*** **Data processing by researchers**

PRISMA has become the accepted standard in conducting systematic literature reviews. The PRISMA process simplifies objectivity and allows researchers to assess the quality of the review. As the PRISMA process explicitly applies inclusion and exclusion criteria to describe the research question, researchers state that PRISMA suits management-focused themes. In addition, the PRISMA standard enables accurate and efficient research into large databases, which makes detailed investigations easier (Moher et al., 2009).

From the screened literature, researchers confirmed the credibility of each journal through the SCImago Journal Rank (SJR) portal. This platform takes its name from the SCImago Journal Rank (SJR) indicator pdf, which SCImagojr developed from the widely recognized Google Page Rank™ algorithm. This indicator shows the visibility of journals in the Scopus database from 1996 (ScimagoJr, 2024). The reviewed articles are listed in Table 3.

Table 3. Reviewed Article

No.	Authors	Source	Variable
1	(Slorach, Jeswani, Cuéllar-Franca, & Azapagic, 2020)	Science of the Total Environment	Anaerobic digestion, Food waste, Incineration, In-vessel composting, Life cycle assessment, Life cycle costing
2	(Lee et al., 2020)	Water Research	Life cycle assessment, Life cycle cost analysis, Biosolids, Organic fraction of municipal solid waste, High solids anaerobic co-digestion
3	(McCarthy, Kapetanaki, & Wang, 2020)	Journal of Cleaner Production	Pre-consumer food waste, Value-added surplus products (VASP), Novel foods, Market segmentation, Perceived benefits of VASP
4	(Al-Rumaihi, McKay, Mackey, & Al-Ansari, 2020)	Sustainability	life cycle assessment, composting, anaerobic digestion, greenhouse gases, waste management, sustainable development
5	(Wang et al., 2020)	Waste Management	Municipal solid waste management Policy-driven transition, EU landfill directive, Nottingham, Material flow analysis Separate collection
6	(Fatimah, Govindan, Murniningsih, & Setiawan, 2020)	Journal of Cleaner Production	Sustainability, Sustainable circular economy, Smart waste management, Maturity model, Internet of things (IoT) Sustainable development goals (SDG's) Industry 4.0
7	(Wang, He, Tang, Higgitt, &, Robinson, 2020)	Journal of Cleaner Production	EU waste directives Municipal solid waste Evolution, Life cycle assessment Global warming potential Nottingham
8	(Lu, Qu, & Hanandeh, 2020)	Journal of Cleaner Production	Life cycle assessment, Home composting, Centralized composting, Life cycle cost Landfilling
9	(Luttenberger, 2020)	Journal of Cleaner production	Waste management, Circular economy, Biowaste, Marine litter Croatia
10	(de Sadeleer, Brattebø, & Callewaert, 2020)	Resources, Conservation and Recycling	Organic waste treatment, Food waste prevention, Recycling rates, Energy efficiency, Avoided greenhouse gas emissions
11	(Albizzati, Tonini, & Astrup, 2021)	Environmental Science & Technology	life cycle assessment, high-value products, food waste pyramid, hierarchy, prevention
12	(Sharma et al., 2021)	Science of the Total Environment	Circular economy, Waste management Sustainability, COVID-19 impact, Sustainable development goals
13	(Badgett & Milbrandt, 2021)	Journal of Cleaner Production	Food waste Biopower, Biofuels Bioproducts, Waste-to-energy, Cost-benefit analysis
14	(Rashid & Shahzad, 2021)	Journal of Cleaner Production	Circular economy indicators, Environmental pollution, Global warming potential, Organic fertilizer, Recycling, Waste management
15	(Wang et al., 2021)	Journal of Environmental Management	Municipal solid waste management, Waste sorting rule, Classification efficiency, Shanghai
16	(Mahmood, Zurbrügg, Tabinda, Ali, & Ashraf, 2021)	Sustainability	Household waste, Black soldier fly larvae, Biowaste treatment, Organic waste recycling

No.	Authors	Source	Variable
17	(Hussein, Uren, Rekik, & Hammami, 2022)	Waste Management and Research	MENA, composting, organic waste, anaerobic digestion, municipal solid waste, biogenous waste, Vision 2030, SDGs
18	(Lin, Ooi, & Woon, 2022)	Science of The Total Environment	Life cycle assessment, General algebraic modeling system, Pareto-optimal solution, Hotspot analysis, Valorization technology, Malaysia
19	(Kharola et al., 2022)	Journal of Cleaner Production	Barriers, Organic waste management, Sustainability, Fuzzy theory, Decision making trial and evaluation laboratory, Circular economy
20	(D'Aquino et al., 2022)	Sustainability (Switzerland)	Renewable energy source, Biogas, Urban waste, Bioelectricity, Waste-to-energy
21	(Jebaranjitham et al., 2022)	Heliyon	Solid waste, Generation rate, Countries investment, Government policy acts, Covid-19
22	(Yang et al., 2022)	Sustainability (Switzerland)	Waste classification, Source sorting, Life-Cycle costing; Life-cycle assessment; Inventory; Anaerobic digestion
23	(Nguyen, Malek, Umberger, & O'Connor, 2022)	Journal of Cleaner Production	Proportional data, Organic waste diversion, Home composting, Curbside collection, Food waste hierarchy
24	(Fadhullah et al., 2022)	BMC public health	Households' Practices and Perception, Waste Segregation and Separation, Principal Component Analysis, Public Health, Solid Waste
25	(Al-Obadi, Ayad, Pokharel, & Ayari, 2022)	Sustainable Production and Consumption	Food waste, Waste reduction, Waste management, Innovation, Waste management technology, Circular economy
26	(Chin, Lee, & Woon, 2022)	Journal of Environmental Management	Eco-efficiency, Life cycle assessment Life cycle costing, Policy-driven, National target, Waste treatment facility
27	(Khan et al., 2022)	Chemosphere	Solid waste management, Municipal solid waste characteristics, Composting
28	(Everitt, van der Werf, & Gilliland, 2023)	Sustainability (Switzerland)	Food waste, Organic waste, Household, COVID-19, Waste generation
29	(Blanchard, Harris, Pocock, & McCabe, 2023)	Sustainability (Switzerland)	FOGO, Household food waste, Municipal solid waste, Social behavior change, Circular economy
30	(Rotthong et al., 2023)	Sustainability (Switzerland)	Environmental assessment, Centralized system, On-site system, Composting, Anaerobic digestion, Landfill, Incineration; home composting, Food waste processor, Composting bin
31	(Nath et al., 2023)	Animals	Food waste (FW), Animal feed, Recycling, Waste management, Treatment technology
32	(Scharff et al., 2023)	Waste Management and Research	Landfill, Methane, Emission, Mitigation, Management, Gas recovery

Source: Data processing by researchers

RESULT AND ANALYSIS

Organic waste management in Indonesia vs global organic waste management that has been proven to reduce GHG emissions

Indonesia's waste management faces challenges due to limited technology, human resources, and financial support, with 74% of waste in Magelang being organic. The main issue is the lack of public awareness about effective waste management (Fatimah et al., 2020). Similarly, 120 landfills in Croatia receive about 72% of the total generated municipal waste. Croatia's municipal waste recycling rate stands at 23.6%, significantly below the 2020 target of 50%. Of the total 1.091 million tons of municipal waste generated, only 34,891 tons were composted, 3,625 tons were treated in biogas plants, and the rest were disposed of in landfills (Luttenberger, 2020).

Thailand uses composting and anaerobic digestion for organic waste treatment, treating garden waste and producing organic fertilizer and biogas. The government encourages source separation of food waste as part of the 3Rs (Reduce, Reuse, Recycle) (Rotthong et al., 2023). AD is more energy-efficient and offers environmental benefits over incineration, especially in recycling rates and GHG emissions, while food waste prevention is the most effective strategy for reducing environmental impacts (de Sadeleer, Brattebø, & Callewaert, 2020). Florida's waste management shows that high solid anaerobic co-digestion (HS-AcD) is a promising alternative for dealing with organic waste and biosolids, with big economic and environmental benefits (Lee et al., 2020).

Malaysia is starting to implement anaerobic digestion that utilizes microorganisms to break down organic matter into biogas and solid residues, which are further utilized for fertilizer and electrical energy (Lin et al., 2022). Malaysia's National Solid Waste Management Policy 2006 (revised 2016) encourages alternative waste management methods like incineration and composting to reduce landfill waste, while raising public awareness about waste segregation and recycling participation is crucial (Al-Obadi et al., 2022).

In 2006/07, Nottingham in the UK saw an increase in recycling (17.5%) and composting (8.6%). In 2016/17, recycling rates increased to 31.5% and composting to 12.9%. In 2016/17, only 7.3% of waste went to landfills, while the majority of it was processed into energy. Nottingham has a target to reduce household waste to 390 kg/person by 2025 and achieve "zero waste to landfill" by 2030 (Wang, et al., 2020). Meanwhile, the Shanghai government requires waste segregation successfully separated about 83.62% of household food waste, achieving a high purity rate of 99.50% (Wang et al., 2021). In New South Wales, the government subsidizes the implementation of organics collection services, such as the Go FOGO grant scheme

Meanwhile, organic waste management in the European Union focuses on prevention, reuse, and recycling. EU policies, such as the European Green Deal and Farm-

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to-Fork strategy, aim to create a sustainable food system and reduce food waste throughout the supply chain (Albizzati, Tonini, & Astrup, 2021). Innovative approaches in organic waste management involve awareness campaigns in university canteens to change consumer behavior and reduce food waste (Al-Obadi et al., 2022).

Efforts to reduce and manage organic waste at the household level

Everitt et al. (2023) suggest various strategies for households to manage organic waste, including promoting meal planning, proper food storage, composting non-edible waste, allowing edible food waste donation to food banks or charities, and offering government incentives for waste reduction programs and improved food waste management. Organic waste should be separated from non-organic waste through waste separation programs in households, restaurants, and other institutions. Good segregation helps in further treatment and reduces the volume of waste going to landfills (Kharola et al., 2022). In Shanghai, waste separation became mandatory in 2019, resulting in a significant reduction in residual waste. Policies that force food waste separation compared to those that are voluntary may result in different outcomes in waste separation behavior (Nguyen et al., 2022).

Household food waste management in the UK focuses on separate collection, more efficient processing, and waste prevention to achieve greater sustainability. The UK has a target to recycle 50% of household waste by 2020, and as per the EU Circular Economy Package, this target increases to 60% by 2030 (Slorach et al., 2020). The EU Landfill Directive (ELD) encourages the implementation of a waste management hierarchy, which prioritizes waste prevention, reuse, recycling, and energy recovery over disposal (Wang et al., 2020).

Everitt et al. (2023) suggest various strategies for households to manage organic waste, including promoting meal planning, proper food storage, composting non-edible waste, allowing edible food waste donation to food banks or charities, and offering government incentives for waste reduction programs and improved food waste management (Rashid & Shahzad, 2021). The most beneficial composting technique is the integrated anaerobic digestion and composting system. This system can reduce the environmental impact of using chemical fertilizers (Al-Rumaihi et al., 2020). MENA countries are implementing composting to manage biogenic waste, reducing landfill volume and producing organic fertilizer for agriculture. Some are developing action plans for improved waste collection and disposal services. The United Arab Emirates has adopted ambitious policies to reduce carbon emissions and improve sustainability, including the "Polluter Pays" principle and tax incentives for recycling (Hussein, 2022).

However, Yang et al. (2022) said anaerobic digestion was found to be better than composting and landfilling and comparable to biodiesel production and combustion. However, in terms of economic costs, the advantages of anaerobic digestion are not always significant, and composting often has lower economic costs. In Surabaya and Sidoarjo, Indonesia, Black Soldier Fly Larvae (BSFL) technology is being used for organic waste management. BSFL larvae convert waste into useful biomass, animal feed, and fertilizer residue. Successful implementation requires community and local authority cooperation in waste collection and facilities (Mahmood et al., 2021). Community involvement is crucial in the success of organic waste management programs. Buyback programs can increase community participation, create jobs, and change the value of the waste management system (D'Aquino et al., 2022).

On the other hand, using waste as an energy source through processes such as gasification or pyrolysis, which convert waste into fuel or electrical energy, and biological processes that convert organic waste into compost that can be used as fertilizer. These are environmentally friendly methods and can reduce the volume of waste disposed of (Khan et al., 2022). However, some of the challenges faced in household waste management include a lack of waste collection facilities, limited financial resources, and a lack of knowledge about proper waste management among the community (Fadhullah et al., 2022).

CONCLUSION

Based on the results of the systematic literature review conducted by the author, it can be concluded that organic waste management plays an important role in reducing greenhouse gas (GHG) emissions globally. However, its implementation in each country has varied forms. Indonesia, for example, continues to face numerous challenges, including reliance on inadequate landfills, limited technology, and low public awareness. However, in one region of Indonesia, there are innovations, such as the use of Black Soldier Fly larvae to process organic waste into biomass and fertilizer, which shows high potential if widely adopted.

Globally, organic waste management is more varied. In Europe, policies such as the European Green Deal and Farm-to-Fork Strategies emphasize food waste reduction and recycling promotion with a hierarchy-based approach to waste management. In contrast, Thailand and Malaysia prioritize technologies like anaerobic digestion for the production of energy and organic fertilizer. Government support and source separation policies are key to success. In Nottingham and Shanghai, there was a significant increase in recycling and waste treatment due to policies requiring segregation and investment in modern waste management facilities. In New South Wales, subsidy programs such as Go FOGO increased community participation in organic waste separation and recycling.

At the same time, the best ways to get people to use less organic waste at home are to teach them how important it is to separate their trash at the source, spread the word about effective composting methods like combining anaerobic digestion with composting, offer incentives and government policy support to adopt environmentally friendly technologies, and set up buyback programs for organic waste that get more people involved and make money. However, organic waste management still faces several challenges, including a lack of facilities and financial resources as well as limited community knowledge. However, with the collaboration of the government, community, and private sector, modern technologies such as anaerobic digestion and energy use from waste can be a sustainable solution to reduce GHG emissions.

REFERENCES

Al-Obadi, M., Ayad, H., Pokharel, S., & Ayari, M. A. (2022). Perspectives on food waste management: Prevention and social innovations. *Sustainable Production and Consumption, 31*, 190-208.

Al-Rumaihi, A., McKay, G., Mackey, H. R., & Al-Ansari, T. (2020). Environmental impact assessment of food waste management using two composting techniques. *Sustainability, 12*(4), 1595; https://doi.org/10.3390/su12041595

Albizzati, P F, Tonini, D., & Astrup, T. F. (2021). A quantitative sustainability assessment of food waste management in the European Union. *Environmental Science & Technology, 55*(23), 16099–16109. https://doi.org/10.1021/acs.est.1c03940

Álvarez-Fernández, M. I., Prendes-Gero, M. B., Pola-Alonso, I., Conde-Fernández, L., & Luengo-García, J. C. (2022). Determination of the explosion parameters of methane-air mixtures as function of the ignition source and the volume and shape of the explosion chambers. *Journal of Loss Prevention in the Process Industries, 80*. https://doi.org/10.1016/j.jlp.2022.104862

Ambina, D. G. (2019). Tinjauan Pemilahan Sampah Menurut Undang-Undang Nomor 18 Tahun 2008 Tentang Pengelolaan Sampah. *Bina Hukum Lingkungan, 3*2), 171–185.

Badgett, A., & Milbrandt, A. (2021). Food waste disposal and utilization in the United States: A spatial cost benefit analysis. *Journal of Cleaner Production, 314*.

Blanchard, C., Harris, P., Pocock, C., & McCabe, B. K. (2023). Food and Garden Organic Waste Management in Australia: Co-Benefits for Regional Communities and Local Government. *Sustainability (Switzerland), 15*(13). https://doi.org/10.3390/su15139901

Bukar, U. A., Sayeed, M. S., Razak, S. F. A., Yogarayan, S., Amodu, O. A., & Mahmood, R. A. R. (2023). A method for analyzing text using VOSviewer. *MethodsX, 11*(May), 102339. https://doi.org/10.1016/j.mex.2023.102339

Chaerul, M. (2007). Municipal solid waste management in Indonesia: status and the strategic actions. *Journal of Environmental Science and Technology,, 2*, 41–49.

Chin, M. Y., Lee, C. T., & Woon, K. S. (2022). Policy-driven municipal solid waste management assessment using relative quadrant eco-efficiency: A case study in Malaysia. *Journal of Environmental Management, 323*, 116238. https://doi.org/10.1016/j.jenvman.2022.116238.

CNN Indonesia. (2023a). *Kebakaran TPA Sampah di Bandung, Solo hingga Semarang, Api Belum Padam.* CNNIindonesia.Com. Retrieved from https://www.cnnindonesia.com/nasional/20230919101416-20-1000785/kebakaran-tpa-sampah-di-bandung-solo-hingga-semarang-api-belum-padam

CNN Indonesia. (2023b). *Puluhan Warga Sesak Napas Imbas Kebakaran TPA Putri Cempo Solo*. CNN News. Retrieved from https://www.cnnindonesia.com/nasional/20230920175900-20-1001604/puluhan-warga-sesak-napas-imbas-kebakaran-tpa-putri-cempo-solo

Craven, J., & Levay, P. (2011). Recording database searches for systematic reviews - What is the value of adding a narrative to peer-review checklists? A case study of nice interventional procedures guidance. *Evidence Based Library and Information Practice, 6*(4), 72–87. https://doi.org/10.18438/b8cd09

D'Aquino, C A, Pereira, B. A., Sawatani, T. F., de Moura, S. C., Tagima, A., Ferrarese, J. C. B. B., … Sauer, I. L. (2022). Biogas Potential from Slums as a Sustainable and Resilient Route for Renewable Energy Diffusion in Urban Areas and Organic Waste Management in Vulnerable Communities in São Paulo. *Sustainability (Switzerland), 14*(12). https://doi.org/10.3390/su14127016

D'Aquino, C.A., Pereira, B. A., Sawatani, T. F., de Moura, S. C., Tagima, A., Ferrarese, J. C. B. B., Santos, S.C., & Sauer, I. L. (2022). Biogas Potential from Slums as a Sustainable and Resilient Route for Renewable Energy Diffusion in Urban Areas and Organic Waste Management in Vulnerable Communities in São Paulo. *Sustainability (Switzerland), 14*(12). https://doi.org/10.3390/su14127016

de Sadeleer, Irmeline, Brattebø, H., & Callewaert, P. (2020). Waste prevention, energy recovery or recycling - Directions for household food waste management in light of circular economy policy. *Resources, Conservation and Recycling, 160*(June 2019), 104908. https://doi.org/10.1016/j.resconrec.2020.104908

Defitri, M. (2020). *Pengertian TPST, TPS, TPS 3R, TPA, Perbedaan & Fungsi Tempat Pengelolaan Sampah*. Retrieved from https://waste4change.com/blog/fungsi-tps-tps-3r-tpst-dan-tpa/

detikJabar, tim. (2023). *5 Fakta Kebakaran TPA Sarimukti Tim detikJabar-detikJabar*.

Everitt, H., van der Werf, P., & Gilliland, J. A. (2023). A Review of Household Food Waste Generation during the COVID-19 Pandemic. *Sustainability (Switzerland), 15*(7). https://doi.org/10.3390/su15075760

Fadhullah, W., Imran, N. I. N., Ismail, S. N. S., Jaafar, M. H., & Abdullah, H. (2022). Household solid waste management practices and perceptions among residents in the East Coast of Malaysia. *BMC Public Health,* 22*(1)*. https://doi.org/10.1186/S12889-021-12274-7

Fatimah, Y. A., Govindan, K., Murniningsih, R., & 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*, 122263.

Förstner, U., Kersten, M., & Wienberg, R. (2005). Geochemical processes in landfills. In: P. Baccini, (ed.), *The Landfill. Lecture Notes in Earth Sciences*, vol 20. Springer, Berlin, Heidelberg. https://doi.org/10.1007/BFb0011258

Galford, G. L., Peña, O., Sullivan, A. K., Nash, J., Gurwick, N., Pirolli, G., Richards, M., White, J., Wollenberg, E. (2020). Agricultural development addresses food loss and waste while reducing greenhouse gas emissions. *Science of the Total Environment, 699*. https://doi.org/10.1016/j.scitotenv.2019.134318

Hussein, L, Uren, C., Rekik, F., & Hammami, Z. (2022). A review on waste management and compost production in the Middle East–North Africa region. *Waste Management & Research, 40*(8). https://doi.org/10.1177/0734242X211068236

Hussein, L., Uren, C., Rekik, F., & Hammami, Z. (2022). A review on waste management and compost production in the Middle East–North Africa region. *Waste Management and Research, 40*(8), 1110–1128. https://doi.org/10.1177/0734242X211068236

Jabeen, S., Malik, S., Khan, S., Khan, N., Qureshi, M. I., & Saad, M. S. M. (2021). A comparative systematic literature review and bibliometric analysis on sustainability of renewable energy sources. *International Journal of Energy Economics and Policy, 11*(1), 270–280. https://doi.org/10.32479/ijeep.10759

Jebaranjitham, J. Nimita, Selvan Christyraj, J. D., Prasannan, A., Rajagopalan, K., Chelladurai, K. S., & Gnanaraja, J. K. J. S. (2022). Current scenario of solid waste management techniques and challenges in Covid-19 - A review. *Heliyon, 8*(7), e09855. https://doi.org/10.1016/j.heliyon.2022.e09855

Kardono. (2007). Integrated Solid Waste Management in Indonesia. Proceedings of International Symposium on EcoTopia Science. *Jukung Jurnal Teknik Lingkungan, 3*(1), 629–633.

Kementerian PPN/Bappenas. (2021). *Laporan Kajian Food Loss & Waste di Indonesia*. Kementerian PPN/Bappenas.

Khan, S., Anjum, R., Raza, S. T., Bazai, N. A., & Ihtisham, M. (2022). Technologies for municipal solid waste management: Current status, challenges, and future perspectives. *Chemosphere, 288*(1).

Kharola, S., Ram, M., Goyal, N., Mangla, S. K., Nautiyal, O.P., Rawat, A., Kazancoglu, Y., & Pant, D. (2022). Barriers to organic waste management in a circular economy. *Journal of Cleaner Production, 361*.

KLHK RI. (2023). *Komposisi Sampah. SIPSN (Sistem Informasi Pengelolaan Sampah Nasional).* Retrieved from https://sipsn.menlhk.go.id/sipsn/public/data/komposisi

Lasminingrat, L., & Efriza, E. (2020). the Development of National Food Estate: the Indonesian Food Crisis Anticipation Strategy. *Jurnal Pertahanan & Bela Negara, 10*(3), 229. https://doi.org/10.33172/jpbh.v10i3.1110

Lee, E., Oliveira, D. S. B. L., Oliveira, L. S. B. L., Jimenez, E., Kim, Y., Wang, M., Ergas, S.J.,& Zhang, Q. (2020). Comparative environmental and economic life cycle assessment of high solids anaerobic co-digestion for biosolids and organic waste management. *Water Research, 171*. https://doi.org/10.1016/j.watres.2019.115443

Lin, Z., Ooi, J. K., & Woon, K. S. (2022). An integrated life cycle multi-objective optimization model for health-environment-economic nexus in food waste management sector. *Science of The Total Environment, 816*.

Lu, H. R., Qu, X., & Hanandeh, A. El. (2020). Towards a better environment-the municipal organic waste management in Brisbane: Environmental life cycle and cost perspective. *Journal of Cleaner Production, 258.*

Luttenberger, L. R. (2020). Waste management challenges in transition to circular economy–case of Croatia. *Journal of Cleaner Production*, *256*.

Lutviyani, A., Farkha, F., & Firdausi, H. (2022). Tinjauan Limbah Makanan Terhadap Lingkungan dalam Persepektif Islam dan Sains. *Interkoneksi Islam Dan Sains, 4*(1), 49–53.

Mahendra, K., & Luthfiana, H. (2023). *Ledakan TPA Leuwigajah, Insiden Paling Parah yang Pernah Terjadi di Indonesia.* Retrieved from https://www.tempo.co/lingkungan/ledakan-tpa-leuwigajah-insiden-paling-parah-yang-pernah-terjadi-di-indonesia-141803

Mahmood, S., Zurbrügg, C., Tabinda, A. B., Ali, A., & Ashraf, A. (2021). Sustainable Waste Management at Household Level with Black Soldier Fly Larvae (Hermetia illucens). *Sustainability, 13*(17).

Mak, T. M. W., Xiong, X., Tsang, D. C. W., Yu,I.K. M., & Poon, C.S. (2020). Sustainable food waste management towards circular bioeconomy: Policy review, limitations and opportunities. *Bioresource Technology, 297.*

Mavropoulos, A., Marinheiro, L., Cohen, P., & Law, J. (2016). A Roadmap for closing Waste Dumpsites. *International Sollid Waste Association, 50*(7), 109–116.

MC Kota Bandung. (2021). *Tragedi Leuwigajah, Kisah Kelam "Bandung Lautan Sampah."* Retrieved from https://infopublik.id/kategori/nusantara/512504/tragedi-leuwigajah-kisah-kelam-bandung-lautan-sampah

McCarthy, B., Kapetanaki, A. B., & Wang, P. (2020). Completing the food waste management loop: is there market potential for value-added surplus products (VASP)? *Journal of Cleaner Production, 256.*

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Reprint-Preferred Reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Physical Therapy, 89*(9), 873–880. https://doi.org/10.1093/ptj/89.9.873

Munawar, E., Yunardi, Y., Lederer, J., & Fellner, J. (2018). The development of landfill operation and management in Indonesia. *Journal of Material Cycles and Waste Management, 20*(2), 1128–1142. https://doi.org/10.1007/s10163-017-0676-3

Nafi'ah, Z. Z., & Dinarjito, A. (2024). Analysis of the potential of implementing methane-based carbon tax on food waste in Indonesia. *Educoretax, 4*(7), 851–871. https://doi.org/10.54957/educoretax.v4i7.974

Nath, P. C., Ojha, A., Debnath, S., Sharma, M., Nayak, P. K., Sridhar, K., & Inbaraj, B. S. (2023). Valorization of food waste as animal feed: a step towards sustainable food waste management and circular bioeconomy. *Animals, 13*(8).

News.detik.com. (2023). *Kebakaran TPA Putri Cempo Solo: Awal Mula hingga Kondisi Terkini.* DetikNews. Retrieved from https://news.detik.com/berita/d-6935953/kebakaran-tpa-putri-cempo-solo-awal-mula-hingga-kondisi-terkini/2

Nguyen, T. T. T., Malek, L., Umberger, W. J., & O'Connor, P. J. (2022). Household food waste disposal behaviour is driven by perceived personal benefits, recycling habits and ability to compost. *Journal of Cleaner Production, 379*. https://doi.org/10.1016/j.jclepro.2022.134636

Paul, S., Choudhury, M., Deb, U., Pegu, R., Das, S., & Bhattacharya, S. S. (2019). Assessing the ecological impacts of ageing on hazard potential of solid waste landfills: A green approach through vermitechnology. *Journal of Cleaner Production, 236.* https://doi.org/10.1016/j.jclepro.2019.117643

Prihatin, R. B. (2020). Pengelolaan Sampah di Kota Bertipe Sedang: Studi Kasus di Kota Cirebon dan Kota Surakarta. *Aspirasi: Jurnal Masalah-Masalah Sosial, 11*(1), 1–16. https://doi.org/10.46807/aspirasi.v11i1.1505

Rashid, M. I., & Shahzad, K. (2021). Food waste recycling for compost production and its economic and environmental assessment as circular economy indicators of solid waste management. *Journal of Cleaner Production, 317*.

Rotthong, M., Takaoka, M., Oshita, K., Rachdawong, P., Gheewala, S. H., & Prapaspongsa, T. (2023). Life Cycle Assessment of Integrated Municipal Organic Waste Management Systems in Thailand. *Sustainability (Switzerland), 15*(1). https://doi.org/10.3390/su15010090

Sadeleer, I de, Brattebø, H., & Callewaert, P. (2020). Waste prevention, energy recovery or recycling-Directions for household food waste management in light of circular economy policy. *Resources, Conservation and Recycling, 160* https://doi.org/10.1016/j.resconrec.2020.104908

Scharff, H., Soon, H. Y., Rwabwehare Taremwa, S., Zegers, D., Dick, B., Villas Bôas Zanon, T., & Shamrock, J. (2023). The impact of landfill management approaches on methane emissions. *Waste Management and Research, 42*(11). https://doi.org/10.1177/0734242X231200742

ScimagoJr. (2024). Retrieved from http://www.scimagojr.com/

Sharma, H. B., Vanapalli, K. R., Samal, B., Cheela, V. R. S., Dubey, B. K., & Bhattacharya, J. (2021). Circular economy approach in solid waste management system to achieve UN-SDGs: Solutions for post-COVID recovery. *Science of the Total Environment, 800*, 149605. https://doi.org/10.1016/j.scitotenv.2021.149605

Slorach, P. C., Jeswani, H. K., Cuéllar-Franca, R., & Azapagic, A (2020). Assessing the economic and environmental sustainability of household food waste management in the UK: Current situation and future scenarios. *Science of the Total Environment, 710*, 135580. https://doi.org/10.1016/j.scitotenv.2019.135580.

Slorach, P.C., Jeswani, H. K., Cuéllar-Franca, R., & Azapagic, A. (2020). Assessing the economic and environmental sustainability of household food waste management in the UK: Current situation and future scenarios. *Science of the Total Environment, 710,* 135580. https://doi.org/10.1016/j.scitotenv.2019.135580

Sukarmawati, Y., Ayu Murti, R. H., & Salam Jawwad, M. A. (2023). Dampak Pembuangan Sampah Terbuka (Open Dumping) terhadap Kualitas Udara di Tempat Pemrosesan Akhir Sampah (TPA) Gohong. *Jurnal Envirotek, 15*(1), 34–48. https://doi.org/10.33005/envirotek.v15i1.218

UNEP (United Nations Environment Programme). (2021). *Food Waste Index Report 2021.* Retrieved from https://www.unep.org/resources/report/unep-food-waste-index-report-2021

van Dinter, R., Tekinerdogan, B., & Catal, C. (2021). Automation of systematic literature reviews: A systematic literature review. *Information and Software Technology, 136*. https://doi.org/10.1016/j.infsof.2021.106589

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Vardhan, S., & Singh, R. R. (2022). Design, simulation and performance comparison of SoI rectangular waveguide and SMF for methane detection. *Proceedings Vol 12148, Integrated Photonics Platforms II*; 121480I: SPIE Photonics Europe, 2022, Strasbourg, France. https://doi.org/10.1117/12.2621459

Wang, D., He, J., Tang, Y. T., Higgitt, D., &, Robinson, D. (2020). Life cycle assessment of municipal solid waste management in Nottingham, England: Past and future perspectives. *Journal of Cleaner Production*, *251*.

Wang, D., Tang, Y. T., Long, G., Higgitt, D., He, J., & Robinson, D. (2020). Future improvements on performance of an EU landfill directive driven municipal solid waste management for a city in England. *Waste Management* (New York, N.Y.), *102*, 452–463. https://doi.org/10.1016/j.wasman.2019.11.009Wang, X. (2020). Systematic Literature Review. *Proceedings of the Design Society International Conference on Engineering Design*, 7–27. https://doi.org/10.1007/978-981-13-5983-5_2

Wang, Y., Shi, Y., Zhou, J., Zhao, J., Maraseni, T., & Qian, G. (2021). Implementation effect of municipal solid waste mandatory sorting policy in Shanghai. *Journal of Environmental Management, 298.*

Yang, N., Li, F., Liu, Y., Dai, T., Wang, Q., Zhang, J., Dai, Z., &Yu, B. (2022). Environmental and Economic Life-Cycle Assessments of Household Food Waste Management Systems: A Comparative Review of Methodology and Research Progress. *Sustainability (Switzerland), 14*(13), 1–19. https://doi.org/10.3390/su14137533

Yong, Z., Dong, Y., Zhang, X., & Tan, T. (2015). Anaerobic co-digestion of food waste and straw for biogas production. *Renewable Energy, 78*, 527–530. https://doi.org/10.1016/j.renene.2015.01.033

Yoshida, H., Gable, J. J., & Park, J. K. (2012). Evaluation of organic waste diversion alternatives for greenhouse gas reduction. *Resources, Conservation and Recycling, 60*, 1–9. https://doi.org/10.1016/j.resconrec.2011.11.011

Zolkos, S., Fiske, G., Windholz, T., Duran, G., Yang, Z., Olenchenko, V., Faguet, A., & Natali, S. M. (2021). Detecting and Mapping Gas Emission Craters on the Yamal and Gydan Peninsulas, Western Siberia. Geosciences (Switzerland), 11(1), 1–23. https://doi.org/10.3390/geosciences11010021