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Review of Household Waste Management Technology for a Greener Solution to Accomplish Circular Economy in Salatiga, Indonesia

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ABSTRACT

Transitioning to a circular economy as an option of mitigating environmental challenges posed by traditional linear consumption patterns has garnered considerable attention. This study examines innovative approaches to circular economy principles in the context of Salatiga's domestic waste management. The aim is to conduct a thorough evaluation of various waste management technologies and their potential to contribute to a more sustainable and circular waste management system. The research utilizes a review-based technique, drawing insights from current academic literature, papers, and case studies relevant to circular economy practices and household waste management technologies. To find new methods that have been successfully implemented in a variety of cities, a comprehensive literature search is performed. This research attempts to give a thorough evaluation of these methods relevance to the Salatiga environment by assessing their accomplishments, obstacles, and outcomes. This research showed that several waste management techniques, such as landfilling, incineration, and minimal recycling, are used in Salatiga. The research uncovered a number of novel methods for enacting a circular economy, including community-based recycling programs, waste-to-energy conversion, and expanded producer responsibility efforts. Few people are aware of the issue, there isn't enough support system in place, and resources are restricted.

Keywords: circular economy, salatiga, waste management.

INTRODUCTION

Salatiga, Indonesia, a city in the center of the country's peaceful scenery, is not immune to the difficulties created by the swelling flow of domestic waste. Waste production in Salatiga has skyrocketed as urbanization and shifting consumption habits have put a strain on the city's waste management capabilities. A number of environmental and health issues, such as soil and water contamination and the spread of disease vectors, have resulted from cities' reliance on traditional waste disposal methods like landfill, open burning, and open dumping (Bandini et al., 2022; Sharma et al., 2018; Siddiqua et al., 2022). Given these difficulties, it's critical that Salatiga's methods for dealing with waste be thoroughly reexamined. The ideas of a circular economy provide a glimmer of hope for those searching for a long-term answer (Gong et al., 2020). Circular economy, with its foundation in recycling and reusing materials, fits in perfectly with modern approaches to waste management (Kurniawan et al., 2022; Sharma et al., 2021). The goal of the circular method is to terminate the "take, make, dispose" cycle by promoting product design that emphasizes durability, repairability, and recycling (Joensuu et al., 2020). To reduce its negative influence on the environment and boost its economic growth, Salatiga could benefit from adopting a more circular economy-oriented perspective.

The advent of cutting-edge technologies has changed the waste management narrative from one of crisis to prospect. This convergence of technology and sustainability is exemplified by recent developments such as "smart waste collection systems," which use sensors to optimize routes while cutting emissions and operational costs, and "automated sorting technologies," which improve the effectiveness of recycling procedures (Bandini et al., 2022; Deepak et al., 2022; Nižetić et al., 2019). In addition, innovative upcycling methods and waste-to-energy technologies that can both lessen waste output and provide new forms of energy stand out as possible game-changers (Mbazima et al., 2022; Mukherjee et al., 2020; Peng et al., 2023). The city of Salatiga can reduce its waste output and serve as an example for other places that are working toward environmental harmony by adopting such cutting-edge practices. San Francisco's innovative waste management system is often cited as a model for other cities to follow (Wagner et al., 2023) San Francisco's excellent 80% waste diversion rate can be attributed to the city's state-of-the-art waste sorting facilities, strict recycling legislation, and extensive public awareness initiatives. Educating its citizens on the need of waste separation and encouraging them to recycle and compost has resulted in a large decrease in the amount of trash headed for the landfill, as well as a boost to the local economy via the development of green jobs and the promotion of a circular economy. Kamikatsu, a small town in Japan, is an example of how people can make a difference by working together (Jarman-Walsh, 2019). Kamikatsu's path to zero waste started with the opening of a Waste Management Center, where careful waste sorting quickly became ingrained in the culture. The community embraced a complicated system of waste classification, which resulted in the segregation of 45 different types of waste. Kamikatsu's commitment to trash reduction measures like as recycling, composting, and reusing has resulted in a staggering 80% waste diversion rate. The transformative power of public interaction and the need of a shared commitment to waste reduction are both highlighted in this case. Sweden's cutting-edge waste-to-energy plants are an additional persuasive case study. For example, Stockholm incinerates its non-recyclable waste to provide energy and heat for the city (Jelonek & Walentek, 2022) . This novel solution helps achieve the country's renewable energy targets while simultaneously addressing the problem of insufficient landfill space. Strong legislative backing and public involvement in Sweden's integrated waste management strategy serve as a prime example of how a comprehensive strategy may transform trash into treasure while reducing negative effects on the environment. The unique composting technique used by Black Soldier Flies (BSF) provides further food for thought. The larvae of the BSF feed on organic waste, transforming into both larval biomass and compost (Purkayastha & Sarkar, 2021; Rindhe et al., 2019; Singh & Kumari, 2019). In addition to speeding up the composting procedure, this method also creates a valuable protein source that may be used in the manufacturing of animal feed. The BSF approach, which is gaining popularity around the world, is highly relevant to Salatiga's mission of minimizing organic waste while simultaneously increasing the value of recycled materials. These studies demonstrate the need to adapt waste management strategies to the specific cultural and economic features of the Salatiga region. There are many obstacles and lessons to be learned on the road to effective waste management systems. The importance of visionary leadership, community participation, breakthrough technologies, and strong policy support emerges as a consistent thread among the case studies.

Environmental deterioration and public health risks are highlighted when compared to the inadequate residential waste management in Salatiga. As a result of improper garbage management, the city's urban landscape is struggling. The accumulation of trash and the clogging of drains are common results of the lack of regulation surrounding trash disposal in public areas, roadways, and water bodies. It also creates a haven for bugs and diseases, which ruins the city's aesthetics even worse. The issue is exacerbated by inadequate trash segregation. The landfilling of mixed garbage causes recycling efforts to be ineffective and resource recovery possibilities to be lost. More money is spent on processing due to improper waste segregation, and precious resources that could be recycled are used up as a result. Lack of education and community involvement also contribute to making the situation worse. Many locals still lack an understanding of the consequences of their wasteful actions, which leaves them unmotivated to change their ways. Sustainable waste management procedures in the city are hampered by the lack of community participation in waste reduction projects.

The most efficient combination of household waste management technologies that are both adapted to the local context and in line with circular economy principles is an unanswered scientific problem in the realm of achieving a circular economy in urban centres like Salatiga. There is a dearth of research that assesses the suitability, potential synergies, and socio-environmental impacts of the various innovative technologies that have shown promise in reducing waste and promoting recycling within the specific framework of Salatiga's waste management landscape. Because of this knowledge vacuum, the current research aimed to critically assess and analyze a variety of household waste management solutions in Salatiga. To help Salatiga move toward a greener and more sustainable waste management system, this study intends to shed light on the benefits and drawbacks of these technologies and evaluate their compatibility with the circular economy model.

METHODS

This research focuses on LCA studies and on household waste management that results from various household waste criteria, this screening is shown in Figure 1. This study utilizes Scopus and ScienceDirect were just two of the reputable academic databases that were searched (Roztocki et al., 2023). The research team wanted to find scholarly publications, papers, reports, and

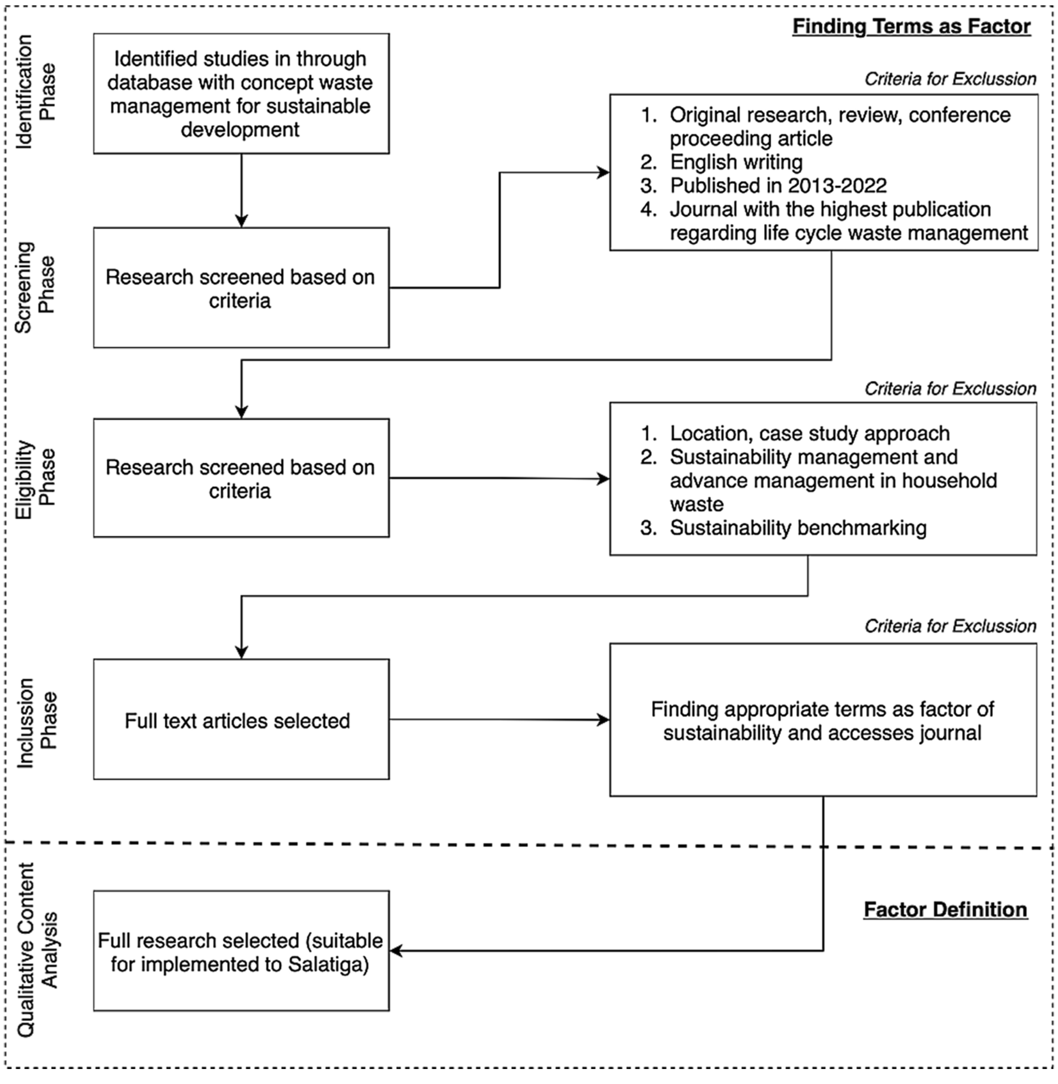

Figure 1. Steps to find, identify, and define houshold waste management with a sustainable concept

case studies about the management of household waste, cutting-edge technologies, and the ideas of a circular economy, and how these may be used in an urban setting like Salatiga. The accumulated literature was subjected to stringent analysis. The articles were chosen because of their potential to shed light on the viability and impact of advanced waste management technology, as well as their relevance to the waste management difficulties facing Salatiga (Rajaeifar et al., 2017; Vanapalli et al., 2021), to ensure the highest level of accuracy and reliability, we only rely on scientific papers from journals with high reputable (Fatimah et al., 2020). Relevant data, such as innovations in technology, waste management approaches, case study specifics, and factors contributing to success, were culled from the reviewed literature. The obtained analyses are accurate for making appropriate comparisons (McCann et al., 2021). The framework included aspects such technological feasibility, compatibility with existing regulations, community involvement, and environmental impact (Bauer et al., 2015; Förster et al., 2022). Focus on implementable actions because the recommendations were prepared with Salatiga's requirements and challenges in mind.

Study area profile

Salatiga, a picturesque community in Central Java, Indonesia, has a unique waste generation and management environment. Salatiga has economic significance despite being less expansive than certain urban centers. The city's per-capita gross domestic product (GDP) is 64.27 million rupiah, with a consistent annual development rate of 3–7%. This economic vitality attracts a diverse population, including students, professionals, and local residents, all of whom contribute to the city's patterns of refuse generation. Within the municipal limits of Salatiga, the nature of waste production is notable. The annual increase in waste generation averages between 3 and 5 percent, resulting in an estimated annual production of 312 942 tons of waste. This waste composition is dominated by organic waste, which comprises 45.32 percent of the total, followed by plastic (20.25%), paper (12.12%), metals (8.50%) and other materials (6.88%). In Salatiga, waste originates from a variety of sources, with households accounting for 79% of the total. 11% and 5% come from markets and industries, respectively, while 5% comes from other sources. Notably, informal actors in waste management play a role in recycling, with approximately 3.82 percent of generated refuse being recycled. Salatiga's waste management policy is notable for its emphasis on plastics recycling, which has resulted in an impressive 48–52% recycling rate. This is more than the recycling rates of paper, metal, glass, and other things combined. According to estimates provided by the local administration, the landfill receives about 71.23 percent of all municipal waste while 22.3 percent is managed through source separation and material recovery facilities. 6.42 percent is eliminated via incineration, landfilling, or other direct environmental disposal methods. In 2019, Salatiga's waste collection activities yielded about 245,198 tons of waste. The K-means cluster technique was used to analyze the geographic features and population makeup of the city. As a result, the neighborhoods were divided up into distinct clusters that mirrored the urban area classifications (rural, outer peri-urban, inner peri-urban, and urban) that had been conceptualized by Hanna Karg and her colleagues. Figure 2 describes the position of selected study area.

RESULTS AND DISCUSSION

Overview of waste management landscape

The dynamic landscape of waste management in Salatiga is shaped by urbanization, consumption patterns, and existing practices (Dewa et al., 2023). This comprehensive analysis reveals the key metrics, prevalent practices, and pressing challenges that characterize the city's current waste management strategy. Some important measures of the amount of waste produced by homes in Salatiga each year include total waste produced, waste produced per person, and waste composition (Andrawina et al., 2019; Ramachandra et al., 2018). A breakdown of the many types of waste that need to be managed effectively indicates the relative amounts of organic waste, plastics, paper, glass, and electronic waste (Kabirifar et al., 2020). This summary demonstrates rising rates of waste production, which call for novel approaches to reroute trash away from landfills and slow down environmental deterioration. This is summarized in Figure 3, this data collected from Dinas Lingkungan Hidup Kota Salatiga.

Salatiga, as a city, has seen a significant shift in household waste generation patterns throughout

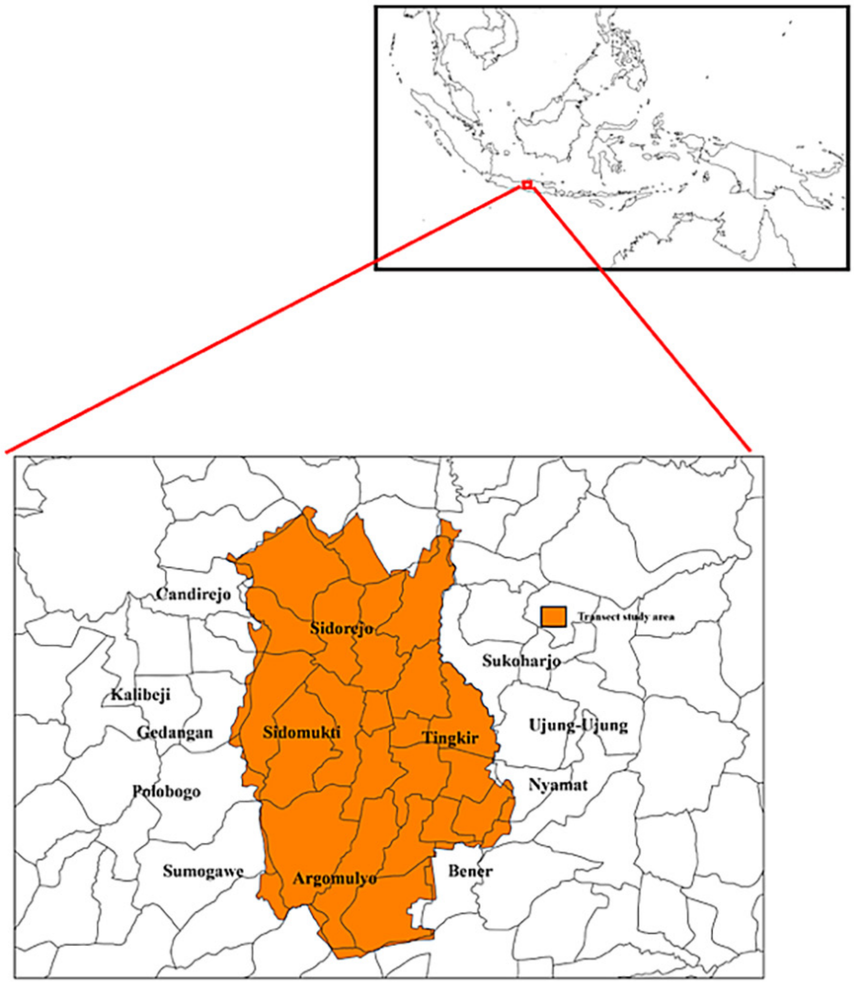

Figure 2. Study area location

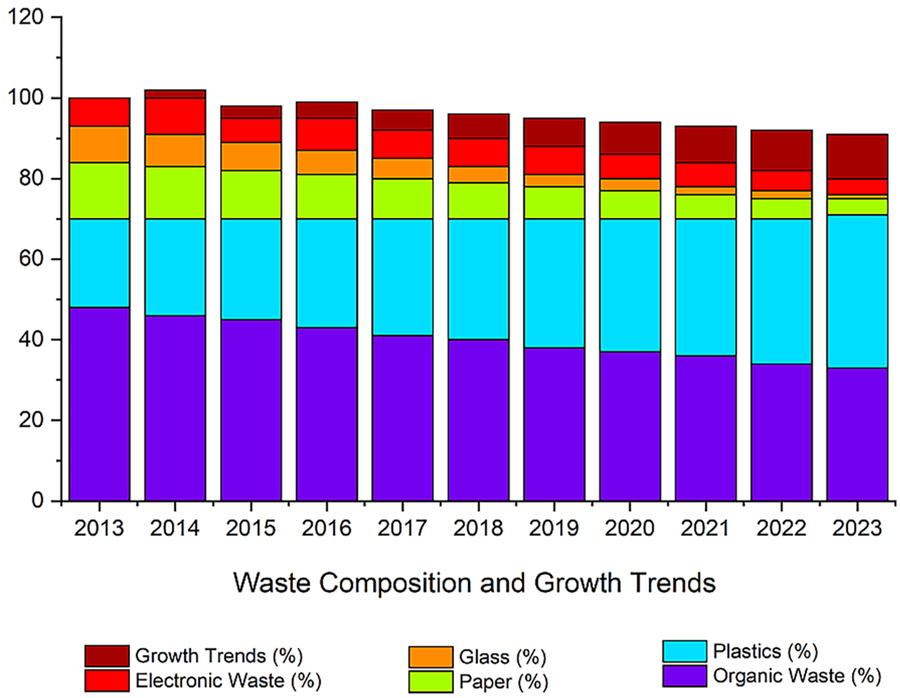

Figure 3. Waste composition and growth trend 10 years back in Salatiga

different Kecamatan districts during the previous decade. Because of population growth, shifting lifestyle preferences, and the spread of urbanization, Waste production patterns have shifted in many areas, examining the dynamics of waste management challenges and opportunities within different districts, an analysis of the growth trends in household waste generation from 2013 to 2022 provides useful insights (El Wali et al., 2021; Zhou et al., 2022). Four Subdistrict areas in Salatiga, namely Sidorejo, Tingkir, Argomulyo, and Sidomukti, were considered for this analysis. Figure 4 presented showcases hypothetical figures, aiming to illustrate the potential changes in waste generation over the specified period. The figures, though generalized, demonstrate how waste generation has potentially increased over the years. The tendencies show that the city's waste management activities are growing more critical. The need for efficient waste management solutions is more crucial than ever in the face of a dramatic increase in waste production (Khandelwal et al., 2019). The demand for cutting-edge strategies to reduce trash, recycle more, and salvage usable materials from rapidly growing cities like Salatiga is higher than ever.

These expanding patterns emphasize the significance of integrating circular economy principles into waste management policies and procedures. Waste reduction, material reuse, and efficient resource management are at the heart of the circular economy's guiding principles (Blomsma, 2018; Sharma et al., 2021). Local governments, communities, and stakeholders must work together to find effective solutions to waste management that are grounded on circular economy principles (Fernando, 2019).

Waste management in salatiga city

Open dumping, open burning, and landfilling are the primary traditional waste management methods in Salatiga (Setiyaningrum & Ariyani, 2023). According to Figure 5 data, this approach frequently causes environmental contamination, soil degradation, and unpleasant sights. In order to quantify a substance's ability to contribute to global warming over a certain time frame, its GWP is measured in CO_2-equivalent units. This analysis shows how climate change has been affected by emissions of greenhouse gases. The bigger the GWP value, the more of an impact it has on warming the planet. High GWP waste management practices, such as those that emit methane (CH_4) and carbon dioxide (CO_2), contribute to long-term climate change by trapping heat in the atmosphere (Budihardjo et al., 2023; Priyambada et al., 2021).

Eutrophication Potential (EP) evaluates the likelihood that nutrient enrichment in water bodies may result in excessive plant growth (eutrophication) and have detrimental consequences on aquatic ecosystems (Ayele & Atlabachew, 2021;

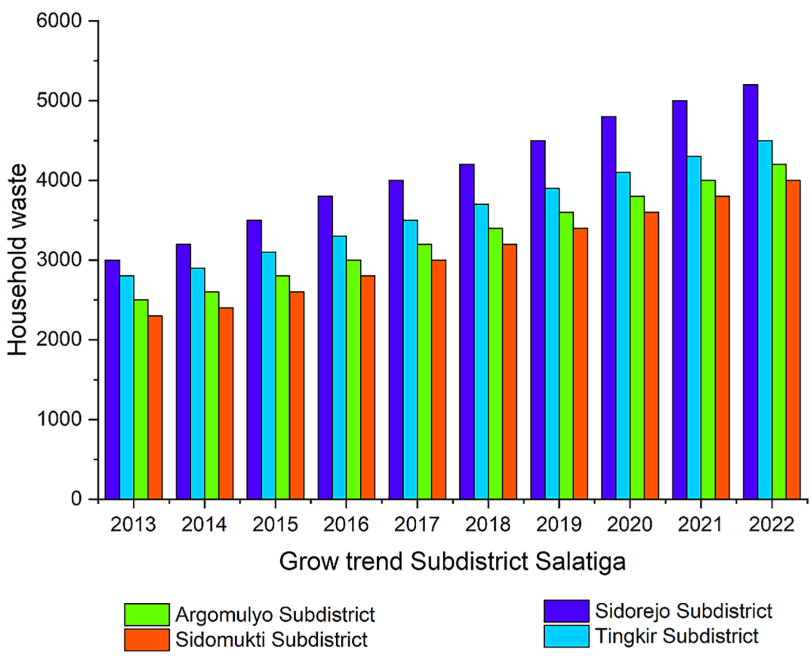

Figure 4. Growth trend subdistrict in Salatiga last 10 years

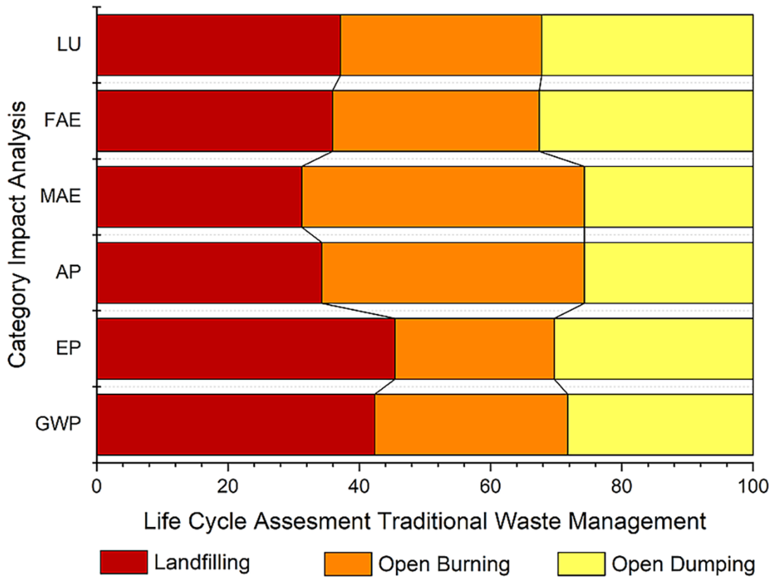

Figure 5. Life cycle assessment waste management in Salatiga City

Hadiwidodo et al., 2023). Methods with high EP values can be harmful to aquatic life because of the excess nutrients (such nitrogen and phosphorus) that release into water systems (El-Sheekh et al., 2021). Waste management's nutrient runoff has been linked to oxygen depletion, algal blooms, and ecological disruption in water bodies (ElFar et al., 2022). The potential for waste management to cause acidification of soil and water is quantified by a metric called acidification potential (AP) (Morsy et al., 2020). More acidic compounds, such as sulfur dioxide (SO_2) and nitrogen oxides (NO_x), could be released with higher AP levels (Saohasakul & Pochanart, 2023). Plants and marine life, among others, may suffer from acidification's effects on soil fertility, water quality, and ecosystems.

The potential for waste to affect marine aquatic life and ecosystems is evaluated through Marine Aquatic Ecotoxicity (MAE) (Deepak et al., 2022). Increasing MAE values represent a more harmful effect on marine life, ccumulating toxins from improper waste disposal threaten the health of marine life and could upset the delicate balance of marine food webs (Haider Jaffari et al., 2023). Like MAE, Freshwater Aquatic Ecotoxicity (FAE) considers the effects of waste management on aquatic ecosystems, but in freshwater environments. Greater toxicity to freshwater creatures and their environments is indicated by higher FAE values (Cui et al., 2021). Waste management's potential for contaminant release has serious consequences for the quality of water, aquatic life, and the stability of freshwater ecosystems (Amoatey & Baawain, 2019). The term "Land Use" (LU) is used to quantify the total area that must be allocated to landfills and other waste management facilities. When the LU value is high, the effects of land use are substantial. Land-intensive waste management methods have the potential to cause biodiversity loss, habitat degradation, and competition between different land uses.

The environmental effects of various waste management strategies are laid out clearly in these impact categories. Taking into account these factors in LCA studies helps determine the overall sustainability and potential hazards connected with each method, which in turn facilitates more educated decisions that mitigate negative effects and advance eco-friendly waste management practices.

Economy circular and waste management

The circular economy and waste management are at the forefront of progressive environmental thinking (Debrah et al., 2022). The organization offer thorough models that attempt to reconsider our connection with resources and the economic structures that control them. The ideas of the circular economy promote a more sustainable and reparative approach to economic activity, whereas the concepts of waste management direct us toward more efficient use of resources and less waste (Nižetić et al., 2019). When taken as a whole, these principles have the potential to completely alter how we produce goods, use resources, and care for the environment. The circular economy is based on the game-changing notion of creating products with many uses in mind (Joensuu et al., 2020). Industries should strive to make items that can be repaired and used multiple times in accordance with this philosophy. Reducing waste and environmental damage is made possible by lengthening the lifespan of items, which in turn requires fewer cycles of labour- and material-intensive production (Mendoza et al., 2022). Furthermore, the need of ecosystem preservation and renewal is highlighted by the concept of regenerating natural systems. The prosperity of economies and society is shown to be inextricably linked to environmental integrity by this guiding principle. Reducing waste and pollution across a product's whole life cycle is another goal backed by circular economy ideas. The goal is to minimize negative effects on the environment in every step of the process, from source to disposal. Clean energy not only lessens the environmental impact but also guarantees long-term energy security, making the transition to renewables crucial (Taghizadeh-Hesary & Yoshino, 2020). Promoting collaborative consumption patterns and innovative business tactics also encourages shared ownership and resource efficiency by challenging the standard consumerist worldview.

Effective waste management practices, in tandem with the circular economy, serve as a link between ethical production and consumption. It is recommended to avoid disposal as much as possible and instead focus on waste prevention and energy recovery, as outlined in the waste hierarchy. The principle of resource recirculation lies at the heart of this complementary relationship (Bhubalan et al., 2022). In a circular paradigm where resources are continuously reused, refurbished, or repurposed, the principles of the circular economy advocate for a departure from the linear "take-make-dispose" approach. In the context of waste management, this means phasing out harmful disposal methods and replacing them with more humane alternatives like recycling and composting. Waste sorting at the source is emphasized to facilitate productive recycling and recovery operations. The transition from one-time-use to reusable items and packaging is essential for efficient waste management within the circular economy paradigm (Zhang et al., 2022). Taking these measures helps cut down on trash from disposal, saves materials, and protects the environment. Product-as-a-service and product take-back programs are two examples of novel business models that boost resource efficiency by allowing manufacturers to keep their products for longer. The economic benefits of integrating circular economy principles into efficient waste management are substantial. Employment opportunities in the recycling, repair, and remanufacturing sectors can benefit from the development of circular supply chains. Costs associated with trash disposal, raw material acquisition, and energy use can all be reduced when businesses adopt circular methods (Romero-Hernández & Romero, 2018).

Every organization and person may play a part in the fight against waste thanks to this guiding philosophy. Responsible waste management relies heavily on the promotion of recycling and material recovery. Reusing old items helps save fossil fuels, decreases demand for new materials, and lessens environmental damage. In addition to helping with energy security and keeping trash out of landfills, waste-to-energy technologies also make use of non-recyclable waste as a source of energy. Communities can develop a culture of responsible consumption and disposal through education and awareness campaigns focused on sustainable waste practices. The concepts of the circular economy promote fresh ways of doing business that put an emphasis on minimizing waste (Morseletto, 2020). For waste management, this means adopting product-as-a-service models, in which manufacturers keep product ownership and are responsible for repairs and disposal. To further encourage long-lasting, recyclable, and reusable product design, extended producer responsibility (EPR) mandates that manufacturers be held accountable for the final disposition of their goods. Circular economy ideas are embodied in waste management strategies that aim to reduce waste, increase resource value, and create a closed-loop system that mimics ecological cycles (Ogunmakinde et al., 2021). Recognizing waste as a resource and adopting circular economy tactics can help society achieve sustainability and regenerative practices that benefit the economy and the environment.

Best household waste management

Environmental sustainability, wise resource exploitation, and robust community participation are the apex of efficient household trash management. This strategy prioritizes minimizing waste's negative environmental impact while maximizing its potential for recycling, reusing, and responsible disposal. Households are the first to begin sorting garbage into recyclable, organic, and non-recyclable materials. Paper, plastic, glass, and metal can all be recycled successfully into new materials with the help of an efficient collecting and processing system. At the same time as composting initiatives are being implemented, organic waste is being kept out of landfills, and compost that is rich in nutrients is being produced for use in soil amendment. Important to this strategy is a commitment to teaching locals through workshops, campaigns, and other educational materials on proper trash segregation, recycling procedures, and sustainable consumption patterns. By getting people involved, initiatives like community clean-up days, garbage collections, and joint projects can do even more to instill a sense of shared accountability. This proactive approach is in sync with cutting-edge technology, such as energy recovery facilities, waste-to-electricity generators, and smart bins, all of which work together to reduce waste and increase efficiency. Supported by legislation such as mandated recycling programs and extended producer responsibility, these systems are ever-evolving thanks to frequent assessments, community involvement, and a dedication to constant improvement. By adhering to these principles, exceptional household waste management not only addresses pressing disposal issues, but also fosters a society that is more mindful in its consumption and disposal practices, which is good for the environment. Research from Budihardjo (2023) Demonstrate various methods that can be used in managing household waste shows in Figure 6.

The optimal scenario for managing MSW and being kind to the environment is shown in Figure 6 to be integrated MSW (IMSW), which involves merging different technologies to handle MSW. The research find out about develop environmentally friendly principles, it is best to integrate technology using a combination of several methods (Colangelo et al., 2021), rather than recycling on a single, centralized technology as is currently the case with MSW management. Recycling materials, recovering usable materials, and decreasing the quantity of garbage sent to landfills, a major cause of environmental pollution, are only some of the goals of an integrated approach to waste management. Recycling products, recovering useful materials, and decreasing the amount of final trash disposed to landfills are all examples of ecologically friendly and effective waste management techniques that can be attained through an integrated approach using multiple approaches (Budihardjo et al., 2023).

Alternative waste management

Alternative waste management options become crucial in a situation when Salatiga is unable to fully implement the IMSW system. These

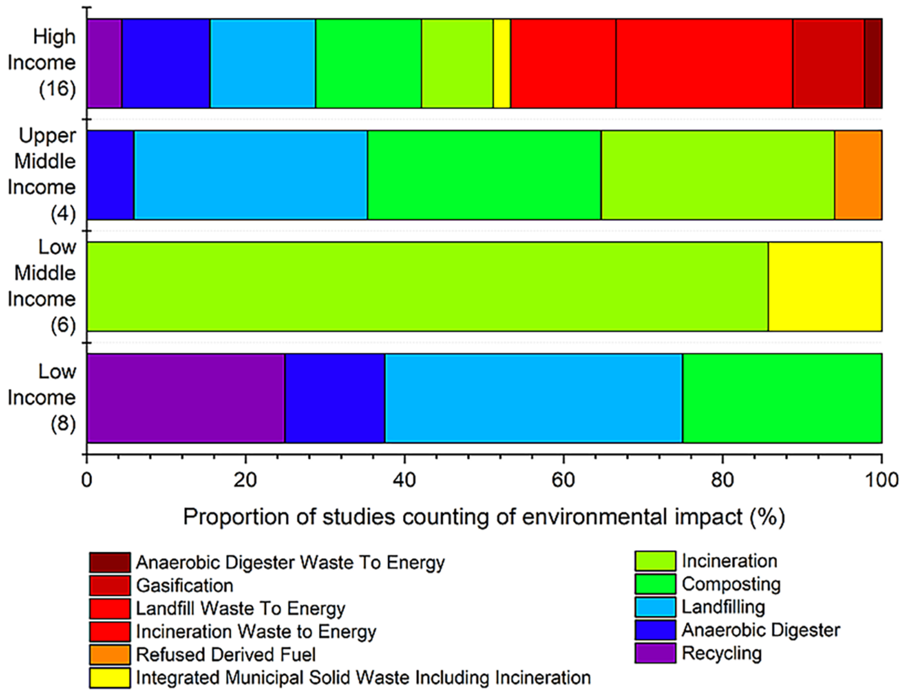

Figure 6. Waste management from counting the environmental impact (Budihardjo et al., 2023)

options aim to achieve efficient waste disposal and environmental protection despite the difficulties caused by the lack of IMSW. The municipality may choose to implement a system of decentralized garbage management. This entails promoting local waste management, such as source separation, recycling, and composting, among communities and individual household waste reduction efforts and public education on the necessity of responsible trash management could result from increased public awareness. Setting up recycling and trash drop-off centers in neighborhoods is another option worth considering. An incentive system might be implemented to boost engagement and ensure the success of this approach. To incentivize locals to bring their recyclables to these centers, the centers could issue points or tokens that can be exchanged for discounts at participating companies. Residents could bring their trash to these collection points, where it would be separated into recyclable and non-recyclable categories and collected by the proper authorities. This method lessens the demand placed on scarce resources by reducing the frequency and distance of garbage transportation.

Decentralizing composting and BSF facilities may be an effective solution for dealing with organic waste. Compos and BSF, a biosynthetically active fraction that improves soil fertility, can be made from organic waste collected and managed jointly by a community. This method helps promote more environmentally friendly farming practices by lowering the amount of waste sent to landfills (Zhang et al., 2022). Collaboration with private sector entities specializing in waste management can also play a pivotal role. Outsourcing waste collection and management services to experienced companies can help Salatiga overcome its infrastructure constraints. These companies can leverage their expertise and resources to streamline waste collection, sorting, and disposal processes(Morseletto, 2020). In addition, advocating for circular economy concepts can spark new approaches to waste management. Products' useful lives can be lengthened and the amount of waste produced can be reduced if materials like plastics and textiles are reused and upcycled (Morseletto, 2020). Community participation and education are still essential in this waste management alternate paradigm. A sense of responsibility and ownership can be fostered by teaching locals about garbage separation, recycling methods, and the bigger picture impact on the environment.

Furthermore, WtE facilities are cutting-edge waste management installations that are crucial to present-day eco-friendly waste management methods. These plants are set up to convert waste that cannot be recycled or composted into useful energy, usually in the form of electricity or heat. WtE facilities are incorporated into regional waste management networks and provide several advantages that aid in environmental sustainability, energy generation, and waste volume reduction. Plastics, mixed paper, textiles, and other types of biological waste are only some of the non-recyclable waste products that are generally collected from homes, businesses, and factories to begin the process within a WtE facility. The waste is first put through a preliminary sorting stage, wherein unnecessary recyclables, hazardous materials, and oversize items are removed. This guarantees that the WtE system is only exposed to acceptable waste. Several processes, including combustion, pyrolysis, and gasification, are used. For example, incinerating garbage entails igniting trash at temperatures between 800 and 1,200 degrees Celsius to generate thermal energy. Instead of using oxygen, pyrolysis warms trash to turn it into gaseous and liquid byproducts like syngas, which can be used as a fuel source. The process of gasification involves the controlled interaction of waste with oxygen and steam to produce synthetic gas (syngas). WtE facilities incorporate cutting-edge pollution control technologies like scrubbers and filters to capture and neutralize dangerous emissions like dioxins, heavy metals, and particulate matter to guarantee compliance with demanding environmental regulations. Bottom ash and fly ash are the waste wastes that remain after energy recovery and pollution control. It's possible to reuse some of these scraps as building materials, while others might need to be disposed of at a landfill.

The goal of sustainable development relies heavily on partnerships between governments, non-governmental organizations (NGOs) (Colangelo et al., 2021), and the corporate sector. It's a smart solution to the complex problems our world is facing right now. Climate change, poverty alleviation, and public health issues are just a few examples of such concerns that are typically too large and varied for any one sector to properly address on its own. By pooling the expertise and resources of multiple parties, collaborative problem-solving is able to take into account the whole scope of an issue. Governments give legislative frameworks and legitimacy; the corporate sector contributes financial resources and innovation; and NGOs contribute their enthusiasm and insights from the ground up. This synergy of resources generates a powerful force that can bring together substantial financing, cutting-edge solutions, and international networks to tackle intractable global problems. Further, with many parties involved in keeping tabs on progress and making sure things are done ethically and responsibly, a culture of accountability is fostered through collaboration. A more sustainable, fair, and resilient future for all is possible because of collaboration's power to promote meaningful and enduring change.

CONCLUSION

Opportunities for a more sustainable future have been uncovered through research into the current state of waste management in Salatiga and its possible connection with circular economy principles. The city's current waste management procedures and future projections for trash production emphasize the need for circular economy approaches to reduce negative environmental consequences and maximize resource efficiency. A look at the changing composition of Salatiga's trash shows a worrying rise in the amount of trash that cannot be composted. Landfilling and open dumping, two of the most common traditional waste management practices, have been linked to environmental degradation and health hazards. Emerging circular economy solutions, however, are positioned to completely transform the way waste is managed. The research on new methods of applying circular economy concepts to the problem of household waste in Salatiga has yielded important findings about the city's potential for eco-friendly and economically viable waste management. This in-depth analysis of home waste removal systems has revealed both obstacles and prospects for Salatiga on the road to a more closed-loop economic system. The evaluation of waste management technologies revealed a few novel approaches, such as community-based recycling initiatives, waste-to-energy conversion, and extended producer responsibility programs, that show promise in lowering waste production, increasing recycling rates, and encouraging responsible resource utilization. However, it is essential to acknowledge that there are obstacles to the successful adoption of circular economy concepts in waste management. To make significant progress, we must overcome the obstacles of low public interest, poor infrastructure, and scarce resources. Policymakers, stakeholders, and the community must work together to find solutions to these problems. Key measures for fostering a culture of responsible waste management include developing receptive policies, investing in infrastructure, and launching public awareness programs. Strategic measures can turn obstacles like growing garbage loads, inadequate waste management facilities, and low levels of public understanding into gains. Salatiga may take a giant leap toward a circular waste management model by adopting a circular economy policy framework, increasing public engagement and education, and investing in cutting-edge technologies

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