

Circular Economy in the Household Sector in Jakarta

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Abstract

Purpose: The primary objective of this research is to investigate the factors and explore the potential of collaboration among stakeholders that influence the successful implementation of a circular business model for household waste management.

Research: A qualitative approach employed to gather the data using In-depth interviews which are semi-structured interviews will be conducted with seven key stakeholders representing industry, community, government, and society. Open-ended exploratory questions will be used to delve into their experiences, perceptions, and insights regarding circular business models, observation, and literature review to identify existing knowledge, theories, and empirical evidence.

Results: The findings of this research are to identify the essential elements of a successful circular business model, determine the factors that positively or negatively impact the implementation of circular business models, and identify potential areas for collaboration among stakeholders.

Conclusions: To develop an effective and sustainable circular business model for waste management in the household sector we need Business Model Innovation. The factors that influence the success of circular business model implementation in the household sector that are most mentioned in the results of this study are as follows. Cooperation between various related parties to support the development and implementation of circular business model.

Limitations: The interview sample size of seven participants may limit the generalizability of the findings. A larger sample size could provide a more comprehensive understanding of the diverse perspectives and experiences of stakeholders.

Contribution: This research will contribute to the existing body of knowledge on circular economy and household waste management in Jakarta. The findings will be valuable for policymakers, businesses, and communities to develop and implement effective strategies for sustainable waste management.

Keywords: *Circular Economy, Household Waste Management, Waste Bank.*

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1. Introduction

The waste problem in Indonesia is an increasingly urgent issue because of its detrimental impact on the environment and public health. One of the leading causes of waste problems is society's increasing amount of waste and the need for adequate waste management infrastructure. Natural Resources and Human Resources are the main capital for of sustainable development. If these resources are not managed properly then the economy is threatened. In addition, the country bears high costs due to the diminishing productivity of natural resources and the declining quality of human resources that decline

due to poor health caused by pollution. The concept of linear economics also only focuses on human activities without paying attention to the concept of the environment as a resource that must be cared for and maintained continuously. As a result, no renewal occurs in the environment itself. For more than a few years now, the world's economists have been environment as a part that needs to be taken seriously in sustainable development. Sustainable development in this case is the continuous provision of resources for the next generation.

Household waste poses a significant challenge in Indonesia, with its volume steadily increasing and burdening the environment. Waste management in the country is far from optimal, leading to environmental pollution and other negative impacts. Household waste contributes the most to the overall waste volume. National waste accumulation reaches 19,560,111.07 tons per year, with only 65.93% (12,895,619.57 tons) managed and the remaining 34.07% (6,664,491.60 tons) unmanaged (Kementerian Lingkungan Hidup dan Kehutanan Direktorat Jenderal Pengelolaan Sampah, 2024). These figures are expected to rise with Indonesia's growing population. There is an urgent need to find effective, measurable, and sustainable ways to partner with informal recycling sectors (Gall et al., 2020).

A circular economy approach offers innovative solutions to address the waste problem by transforming waste into valuable resources, yielding economic, environmental, and social benefits simultaneously and building a system where economic development, society, and environmental protection are coordinated in line with sustainable development goals. With the increasing economic value of waste, job creation and environmental conservation will be fostered. Waste, emissions, and energy loss will be minimized. Consequently, product lifecycles can be extended, products can be reused, and waste can be recycled into original or new products. As a result, the amount of waste ending up in landfills and the environment will decrease (Khaw-ngern, 2021; Mita, 2023).

Solutions for waste management require a systematic analysis that considers local factors as crucial. Waste management is an ongoing process and requires significant time. The selection of circular business models should begin with research and development based on existing systems and concepts. A study of factors that can influence the successful implementation of circular business models in Indonesia, coupled with collaboration among all relevant stakeholders, is essential.

2. Literature Review

2.1 Circular Economy and its Principles

The circular economy (CE) is a sustainable development strategy aimed at addressing environmental degradation and resource scarcity (Heshmati, 2017). It is based on the principles of reducing, reusing, and recycling materials to create a closed-loop system where all resources are utilized efficiently. CE principles guide businesses to redesign products for reuse or recycling, potentially leading to new value creation opportunities and increased profits. Implementation of CE in industry requires consideration of principles such as accounting for waste potential cost, resource differentiation, and product life extension (Titova, Natalya Yu., Terentyeva, 2020). The transition from a linear to a circular economy involves various business strategies, policy mechanisms, and economic efficiency criteria (Domenech, T., & Stegemann, 2021; Titova, Natalya Yu., Terentyeva, 2020). CE aims to maintain resource value through product life extension, reuse, repair, remanufacturing, and recycling, ultimately promoting economic stability, equitable resource sharing, and reduced environmental impact (Domenech, T., & Stegemann, 2021).

The circular economy model offers numerous benefits for sustainable development across environmental, economic, and social dimensions. Environmentally, it reduces carbon dioxide emissions, landfill usage, and consumption of scarce resources. Economically, it creates sustainable demand for secondary materials, reduces costs for waste storage, and promotes economic growth (Zemanová, 2023). Socially, it increases social responsibility, creates jobs, and improves public relations. The circular economy aligns with many of the UN's Sustainable Development Goals (Berg et al., 2018) and presents a practical approach to sustainability by redesigning, reusing, recycling, and remanufacturing products (Chen, C., Chen & Jayaraman, 2021). However, implementation faces barriers across industries. Key obstacles include insufficient awareness and consumer interest, limited

infrastructure for recycling and reusing materials, and complex supply chains (Kirchherr et al., 2017; Vasconcelos, Maria Luisa., Bernardo, 2024). Furthermore, high start-up costs and upfront investments pose significant market barriers. Technical challenges include lack of information on product design, insufficient technical skills, and time-consuming disassembly processes. To overcome these barriers, suggested actions include developing comprehensive policy frameworks, establishing knowledge-sharing platforms, providing R&D grants, and implementing financial incentives and awareness campaigns (Rizos & Bryhn, 2022; Vasconcelos, Maria Luisa., Bernardo, 2024).

2.2. Household Waste Management

Household waste management faces numerous challenges globally. Obstacles include complying with legislation, improving recycling yields, and changing behavioral attitudes towards waste reduction (Cole et al., 2011). Common issues across countries involve improper disposal methods, inadequate collection infrastructure, and lack of technical skills (Sankari, 2018). The transition from waste disposal to prevention, reduction, and recycling is crucial, with many countries looking to adopt best practices from European models. In developing nations, particularly in Africa, uncontrolled urbanization and industrial development have led to increased waste production, overwhelming existing management techniques (Naghel et al., 2022). To address these challenges, integrated waste management systems, improved segregation practices, and increased public participation in recycling efforts are necessary. Additionally, implementing waste prevention measures and adopting sustainable management strategies aligned with global environmental goals is essential for effective household waste management (Cole et al., 2011).

2.3. The potential of circular economy

The circular economy (CE) offers potential solutions to address environmental challenges by reducing waste and promoting resource efficiency. Key strategies include recycling, re-manufacturing, and urban mining (Cossu & Williams, 2015; Rakesh et al., 2023; Reuter et al., 2019). Advanced technologies like material characterization and additive manufacturing can enhance recycling processes, while digital twin technologies may improve efficiency (Rakesh et al., 2023). Urban mining of e-waste presents opportunities for recovering valuable materials, including critical raw materials (Cossu & Williams, 2015). However, the CE faces challenges such as material degradation, contamination, and technological limitations. The complexity of modern consumer goods and waste streams further complicates CE implementation (Reuter et al., 2019). Additionally, the accumulation of materials in societal infrastructure limits the potential for reducing primary raw material consumption in the short term (Fellner et al., 2017). Overcoming these challenges requires innovative solutions, robust regulatory frameworks, and industry participation (Rakesh et al., 2023; Reuter et al., 2019).

2.4. Stakeholder Collaboration in Circular Economy Transition

Driving the shift to a CE requires stakeholder collaboration. According to research, close interactions between a variety of stakeholders are necessary for successful collaborations (Schultz et al., 2024). Networking, knowledge sharing, and co-creation are all essential components of collaborative relationships, which are founded on openness and trust. Cooperation among stakeholders is essential for promoting the adoption of CE; research indicates that stakeholders are highly aware, cooperative, and prepared, even though their practices don't always follow these principles. Cooperation between vertical and horizontal supply chains is essential for building construction projects that seek to achieve circularity. Collectively governance-oriented strategies, rather than company-centric approaches, are necessary for a systemic CE transition (Schultz et al., 2024).

Recent research emphasises the value of stakeholder collaboration in promoting sustainable waste management. The circular economy model is emphasised as a key approach, requiring cross-sector collaboration and active participation from various stakeholders to achieve sustainability goals (Imawati et al., 2024). Effective stakeholder management is critical, and models such as the Power Versus Interest Grid can help resolve conflicts in solid waste management projects (Tennakoon & Kulatunga, 2021). The challenges of increasing stakeholder participation remain, necessitating behavioural changes and improved collaboration among the government, private sector, and society (Napitupulu & Muhyidin, 2021). Solid waste management often employs decision support models such as life-cycle assessment,

cost-benefit analysis, and multi-criteria decision-making. Game-theoretic approaches have the potential to model and analyse multi-stakeholder decision-making, with the waste management bargaining game serving as a framework for future model development (Karmperis et al., 2013). These studies emphasise the importance of stakeholder engagement in achieving sustainable waste management practices.

Recent studies highlight the potential of circular economy initiatives in household waste management. In urban areas, community-based waste banks have demonstrated success in bolstering cross-sector ties and improving circular economy practices (Istiyani & Handayani, 2022). The Turikale Main waste bank in Maros Regency is an example of how these programs can strengthen local economies and encourage effective waste recycling (Fatmawati et al., 2024). Indian case studies highlight the value of integrated systems approaches and stakeholder engagement in demonstrating the applicability of circular economy principles in both urban and rural contexts (Fiksel et al., 2021). Servitized business models and supply chain management initiatives are common in the home appliance sector, where adoption patterns of the circular economy range from gradual to drastic. These efforts are greatly aided by digital technologies, especially IoT and Big Data (Bressanelli et al., 2020).

3. Methods

This approach will provide in-depth insights into the perceptions, experiences, and practices on behalf of stakeholders (industry, community, government, and society). This research employs in-depth interviews as a research instrument to understand government policies and programs, the challenges and obstacles faced in implementing a circular economy, and the drivers for circular economy transition among all key stakeholders. The interview questions are designed as open-ended exploratory questions. These questions are developed to obtain information on the understanding of the circular economy, the drivers influence circular business model in the household sector and how can collaboration be fostered among stakeholders. The structure of the interview questions and related guidance are designed based on a literature review, as this background provides a basic understanding of the current understanding of circular economy.

This research employs in-depth interviews as a research instrument to understand government policies and programs, the challenges and obstacles faced in implementing a circular economy, and the drivers for circular economy transition among all key stakeholders. The interview questions are designed as open-ended exploratory questions. These questions are developed to obtain information on the understanding of the circular economy, the drivers and challenges faced in the transition to CE, supporting factors, and barriers. The structure of the interview questions and related guidance are designed based on a literature review, as this background provides a basic understanding of the current understanding of CE and the driving factors, challenges, enablers, and barriers seen in the Jakarta region.

Interviews were conducted to gain insights into the participants' perspectives on the driving factors, challenges, enablers, and barriers they encountered. The significance of these factors was determined by their frequency of mention in the interviews and was subsequently analyzed using thematic analysis. According to Braun & Clarke (2006), thematic analysis is a method employed to analyze qualitative data by identifying, analyzing, and interpreting recurring patterns within the data. These themes can be words, phrases, or ideas that appear repeatedly in the data and are considered significant for addressing the research question.

No weighting scale was employed to assess the significance of each factor. Participants for the interviews were purposively selected, focusing on key actors involved in the sustainability of the circular economy concept in Indonesia. Interviewees were recruited based on a list of key actors with practical experience in implementing the circular economy within the household sector. Potential participants were contacted through recommendations from peers and their track record in circular economy implementation. Ultimately, 8 participants agreed to be interviewed for this research project.

Tabel 1. Participants list agreed to be interviewed for this research project

No.	Name	Role	Organization	Sector
1.	Mr. Chandra Beixon	Supervisor Assistant	PT Solid Eko Teknologi	Small Medium Enterprises
2.	Mr. Mufahim Abqary	Partnerships and Programs	Impact Hub	SMES Support, Community Based
3.	Ms. Eti Smarwati	Initiator	“Hijau Selaras Mandiri” Waste Bank	Waste Bank
4.	Mr. Edi Mulyanto	Head of Sub-District Environmental Service	Sub-District Environmental Service Jakarta	Government
5.	Mr. Sena Pradipta	Head of Administrative Sub-Division of the Waste Reduction Directorate	Ministry of Environment and Forestry Indonesia	Government
6.	Mr. Rafi Nur Arifman	First-level Environmental Educator at the Waste Reduction Directorate	Kementrian Lingkungan Hidup dan Kehutanan	Government
7.	Mr. Triyono Edi	Public Facilities and Infrastructure Management Unit	Public Worker	Government
8.	Mrs. Kusbandiyah	Users	Housewife (Member of Bank Sampah Community)	Society

Source: Based by author data

4. Result and Discussion

Based on an interview with Mr. Pradipta from Ministry of Environment and Forestry (KLHK) regarding waste management policies in Indonesia, since 2008, Indonesia has had a comprehensive law on waste management, UU No. 18 of 2008. This law was further detailed in Government Regulation No. 81 of 2012 concerning the management of household waste and similar waste which are household waste and similar waste (personal communication, September, 2024).

Government Regulation 81 mandated regional governments to develop specific policies, particularly since waste management is primarily a local government responsibility. These regional policies, known as Jakstradas (Regional Policies and Strategies for Waste Management), are guided by the national Jakstranas (National Policies and Strategies for Household Waste and Similar Waste Management), as outlined in Presidential Regulation No. 97 of 2017. This presidential regulation delineates the roles and responsibilities of both the central government (through institutions like the National Development Planning Agency) and regional governments (Arifman, personal communication, September, 2024).

According to Pemerintah Republik Indonesia (2008), 'waste' is defined as the residue of human daily activities and/or natural processes that is in solid form. Liquid residues are not considered waste. It's important to distinguish between waste and 'wastewater' or 'effluent.' The latter is governed by a separate law, UU No. 32 of 2009, which categorizes waste into hazardous and non-hazardous types. Hazardous waste refers to substances that are toxic or dangerous, while non-hazardous waste is not. These two types have different regulatory frameworks. In Indonesia, waste and wastewater are treated as distinct entities.

Based on UU no 18 tahun 2008, every individual involved in the management of household waste and similar waste is obligated to reduce and manage waste in an environmentally friendly manner. Further

provisions regarding the procedures for carrying out the obligations of household waste and similar waste management, as referred to, shall be regulated by regional regulations.



Figure 1. Indonesia Household Waste Management

Household waste management is generally divided into two main stages. Waste reduction which focuses on efforts to reduce the amount of waste generated from the outset. This involves activities such as reducing consumption, choosing environmentally friendly products, and recycling. Second, Waste handling includes all processes carried out after waste is generated, from source separation, collection, transportation, to final processing (such as in landfills).

Waste reduction is further divided into three activities which are waste generation reduction, waste recycling and waste reuse. Waste generation reduction preventing as much waste as possible from being generated, for example by reducing the use of single-use plastics. Waste recycling converting waste into new products, such as turning plastic bottles into fibers to make clothing. Waste reuse reusing waste without a complex processing process, such as using used bottles as pencil cases.

1. Waste handling covers the entire process after waste is generated.
2. Sorting in the form of grouping and separating waste according to its type, quantity, and/or properties (organic, inorganic, plastic, paper, etc.)
3. Collection in the form of picking up and transferring waste from its source to a temporary storage facility or an integrated waste processing facility (households, offices, etc.)
4. Transportation involving the movement of waste from the source and/or from temporary storage facilities or integrated waste processing facilities to the final disposal site.
5. Processing involving the alteration of the characteristics, composition, and quantity of waste.
6. Final disposal: Final handling of waste, usually in a landfill.
7. Business innovation model is necessary in circular business model for household waste management.

Developing effective and sustainable circular business models for waste management requires innovation that addresses environmental, social, and economic dimensions of sustainability (Keyser, Erika De; Mathijs, 2023). A framework for sustainable circular business model innovation should consider ecosystem trends, stakeholder value, and sustainability impact (Antikainen & Valkokari, 2016). Circular economy business models can contribute to achieving multiple Sustainable Development Goals, particularly in areas such as education, gender equality, clean energy, economic growth, and responsible consumption (Puntillo, 2023). To operationalize circular business models, various tools and approaches are emerging to support innovation processes (Bocken et al., 2019). These models aim to slow, close, and narrow resource loops, moving away from linear "use-it-once-and-throw-it-away" mentalities towards integrated, holistic systems that emulate nature's cyclical processes (Puntillo, 2023). Successful implementation of circular business models in waste management can lead to significant environmental, social, and economic benefits. One innovative approach that has emerged from recent studies is the development of digital waste banks, which offer a more efficient and transparent way to manage waste.

There are innovations in the business model that can be done based on the results of interviews such as digital waste banks, collaboration with MSMEs, reward programs and sustainable education. Digital

waste banks are emerging as an innovative solution for managing household waste and promoting recycling. These systems utilize mobile applications to improve efficiency in waste collection, sorting, and data management (Desyanti et al., 2022; Andry et al., 2023). The digitalization of waste banks has shown promising results in reducing inorganic waste generation and preventing potential leakage into oceans, with one study reporting a 54.04% reduction (Brasika et al., 2022). Implementation of digital waste banks has led to rapid growth in waste bank units, customer numbers, and waste management capacity (Brasika et al., 2022). The eco-design of digital waste banks employs a pentahelix synergy approach, involving collaboration between government, academia, business, community, and media sectors (Karnawijaya et al., 2022). These systems have demonstrated improved usability, with one application receiving a System Usability Scale score of 77.8, indicating acceptable user-friendliness (Desyanti et al., 2022). Digital transformation has the power to significantly improve the rural economy and empower communities in sustainable ways (Kosasih & Sulaiman, 2024). Community empowerment involves strengthening a community's capacity and autonomy to address its own challenges and actively participate in its own growth (Afnan et al., 2024).

Collaboration with SMEs that utilize recycled materials to create value-added products as an innovative business model for household sector waste management is necessary in developing countries. Studies highlight the potential of innovative approaches to create value from waste, improve livelihoods, and achieve environmental benefits. In line with Mr. Beixon, “the company operates within the waste management sector, an industry of paramount importance due to the pervasive presence of waste. The global pursuit of net-zero emissions has spurred heightened demand for eco-friendly products and services” (personal communication, in september, 2024). This burgeoning environmental solutions market presents substantial avenues for the company's expansion. In Pakistan, a proposed recycling model could recover 26,070 tons of materials daily, contributing to economic growth and debt reduction (Iqbal et al., 2023). The Philippines demonstrated success by formalizing waste pickers into a registered association, enabling new livelihood options and reducing environmental impacts (Iqbal et al., 2023). In Sweden, a collaborative multi-actor approach in textile waste management could increase reuse and reduce incineration (Chizaryfard et al., 2018). Similarly, an inclusive blockchain-enabled framework for MSWM in India, involving various stakeholders, can help attain multiple UN Sustainable Development Goals by promoting circular economy practices and extended producer responsibility (Ajwani-Ramchandani & Bhattacharya, 2022). Also, collaborating with microfinance institutions would further enhance this support (Mabhanda, 2024).

In term of public awareness, the raising public awareness about circular economy is crucial for its successful implementation (Smarwati, personal communication, in september, 2024). Workshops, socialization campaigns, and educational initiatives can effectively increase understanding and promote sustainable behaviors (Vagner, 2021). To achieve sustainable development goals, the used online social media to educate and empower the public aimed to increase awareness, build partnerships, and encourage people to actively participate in sustainable practices (Amanah et al., 2024). Studies suggest focusing on long-term interactions, involving companies in communication efforts, and targeting young students as powerful transmission vectors for promoting sustainable habits (Romero-Luis et al., 2022). While some populations demonstrate a correct understanding of sustainable development and circular economy concepts, there remains a need for continued education to support wider implementation (Lewandowska et al., 2022). Effective strategies include exploring cooperation, preparing work plans, and creating tailored socialization materials. Additionally, addressing political barriers and prioritizing waste management practices such as recycling, reusing, reducing, and refusing can further enhance public engagement in circular economy principles (Romero-Luis et al., 2022; Vagner, 2021).

Beside from business model innovation, product diversification is also one of the ways to develop an effective and sustainable circular business model for waste management in the household sector (Smarwati, personal communication, September, 2024). Diversification of recycled products offers multiple benefits for waste management and resource recovery. Composting organic waste produces a valuable soil conditioner, reducing landfill burden and dependence on chemical fertilizers (Matter et al., 2015). Handicrafts made from recyclable materials provide economic opportunities and increase waste absorption, though this requires training and socialization (Fatoni et al., 2017). Renewable

energy, such as biogas from organic waste, can help address energy shortages in developing countries (Matter et al., 2015). However, market incentives and policy support are crucial for promoting these alternatives. While informal recycling sectors have developed for inorganic materials, organic waste recycling faces competition from conventional products (Matter et al., 2015). Effective waste management strategies should incorporate source reduction, recycling, and reuse (3R) approaches. Various composting systems, from simple windrows to sophisticated mechanical plants, can be implemented based on local needs and resources (Manser, A.R., Keeling, 1996). This is in line with Ms. Smarwati, where the waste bank made product diversification from liquid fertilizer and compost. In addition, there is also maggot cultivation, processing of rosella flower, and also the results of plants grown by farmer groups (Personal communication, September, 2024). SDGs are fulfilled when villages achieve zero poverty through economically viable waste management, eliminate hunger, ensure prosperity and health, actively involve women, distribute economic growth equitably, and promote environmentally sustainable consumption and production (Asiyah et al, 2023).

5. Conclusion

The conclusions section shows the answer or clarification of the research questions and opportunities for future research. To develop an effective and sustainable circular business model for waste management in the household sector we need Business Model Innovation such as. Digital waste bank integrated digital system to facilitate recording, transaction, and transparency of waste management. Collaboration with MSMEs, collaborate with MSMEs that utilise recycled materials to create value-added products. Reward programme, provide incentives to people who actively participate, such as points that can be redeemed for environmentally friendly products or discounts at certain stores. Continuous Education, organise workshops, socialisation, and campaigns to raise public awareness on the importance of circular economy.

The factors that influence the success of circular business model implementation in the household sector that are most mentioned in the results of this study are as follows. Internal Factors such as strong and visionary leadership at the neighbourhood level is essential to motivate the community, availability of volunteers or officers (HR) who are competent in managing the waste bank, and also adequate facilities/infrastructure, such as waste segregation bins, processing equipment, and storage. The external factors must be, supportive government policies, budget allocations, and ease of licensing, level of community awareness and participation in the waste bank programme, and partnership/Cooperation with various parties, such as private companies, educational institutions, and communities.

Cooperation between various related parties to support the development and implementation of circular business model. Government such as LKLH and Sudin LH is provision of regulations by drafting regulations that support the development of circular economy and provide incentives for businesses, conducting massive socialisation to the public on the importance of waste management and circular economy, and also facilitate cooperation between various related parties, such as local governments, businesses, and communities.

Recommendation

For future research, we suggest to deepening understanding of community dynamics, expanding the scope of circular business models, technological advancement, scaling up circular business model, policy and regulatory framework which include policy gap and evaluation.

Limitation

The interview sample size can be considered a limitation of this study given the number. Although the participants were directed to answer interview questions from their organisational perspective, there is a possibility that personal opinions/idea may have been included in responses.

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