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RECLAPAN: A SOLUTION TO HOUSEHOLD WASTE ISSUES BASED ON AN APPLICATION TO PROMOTE CIRCULAR ECONOMY

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Abstract:

Background: Waste management in Indonesia is an unresolved problem; factors such as inadequate facilities, ineffective management mechanisms, and community habits are the causes
Purpose: This research aims to design solutions through application prototypes and business models that align with household waste management behavior, expectations, and problems.
Design/methodology/approach: This research uses customer discovery and Lean Canvas methods, with 100 respondents at the problem test stage and 69 at the solution test stage.
Findings/Result: The problem test showed that 86 percent of respondents experienced problems such as segregated waste being re-mixed during transportation, not having bins based on the type of waste, lack of frequency of waste transportation, far location of disposal sites, and inadequate disposal facilities. The solution is crafted by applying circular economy principles and packaged into an application that serves as a bridge between households facing waste management challenges and companies struggling to obtain quality recycling materials. Reclapan is an acronym for "Recycle Across the Planet for Nature." the name of the app reflects the concept of recycling as a global effort to maintain and restore the earth's natural conditions. Reclapan encourages creative and fun sorting actions with gamification features and rewards in the form of shopping vouchers and other features that can solve most household waste management problems.
Conclusion: The "Reclapan" prototype was designed based on respondents' preferences and was considered more practical than current waste management practices. Given the positive response from respondents willing to use "Reclapan", it can be concluded that "Reclapan" effectively addresses the issue.
Originality/value (State of the art): Reclapan is a prototype circular economy-based platform that connects households with companies that need high-quality raw materials from waste.

Keywords: application prototype, customer discovery, circular economy, lean canvas, waste management

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INTRODUCTION

The management of waste poses a serious and yet unresolved challenge for Indonesia. The exponential growth of population, industrial development, and urbanization has triggered an increase in waste production (Das et al. 2019). Furthermore, changes in societal consumption patterns have led to a rise in plastic, electronic, and hazardous waste, necessitating a sorting process for proper waste management according to its type. The rapid advancement of technology and its utilization to address everyday life issues allow for a potential solution in the form of applications that expedite circular economy.

Indonesia ranked fifth as the world's largest producer of waste in 2020, approximately 65.2 million tons (Ahdiat, 2023)(Figure 1). According to Kementerian Lingkungan Hidup dan Kehutanan (KLHK, 2022), the largest percentage of waste sources in Indonesia comes from households, accounting for 38.4 percent, with a waste management performance achievement of 36.0 percent of the total waste generated in Indonesia not managed, equivalent to 13,035,197.8 tons/year (KLHK, 2022). Additionally, based on (Katadata, 2019), 50.8 percent of households in Indonesia do not segregate waste, and according to data from the Socioeconomic Survey (Susenas, 2017) cited in (Katadata, 2020), 66.8 percent of the Indonesian population still burns unsegregated waste. This issue is further exacerbated by Indonesia's import of plastic waste due to the imbalance between domestic waste management capacity and the demand for recyclable raw materials. In 2020, Indonesia still imported 138,000 tons of plastic waste (Pahlevi, 2022). Although to meet the shortage of recyclable raw materials, importing plastic waste creates an additional burden on the national waste management system.

Concrete steps taken by the government in the form of policy include implementing a carbon tax in 2025, which had previously experienced delays. This delay in the carbon tax is the latest after the government, at the end of 2021, planned to implement the carbon tax mandated by Law Number 7 of 2021 on Taxation Harmonization, which was originally scheduled to take effect from April 1, 2022, citing that the implementation was postponed to allow time for the preparation of carbon market mechanisms (Purwanti, 2022). Furthermore, the shift in environmental concern is increasingly evident among Generation Z (Gen Z) and Generation Y (Gen Y). Based on data from the Discussion Group and Public Opinion Study of Indonesia cited in (Dihni, 2021), in 2021, 78.2 percent of Gen Z (14-24 years old) were interested in environmental issues, and 76.5 percent of Gen Y (25-40 years old) showed interest.

Alongside the increasing awareness of the environment and the mounting pressure on the business sector to reduce carbon footprint, the shift towards environmentally friendly business practices becomes increasingly urgent. Existing solutions must address household waste management issues, meet the needs for domestic recycled raw materials, and contribute to the economic growth of surrounding communities. One concept that aligns with these needs is the circular economy. A holistic and inclusive circular economy solution will enable every actor in waste management to develop new revenue streams, achieve greater efficiency, and shorten the waste supply chain through decentralized waste processing (Buch et al. 2021). The circular economy is about maximizing the value of resources within the vision of a sustainable society, encompassing natural, human, cultural, financial, and manufacturing resources through an economic lens (Stahel, 2019). This idea promotes a shift from a linear process to a circular one (Halog and Anieke, 2021). The implementation of the circular economy in various sectors in Indonesia has provided benefits such as operational cost savings of more than 431.9 billion rupiahs, creating jobs for 14,270 people, reducing emissions by more than 1.4 million tons of CO2e, saving energy by more than 4.8 million MWH, reducing water consumption by more than 252,000 m^3, and reducing waste by more than 827,000 tons (Bappenas, 2022). Waste accumulation data based on cities/counties indicate that the amount of waste in the DKI Jakarta and Bogor City regions reaches 3,381,259.13 tons per year, equivalent to 17.73 percent of the total waste in Indonesia (KLHK, 2022). Furthermore, survey results (Datanesia, 2022) indicate that Bekasi City, Depok City, Central Jakarta, South Jakarta, East Jakarta, and Bogor City are among the top ten areas with the highest e-commerce transaction populations, with high internet usage and mobile phone ownership as well.

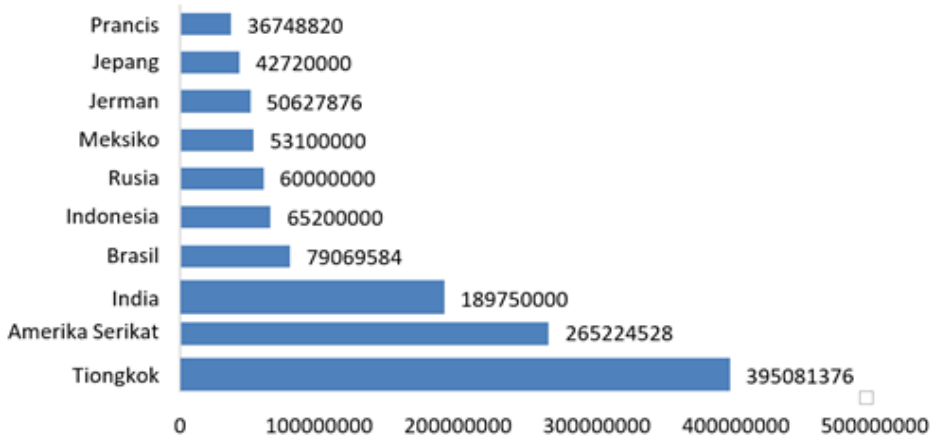

Figure 1. Waste distribution based on the ranking of the world's largest waste producing countries (Ahdiat, 2023)

The circular economy cycle can be accelerated by integrating all stages of the process into a platform that aligns and optimizes complex logistics and materials from production to use, recycling, and back into the production cycle. As Salim (2023) mentioned, the digitalization of the circular economy can build a positive environment and optimize the financial aspect so that the benefits can be felt by all parties in an integrated manner. According to (Parker et al. 2016), certain industries reliant on complex logistics processing have undergone transformation due to the superior capabilities of platforms to coordinate vehicle movements and resources using highly efficient algorithms to align demand and supply. With a fully integrated platform, data can be accessed more efficiently, enabling stakeholders to make faster and more accurate decisions in driving the circular economy, thus creating a more responsive and economically sustainable ecosystem.

The integration process into a platform utilizes the concept of the sharing economy, which enables collaboration among all stakeholders. The sharing economy is a business model based on renting, and self-rental can reduce wastage and increase efficiency by making initially inactive assets and labor useful and contributory (Ganapati and Reddick, 2018). The sharing economy used focuses on collaboration between waste transport service providers who already have facilities for distributing waste and collectors who have waste storage facilities in meeting the service demands of households and the demand for recyclable waste materials.

In previous studies, waste management prototypes were only specialized for plastic waste (Karnawan, 2021), did not use the concept of circular economy (Bau et al. 2023), and converted the waste management system from the government (Yunita et al. 2021). This research aims to identify the expectations, behaviors, and issues of households in waste management. Then formulate a prototype and solution in the form of a comprehensive business model for these problems. Additionally, this research also investigates the willingness of household actors to use environmental sustainability-driving solutions through small and enjoyable steps such as waste sorting with gamification and reward features. Reclapan then became a prototype designed to apply the principles of the circular economy packaged into a platform that connects household actors with companies that need quality waste raw materials. The idea in the prototype emphasizes the importance of actions to reduce waste, conserve natural resources, and sustainably maintain environmental ecosystems.

METHODS

This research is a process of testing and discussing new business ideas based on waste management problems experienced by households. This research framework is designed based on the customer development approach introduced by (Blank and Dorf, 2012) by focusing on the customer discovery stage, which is then modified by adding the process of identifying internal and external factors that influence consumer behavior in sorting waste at the problem test stage. The research framework is illustrated in Figure 2. The research stages include:

1) Market Analysis

Market analysis estimates the state and size of the market by collecting information from various trusted sources through brainstorming, benchmarking, and literature studies.

2) Problem Test

Problem testing is a stage of testing the problem hypothesis with the aim that researchers can understand the problems faced by customers, confirm that enough customers experience these problems, and how much customers care about the problem so that it can become a profitable business. The results of the problem test obtained will be summarized and then added to the problem hypothesis and used to design the medium fidelity MVP prototype and Lean Canvas 1.

3) Solution Test

Solution testing is a stage of testing the solution hypothesis and medium fidelity MVP prototype so that researchers can determine whether the solution designed can answer customer problems. The solution test results will be summarized, added to the solution design, and used as a reference for updating the medium fidelity MVP. After that, Lean Canvas 1 was updated to Lean Canvas 2.

4) Lean Canvas Verification

At this stage, researchers verified the Lean Canvas before it became a business. According to (Blank and Dorf 2012), Lean Canvas verification is done through three essential aspects, namely: (1) ensuring the accurate customer profile of the designed business model and how to reach it, (2) the designed product has a match with market needs (product-market fit), (3) ensuring the business model can grow into a valuable company.

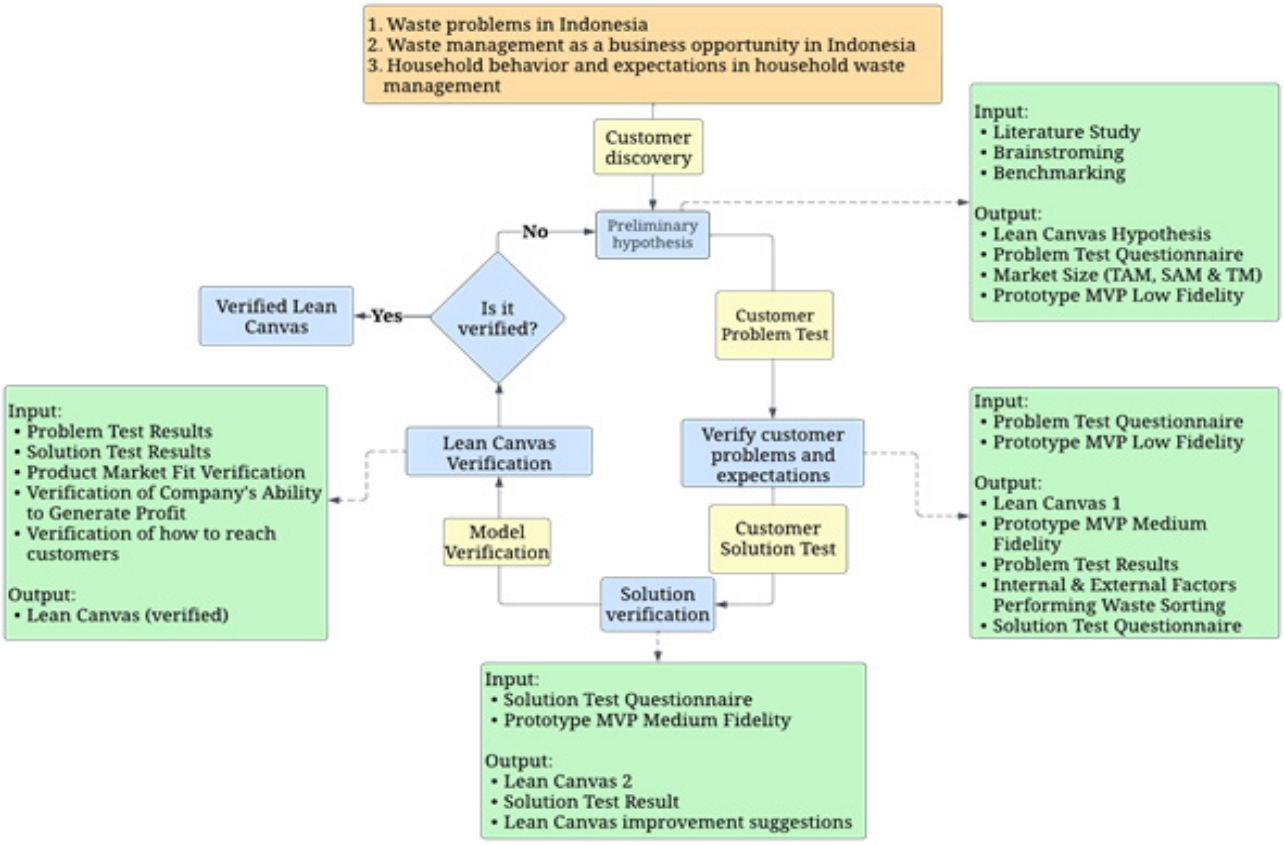

Figure 2. Research framework

Meanwhile, data management and analysis in this study utilize both qualitative and quantitative descriptive methods. Respondent selection is done using non-probability sampling techniques, namely purposive sampling. Data collection for the research was conducted from June to September 2023 in Jabodetabek. The selection of respondents, one of the household members, considers research conducted by (Bagastyo et al. 2023) that studies one of the household members representing all members. The selection of respondents also takes into account the findings of the Discussion Group and Public Opinion Study of Indonesia by (Dihni, 2021) in 2021 regarding the interest of Gen Z and Gen Y in environmental issues. Therefore, the test respondents are those who meet the following characteristics: Aged 14 to 40 years; Residing in jabodetabek; Owning a smartphone; Being an e-commerce user; Involved in household waste management processes; Daily needs are not managed by a foundation or institution.

As for the requirements for testing the solution, respondents have gone through the problem-testing phase and meet the following criteria: Having an interest in the prototype of the low-fidelity waste management platform as a designed solution; Confirming willingness to participate as respondents in the solution-testing phase.

Based on (Blank & Dorf, 2012), a recommendation for the number of respondents in the problem-testing phase is 50 individuals. Meanwhile, in the solution-testing phase, a minimum of 50 respondents is required because according to (Blank & Dorf, 2012), responses from that number of respondents are sufficient for the product or service launch process to the market.

RESULTS

The obtained data consists of 100 respondents in the problem-testing phase and 69 in the solution-testing phase. Descriptive analysis of the demographic data indicates that the majority of respondents are from Bogor, accounting for 59 percent, with 60 percent being female and 40 percent male. When grouped by generation, 90 percent are Gen Z and 10 percent are Gen Y. Furthermore, the majority have an educational background of 12 years, comprising 52 percent.

Problem Testing

Knowledge and expectations regarding waste management were measured using an ordinal scale from one to four. The results found that 77 percent of respondents strongly agree that poor waste management is the main factor leading to flooding, the spread of diseases, and pollution of water, air, and soil. Ritonga and Usiono (2023) also mentioned that waste has the potential to be a source of disease and various environmental problems.

Additionally, 81 percent strongly agree that waste accumulation in landfills is a serious issue, and 61 percent believe that government regulations play a crucial role in raising awareness about proper waste disposal. Furthermore, Figure 3 shows the distribution of respondents based on their knowledge and expectations in waste management.

Regarding waste management behavior, the majority of respondents generate inorganic waste (65%), followed by organic waste (33%). Most respondents (80%) dispose of their waste in Waste Disposal Sites (TPS), while 39% distribute it to collectors. However, a small portion of respondents (7%) still burn waste, although this action violates Law Number 18 of 2008 Article 29 paragraph (1) letter g, which states that individuals are prohibited from burning waste that does not comply with the technical requirements of waste management.

Additionally, 72 percent of respondents do not segregate waste, with the main reasons being concerns about waste mixing during transportation (70.8%) and the lack of separate waste bins based on waste types (63.9%). Among respondents who segregate waste, most are influenced by external factors such as family (75%) and marketing activities (67.9%), as well as internal factors such as perception (92.9%) and attitude (85.7%). Around 35.7% of those who segregate waste face difficulties, including issues such as waste mixing during transportation, lack of understanding about waste classification, and difficulty in maintaining consistency in segregation. The majority of respondents (73%) subscribe to waste collection services, with the main reasons being convenience (19.2%) and regular collection schedules (17.8%). Most of them (79.5%) spend between twenty thousand to thirty thousand rupiahs per month for these services, with collection frequencies ranging from one to seven times a week. The highest percentage of respondents subscribing

to waste collection services is three times a week, at 31.5 percent. Issues experienced by 86 percent of respondents are quite diverse, with the most common obstacles being mixed segregated waste (51%), lack of waste bins by type (46%), insufficient collection frequency (43%), distant TPS locations (35%), and inadequate TPS facilities (25%).

Household waste issues can be addressed by implementing a circular economy system. Otivriyanti et al. (2023) mentioned that the circular economy can be realized in achieving the National Policy and Strategy on Household Waste Management targets through an integrated recycling process. The designed prototype applies circular economy principles packaged into a platform that serves as a connector, supporter, and accelerator of the circular economy cycle, where the positions of household waste, recycling waste management companies, and "Reclapan" are structured in a way that enables good circular interaction. The "Reclapan" platform connects households facing waste management issues with companies struggling to obtain quality waste raw materials. The circular interaction of "Reclapan" encourages households to segregate waste with rewards in the form of shopping vouchers, which are then collected by waste collectors called Green Heroes and transported to a storage warehouse called the Green Warehouse for grading and processing into recyclable raw materials. Subsequently, organic and inorganic raw materials are purchased by recycling businesses and factories to be processed into products marketed back to households. Products produced from inorganic raw materials can include recycled plastic, metal, and paper, as well as various other arts and crafts. Meanwhile, organic waste can be turned into compost fertilizer, maggot food, and biogas. An illustration of "Reclapan" as a driver of the circular economy system can be seen in the Figure 4.

Reclapan's advantages that are difficult to imitate by competitors lie in the business model, business partners, and customer relationships. Furthermore, the advantages of Reclapan are as follows:

1. Intensive voucher

Incentive vouchers given to customers are a form of cooperation with business partner "Reclapan." This form of cooperation is written in a binding work contract with applicable provisions. Therefore, it can add value and is difficult for competitors to imitate.

2. Multi-waste solution platform

Reclapan is a platform that distributes and manages all types of household waste. Each type of waste has a different value, which is why some businesses only take waste that has a selling value. Unlike Reclapan, which distributes all types of waste, both recyclable and non-recyclable.

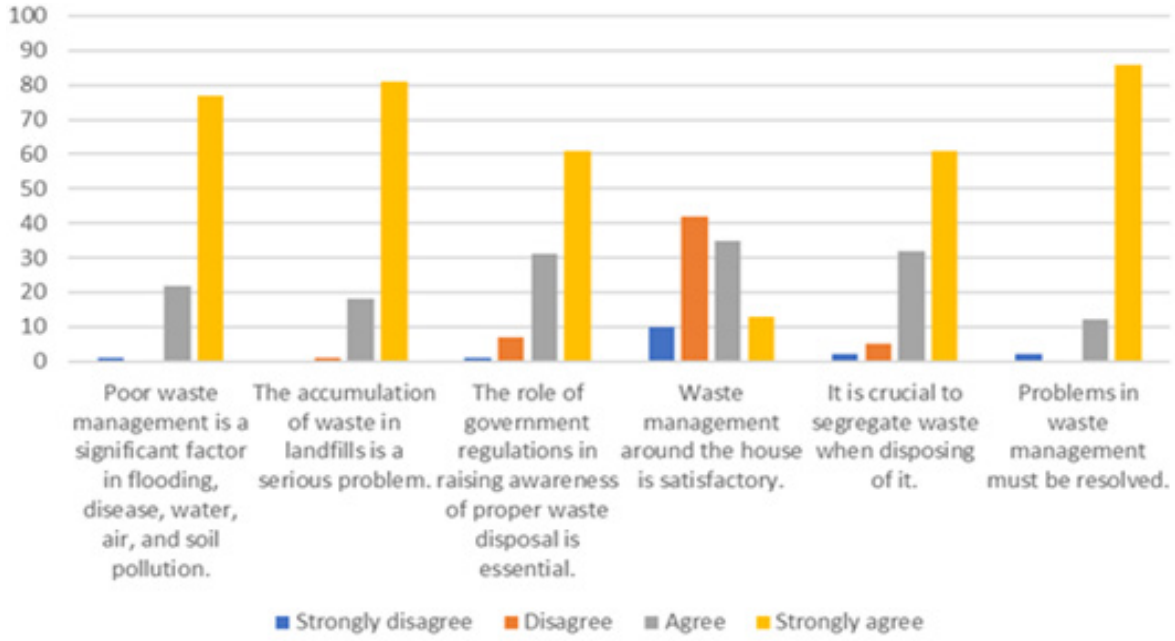

Figure 3. Distribution of respondents based on their knowledge and expectations in waste management

Figure 4. Illustration of "Reclapan" as a driver of the circular economy system

3. Rec-community

"Rec-community" is a community that accommodates volunteers from various circles who care about the environment. This community was formed to provide understanding and role models to change the habits of Indonesian citizens who manage waste irresponsibly. Customers who participate in "Rec-community" activities will receive attractive promos to appreciate their concern for the environment and other humans.

4. Procurement of waste bins

Reclapan provides a solution in the form of increasing the number of bins based on the type of waste with several procurement schemes as follows: Reclapan provides free bins as an advertising medium for companies that want to cooperate to procure bins; Reclapan offers bins with attractive designs as items to exchange for customer points; Reclapan cooperates with the government to expand the procurement of bins according to the type of waste.

Lean Canvas 1

The Lean Canvas designed is a business model that utilizes an application as a channel to address household waste management issues (Figure 5). This solution has advantages such as being able to solve most of the problems experienced by households, easy access, integrated services, and data. Furthermore, it has a lower dependency level on external parties and is considered mutually beneficial for various parties, thus deemed robust enough to continue operating and become a long-term solution.

The "Reclapan" prototype was created based on identified issues, followed by benchmarking, literature review, and discussions with experts to design features as solutions to household waste problems, as shown in the Table 1. The solutions listed in Table 1 can be provided in the form of the "Reclapan" application prototype. The prototype in the form of this application tries to offer solutions to solve problems that occur in society. Previous research conducted by Ramdhani et al. (2022) applies the prototype method to ensure the product can meet its users' needs by communicating, designing and modeling, construction, and user evaluation. Prototype testing is carried out by direct interaction by respondents with medium fidelity MVP in the form of application prototypes that researchers have made as a form of solution given to the problems experienced by respondents. After that, respondents are asked to provide feedback on the "Reclapan" prototype so that improvements and refinements can be made to the solutions that have been provided. Regular user feedback is needed to improve effectiveness and avoid unnecessary work in optimizing prototype functions (Ramdhani et al. 2022).

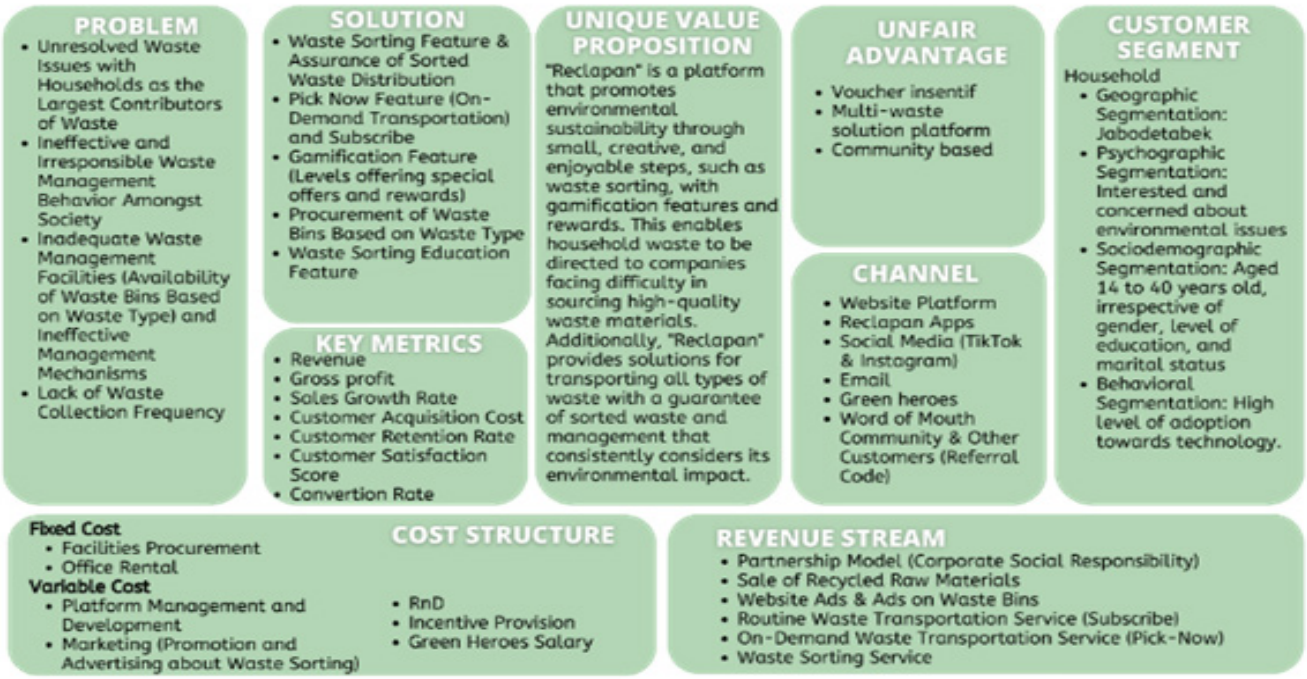

Figure 5. Lean Canvas 1

Table 1. Problems, solutions and types of features designed by researchers

Problem	The Solutions Offered	Features
• Lack of waste transportation frequency	• On-demand waste transportation service feature and customizable scheduled transportation according to needs	• "Pick-now" • "Subscribe"
• No waste transportation service available	• Nearest waste disposal location feature	• "Dumping Site Location"
• Minimal information about final waste disposal locations	• Waste transportation service feature that can be monitored in real time to ensure the segregation process until recycling and degradation	• "Transport Monitoring "
• Concerns about segregated waste being mixed back together during transportation	• Offering segregated waste bins as rewards exchanged for points	• "Trash Bins Reward"
• Lack of segregated waste bins	• Education feature consisting of posts on sorting tips, eco-friendly products, and environmentally related entertainment content	• "Educational"
• Lack of knowledge about proper waste sorting	• Providing discounts on services, shopping vouchers, and awards to households that sort waste	• "Voucher Reward"
• Inconsistent waste sorting	• Forming and facilitating environmental care communities to attract public interest in environmental preservation	• "Rec-community"
• Waste sorting is inconvenient	• Waste transportation and sorting service features	• "Sorting Service"
• No time for waste sorting		
• Waste is already mixed with other waste before sorting can be done		
• When sorting waste, there are dirty and oily packaging that need to be washed first		

The "Reclapan" prototype is designed with a green base color to convey a sense of freshness and harmony with nature. Additionally, the icons used in the "Reclapan" application are designed to be simple and modern, appealing to customers from Generation X and Gen Y. The "Reclapan" Prototype can be seen in Figure 6. The application's design can be one of the reasons users continue to use the application, as it presents apparent features, appropriate design, and attractive colors (Paramitha, 2020). Research by Wawolumaja et al. (2021) also found that the appearance/look of the application is one of the factors that influences users' ease of use.

Solution testing

The solution testing was conducted through direct interaction by respondents with the medium-fidelity MVP in the form of an application prototype. Subsequently, respondents were asked to provide feedback, and it was found that the three most desired features by respondents were the scheduled waste collection service feature that can be customized to their demand, with 87 percent. Rahman and Setiawati (2023) found that the analysis of the information system for inputting, sorting, and collecting waste at the Jakarta Provincial Environmental Service is still simple, using paper media as input tools and computers for reporting through Google Forms. In addition, the on-demand instant waste collection service feature, with 71 percent, and the nearest waste disposal location feature, with 71 percent. Meanwhile, the least desired feature was the complaint service feature, at only 1.4 percent.

Additionally, respondents were asked to rate the color theme, appearance, and icons on the prototype on a four-point ordinal scale, and it was revealed that the majority of respondents chose three, which means good, and four, which means very good. However, there were 5.8 percent who rated two, meaning poor, for the color theme selection, 8.7 percent rated two for appearance, and 5.8 percent rated two, indicating poor, regarding the icon and feature selection. Application design, such as icons, sizes, colors, buttons, and language, can influence user convenience and satisfaction (Pujiastuti et al. 2021). For the functionality alignment of the features as a solution, the highest alignment rate was found for the education feature, at 98.6 percent, followed by the "Reward" feature in the form of discount vouchers, at 97.1 percent, and the sorting service feature, at 95.7 percent. Furthermore, the lowest percentage of alignment for the feature-based solution in the application concerning the problem was 79.7 percent (Table 2).

Figure 6. "Reclapan" Prototype

Table 2. "Reclapan" Prototype

Problem	Features	Suitability (%)
Lack of waste transportation frequency	Pick-now	92.8
	Subscribe	91.3
No waste transportation service available	-	
Minimal information about final waste disposal locations	Dumping Site Location	88.4
Concerns about segregated waste being mixed back together during transportation	Transport Monitoring	87.0
Lack of segregated waste bins	Trash Bins Reward	89.9
Lack of knowledge about proper waste sorting	Educational	98.6
Inconsistent waste sorting	Voucher Reward	97.1
	Rec-community	79.7
Waste sorting is inconvenient	Sorting Service	95.7
No time for waste sorting	-	
Waste is already mixed with other waste before sorting can be done	-	
When sorting waste. there are dirty and oily packaging that need to be washed first	-	

Solution testing shows that 89.9 percent of respondents find using "Reclapan" more practical compared to their current waste management methods. Meanwhile, 10.1 percent do not feel the same. Additionally, 89.9 percent are willing to use the "Reclapan" application to address their waste management issues, while 10.1 percent are not willing. Thus, it can be concluded that "Reclapan" provides a solution to the majority of respondents in terms of theme suitability, feature suitability, and practicality.

Lean Canvas 2

Improvement of Lean Canvas 1 to Lean Canvas 2 affects three sections of the Lean Canvas, namely solution, cost structure, and channel (Figure 7). These improvements highlight four aspects including;

1. The large size of the application which can make it difficult for the general public to download. In response, a lite version with smaller size and essential features will be added to facilitate downloading.
2. The real-time monitoring feature of waste sorting transport originally will be adjusted to notification reporting to save battery power and to enhance consumer trust branding will be conducted through social media.
3. The scheduling feature "subscribe" will be limited by region for time, cost, and resource efficiency. With a transportation frequency of three times a week divided by region.
4. The implementation of a sharing economy in the "Reclapan" business model. According to respondents, "Reclapan" should adopt a partnership system similar to Gojek's to avoid harming the waste management industry.

The sharing economy implemented focuses on collaboration with waste transporters who have waste distribution facilities as "Green Heroes" and collectors who have storage places as "Green Warehouse" to meet the demands of households and recycling businesses (Figure 8). The research has demonstrated that businesses utilizing a sharing economy model can generate sustainable value with diverse areas of emphasis (Laukkanen & Tura, 2020). The implementation of this sharing economy considers that the presence of "Reclapan" should not negatively impact conventional waste management entities as much as possible and minimize the costs of acquiring transportation and storage facilities, while also creating new job opportunities as "Green Heroes" for scavengers and improving the welfare of waste management industry workers.

Key Partners

"Reclapan" relies on resources from key partners to maximize and accelerate the circular economy. Previous research found that partner collaboration and management support affect innovation speed (Munawar & Tarmidi, 2020). The key partners of "Reclapan" include:

1. Green Heroes: These are conventional waste collectors and scavengers who partner with "Reclapan" to transport, distribute, and sort waste.
2. Green Warehouse: These are collection partners responsible for storing, sorting, processing, and grading recyclable materials. Storage locations close to residential areas can minimize transportation costs.
3. Government: They can design policies and regulations that support circular economy practices and recycling businesses, promote awareness of the importance of waste sorting, and collaborate as partners in improving waste management infrastructure.
4. Brand: "Reclapan" acts as an extension of the brand in addressing the environmental impacts of its products. This allows the brand to claim that its products are environmentally responsible by allocating corporate social responsibility (CSR) funds to support Reclapan's operations.

Comparison of "Reclapan" Value with Competitors

"Reclapan" has the advantage of a sharing economy with conventional waste haulers and recycling raw material grading. The main advantage of implementing grading is to provide businesses with various options of raw materials that match their product characteristics and financial capabilities, thus opening up opportunities for better product innovation. Additionally, the sharing economy with conventional haulers provides easier access for households accustomed to subscribing to waste collection services to continue using those services, while "Reclapan" adds value by offering segregated waste collection and separate bins for different types, as well as rewards to encourage sorting behavior. On the other hand, this also benefits conventional haulers as they can expand their customer base and capture new market share by providing services that align with environmental sustainability trends. The sharing economy fosters entrepreneurship, job creation, and economic growth (Mauri et al. 2018), driven by financial gain for participants as service providers and receivers (Milanova & Maas, 2017).

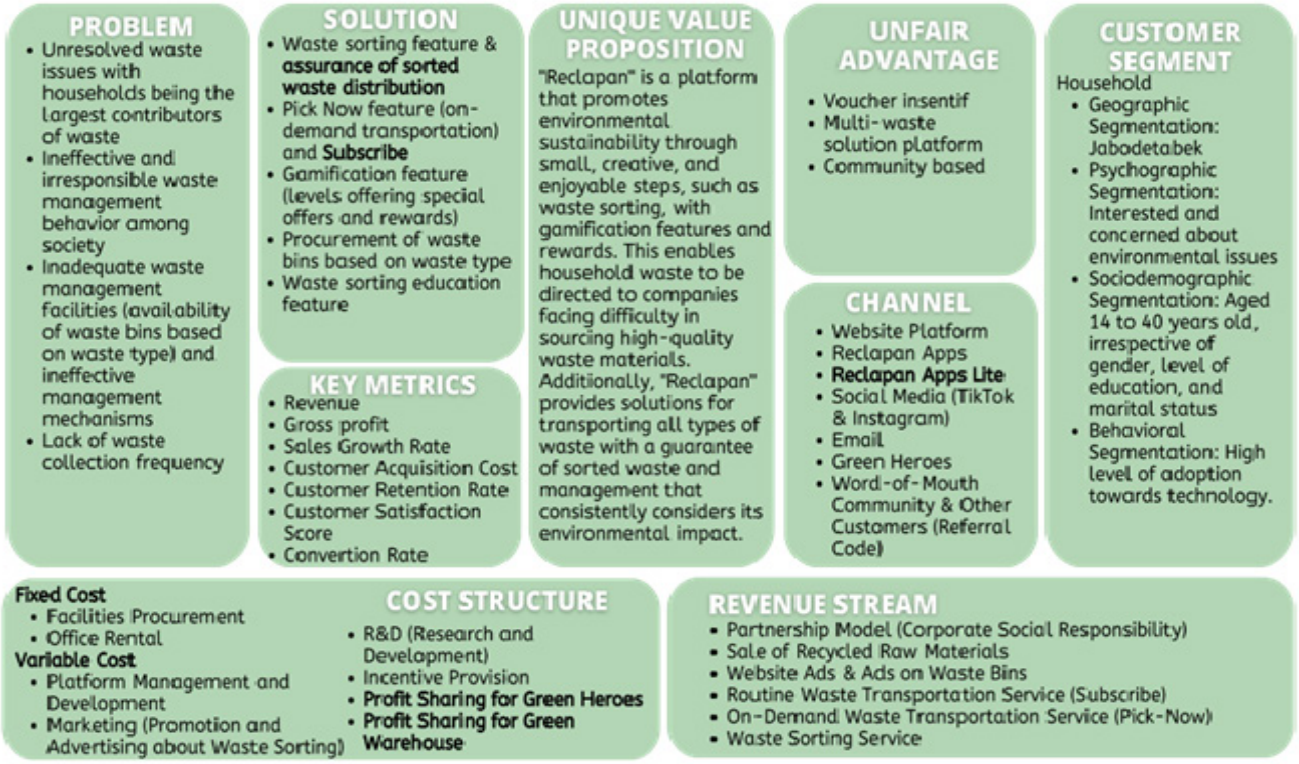

Figure 7. Lean Canvas 2

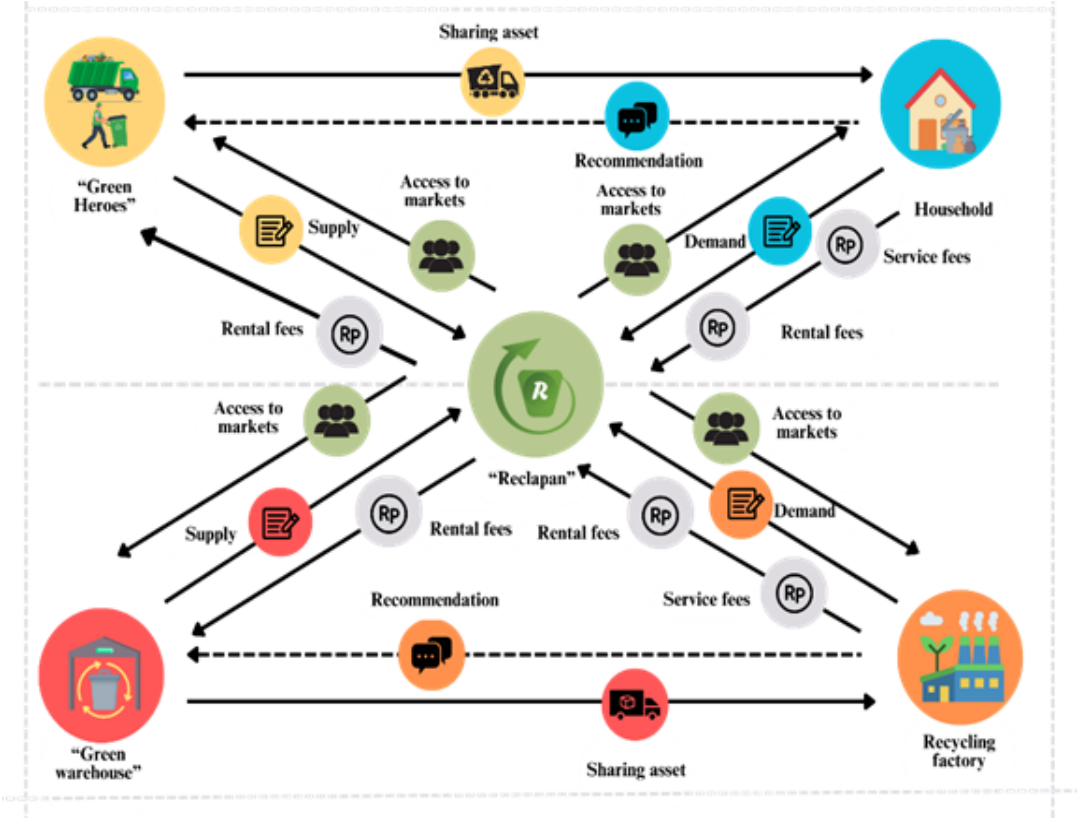

Figure 8. "Reclapan" sharing economy based on (Business Model Toolbox, 2019)

Lean Canvas Verification

The verification process has confirmed that the "Reclapan" business model is viable to proceed to the next stage. This is based on the complexity of the problem it aims to solve and the absence of an effective solution. The features are designed based on desired solutions and considered suitable for the issues faced by the respondents. With a percentage of 89.9 percent from 69 respondents stating that "Reclapan" is a practical solution and they are willing to use it.

The target market served by "Reclapan" reaches 8.087.388 individuals based on BPS 2021 data, reflecting significant potential to grow into a valuable company. This business model can reduce waste accumulation and promote environmental awareness, meet the needs of recycled raw materials, and provide benefits to customers in the form of shopping vouchers, while also creating job opportunities. Furthermore, this business model forms a circular economy system that has a positive impact on the economy, environmental sustainability, and overall human life.

Managerial Implications

The research results regarding the situation and respondents' perceptions of household waste can be an input for the government to participate in tackling the problem. Prototypes developed based on household waste problems can complement and encourage implementing various government programs related to waste management. In addition, the respondents' good response to the "Reclapan" application as a means of overcoming household waste problems is an opening for various related agencies to conduct further trials. Gradually, further research can be carried out to solve the problem of household waste sustainably.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This research focuses on providing solutions to household waste management issues by identifying respondents' expectations, behaviors, and problems. According to the respondents, it is crucial to conduct waste sorting, and the importance of government regulations in increasing awareness of proper waste disposal is paramount. Additionally, households

express low satisfaction with waste management and hope for a better system.

The majority of respondents experience issues such as insufficient frequency of waste collection, distant disposal locations, inadequate disposal facilities, and lack of waste transportation and management services resulting in burning waste. Although most respondents consider waste sorting important, the majority have not done so because there are no separate waste bins based on types, and they believe that sorted waste gets mixed back together during transportation.

The application-based solution became the focus of this research because it is easily accessible and can provide rewards to enhance waste sorting behavior, which was considered suitable as a solution by the majority of respondents, as well as other features. According to respondents, the provision of rewards was deemed capable of encouraging those who do not sort waste to start doing so. The "Reclapan" prototype was designed according to respondents' preferences and was considered more practical compared to the current waste management practices. With the positive response from respondents willing to use "Reclapan," it can be concluded that "Reclapan" is effective in addressing the issue.

Recommendations

The implementation process of the designed business model requires collaboration from key partners to gain potential consumer growth on a massive scale. This research aids businesses, governments, and society in addressing waste issues and the lack of recycling materials with a business model that accelerates the circular economy in Indonesia. However, this study has limitations in scope, as it only reaches the verification stage in customer discovery, is limited to the Jabodetabek area, does not deeply examine financial feasibility aspects, and only focuses on identifying issues and consumer behavior in household waste management, as well as providing a solution in the form of the "Reclapan" business model and application prototype. Further development of "Reclapan" can be done by conducting a comprehensive assessment of financial feasibility, improving the type of prototype to be easily understood by customers of all ages, utilizing AI technology to estimate the most effective waste transportation route, and continuing the research to the next stage of validation and customer reaction.

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