

## Designing Targeted Behavior Change Program by Utilizing Barrier Analysis of Household Waste Segregation Behavior in Urban Jakarta. Comparison between: PHINLA Project In East-North Jakarta and Kepulauan Seribu

Franz Sinaga<sup>1,\*</sup>, Theo F Manurung<sup>1</sup>, Alfa Miranti Kuntaryo<sup>2,\*</sup>, Wingky Vikri Saputri<sup>2</sup>

<sup>1</sup> Wahana Visi Indonesia, Graha Bintaro GB/GK 2 Street No. 9, Pondok Aren, South Tangerang, Indonesia

<sup>2</sup> Divers Clean Action, RS Fatmawati Street No. 72, South Jakarta, Special Capital Region of Jakarta, Indonesia

\* Corresponding author: franz\_sinaga@wvi.org, alfa@diverscleanaction.org

### Abstract

Evidence-based design of behavioral change programs is critical in developing countries such as Indonesia, where households generate more than half of waste transported to landfill. Barrier Analysis study is conducted to identify targeted behavioral change interventions aimed at changing community perceptions around 12 behavioral change determinants. First, the study compares households who have already segregated their wastes (doers) and those who have not (non-doers) to identify significant behavior change determinants, which has p-value <0.05. The study's results indicate both similarities and differences among the determinants, including perceived self-efficacy, social norms, negative and positive consequences, action efficacy, perceived divine will, and policies in Jakarta mainland and Kepulauan Seribu. In Jakarta mainland, Doers are 1.6 times more likely to report participation in government policy socialization compared to Non-Doers. In Kepulauan Seribu, Doers are 2.6 times more likely to indicate that the presence of a waste bank program encourages waste segregation behavior. The study results are employed to develop targeted behavior change interventions, such as conducting Door-to-Door Education campaigns, and providing support to enhance waste segregation practice in the community. The behavior change program through PHINLA will be implemented from 2024 to 2027, with regular monitoring.

**Keywords:** program design, behavioral change, solid waste management, waste segregation, barrier analysis

## **1. Introduction**

The Special Region of Jakarta which is populated by more than eleven million people produced 8,607 ton waste/day or equivalent to 3.14 million tons of waste in 2023 (Information and Statistics Agency of DKI Jakarta, 2024). If categorized by the source, 60% of waste in Jakarta comes from households, 22% from offices, and 18% from other sources such as industrial, schools and markets. In 2022, Jakarta has achieved 26% waste reduction and 73% of waste treatment and transporting (Environmental Agency of DKI Jakarta, 2023). There is a need for extra effort to fulfill the government's 30% waste reduction target in 2025, which is mandated by Law number 18/2008 about Waste Management.

Based on U.S. Environmental Protection Agency (2024), reducing waste at its source is the most environmentally friendly strategy. This makes waste segregation at households and proper handling an important practice to implement. Individuals in households could segregate organic and inorganic waste, with the inorganic being sold to waste banks or junk shops, while organic waste is managed appropriately.

In 2022, PHINLA phase I project conducted an endline survey and reported that 97% of targeted communities are aware of the impact of waste on pollution and health, whereas 48% of the respondents practice waste segregation. Therefore, PHINLA Project is being carried out in Jakarta to help the government seek best practices in behavioral change programs, which could help to achieve 30% waste reduction as mandated by the law.

The post-evaluation behavior change program in PHINLA phase I indicated the emergence of certain behavioral and normative changes. Whilst it is early to state that the intervention has led to a change in social norms, it has at least led to the establishment of a new social norm that endorses waste segregation. Therefore, PHINLA Phase II aims to scale up participation, ensuring that the practice of waste segregation becomes more widespread.

In PHINLA phase II, the targeted areas extends to Kepulauan Seribu, which remains an administrative part of Jakarta. Despite the islands' proximity to Jakarta, the demographic characteristics of the people are markedly distinct, necessitating varied methods and interventions. In this perspective, comparing Barrier Analysis in both areas is essential to identify barriers and enablers of behavioral change regarding waste segregation within the community.

## **2. Objective**

The primary objective of this Barrier Analysis is to identify and understand the specific barriers and enablers that influence waste segregation practices among households in PHINLA project areas. There are three villages in North Jakarta (Marunda Village, Cilincing Village, and Semper Barat Village), one village in East Jakarta (Cipinang Besar Selatan Village), and Kepulauan Seribu (Kelapa Island, Kelapa Dua Island, Untung Jawa Island, Pramuka Island, Harapan Island and Tidung Island). By comparing the behaviors, beliefs, and motivations of Doers and Non-Doers, this study aims to uncover actionable insights that can inform and advocate the development of effective community-based waste management strategies. The objective is also to compare the barrier and enabler between east-north Jakarta and Kepulauan Seribu.

This result will determine the behavior change interventions and the development of IEC materials.

### 3. Methodology

This research is conducted using a mix of qualitative and quantitative methods to identify barriers and enablers of waste segregation behavior in the community. Enumerators and data collection supervisors are trained in sampling methodology, and data collection using both close-ended and open-ended questions and probing techniques. The barrier analysis questionnaires were prepared using Kobo.

A total of three areas which were assisted by PHINLA were selected for the study. These targeted regions represent areas which have similar geographical, social and economic context. The area is a densely populated area with low to middle social and economic status. The following table shows villages/island and the number of questionnaires which were collected from doers and non-doers respondents in each area. The data collection was divided into two time periods, one period conducted in 2022 for North-East Jakarta (Jakarta mainland) and 2024 for Kepulauan Seribu (Jakarta Islands).

**Table 1** Number of Doers and Non-Doers Respondents

Area	Doers	Non-Doers	Total Respondents
<b>Jakarta mainland</b>			
Marunda	8	8	16
Cilincing	14	14	28
Semper Barat	14	14	28
Cipinang Besar Selatan	14	14	28
<b>Kepulauan Seribu</b>			
Kelapa Island	16	16	32
Kelapa Dua Island	16	16	32
Untung Jawa Island	16	16	32
Pramuka Island	16	16	32
Harapan Island	16	16	32
Tidung Island	16	16	32

Field data was collected using Kobo on Android devices. Enumerators were assigned to do face-to-face interviews with the community using the finalized questionnaire in different villages each day. The total Barrier Analysis samples are 292 respondents. This includes at minimum 45 individuals who report practicing the desired behavior, referred to as “Doers” and 45 who report not practicing the behavior, referred to as “Non-doers” (ND). The sampling was spread across the 4 villages and 6 islands. In Kepulauan Seribu, total respondents are 97 “Doers” and 97 “Non-Doers”. Responses were recorded to capture qualitative insights into motivations and barriers. After collection, responses were coded and entered into the Barrier Analysis Tabulation Sheet (BATS). The BATS contains the formulas to compare the responses of Doers to ND and delivers statistically significant results to a p-value of <0.05 for a confidence interval (CI) of 95%.

The analysis highlighted the main barriers hindering Non-Doers from adopting the target behaviour, along with the enablers that motivated Doers to engage in the behavior. These

insights were then translated into actionable strategies, referred to as "Bridges to Activities." These strategies were designed to address the barriers and leverage the enablers, informing the development of effective behavior change interventions.

### **3. Result**

It is worth noting that though some findings may be statistically significant, they are not all actionable. This assessment of what is actionable and should be included in the DBC and program plans largely depends upon the source of the response; meaning whether the answer came from Doers or from Non-Doers (NDs). Interpretation is the key to ensuring that programmatic decisions are based on the evidence through testing the responses logically and examining their implications. All responses refer to questions asked surrounding the 12 determinants of behavior in reference to the behavior statement "Housewives/mothers segregate household solid waste into organic and inorganic waste in their homes."

#### **3.1 Self-efficacy**

In Jakarta mainland, Doers are 2.6 times more likely to separate waste compared to Non-Doers, while in Kepulauan Seribu, this likelihood increases to 2.8 times. The doers explained, "It's easier because I have a separate waste bin or bag at home." p-value 0.000.

The main barrier under self-efficacy is perception of the doers which stated that they believe they are able to segregate waste because they have separate waste bins or bags at home. In the other hand, Non-Doers has perception that they did not segregate their waste because they did not have a special bin for doing the behavior. The fact is, they can use any container such as a bin, plastic bag, cement sack, or other container to segregate their waste like the doers.

Perception of lack of space at home in non-doers is also significant barriers which make Non-Doers do not segregate their waste. On the other hand, Doers said that lack of space did not prevent them from segregating waste, since they regularly store the waste to the waste bank and they can put the recycle-able waste bag or container outside their home. Non-Doers also perceive that waste segregating is difficult and complicated. They also said that segregating waste at home is time consuming. In contrast, Doers said that it is easy to segregate waste when they have had separate containers for organic and inorganic waste at home. It is also not time consuming, since they just put the waste in the right container in the time they produce the waste.

#### **3.2 Perceived Social Norms**

People's perception of the behavior of most others or the opinions of those important to them in determining whether a behavior should or should not be performed (Kittle, 2017). This determinant have two parts which is:

- a) Injunctive: The behavior considered necessary to perform based on the opinions of those important to them. Such as Family members
- b) Descriptive: Behavior that people believe most others engage in. Such as most people in the environment put waste in the waste bin.

The result from Jakarta mainland saw, Doers are 2 times and Kepulauan Seribu are 1.6 times more likely to say, "It is easier because I get support from my children and husband to separate waste and take it to waste banks" than ND, p-value 0.026. This different result saw the participation of family members is higher in Jakarta mainland than Kepulauan Seribu. Furthermore, in Kepulauan Seribu, Doers are 1.7 times more likely to say, "Neighbors help sort the trash." than ND, p-value 0.020.

The Doers in Jakarta mainland are 2.2 times more likely to say, "My extended family members approve of me segregating waste by participating in waste segregation" than ND, p-value 0.001. In Kepulauan Seribu, Doers are 3.3 times higher than Jakarta mainland. Doers is 2.4 times more likely to say, "Most of the other parents in my community segregate waste" than ND, p-value 0.005. In Jakarta mainland, Non-Doers are 2.4 times and in Kepulauan Seribu are 2 times more likely to say, "Most of the other parents in my community do not segregate waste." than Doers, p-value 0.002.

The results saw the program PHILA needs activities to enhance the perception that many people, including mothers, are already sorting waste, and that waste sorting is everyone's responsibility, not just mother. It also requires activity to improve access to information for the community regarding waste sorting appeals from neighborhood (RT/RW).

### **3.3 Negative Consequences**

In Jakarta mainland, Non-Doers are 3 times more likely to say, "The disadvantage of segregating waste is it takes more time/wasting time" than Doers. p-value 0.046. Non-Doers are 4.1 times more likely to say, "It is difficult because segregating waste is bothersome, complicated, and impractical." than Doers, p-value 0.007.

In Kepulauan Seribu, Doers are 2.3 times more likely to say that there are no disadvantages in segregating waste than Non-Doers. p-value 0.000. Non-doers are 2.3 times more likely to say that they feel disadvantaged in terms of their time/effort/energy to segregate waste, p-value 0.000. Non-doers are 2.3 more likely to say that segregating waste is bothersome, p-value 0.018

The research assesses the perception of doers and non-doers about negative consequences that will happen if they do waste segregation. Non-doers in both areas perceive waste segregation as bothersome, to the extent of it being complicated, impractical, and time wasting. Non-doers also perceive that if they segregate waste, it will result in disadvantage for themselves. On the other hand, Doers perceive no disadvantages come from doing waste segregation. In the other hand, as mentioned in self-efficacy section, doers said that, in the segregation is not complicated and time consuming.

### **3.4 Positive Consequences**

In Jakarta mainland, Doers are 3.3 times more likely to say, "The advantage of segregating waste is we can sell the inorganic waste and crafts we make from them for additional income." than ND, p-value 0.003.

In Kepulauan Seribu, Doers are 1.5 times more likely to say that segregating waste has benefits for the cleanliness of the environment (reducing smell, keeping the environment clean and orderly, preventing pollution), p-value 0.015. Doers are 1.4 times more likely to say that waste segregation gives advantage in increasing practices (enabling waste management for individuals and Waste collectors, opportunities to make handcrafted products), p-value 0.035.

Result of both areas' questionnaires about positive consequences of waste segregation behavior shows that there is a contrast perception between doers and non-doers. Doers said that they are getting positive consequences by segregating their waste at home, since they can sell the recycle-able to waste bank or local junk shop, and can create products from waste. Non-doers perceive that they will not get any advantage in doing waste segregation at home.

### **3.5 Action Efficacy**

In Jakarta mainland, Non-Doers are 1.7 times more likely to say, "Even if I separate my waste, it is somewhat likely that the landfill in my neighborhood will become full." than Doers. p-value 0.041. In Kepulauan Seribu, Non-Doers are 2.7 times more likely than Doers to do the same thing as the mainland.

Both areas' non-doers' perception about the efficacy of waste segregation in household level is low. They perceive that the behavior is not effective enough to solve the environment or solid waste management problem in their neighborhood. The Bantargebang landfill will still get full soon even if they segregate their waste. In contrast, doers think that they contribute to waste reduction if they segregate waste.

### **3.6 Perceived Divine Will**

In Jakarta mainland, Non-Doers are 3.4 times more likely to say, "I think maybe God would approve of me segregating waste." than Doers. p-value 0.026. Questionnaires of this research also asked perception of doers and non-doers about what God want them to do to their waste. Uniquely non-doers think that God want them to segregate waste, since cleanliness of their environment also reflect their faith to God. In the other hand, doers do not mention in specific that God will influence their action.

In Kepulauan Seribu, Doers were found to be 1.6 times more likely to believe that sorting waste is part of a religious command or recommendation to maintain cleanliness, p-value 0.037. In contrast, the Non-Doers group was 2.3 times more likely to state that maintaining cleanliness is a religious teaching, but the behavior is seen more as individual awareness in applying religious teachings in daily life, p-value 0.012.

Furthermore, Non-Doers were 1.9 times more likely to state that self-awareness plays an important role in maintaining cleanliness, including sorting waste, p-value 0.007. They were also 1.7 times more likely to say that piles of waste are the result of human unawareness of the consequences of littering behavior, p-value 0.036.

### **3.7 Policies**

In Jakarta mainland, Doers are 1.6 times more likely to say, "I have participated in an educational session from the government regarding waste segregation policies." than ND. p-value 0.035. Non-Doers are 2 times more likely to say, "I have not participated in an educational session from the government regarding waste segregation policies." than Doers, p-value 0.004. In terms of policy sensitization about waste segregation, doers admit that they have participated in educational session from government. In contrast, non-doers said that they have not participated in educational session about waste segregation.

In Kepulauan Seribu, Doers were found to be 2.6 times more likely to mention that the existence of a waste bank program encourages waste segregation behavior, p-value 0.007. On the other hand, Non-Doers were 3.3 times more likely to mention Governor Regulation No. 77/2020 which regulates waste management at the neighborhood level as a guide that encourages waste segregation at home, p-value 0.001. In addition, Non-Doers are 3.2 times more likely to identify village or local community regulations that prohibit littering, including into the sea, as a factor that influences their behavior, p-value 0.029.

However, there is an awareness of fines for violating this regulation, most Non-Doers do not know the details of the fine amount or the payment procedure, p-value 0.000.

### **3.8 Designing Behavioral Change Program**

Similarly to the behavior change design in PHINLA Phase I, the objective is not to formulate a whole new design for government implementation in the project areas. It is to maximize and redirect efforts towards the most impactful interventions in context.

The barrier analysis results for each determinant reveal that Jakarta mainland and Kepulauan Seribu reflect both similarities and distinctions. Social norms place more influence in Kepulauan Seribu than in Jakarta mainland. In Kepulauan Seribu, individual behavior is mostly influenced by the surrounding environment or community, but in Jakarta mainland, familial influence is more significant in inspiring individuals toward making changes. This highlights the contextual differences between island and mainland communities.

From the first phase to the current second phase, door-to-door education (DtDE) activities for the target group have been a strategy in PHINLA. The goal of DtDE is to instill increased environmental awareness as well as changes in knowledge, attitude, and behavior towards more positive practices related to waste. This includes the 3R concept: reducing waste, reusing, and recycling resources. The results on perceived self-efficacy suggest that the educational materials will point out that waste segregation is possibly doable using accessible household tools, requiring less time and space.

The PHINLA program emphasizes livelihood enhancement and household welfare through waste management; thus, the waste bank practices established in the first phase and further developed in the second phase will be included in the DtDE materials. In both Jakarta and Kepulauan Seribu, individuals who have sorted their waste recognize its economic value. Accordingly, it is essential to provide information regarding the types of waste that can be sold in DtDE material.

Waste banks will function as a catalyst for waste segregation by educating individuals who have yet to presently segregate their waste, encouraging them to do so since their waste can be turned into a profit at the banks. Through these activities, waste banks can both assist community-led initiatives and also attract new members, enhance waste reduction, and thus increase their revenue from waste sales.

In designing behavior change programs from the results of barrier analysis, social influence is also a factor that is considered. To conduct a wider outreach, collaborating with respected figures in the community will also be carried out. These include religious leaders or influencers. PHINLA designed an intervention involving religious leaders to convey the message that waste segregation is part of a religious obligation.

Alongside the DtDE activities, campaign initiatives using social media and local events to increase knowledge dissemination are also prioritized. Videos will be created to illustrate the negative impacts of improper waste management. A 360° virtual reality (VR) will be developed to illustrate the condition of Bantar Gebang landfill, as a result of inadequate waste management and low community participation in 3R initiatives, aiming to strengthen community awareness that results in action.

Moreover, the analysis reveals an important gap between knowledge and behavior in relation to policy. In the case of Kepulauan Seribu, non-doers acknowledged the government's mandate for waste segregation yet failed to take appropriate action. Thus, the community will be informed about the legal penalties associated with littering, including the IDR 500,000 fine for offenders, and how to prevent these penalties through proper waste segregation.

Table 2 presents an overview of the motivators and barriers associated with each determinant and intervention strategy.

**Table 2** Summary of Barrier and Motivator of Determinant and The Intervention Strategy

Determinant	Motivator (Doers)	Barrier (Non-Doers)	Intervention Strategy
Self Efficacy	Doers have a separate trash bin at home so it is easy to do segregation	Non-Doers do not have dedicated bins, feel a lack of space, and find sorting difficult and time-consuming.	<ul style="list-style-type: none"> <li>- DtDE will emphasize the use of simple waste bin for segregation</li> <li>- Distribute segregated waste bags</li> </ul>
Perceived Social Norms	<ul style="list-style-type: none"> <li>- Support from family, especially children and husband</li> <li>- Participation of neighbors and community in sorting waste</li> </ul>	Non-Doers feel that most people in their community do not segregate waste	<ul style="list-style-type: none"> <li>- Provide sticker with a message "This house segregate waste" on houses that participate in DtDE and get segregated waste bags</li> <li>- Install banners in areas with the message "This area already sorts waste" to establish a social norm</li> </ul>
Negative Consequences	Doers do not see any disadvantages in sorting waste	Non-Doers find sorting waste time-consuming, troublesome, and impractical	Training and campaigns that emphasize that sorting waste is easy and convenient with



Determinant	Motivator (Doers)	Barrier (Non-Doers)	Intervention Strategy
			easy and practical steps explained.
Positive Consequences	Doers gain economic benefits from selling inorganic waste and making recycled products	Non-Doers feel no benefit from sorting waste	Socialization program on the economic benefits of waste segregation, with real-life examples and testimonials from waste banks.
Action Efficacy	Doers believe that waste segregation helps reduce the amount of waste in landfills	Non-Doers feel that sorting is not effective in reducing the waste problem in their environment	Create educational video and 360° VR that shows the condition of Bantar Gebang landfill due to poor waste management and low participation in the 3Rs.
Perceived Divine Will	Doers believe that waste segregation is in accordance with religious teachings on cleanliness	Non-Doers feel that cleanliness is a personal responsibility that is not always related to waste segregation	Involve religious leaders in conveying the message that waste segregation is part of the religious obligation to maintain cleanliness.
Policies	Doers are driven by the waste bank program and supporting regulations	Non-Doers recognize the existence of regulations but lack understanding of details about sanctions or implementation	Educate the public on regulations and sanctions, and how the waste bank program can facilitate better waste management through DtDE.

The attitude and behavior modification process derived from Clark et al. (2017) in the PHINLA project is illustrated in Figure 1.

### 1. Knowledge and approval

Knowledge is the foundation of behavior change. Approval follows the knowledge stage and represents the community's acceptance of waste segregation as a beneficial practice. In this stage, individuals internalize the information they have received and begin to see waste segregation as necessary, not only from an environmental perspective but also from a social and religious standpoint.

### 2. Intention

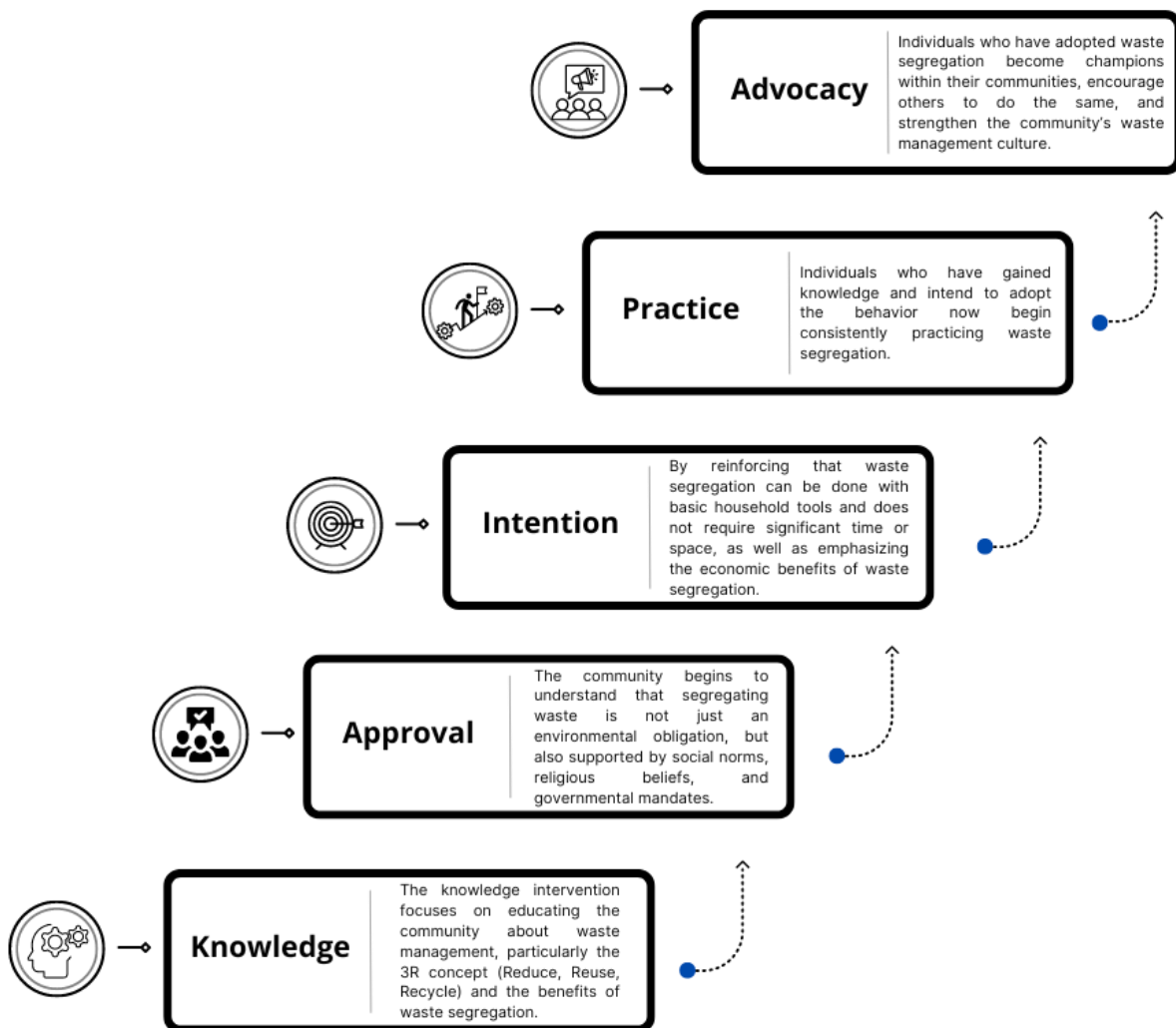
Intention involves individuals deciding that they want to adopt the new behavior. In this case, after gaining knowledge and approval, people express a willingness to start segregating waste.

### 3. Practice and Advocacy

PHINLA encourages waste separation in the targeted community by supplying separated waste bags. This prompts individuals to implement segregation at home. Subsequently, each household will display a sticker indicating "Home Already Sorting" to function as a visual prompt for households to persist in waste separation.

Banners will be installed in targeted areas that have adopted garbage segregation, to improve community awareness and invite more participation. It additionally functions to

establish segregation as a societal norm within the area. PHINLA aims to cultivate social support and inspire more commitment to waste segregation practices within the community by highlighting its effectiveness through the use of stickers or banners.



**Figure 1** Attitude and Behaviour Change Process in PHINLA Project

### 3.9 Monitoring Program

PHINLA Phase II centres on bridging the gap between existing rules and regulations and their implementation, thereby making monitoring crucial for assessing the achievement of this objective. Three actions are outlined below to monitor the program.

#### 3.9.1 Baseline of Behavior

Prior to monitoring the behavior change program, it is essential to create a baseline for existing waste segregation. This baseline data will function as a benchmark to evaluate the program's efficacy by assessing any improvement in community engagement in waste segregation by the end of program.

### 3.9.2 Monitoring the Intervention Activities

According to the RARE Center for Behavior & the Environment, monitoring or enforcing behavior might be particularly challenging, especially for behaviors conducted in private. Instead, PHINLA will enhance the visibility of behavior change monitoring through the engagement of waste banks. Residences that diligently segregate waste may engage more regularly in local waste bank initiatives. Attendance data and the volume of waste collected can serve as indicators of household waste segregation. It will be conducted in form of regular monitoring.

### 3.9.3 Lesson Learned and Further Improvement

The evaluation process includes data collection on community behavior (baseline survey), post-intervention survey, and ongoing evaluation of the performance of the waste collection initiative. Regular evaluation of the waste bank's operational performance and community engagement will provide insights and lessons for further program improvement.

## 4. Acknowledgement

This study and report were made possible through the generous support from BMZ, who funds the PHINLA project and this research. We dedicate gratitude to Wahana Visi Indonesia and Divers Clean Action team, particularly Ms. Sherly Vantono, Ms. Reny Septiani, Mrs. Swietenia Puspa Lestari and Ms. Kristi Tanjung, supervisors who assisted during the data collection and analysis stages. A very sincere thanks is extended to the Chiefs of the villages where the research was conducted for their leading roles in facilitating entry into the communities.

## References

- Clark, C. J., Spencer, R. A., Shrestha, B., Ferguson, G., Oakes, J. M., & Gupta, J. (2017). Evaluating a multicomponent social behaviour change communication strategy to reduce intimate partner violence among married couples: study protocol for a cluster randomized trial in Nepal. *BMC Public Health*, 17(1), 1–14. <https://doi.org/10.1186/s12889-016-3909-9>
- Environmental Agency of DKI Jakarta. (2023). *Regional Environmental Management Performance Information Document 2023*.
- Information and Statistics Agency of DKI Jakarta. (2024). TPS 3R is the Right Solution to Deal with Jakarta's Waste. *JaKita: Information Media of The Provincial Government of Jakarta*, 02, 15–16. <https://jakita.jakarta.go.id/magazine/eng#>
- Kittle, B. L. (2017). *A Practical Guide to Conducting a Barrier Analysis* (2nd ed.). Helen Keller International.
- U.S. Environmental Protection Agency. (2024). *Sustainable materials management: Non-hazardous materials and waste management hierarchy*. <https://www.epa.gov/smm/sustainable-materials-management-non-hazardous-materials-and-waste-management-hierarchy>