APPLYING THE THEORY OF PLANNED BEHAVIOR TO WASTE SEPARATION PRACTICE OF INDONESIAN IMMIGRANTS IN JAPAN

Master Thesis

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Abstract

This study examines the change in waste separation behavior among Indonesian immigrants living in Japan by applying the Theory of Planned Behavior (TPB) and proposing an extended model. Although Indonesia faces challenges in sustainable waste management, particularly in promoting household waste separation to support waste bank sustainability, Japan is known for its strict and efficient waste management system. This contrast presents a valuable opportunity to understand how living in different cultural and regulatory environments influence immigrant behavior.

A mixed-methods approach was adopted, combining quantitative data from 336 Indonesian immigrants with data from 10 participants for qualitative interviews. A quantitative analysis using the Wilcoxon Signed-Rank Test confirmed a statistically significant improvement in daily waste Practice (food waste separation, recyclable waste separation, and rule adherence) after moving to Japan. Further structural equation modeling (SEM) revealed that perceived behavioral control and behavioral intention significantly influenced waste separation behavior, while attitude showed a relevant effect. Other factors, such as subjective norms, rules, system trust, and past habits were found to be insignificant in the proposed model. However, after the model adjusted, the system trust was found significant to intention.

The qualitative analysis validated and contextualized these findings, highlighting that personal motivation and the ease of infrastructure in Japan contributed to behavioral shifts. Rules, social norms, and past habits were less relevant because of a lack of community networks and speed of adaptability. These findings offer insights into how behavioral changes occur in transnational settings, particularly for improving waste management practice in developing countries.

Keywords: Waste behavior, Indonesian Immigrants, Japan, Theory of Planned Behavior

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I INTRODUCTION

1.1 Background

In an era defined by urbanization, consumerism, and industrialization, waste management has become a paramount challenge for both developed and developing societies. Driven by a growing population and changing consumption patterns, waste generation worldwide has grown exponentially. In 1980, the US database recorded 6,830 million tons of waste. In 2018, it grew to 35,680 million tons of waste, which was almost six times higher than that in the previous three decades (Tiseo, 2023). World Bank Data also records that this world has generated more than 2.01 billion tons of waste every year and is projected to raise 3.4 billion tons by 2050. This huge amount generated 44% of food/organic waste, and 56% of it was nonorganic waste (The World Bank, 2023). Beginning in 1950, 8.3 billion metric tons of plastics were produced, and 6.3 billion metric tons of plastics have become plastic waste. Ironically, only 9% of these have been recycled (National Geographic, 2018). This is primarily driven by the disposal of waste in open dumps and landfills without landfill gas collection systems. Unsustainable waste disposal Practice, such as landfilling and incineration, deplete natural resources, pollute the environment, and contribute to greenhouse gas emissions.

This global surge in waste management has created a need for innovative and comprehensive solutions. As for solutions, individual controls from waste creation are required. Many governments have created waste management rules to minimize waste, such as providing recyclable pet bottle banks and giving credits for proper waste separation until household waste separation rules. Among these solutions, in accordance with household waste separation Practice, the concept of waste banks, coupled with a focus on human behavior, has become a promising approach to address the waste crisis. Waste banks encourage waste separation, recycling, and upcycling, thereby reducing the environmental impact of waste and creating economic opportunities.

The concept of waste banks has evolved over time and has not been attributed to a single origin. Countries such as Malaysia, Thailand, Ghana, South Africa, Colombia, Brazil, and India have systems similar to waste banks (Resengren, 2016). However, one notable early example is the establishment of a waste bank in Indonesia, which began in the 1990s and formally in the early 2000s. Surabaya, one of the biggest cities in Indonesia, established Surabaya’s Green and Clean

Program, which teaches housewives to make marketable handicrafts from plastic waste that was first collected during waste storage. This program successfully supplemented households' revenue streams by as much as Rp 400,000. This program also influenced Bambang Suwerda, a public health lecturer, to establish Gemah Ripah Waste Bank's first formal waste bank. This waste bank stores plastic waste collected by households, recycles it into more useful products by the community, and sells it to obtain waste bank revenue (Geldin, 2017). This model spread to various locations and evolved into a more localized waste bank.

According to the Indonesian Ministry of Environment and Forestry (KLHK), approximately 11.556 waste banks have been set up covering 336 regencies or cities in the country. These waste banks have contributed to reducing the amount of waste sent to landfills by 2,7% at the national level in 2021 [IGES Centre Collaboration with UNEP on Envrionmental Technologies, 2021]. However, after decades, these waste banks often failed to gain the revenue they needed to conduct operations, resulting in waste bank disclosure. The operation process is often misconducted due to as the lack of waste quantity, price differences, and quality failures. Many studies suspected that the lack of community participation is the source of this waste bank operation failed (Zakianis, Sabarinah, & Djaja, 2017).

Successful waste banks rely on active community participation. Lack of awareness or interest among community members will make the waste bank struggle to obtain sufficient recyclable materials to be sold or recycled. In some failed waste banks, the community has been active in collecting their waste, but the waste is not well separated. This condition resulted in a high waste separation cost and led to difficulties in maintaining waste bank operation. To make the waste bank sustainable, the community needs to be active and exhibit proper waste behavior.

Most Indonesians do not have good separation behavior. However, some Indonesians who live under strict waste management policies may develop this behavior, and it is necessary to learn from them. For example, some Indonesian immigrants live in Japan. As Japan is renowned for its strict and efficient waste separation systems, Indonesian immigrants may encounter environments that influence their waste behavior, which makes them practice waste separation daily. Understanding the reasons for the waste behavior of Indonesian in Japan is necessary to build a better waste management community, both in Japan and Indonesia. Through a comprehensive analysis of case studies, empirical data, and behavioral theories, this study examines the factors that determine the waste separation behavior of Indonesian immigrants in Japan.

1.2 Motives

The motive behind this study arises from the pressing global waste crisis, coupled with the operational challenges faced by waste banks in Indonesia. Despite their potential, many waste banks fail due to low participation and improper waste separating at the community level. Understanding why certain individuals—specifically Indonesian immigrants in Japan—adopt effective waste separation behaviors under a more regulated system provides a valuable opportunity to identify the psychological and environmental conditions that foster sustainable waste Practice. By learning from these behavioral shifts, the study seeks to inform strategies that can enhance waste bank effectiveness and public engagement in Indonesia.

1.3 Purpose

The primary purpose of this study is to examine the key behavioral factors that influence waste separation practice among Indonesian immigrants living in Japan. By applying behavioral theories and analysing empirical data, the study seeks to understand how exposure to Japan's strict waste management system shapes the waste-related attitudes, intentions, and actions of Indonesian individuals. The findings aim to provide insights that could support the development of sustainable community-based waste management models, such as waste banks, in Indonesia and other similar contexts.

1.4 Chapter Structures

The writing of this master's thesis is arranged to facilitate the analysis and discussion of the research so that it is easy for the readers of the research to understand. Systematics also limits the content of the writing so that it makes it easier for the writer to compose. The final assignment is divided into 8 (eight) chapters with the following structure.

Chapter 1. Introduction. This chapter provides an overview of the research, such as research background, motives, and purpose about why this topic of research, waste behavior of Indonesian immigrants, is addressed as an important issue, and how the systematics of chapter structures are.

Chapter 2. Literature Review. This chapter provides details of the literature review, which consists of relevant studies in the field, such as waste management in Indonesia in Japan, and theoretical frameworks that have been used in past studies, to understand how the research has been conducted and to identify the research gaps.

Chapter 3. Research Questions. This chapter presents the research questions based on the purpose and research gaps.

Chapter 4. Methodology. This chapter describes how to answer the research questions using mixed quantitative and qualitative methods.

Chapter 5. Data Collection. This chapter describes how the data are collected, and what the data have been collected using the methods in Chapter 4.

Chapter 6. Result and Analysis. This chapter describes the results of the data analysis, interpretation, and analysis.

Chapter 7. Discussion. This chapter explains how the research question is addressed, based on the analysis and literature.

Chapter 8. Conclusion. This chapter covers the conclusions, contributions, limitations, and future research directions of this study.

II LITERATURE REVIEW

2.1 Waste Management in Indonesia

Indonesia is a country located in Southeast Asia with a diverse archipelago and a large population. It has about 7,500 islands and 278,4 million people with more than 56% of the population live in urban areas. Administratively, this country is divided into 37 provinces and more than 465 municipalities, with 15 big cities (500.000 – 1 million population), 56 medium cities (100.000 – 500.000 population), and 380 small cities (20.000 – 100.000 population).

In terms of waste management implementation, Indonesia poses a particularly complex and challenging environment, which is mainly caused by the challenging landscape marked by a growing population of more than 273,8 million people, rapid urbanization, and industrialization. Rapid urbanization and population growth have caused the generation of waste to increase significantly and approximately reached 14,86 million metric tons in 2021. This number rises drastically, almost four times higher than the previous year, which is 4,32 million metric tons of municipal solid waste (MSW). Solid Waste Management Act 18/2007 defines MSW as the residue of daily human activities and/or residues of natural processes in solid forms. MSW can be domestic or household waste, commercial/retail waste, and institutional waste.

At the national level, MSW is handled by the Ministry of Public Works (MPW) for infrastructure planning and implementation, the State Ministry of Environment (SME) for control and monitoring, and some other related Ministry or Board of the Central Government. They were responsible for providing guidance and supervision. In other cases, they also provide an allocation for the initial investment as well as technical assistance. At the local government level, the provincial government is responsible for coordinating cities/districts for centralized MSW disposal. In other words, the conduct of MSW management differs in each area based on the decentralization system.

Generally, MSW management in Indonesia uses collect-transport-disposal systems. The disposal system is mainly an open dumping, refers to system where MSW is disposed on a land disposal site in a manner that does not protect the environment and is susceptible to open burning. Open dumping is prohibited because of the high pollution risk. According to data from the Ministry of Environment, 60% of landfills in Indonesia have reached their maximum capacity limit (Wirukendra, Abdeljawad, & Nagy, 2023). Therefore, the government was required to close open

dumping landfills and replace them with a new dumping system in 2015. The new landfill must be replaced with a new landfill with a sanitary landfill system. However, the government is not yet capable of handling large quantities of MSW, especially when it is not sorted. This caused the new landfills to mostly operate as controlled open dumping, even though the starting point is a sanitary landfill. Consequently, the practice resulted in a high pile of MSW of more than 15 m, high emissions of leachate, and greenhouse gas emissions (Wirukendra, Abdeljawad, & Nagy, 2023). In addition, burning landfill accidents often occur during the dry season.

Every year, Indonesia produces 64 million tons of waste, most of which comes from household waste. From that amount, only 55.5% was processed in the landfills, which resulted in more than 44% dumping without processing. However, this large number cannot generally predict all MSW in Indonesia. According to national statistics, only 60-70% of the overall MSW can be carried by government organizations such as the city/district cleanliness division to final disposal (Damanhuri, Handoko, & Padmi, 2014).This causes the remaining 40% to be managed individually or by communities such as the waste bank.

Waste management can be performed appropriately at the individual level. There is a trend in individual waste management by home, such as bag composting or bio-pore infiltration holes, among environmental activists. However, the majority of rural people conduct illegal dumping, such as waste throwing to rivers and waste burning, which contributes to more pollution and hazards.

Community waste management is a support for the Indonesian government's waste management policy. Most of the community, from nonprofit organizations/NGOs until private companies, initiated a waste bank system in which individuals deposit recyclable materials in exchange for incentives or financial rewards. This has contributed to the circular economy by incentivizing the collection and recycling of materials. This approach not only reduces the volume of waste, but also provides economic opportunities for community members. However, the implementation of this waste bank faces several challenges. Common issues include limited awareness and understanding of the waste bank concepts, inadequate infrastructure, and financial constraints. Government support and local authorities' policies also play crucial roles in the success of waste banks. Although Indonesia has enacted laws related to waste management, the implementation and enforcement of these regulations need to be improved, especially the

coordination between the government and local authorities to ensure effective waste management practice.

2.2 Challenges on Waste Practice in Indonesia

Indonesia, as a nation with breathtaking landscapes and diverse cultures, faced a pressing challenge in waste behavior. The archipelago grapples with the consequences of a throwaway culture that strains its ecosystems. While government policy might be enhanced, the understanding of waste behavior among Indonesian people can only be fully comprehended by various factors, such as cultural Practice, economic conditions, education levels, and the availability of waste management infrastructure.

1. Cultural Practice

Cultural Practice in waste behavior are mainly driven by traditional or community Practice, including communal gatherings and events that often generate significant amounts of waste. A huge amount of waste can be found in marriage events, baby birth, and death events, which are, if not *closely*, related to cultural identity. Wiradimaja et al. (2023) found that in the cultural influences of waste behavior studies, some ethnic groups made littering a tradition from their ancestors. Their ancestors deliberately made the floor of their houses on stilts to ease the disposal of food waste inside their homes. The kitchen windows were designed to allow people to throw their waste directly from the kitchen to the outside. They found that is a habit from older generations of people who were born in the 1940s, when their waste was mainly composed of organic waste that could be easily decomposed by microorganisms or eaten by pets. This habit is no longer related to recent conditions, where most of the waste is covered by inorganic materials that can only be decomposed after thousands of years.

Indonesians have also preserved their traditional markets. While traditional markets in the older generation use a lot of organic packaging, this generation uses a lot of plastics or nonorganic packages because of their low economic price and ease of use. The government has recently suggested a reduction in single-use plastic consumption, but this is only effective for shoppers and consumers.

2. Economic Factors

As Indonesia is a multicultural country, some study cases show that Indonesians with higher income levels have a higher opportunity to separate their waste. The study case in Sepaku

Regency showed that 29% of people did not separate their waste from a higher income level and 20% from a middle-upper level. The percentage of the lower income level is more towards separation behavior (Wiradimadja, Mori, & Rizkiah, 2023). An environmental care behavior survey from Statistics Indonesia also found that people with low-income households tended to separate their waste more than those with high-income households. This is due to the incentives they received from recycling (Zakianis, Sabarinah, & Djaja, 2017). These economic motives can be achieved with the support of a waste bank.

3. Education and Awareness

The education level in Indonesia did not reflect the level of waste separation behavior. In the case of the Sepaku Regency, 33% of the respondents did not separate their waste, and it came from senior high school graduates. Zakianis et al (2017) also found that individuals with low education are more likely to separate their waste than those in higher educated households. From the survey, 93,7% of people knew about knowledge of managing waste management, but only 9% sorted their waste. The study also supported that households with low education, but large surface areas have waste separating behavior due to the availability of sorted waste storage. Many Indonesians also have NIMBY (Not in My Back Yard) syndrome. In conclusion, they may have wasted knowledge but lack awareness, which prevents them from conducting waste separation behavior.

4. Waste Management Infrastructures

The lack of infrastructure is a challenge for waste management in Indonesia, which aims to have zero waste by 2050 (Wirukendra, Abdeljawad, & Nagy, 2023). Waste collection and transportation are the responsibility of local governments. However, only some areas, such as Surabaya (the best city for waste management in Indonesia) and other cities in Java islands, have access to the recycling industry along with proper waste management infrastructure. Rural areas, especially Indonesia, do not have proper waste management infrastructure, including final disposal landfills.

2.3 Waste Management in Japan

Japan has been developing waste management rules since the post-war period, focusing on environmental sanitation and public health improvement through the enacted Public Cleansing Act in 1954. In the 1960s and the 1970s, the increase in industrial waste caused pollution problems

and required environmental protection. Three laws were enacted 3 laws: the Act on Emergency Measures Concerning the Development of Living Environment Facilities (1963). Waste Management Act (1970) and Revision of the Waste Management Act (1976). Since then, Japan has continued to take measures to manage waste until early 2000, when it enacted the Basic Act for Establishing a Sound Material-Cycle Society by promoting 3R recycling (Ministry of the Environment in Japan).

3R, which is known to reduce waste, reuse, and recycle, is a principle in current Japanese waste management. Reducing means choosing to use objects with care to reduce the amount of waste generated. Reusing means repeating the use of items or parts of the items that still have usable aspects. Recycling refers to the use of waste as a resource. 3R must be implemented in the reduction, reuse, and recycling steps to achieve waste minimization. Waste that cannot be recycled will be disposed at the final disposal using an incinerator.

Japan also enhances industrial waste management and illegal dumping regulations through laws such as the Food Recycling Act (2000), Revision of the Waste Management Act (2000), Act on Special Measures Concerning Promotion of Proper Treatment of PCB Wastes (2001), the Automobile Recycling Act (2002), the Act on Special Measures Concerning Removal of Environmental Problems Caused by Specified Industrial Wastes (2003), Revision of the Waste Management Act (2003 to 2006, 2010), and Small Home Appliance Recycling Act (2013). Based on these laws, local governments and residents have become more aware of municipal waste management.

Japan also uses Extended Producer Responsibility (EPR) which means that producers/manufacturers are responsible for adequate reuse, recycling, and disposal of their discarded products. As a result, they adopt a Life Cycle Assessment (LCA) to minimize the environmental impact of their products. Notable actions include using easy-to-recycle containers, creating uniform returnable bottles, and using ecolabeling (Ministry of the Environment Japan, 2005).

Since the promotion of 3R and Japan's EPR system, the collection of combustible or recyclable waste has been cost-free and covered by the government. However, residents need to pack their waste using a respectable plastic bag that is determined by the city. For glass bottles and cans, PET bottles, paper, and textiles were collected separately for recycling purposes. Japan has also implemented a pay-as-you-throw system, in which households are charged based on the

amount of waste they generate, to encourage waste reduction (Weng et al., 2012), such as bulky or assembled items such as beds, cabinets, and other electronic devices (Fernando & Tsuji, 2024). Each waste has its own collection schedule, so residents must separate their waste from their household and throw it in appropriate locations and at the appropriate time.

This synergized action, which comes from producers to consumers, made big changes in Japanese waste management so almost no waste littering in the environment. Japanese people managed to comply with the rules and do 3R, including waste separation actions daily according to the rules. Despite the actions, there is no punishment for not separating waste stated in the law to individuals except for illegal dumping/burning (Ministry of the Environment Japan, 2014). The punishment for individuals is a social judgment, and their waste will not be collected.

2.4 Indonesian Waste Separation Behavior Study Using Theory of Planned Behavior

Several aspects need to be considered in the process of establishing well-performed solid waste management. One of the most studied aspects is behavior towards waste management. In the past three decades, research on the linkages between waste management and behavior has progressed rapidly. Several theories on behavior approaches have been applied to explain the factors affecting waste behavior, especially in waste separation or other pro-environmental behavior.

In Indonesian case, the study of waste separation behavior grows enormously due to government commitment to achieve sustainable goal: “Indonesia is to reduce wastes through reduce-reuse-recycle up to 30% until 2025 and targeting reduction of marine plastic debris as much as 70% by 2025”. As the fourth most populous country and second-largest plastic polluter in the world after China, the government is pressuring Indonesians to properly separate their waste. Various policies have been implemented, including collaborations with waste banks. However, until early 2024, the practice of separating waste from households had not yet achieved appropriate results. Since then, many researchers have studied Indonesian waste separation behavior using various theories. The theories that used the most as foundation in research predicting on waste behavior is Theory of Planned Behavior (TPB) by Ajzen (1985) which is explained below.

2.4.1 Theory of Planned Behavior (TPB)

TPB originates from the Theory of Reasonable Action, which argues that behavior stems from individual intention and perceived behavioral control (PBC). Intention is described as "indicators of how hard people are willing to try… to perform the behavior' (Ajzen, 1991, p. 181), influenced by three primary factors: attitude, subjective norm, and PBC. Attitude is the individual's favorable or unfavorable evaluation of the behavior, subjective norm involves the perceived social pressure to perform or not perform the behavior, and PBC reflects the personal assessment of the difficulty or ease of executing the behavior in various situations. According to the TPB, these three direct predictors of intention are shaped by behavioral, normative, and control beliefs, also known as indirect predictors. Behavioral beliefs are the perceived benefits and drawbacks of engaging in a particular behavior; normative beliefs pertain to "a person's subjective probability that a particular normative referent wants the person to perform a given behavior" (Ajzen, 2012, p. 441); and control beliefs concern the factors (such as time, cost, and available resources) that either hinder or facilitate the behavior. The original TPB model is shown in figure below.

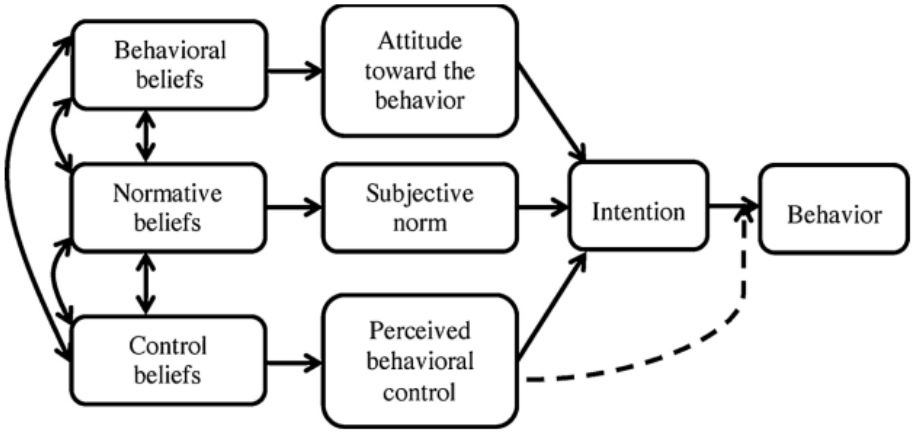

Figure 1 Original Model of Theory of Plan Behavior

Source: Ajzen's official website: https://people.umass.edu/aizen/tpb.diag.html (accessed on 7th July 2024).

2.4.2 Indonesian Waste Behavior Summary Using TPB

Much research has attempted to explain waste behavior in Indonesian people using either TPB or extended TPB models. As waste knowledge, policy, and environment evolve over time,

the factors affecting waste behavior in Indonesian people also change. By focusing on the literature from 2018 to 2024, which used TPB as their main approach, nine papers were collected and analyzed. All the papers supported that attitude, as one of the primary factors in TPB, affects Indonesian waste separation behavior. However, it was found that even when using TPB, the other two primary factors–subjective norms and perceived behavior control–sometimes do not affect the waste separation behavior of Indonesians.

Several papers then use an extended model of TPB by adding some factors to explain the behavior of Indonesian people, such as government role. However, none of them can explain the exact behavior of Indonesian people, since the factor determinants are almost different in every study. Here is a summary of the literature from 2018 to 2024 that explains Indonesian waste separation behavior using the TPB model.

Table 1 Summarized of Analyzed Studies

Title	Method	Claim
Assessment of citizens' environmental behavior toward municipal solid waste management for a better and appropriate system in Indonesia: a case study of Padang City Ulhasanah & Goto (2018)	Using extended model of TPB by adding factors: habit, environmental knowledge, environmental awareness, role of government, and law of enforcement.	Padang citizens behavior influence by social norms, environmental awareness, quality of knowledge, government provision, habits, and **government information as the highest predictor.** Law enforcement have the highest effect on the intention. Government, knowledge, awareness, and social norms has the last effect. The writers claimed that rather than intention, feeling have more correlation with behavior.
Community Participation in Household Waste Management: An Exploratory Study in Indonesia Santoso & Farizal (2019)	Using extended model of TPB by adding demographic factor. The questionnaire was spread in DKI Jakarta and Depok (the most populated area) with 301 samples.	Attitude has a significant influence on intention and behavior, but Subjective norms **are not significant.** The writers suggest adding variables such as **infrastructure** to the model because this model still cannot explain the waste behavior in Indonesian.
Modification of Theory of Planned Behavior to Measure the Intentions and Behavior of Peoples Participation in The Waste Bank Program (Case : Bantul Regency)	Using extended model of TPB by adding several factors: knowledge of how and what, knowledge of consequence, and situational factors as	All factors except PBC have significant influence on intention. The writers suggest to study about adding different variables such as **race** to test the **difference in recycling habits.**

Title	Method	Claim
Fatliana, Handayani, Mahacandra, & Linarti (2021)	factors influence the intention.	
Household Behavior on Plastic Waste Separation in Indonesia (Hafsah & Asih, 2021)	Combine TPB and Norm Activation Model (NAM) to examine variables influence such as aware ess of consequences and ascription of responsibility that formed personal norm.	**Attitude and past habit** have influence on intention and behavior, while **Subjective norm and PBC are not**. Situational factors influence intention but not behavior. There is explanation why SN and PBC have no relationship with intention in Indonesian case.
Community-Based Waste Management (Waste Bank) as Intention Recycling Behavior Predictor Using Structural Equation Modeling in Semarang City, Indonesia (Soesanto, Rachman, & Matsumoto, 2021)	Using extended TPB model with additional factor: effectiveness recognition of waste bank.	Waste bank has the least impact on intention, positive but not significant. All factors have positive impacts with **SN as the highest on intention to behavior.**
Planned Behavior Theory Approach to Waste Management Behavior in South Denpasar District (Jacob & Dwipayanti, 2022)	Using TPB approach with cross-sectional study with 110 samples from 5 sub-districts, using logistic regression for analysis. The model use is original TPB.	**Knowledge, attitude, and PBC significantly influence waste behavior.** No significant relationship between demographic factors. The proportion of good and poor knowledge in separating waste is not different which conclude **state of knowledge may not explain the behavior.**
Factors Influencing Behavior to Reducing Household Food Waste in Indonesia (Niha, Amaral, & Tisu, 2022)	Using extended model by Russell et al (2017) with additional factor: emotion to intention and behavior, and habit to behavior.	**SN and emotion have no significant effect on intention and behavior**.
Understanding of The Behavior of Solid Waste Management in The Context of Waste Hierarchy: A Case Study Of Bogor District, West Of Java –Indonesia Rimantho et al (2023)	Using extended model with additional factors: situational factor, trash behavior, and desired to protect environment.	**Attitude has most significant factor**. Situational factor is not significant to trash behavior. The present investigation revealed that the TPB model did not exhibit the expected level of efficacy so other model needed to predict the intention.
Analysis of Waste Separation Drivers in Urban Centers Using the Theory of Planned Behavior and the Norm Activation Model	Create modification model of TPB and NAM with additional factors such as market facilities,	**Only market facilities and past behavior affect intention**. Market facilities have the highest influence on behavior.

Title	Method	Claim
Maghfiroh et al, 2024	perceived information, perceived inconvenience, mistrust in waste management system, and past behavior.	

Based on the table above, the waste behavior of Indonesians in Indonesia varies based on the area and conditions. Most studies use TPB as their main model to understand this behavior. Out of nine literatures, 6 literatures find attitudes were mostly significant to intention. Five studies found that subjective norms were not significant factors for either intention or behavior. However, in community-based waste management systems, such as waste banks, subjective norms play a significant role in behavior. Only four studies found perceived behavioral control to be a significant factor for both intention and behavior. Other additional factors mentioned past habits have an influence on behavior.

2.5 The Extended Model of TPB in Other Countries

Depending on the research scope, the use of TPB in predicting waste behavior is often modified, and more of them are increasing factors as intention predictors. More than 20 studies have examined waste behavior in certain countries. As the TPB model is often modified, such as reducing insignificant factors or adding several factors into the models, the understanding of human behavior on waste separation is also extended. The table below summarizes the extended TPB model outside the Indonesian case.

Table 2 Extended Models Review Inside and Outside Indonesian Case

Author (Year)	TPB Extension / Key Findings	Research Gaps / Notes
Xu et al. (2017)	Extended TPB by adding **moral obligation** to attitude, and **past behavior** to both intention and actual behavior. Found that **past behavior** is the strongest predictor.	Although attitude explained 65% of variance, **H2 and H4 were rejected**, showing inconsistency in predictors.
Stoeva & Alriksson (2017)	Analyzed satisfaction with local waste facilities. Found **no influence** of facility satisfaction on behavior.	Different demographic groups show **different dominant predictors**. Local satisfaction does not always lead to behavior.
Tang (2020); Hu et al. (2021)	Identified **environmental knowledge** and **rules/regulations** as top predictors of intention and behavior.	Suggests strong influence of **institutional support**, but lacks behavioral mechanism explanation.
Fan, Yang, & Shen (2019)	Cross-country study comparing **Singapore and China**. Emphasized	Highlights need for **localized behavioral analysis**, as national context heavily shapes behavior.

Author (Year)	TPB Extension / Key Findings	Research Gaps / Notes
	how **contextual factors** vary across countries.	
Wang et al. (2021)	Found that **knowledge**, **personal involvement**, and **moral responsibility moderate** the effect of PBC on behavior.	Calls for more study on **interaction effects** between TPB components and psychological variables.
Toan (2021)	Found **knowledge** to be the **strongest predictor** of intention. **Propaganda and attitude** were key drivers of intention.	Reveals the critical role of **communication strategies**, yet lacks deeper socio-cultural factors.

Based on Table 1, no model can explain waste separation behavior. Therefore, I propose a new extended model of TPB by adding some significant factors that have been mentioned to explain waste separation behavior in previous research: past habits, government provision, market facilitators, rules, and propaganda.

2.6 Research Gaps

Based on the literature review on Indonesian waste separation behavior, two research gaps were identified in this research.

1. Population Gap

   There are many studies on Indonesian waste behavior, but only nine were selected based on TPB theories, and all of them studied Indonesian behavior in a limited area of Indonesia. While there is extensive research on waste management and TPB, studies specifically focusing on immigrant populations, particularly Indonesians in Japan, are limited; if not, they are non-existent/under-researched. Thus, research on this specific population is required.

2. Methodological Gap

   While almost all studies use extended models of TPB, there is no consistent model that can explain the waste separation behavior of Indonesians, both within and outside the country. Many TPB-based studies have relied heavily on quantitative methods. Variations in the research methods are necessary to gain new insights.

III RESEARCH QUESTIONS

Based on the research background, literature review, and research gaps, the main purpose of this study is to identify the major factors affecting the waste separation behavior of Indonesian immigrants in Japan. Therefore, the questions for this study were formulated as follows:

RQ1: To what extent do Indonesians in Japan adapt to Japanese waste separation practice?

RQ2: How do Indonesians exhibit waste separation behaviors in Japan?

RQ3: What lessons can be learned from the Japanese waste separation system that can be applied to improve practice in Indonesia?

IV METHODOLOGY

4.1 Research Methodology

The objective of this research is to verify whether there is a behavioral change between Indonesian immigrants before and after living in Japan and to identify the factors influencing behavior in Indonesian immigrants in Japan using the Theory of Planned Behavior. Because there are population and methodological gaps, the methodology used in this research consists of mixed quantitative and qualitative methods. The research method is shown in the flowchart below:

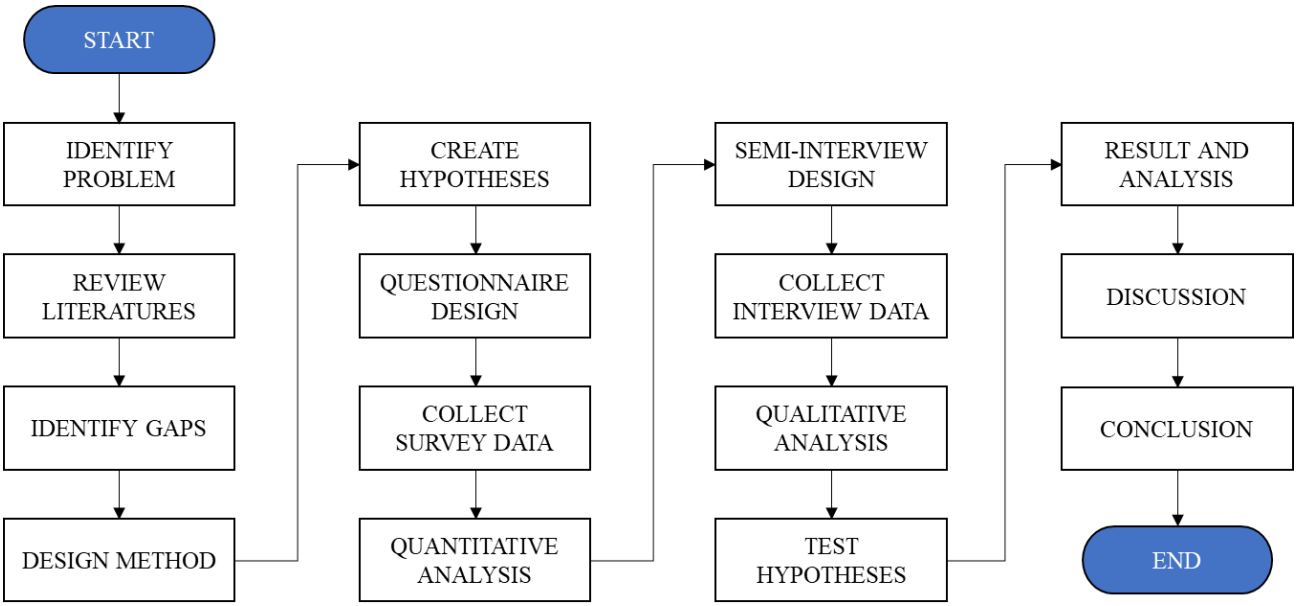

Figure 2 Research Methodology Flowchart

Based on figure 2, this study was initiated by problem identification. After identifying gaps in the literature review, the mix method was designed. First, after designing the conceptual model that used the extended version of the Planned Behavior as the main model, hypotheses were created. A web questionnaire was then designed using questions from literature reviews and a Likert scale. Third, survey data were collected in g-form using channels from the Indonesian community in Japan. After data collection, the data were screened and analyzed using quantitative analysis, such as the Wilcoxon Signed Rank Test, regression analysis, and CBS-SEM analysis.

Results from the quantitative data analysis were used as a baseline in the qualitative method, which is a semi-structured interview design. Questions were created from the main TPB model and extended factors that have been significant for either waste separation intention or behavior.

After the interview data were collected, they were analyzed using a qualitative method which is framework analysis. The hypotheses are tested, and the results are discussed in the next section. This research was closed by the conclusion, recommendation/future research, and implications.

4.2 Proposed Conceptual Model

Research instruments will be created using the modification of the theoretical instruments in the previous study mentioned in the previous chapter. As mentioned in Section 2.4.2, the current study of waste separation behavior in Indonesia cannot explain all the behavior, as there are many differences in the determining factors influencing the current behavior. Therefore, I propose a new conceptual model using an extended model of the Planned Behavior, with several factors added to the original model. The proposed conceptual model for this study uses the extended model of the Theory of Planned Behavior in Fan, Yang, & Shen (2019), which uses contextual, situational, and habitual factors in addition to general environmental factors. Here, represents the definition and variables added based on other factors identified in previous research.

1. Contextual factors

   The role of contextual factors in behavior is critical (Stern, 1999) but is disregarded by TPB (Ajzen, 1991). Contextual factors such as infrastructure and recycling knowledge have proven to be significant to intention and behavior. Therefore, in this model, I propose system trust as the contextual factor, which refers to the level of confidence or reliance that individuals have in a system and the belief that the system will perform to fulfill its purpose, including the government infrastructure and the work of the waste management system.
2. Situational factor/specific environmental factors.

   Fan et al. (2019) used the perception of scroungers as a factor influencing waste behavior. In the Indonesian context who live in Japan, the scrounger is limited (rare), and I propose rules and policy as the situational/specific environmental factor in the extended model. As every prefecture/city has different rules and policies, this study assumed that rules may substantially influence behavior.
3. Habitual Factor.

   Past habits have proven to be significant to all research in the Indonesian context. Past habits were also proposed in the extended model.

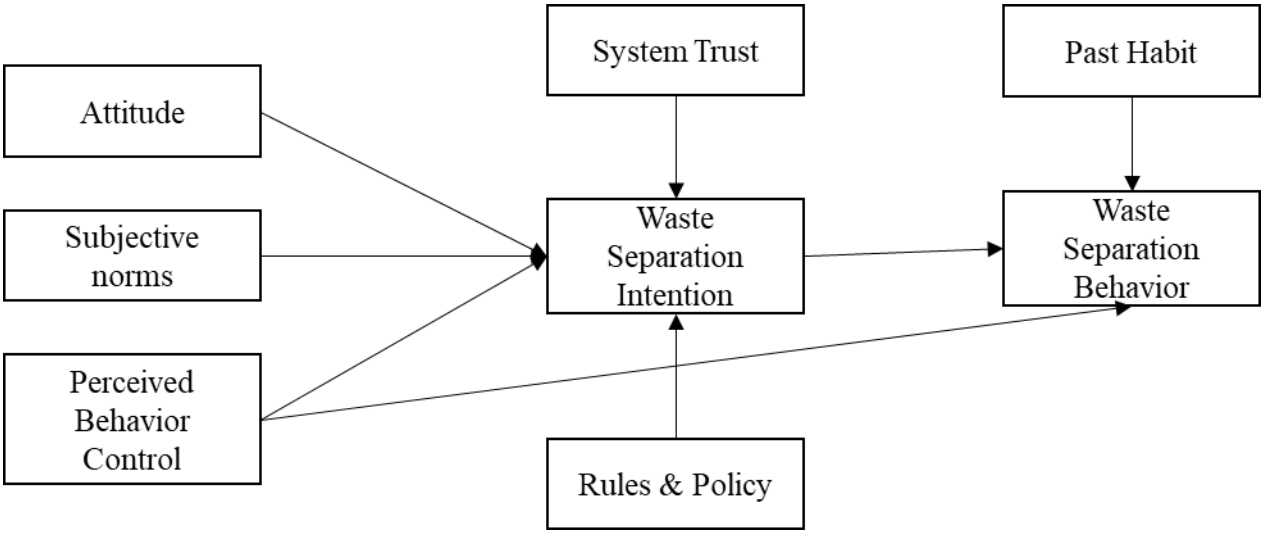

Figure 3 Proposed Extended Model of TPB

4.2 Hypotheses

Based on Figure 3, there are several factors affecting waste separation intention and several factors affecting waste separation behavior. Since the research aims to understand the waste behavior of Indonesian immigrants in Japan, verifying that behavioral changes occur in them is also important. Therefore, the hypotheses tested in this study are as follows:

Hypothesis 1 (H1): There are significant change on waste behavior of Indonesian immigrants in Japan before and after coming to Japan

Hypothesis 2 (H2): Attitude influences waste separation intention.

Hypothesis 3 (H3): Subjective norms influence waste separation intention.

Hypothesis 4a (H4): Perceived behavioral control influences waste separation intentions.

Hypothesis 4b (H5): Perceived behavioral control influences waste separation behavior.

Hypothesis 5 (H6): Rules influence waste separation intentions.

Hypothesis 6 (H7): System trust influences waste separation intention.

Hypothesis 7 (H8): Past habits influence waste separation behavior.

Hypothesis 8 (H9): Waste separation intention influences waste separation behavior.

To test these hypotheses, a mixed method consisting of quantitative and qualitative methods was used. First, a quantitative method was employed to measure the relationship, significance, and value of factors influencing the waste separation behavior of Indonesian immigrants in Japan. This method uses surveys as tools to collect data, and several statistical tools

such as SPSS/AMOS are used to test the hypotheses based on statistics alone. The results of the quantitative method were used as a baseline for the qualitative method. Qualitative methods consisting of semi-structured interviews will focus on the experience and differences in waste management between Japan and Indonesia on various backgrounds of immigrants and will be analyzed using framework analysis. The details of these methods are explained on 4.4 and 4.5.

4.4 Quantitative Method

4.4.1 Research Scope

Quantitative research began on July 17, 2024, until February 28, 2025. The scope is Indonesian immigrants living in Japan; thus, Indonesians must have Japanese residence cards that exclude short-term visitors. Since the objective is about waste behavior change, the participants in this research must be Indonesians above 18 years old and live in the community for more than three months. To collect data, a web survey was employed with a questionnaire built online on Google Forms. These are shared via Facebook and Line.

4.4.3 Questionnaire Design

The models proposed in 3.2.1 are built to understand the pattern of behavior in waste separating for Indonesians living in Japan, which expands the scope of the psychological factors. The questionnaire was designed with several variables explaining the factor (constructs) and was divided into three sections:

1. The demographic section consisted of the following questions:
    - Name (can be anonymous)
    - Gender (only male and female)
    - Region of origin (prefecture) in Indonesia
    - Current prefecture of living in Japan
    - Duration of stay in months
    - Age range
    - Latest education degree earned by respondent
    - Income range
    - Residential number of people, means the number of people living together
2. Past Knowledges

- Basic knowledge of Indonesian waste separation types.
- Basic knowledge of waste bank
- Past behavior of waste separation in Indonesia

3. Extended TPB Factors Section

   This section consisted of 27 questions representing the eight constructs measured. The details of the questionnaire for the extended TPB Factors sections are explained in Table 3. All questions were assessed on a 7-point Likert scale, with following interpretation:

   1: If You Strongly Disagree

   2: If You Disagree

   3: If You Somewhat Disagree

   4: If You Don't Feel Agree or Disagree

   5: If You Somewhat Agree

   6: If You Agree

   7: If You Totally Agree

   For example, the question of B1: "I separate food waste in daily life after coming to Japan", if the respondent feel disagree with the statement, he will choose scale 2 with meaning disagree. The scale and interpretation of the scale were provided in every question.

Table 3 Survey Questionnaire Design

No	Constructs	Definition	No	Item	Form of Questions	Original Reference
1	Waste Separation Behavior (B)	An observable action, conduct, or activities of an individual to separate the waste.	1	B1	I separate food waste in daily life	Hopper & Nielsen (1991)
			2	B2	I have been separating recyclable waste every day	Xu et al (2017)
			3	B3	I obey the rules related to waste management	Ulhasanah (2017)
2	Waste Separation Intention (WSI)	An individual's conscious decision or plan to perform WSB	4	I1	Starting today, I think to separate waste soon	Davis et al. (1989)
			5	I2	I plan to separate waste frequently	Tang (2020)
			6	I3	I would support a solid waste management program in a society	Soesanto et al (2021)
3	Waste Behavior Attitude (A)	Individual's overall evaluation of waste behavior, including beliefs of consequence	7	A1	Waste separating is important thing that must be done in life	Tang (2020)
			8	A2	I understand the impact on the environment if organic and inorganic waste is burned or dumped carelessly	Soesanto et al (2021)

No	Constructs	Definition	No	Item	Form of Questions	Original Reference
			9	A3	I believe it is beneficial to do waste separating for my life	Researcher modification
4	Subjective Norms (SN)	Perceived social pressure to or not perform the behavior	10	SN1	Most people I know support waste sorting	Ajzen (1991)
			11	SN2	People invited or encouraged me to separate or process our waste	Soesanto et al (2021)
			12	SN3	People think if waste scattered in the environment same with becoming poor area	Soesanto et al (2021)
			13	SN4	People around me have concerned about environmental problems	Researcher modification
5	Perceived Behavior Control (PBC)	Perceived ease or difficulty of performing behavior	14	PB1	I am able to separate waste properly	Tang (2020)
			15	PB2	It is convenient for me to separate waste in daily life	Researcher modification
			16	PB3	I always dispose the waste at the right place	Soesanto et al (2021)
6	Rule and Policy (RP)	Guidelines or principle that govern behavior	17	RP1	Government provide a scientific, effective, and concise waste separating standard	Xu et al (2017)
			18	RP2	Government attaches great importance to waste separation problem and has been actively advocating effort to get residents involved in the daily waste separation	Xu et al (2017)
			19	RP3	The government requires everyone to separate waste	Researcher modification
			20	RP4	I will get profit from doing waste separating such as incentive money	Olander & Thogersen (1995)
			21	RP5	I will get penalty for not separating waste	Ulhasanah (2017)
7	System Trust (ST)	Level of confidence or reliance that individuals have in a system. Belief that system will perform to fulfill the purpose	22	ST1	Government provide adequate bins to separate our waste	Ulhasanah (2017)
			23	ST2	I can assure that government provide sufficient number of workers to transport waste so that is not piled up	Ulhasanah (2017)
			24	ST3	I can assure that my waste will be managed well	Researcher modification
			25	ST4	My complain/suggestion is well responded by waste management	Researcher modification
8	Past Habit (PH)	Behavior pattern or routine that	26	PH1	I usually throw all waste into a single bin	Stern (2000)

No	Constructs	Definition	No	Item	Form of Questions	Original Reference
		individuals have developed over time regarding how they dispose waste	27	PH2	I usually ignore the waste separating sign	Researcher modification

Based on these variables, the questionnaire was designed in Google form to simplify the data collection on various platforms. After the data collection period, the Google form was closed.

4.4.3 Respondent Sample

The number of samples required was calculated using the Slovin method and rules of thumb using SEM analysis. In December 2023, the Indonesian population in Indonesia was 149.101 people. Using a margin of error of 5% and the Slovin formula, the number of samples required is

N (total population) = 149.101

e (margin of error) = 5%

n (no of sample) $= \frac{N}{(1+(N\times e^2))}$

$= \frac{149101}{(1+(149101\times 5\%^2))}$

$= 398{,}92 \approx 400$

The sample target was 400 respondents who participated in the survey. However, SEM scholars (Kline, 2011,2016) have argued that for SEM analysis, the minimum sample size can be 200. On the other hand, Hair et al. (2010) suggested that the sample size should be 5 to 10 times the number of indicators/items in the questionnaire. Because the proposed model has 27 variables, the minimum number of samples needed is 270, with all constructs having variables observed. Therefore, the target respondents were 270 Indonesians above 18 years old who had lived in the community for more than three months.

4.4.4 Data Collection Method

After the questionnaire was designed and the sample size was calculated, a web survey was employed to collect quantitative data. First, a pilot survey is conducted to test the reliability and validity of the questionnaire. This pilot survey targeted 26 people from various backgrounds (not

limited to Indonesian immigrants living in Japan). Several adjustments were made after some suggestions, and an actual web survey was employed. A web survey was started in Japan and was shared among Indonesian community groups, especially the Facebook Group Indonesian Community in Japan, Line Group PPI Shizuoka (Association of Indonesian Students in Shizuoka), and other Indonesian communities on Instagram. The writer also promoted a survey of the Indonesian festival. The data collection period was July 17, 2024, until February 28, 2025.

4.4.5 Data Analysis Method

The data collected from the web survey were analyzed using several quantitative tests with SPSS and AMOS. Before the data were analyzed using these tests, the data were screened to verify whether any missing data, straight lining, and outliers occurred in the collected data. The data distribution was also tested to identify quantitative tools that can be used for these distributions. As the data distribution was not normal, the quantitative tools were non-parametric. Below is an explanation of the tools used in this study.

a. Wilcoxon signed-rank test.

Wilcoxon signed-rank test was used to determine the significance of the waste behavior change since the respondents came from the same people. This test is an alternative option if the T-paired test cannot be used, such as if the data distribution is abnormal or the data scale is ordinal. Since the variables were measured using a Likert-type scale (ordinal scale) and the data distribution was abnormal, the Wilcoxon signed-rank test was used. Each variable in the waste behavior was analyzed to determine whether there was a significant behavioral change in the respondents after living in Japan.

b. Kruskal Wallis Test

Kruskal Wallis Test is a non-parametric statistical test for testing whether samples/groups originate from the same distribution. It is used to compare two or more independent samples/groups of equal or different sample sizes. A significant Kruskal–Wallis test indicated that at least one sample stochastically dominated one sample. The test does not identify where this dominance occurs or the number of pairs of group dominance is obtained. This test was used to test whether different demographic groups have different waste behaviors, such as age and income.

c. Structural Equation Modelling (SEM)

SEM is a tool that combines factor and regression analyses (Ginting, 2009). To determine the validity of the conceptual model in terms of factors affecting waste behavior, the relationship between the variables, especially the latent variables (intention), is needed. Confirmatory factor analysis (CFA) was used to test the measurement model to determine whether the independent variables could explain the construct variables. Multi-regression analysis was used to test the significance of the relationship between the variables in the conceptual model. SEM images were processed using AMOS software.

4.5 Qualitative Method

A qualitative method was employed to validate the results of the quantitative data analysis. As the web survey was answered based on only one experience, there is a possibility of bias and difference because of memory loss. Therefore, this method was used to explain this phenomenon, which cannot be explained quantitatively. Semi-structured interviews were conducted to explore the experiences, motivations, obstacles, and perceptions of Indonesians living in Japan in separating waste, as well as the social, cultural, and systemic factors that influence this behavior. The interviews were conducted online via Facebook and WhatsApp, with respondents from various backgrounds.

4.5.1 Semi-structured Interview Design

The semi-structured interview was designed using a TPB framework and open-type questions. Therefore, some questions were based on dominant factors in the results of the extended model of TPB SEM analysis, such as attitude, perceived behavioral control, and/or system trust. Some questions related to the differences in waste management systems in Indonesia and Japan, obstacles, and opportunities for improvement were also asked. However, because the questions were open, not all questions were asked to the respondents.

Part 1. Waste Separation Behavior

- How do you dispose waste in Japan? Do you separate your waste according to type?

Part 2. Obstacles and Convenience (Perceived Behavioral Control)

- What is the biggest challenge you face when trying to separate your waste into Japan?
- How did you learn to separate your waste in Japan? (brochures, internet, friends, etc.)

Part 3: Social Norms and Environmental Pressure (Subjective Norm)

- Do you feel that your neighbors, or community encourages you to separate your waste?

- Have you ever been reprimanded or given input on how to dispose of waste in Japan?

Part 4: Trust in the Waste System and Management

- Do you feel that your efforts to separate the waste will contribute to the system?

Part 5 Expectations and Recommendations

- What can be done to make the waste separating system easier for Indonesians in Japan to understand?
- Do you have any suggestions for the Japanese government or Indonesian community regarding waste management?

4.5.2 Data Collection Method

The respondents were chosen using purposive sampling from the Facebook Group Indonesian Community in Japan, especially people who were once filled in the questionnaire (either pilot project or real web survey), and/or people who have been living in Japan for a long period but have recently returned to Indonesia. Purposive sampling was used to select participants with diverse but relevant characteristics to gain in-depth insights into their experience with waste sorting, their level of adjustment to the Japanese system, and other factors. The data were collected only after the respondents agreed to participate in the interview. Here are the criteria profiles of the purposive sampling used in this research.

Table 4 Criteria Profile of Purposive Sampling

Category	Criteria	Purpose
VISA type	Student, Working VISA, dependent	To see experience in daily life
Living period	<1 year, >1 year	To see adaptation process
Community Activity	Active, passive	To see the encourage process from community as social influence

4.5.3 Data Analysis Method

The data collected from semi-structured interviews were analyzed using Framework Analysis because the questions were based on the Theory of Planned Behavior. Several steps in this data analysis were familiarization, identification of themes, Indexing, Matrix, and Interpretation. After the data were analyzed, the hypotheses tested using quantitative analysis were validated. Suggestions were created based on the interview results.

V DATA COLLECTION

5.1 Quantitative Data Collection

Quantitative data were collected using Google's web survey from July 17, 2024, until February 28, 2025, via several community online platforms such as the Indonesian Community in Japan (ICJ) Facebook Group, Pelajar Perfektur Shizuoka Line Group, and others. In total, 348 samples were collected from various living prefectures. After data screening of missing data, straight lining responses, and outliers, a total of 336 samples were chosen for the next step. Therefore, the minimum number of samples for the SEM analysis was obtained. Respondents' demographic data, such as gender, province of origin, age, and income, were collected. The figures below show the distribution of the demographic data.

5.1.1 Gender Distribution

Among the respondents, the gender distribution was almost balanced, with 52.08% male (175 individuals) and 47.92% female (161 individuals).

Table 5 Gender Distribution

Gender Distribution		
Gender	**Frequency**	**Percent**
Female	161	47.9
Male	175	52.1
Total	336	100.0

5.1.2 Geographics of Living Prefecture

This survey included respondents from 40 of the 47 prefectures in Japan. The largest number of respondents came from Tokyo, which covered 15.8% (53 individuals), followed by 14% from Shizuoka (47 individuals, 6.3% of each Kanagawa and Chiba (21 individuals), and 6% from Okayama (20 individuals). Most respondents were individual representatives of their own living prefectures.

Table 6 Distribution of Resident Living Prefecture

Distribution of Resident Prefecture							
No	**Prefecture**	**Frequency**	**Percent**	**No**	**Prefecture**	**Frequency**	**Percent**
1	Aichi	18	5.4	22	Nagano	3	0.9
2	Chiba	21	6.3	23	Nagasaki	1	0.3
3	Ehime	1	0.3	24	Nara	3	0.9

Distribution of Resident Prefecture							
No	**Prefecture**	**Frequency**	**Percent**	**No**	**Prefecture**	**Frequency**	**Percent**
4	Fukui	1	0.3	25	Niigata	1	0.3
5	Fukuoka	11	3.3	26	Oita	5	1.5
6	Fukushima	1	0.3	27	Okayama	20	6
7	Gifu	4	1.2	28	Okinawa	6	1.8
8	Gunma	8	2.4	29	Osaka	16	4.8
9	Hiroshima	4	1.2	30	Saga	1	0.3
10	Hokkaido	10	3	31	Saitama	15	4.5
11	Hyogo	9	2.7	32	Shiga	3	0.9
12	Ibaraki	7	2.1	33	Shimane	1	0.3
13	Iwate	2	0.6	34	Shizuoka	47	14
14	Kagawa	5	1.5	35	Tochigi	3	0.9
15	Kagoshima	4	1.2	36	Tokyo	53	15.8
16	Kanagawa	21	6.3	37	Toyama	1	0.3
17	Kochi	1	0.3	38	Wakayama	1	0.3
18	Kumamoto	3	0.9	39	Yamaguchi	3	0.9
19	Kyoto	5	1.5	40	Yamanashi	2	0.6
20	Mie	10	3	Total		336	100
21	Miyagi	5	1.5				

5.1.3 Age Distribution

In terms of age, the survey divided respondents into five categories. The most representative in this survey with 63.39% are respondents age 26-35 (213 individuals), followed by 17.3% from respondents aged 18-25 years old (58 individuals), 14.9% from to 36-45 years old (50 individuals), and 3.9% of respondents from 46-55 years old (13 individuals). Only 2 individuals were >55 years old.

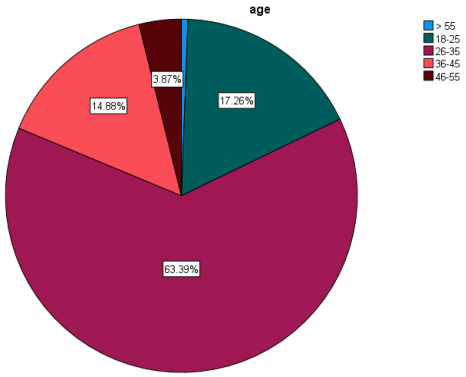

Figure 4 Age Range Distribution

5.1.4 Last Education

In terms of last education, this survey divided respondents into six categories. The most representative in this survey with 44.94% are respondents with bachelor's degrees as their last education (151 individuals), followed by 23.51% from respondents with last education as Senior High School (79 individuals), 22.02% from respondents with last postgraduate education (74 individuals), and 8.63% from diploma (29 individuals). There were two respondents with last education in Elementary School, and one from Junior High School.

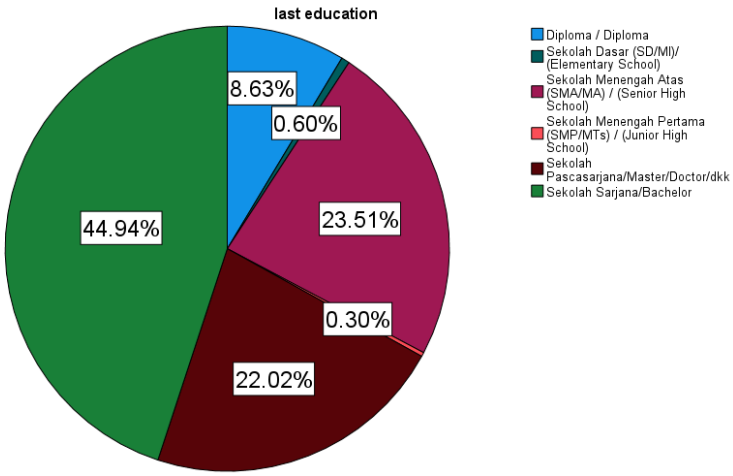

Figure 5 Last Education Distribution

5.1.5 Income

In terms of income, the survey divided the respondents into six categories. The most representative in this survey with 37.20% are respondents with income IDR 10.000.001 – 20.000.000, which is equal to JPY 88.343 –176.686 (125 individuals), followed by 23.8% from respondents with income IDR 20.000.001 –30.000.000, which is equal to JPY 176.687–265.029 (80 individuals), 18.2% from more than IDR 30.000.000 equals JPY 265.030 (61 individuals), and 13.7% of respondents from IDR 5.000.001 – 10.000.000 equals JPY 44.171-88.342 (46 individuals). Both 3.6% of respondents come from IDR 1.000.001 – 3.000.000 equals JPY 8.834-26.502 (12 individuals) and IDR 3.000.001 – 5.000.000 equals JPY 26.503-44.171 (12 individuals).

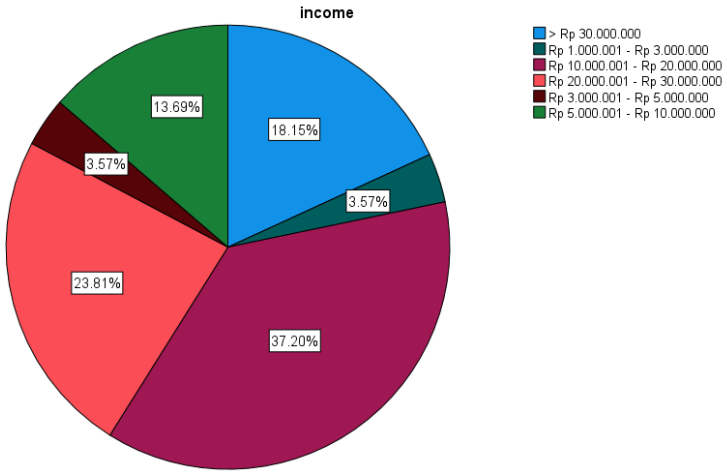

Figure 6 Income Distribution

5.1.6 No of People Live with the Resident/Respondent

In terms of the number of people living in a residence, this survey divided the respondents into four categories. The most representative in this survey (36.31%) were respondents living alone (122 individuals), followed by 32.7% of respondents lives in 3-5 people residence (110 individuals), 21.4% from 2 people (72 individuals), and 9.5% from more than 5 people.

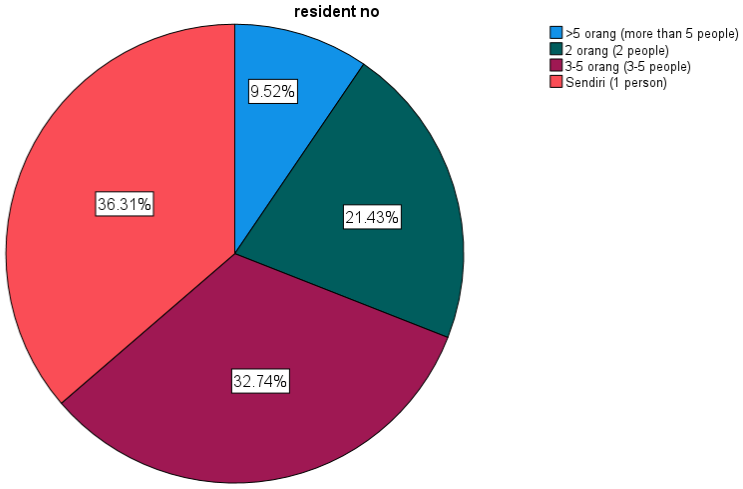

Figure 7 No of People in Residence Distribution

5.1.7 Knowledge About Waste Separation Type

In terms of knowledge of waste separation type in Indonesia, only 44.64% of respondents answered yes (150 individuals), and 17.56% answered maybe (59 individuals). A total of 37.80% (127 individuals) answered no. This shows that knowledge of waste separation in Indonesia is considered low.

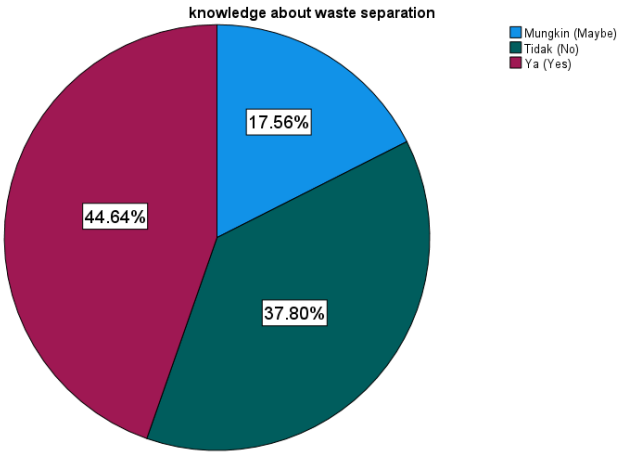

Figure 8 Knowledge about Waste Separation Type

5.1.8 Knowledge About Waste Bank

In terms of knowledge of the waste bank, 52.7% of the respondents answered no (177 individuals). Only 33.3% of the respondents answered yes (112 individuals) and 14% answered maybe (47 individuals). This indicates that more than half of the respondents knew nothing about the waste bank.

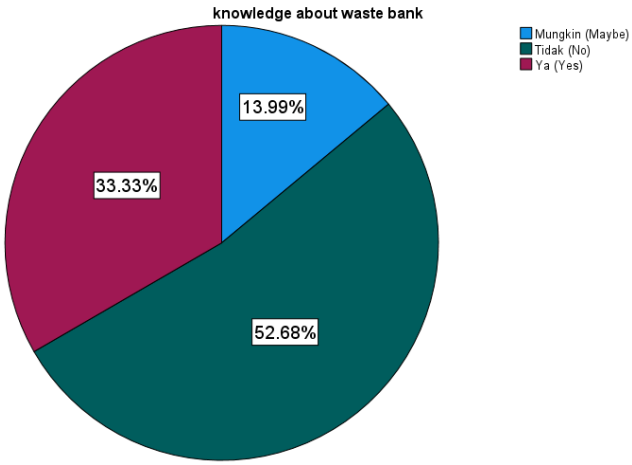

Figure 9 Knowledge of Waste Bank

5.1.9 Living Period in Japan

From 336 respondents, the shortest living period in Japan is 3 months with 4.2% (14 individuals), and the longest living period is 1 individu with 420 months or equals 35 years of living. Most respondents lived in Japan for 24 (21 individuals) or 60 months (21 individuals). The average living period was 52.97 months (4 years and 5 months).

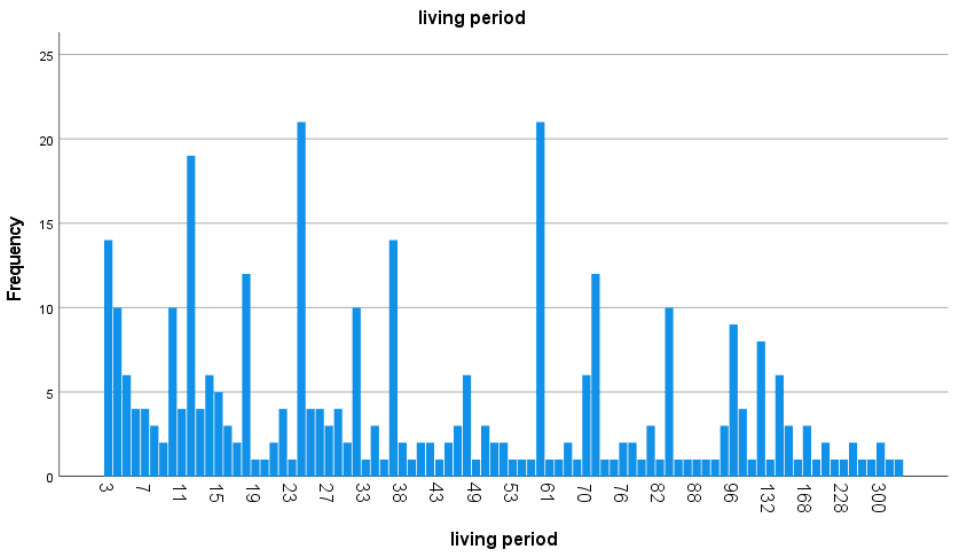

Figure 10 Living Period in Japan Distribution

5.1.10 Descriptive Statistic of Survey Data

The average score of various questions related to waste separation was mostly in the range of 4-7, indicating a positive tendency towards waste separation behavior in Japan. The minimum score on some questions was 1, indicating that there were respondents who disagreed or did not have the habit of separating waste before.

5.2 Qualitative Data Collection

In the qualitative method, only 10 collected with the participant's trait, as shown below.

Table 7 Interview Participant Traits

No	Initial	Visa	Living Period	Community Activity
1	P01	Worker	5 years	Active in FB
2	P02	Student	5 years	Active in PPI
3	P03	Worker	3 years	Active in FB
4	P04	Dependent	7 years	Not active
5	P05	Worker	6 years	Not active
6	P06	Worker	7 years	Not active
7	P07	Dependent	4 years	Active in Moslem Community
8	P08	Dependent	2 years	Active in Moslem Community
9	P09	Worker	3 years	Not active
10	P10	Worker	7 years	Not active

The data were then analyzed using a framework analysis, which is summarized in the table below.

Table 8 Summary of Framework Analysis Data

Variable	Positive	Challenge Note
Attitude	10/10 positive	Some mentioned "Eco green," "important recycling," and "clean air."
Subjective Norm	~9 positive/mixed	Support from neighbors, but the Indonesian community is inactive.
Perceived Behavioral Control (PBC)	6–7 positive, the rest cited technical difficulties	Challenges: too many categories, language barrier, incomplete brochures.
System Trust	All positive, but with some skepticism or limited information	E.g., "80% believe," "70%, not sure why not 100%."
Intention	All positive	The intention to separate became clear after living in Japan.
Behavior	All active after living in Japan, not all active before	This supports differences in cultural contexts and systems.
Quotes	Contains themes: Japanese cleanliness, electronics challenges, brochures, labels	

Based on Table 8, in terms of attitude, all participants stated that they think that waste separation is important and all stated that they have negative feelings when seeing people do not separate or separate their waste. In terms of subjective norms, nine of the ten participants stated that neighbors support them in waste separation. However, some of them also have experience in getting guidance or being reprimanded as they throw waste in improper categories or schedules. Indonesian community was also found to be inactive in supporting or helping them separate their waste.

In terms of PBC, six participants stated that separating waste in Japan was easy because of clear guidelines. However, some are cited with technical difficulties, such as language barriers, too many categories, or incomplete brochures, especially in electronics sites that were mentioned by two participants. In terms of system trust, all stated that they trust the waste management system in Japan, but not 100% because of limited information or skepticism. The intention and behavior were all positive, especially after coming to Japan.

VI RESULT AND ANALYSIS

Based on the methodology in Chapter 4, all data were analysed using quantitative or qualitative methods. This chapter provides the results of the analysis and interpretation of each variable. The following subsections provide the specific details of each survey question.

6.1 Indonesian Immigrants Adaptation to Japanese Waste Separation Practice

In the quantitative data collection, there were questions about the waste behavior of Indonesians before and after coming to Japan. There are 3 pairs of questions were utilized to identify if there is a behavior change that occurs in the immigrant's scope. The 3 pairs are:

PB1: "I separate food waste in daily life before coming to Japan" and **B1:** "I separate food waste in daily life in Japan."

PB2: "I have been separating recyclable waste every day before coming to Japan" and **B2**: "I have been separating recyclable waste every day in Japan."

PB3: "I obey the rules related to waste management before coming to Japan" and **B3**: "I obey the rules related to waste management in Japan."

Wilcoxon signed-rank test was chosen as a nonparametric test, which does not assume that the data follow a normal distribution. Here, represents the result of the Wilcoxon signed-rank test.

Table 9 Wilcoxon Signed Ranks Test on Waste Behavior Before and After Coming to Japan

Ranks

		N	Mean Rank	Sum of Ranks
B1 - PB1	Negative Ranks	22[a]	79.95	1759.00
	Positive Ranks	247[b]	139.90	34556.00
	Ties	67[c]		
	Total	336		
B2 - PB2	Negative Ranks	19[d]	89.71	1704.50
	Positive Ranks	249[e]	137.92	34341.50
	Ties	68[f]		
	Total	336		
B3 - PB3	Negative Ranks	25[g]	94.88	2372.00
	Positive Ranks	215[h]	123.48	26548.00
	Ties	96[i]		
	Total	336		

a. B1 < PB1
b. B1 > PB1
c. B1 = PB1
d. B2 < PB2
e. B2 > PB2
f. B2 = PB2
g. B3 < PB3
h. B3 > PB3
i. B3 = PB3

Based on the table above, the negative ranks representing the number of respondents who showed a decrease from the second condition (after Japan) compared to the first condition (in Indonesia). Therefore, the higher the number, the more respondent do less behavior after coming to Japan. Positive ranks representing the number of respondents who showed an increase from the second condition (after Japan) compared to the first condition (in Indonesia). Therefore, the high number in positive rank means more respondents do behavior after coming to Japan. Ties representing the number of respondents who did not experience any change between before and after. Mean Rank and Sum of Ranks represents the average and total value of the absolute rank of their differences. While the test statistics for each pair are shown below.

Table 10 Wilcoxon Test Statisticst on Waste Behavior Before and After Coming to Japan

Test Statistics[a]

	B1 - PB1	B2 - PB2	B3 - PB3
Z	-12.892[b]	-12.896[b]	-11.293[b]
Asymp. Sig. (2-tailed)	<.001	<.001	<.001

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

The Z-statistic value of the Wilcoxon test calculated based on the difference between positive and negative ranks. Therefore, the larger the absolute Z-value, the stronger the detected difference. A negative Z-value typically appears because the calculation is based on "negative ranks" (SPSS default). The asymp. Sig (2 tailed) is the statistical significance value for a two-tailed test, with interpretation: If $p < 0.05$, there is a significant difference, and If $p \geqslant 0.05$, there is no significant difference. Based on these criteria, according to Table 9 and table 10, the interpretation of each pair is as follows.

1. B1 - PB1 (Separating Food Waste Daily)

Positive Ranks (N=247) mean that more people now separate food waste daily in Japan than in Indonesia. Negative Ranks (N=22) means that few people separated less than before, and Ties (N=67) means there were no changes in 67 individuals. Most respondents in Japan improved their food waste separation habits. Cultural and regulatory factors are likely to contribute to changes in waste behavior. Because the Z value is -12.892 and the p-value (2-tailed) <0.001, we reject the null hypothesis. There has been a significant increase in food waste separation.

2. B2 - PB2 (Separating Recyclable Waste Daily)

Positive Ranks (N=249) indicate that most respondents now separate recyclable wastes more frequently. Negative Ranks (N=19) meant very few decreased their behaviors, and ties (N=68) meant that some stayed the same behavior. Strong behavioral shift toward proper recyclable separation in Japan. This probably reflects Japan's systematic and well-communicated rules. Because the Z value is -12.896 and the p-value (2-tailed) <0.001, we reject the null hypothesis. There has been a significant increase in recyclable waste separation.

3. B3 - PB3 (Obeying Waste Rules)

Positive Ranks (N=215) indicated that the majority improved in the following waste rules. Negative Ranks (N=25) mean a few declined to follow the rules. Ties (N=96) indicated that many remained consistent. Many people now comply better with waste regulations in Japan, but a relatively higher number than in B1/B2 shows no change. Obeying rules might require deeper internalization than just separating the waste. Since the z-value is -11.293 and the p-value (2-tailed) <0.001, we reject the null hypothesis. There was a significant increase in obeying the waste rules.

The Wilcoxon Signed-Rank Test revealed statistically significant differences in all three waste separation behaviors (food waste, recyclable waste, and rule compliance) before and after migration to Japan ($Z = -12.892$ to -11.293, $p < 0.001$). These results indicate that Indonesian immigrants significantly improved their waste management behavior after relocating to Japan. The findings support Hypothesis 1 and highlight the strong influence of systemic and environmental factors in shaping behavioral adaptation in a new cultural context.

6.2 Factors Affecting Waste Separation Behavior of Indonesians live in Japan

6.2.1 Demographic Factors Influence to Waste Separation Behavior

Based on five demographics data that were collected in subsection 5.1, namely gender, age, last education, income, no residence, and living period, a Multiple Linear Regression test was utilized to identify whether there is an influence on waste separation behavior between different demographic factors. Below are the results and interpretation of demographic factors influencing

each behavior variable, namely separating food waste, recyclable waste, and following the rules on waste management in Japan.

In linear regression, B (Unstandardized Coefficient) is the absolute change in B1 for every 1-unit change in the predictor variable. Beta (Standardized Coefficient) is the magnitude of the effect on a standardized scale (for comparing between variables). The t-value for testing the significance of each coefficient. Sig. representing the p-value which is to measure the significant of the influence. If $p < 0.05$, the effect is significant. Tolerance & VIF are to measure multicollinearity (correlation between predictor variables). There is no problem of the equation if Tolerance > 0.1 and VIF < 10. Following this definition, the result of multilinear regression analysis are shown below.

1. B1 (Separating Food Waste Daily in Japan)

The table below showed the regression results for separating food waste behavior.

Table 11 Demographic Factor in Separating Food Waste Regression Result

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	5.769	.450		12.815	<.001		
	gender	-.023	.152	-.008	-.149	.882	.930	1.076
	living period	.001	.001	.048	.818	.414	.890	1.123
	age range	-.055	.104	-.030	-.531	.596	.949	1.054
	last education	.099	.067	.082	1.463	.144	.956	1.046
	income	.026	.063	.024	.412	.681	.907	1.103
	no of residents	-.062	.072	-.047	-.852	.395	.980	1.020

a. Dependent Variable: B1

Based on Table 11, a constant value of 5.769 with significance <0.001 means that when the demographic factors are zero (not functioning), the result of agreeing to do the separate food waste in daily is still high. Regarding the result, gender have B -.023 means man tends to do less behavior. But since the sig is 0.882, more than 0.05, this factor is not significant. Living period has beta of 0.001 and sig 0.414 means even though the effect is the slightly positive, the effect is not significant. Age range has beta of -0.055 and sig 0.496 means while higher age range give negative effect, the effect is still not significant. Last education has beta of 0.099 and sig 0.144, means higher education range give positive effect, the effect is also not significant. Income has

beta of 0.026 and sig 0.681 means the higher income, more likely do behavior but the effect is not significant too. No of residents in the home/apartment has beta -0.062 and P value 0.395 means that more resident number, make less behavior but the effect also not significant.

In summary, all demographic factors (gender, living period, age range, last education, income, and residents' number) have a low value (Unstandardized B coefficient) on B1, and all the significance (p-value) were more than >0.05. This means that all demographic factors have no significant influence on respondents' separation of food waste behavior.

2. B2 (Separating Recyclable Waste Daily in Japan)

The table below shows the regression results for separating recyclable waste behavior.

Table 12 Demographic Factor in Separating Recyclable Waste Regression Result

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	5.432	.468		11.619	<.001		
	gender	-.120	.158	-.043	-.762	.446	.930	1.076
	living period	.001	.001	.055	.943	.346	.890	1.123
	age range	-.002	.108	-.001	-.021	.983	.949	1.054
	last education	.093	.070	.074	1.324	.186	.956	1.046
	income	.043	.066	.038	.662	.508	.907	1.103
	no of residents	.026	.075	.019	.352	.725	.980	1.020

a. Dependent Variable: B2

Based on Table 12, a constant value of 5.432 with significance <0.001 means that when the demographic factors are zero (not functioning), the result of agreeing to do recyclable waste separation behavior is still high. Regarding the result, gender have B -.020 means man tends to do less behavior. But since the sig (p-value) is 0.445, more than 0.05, this factor is not significant. Living period has beta of 0.001 and sig 0.346 means even though the effect is the slightly positive, the effect is not significant. Age range has beta of -0.002 and sig 0.983 means while higher age range give negative effect, the effect is still not significant. Last education has beta of 0.093 and sig 0.186, means higher education range give positive effect, the effect is also not significant. Income has beta of 0.043 and sig 0.508 means the higher income, more likely do behavior but the effect is not significant too. No of residents in the home/apartment has beta 0.026 and P value

0.725 means that more resident number, more likely do the behavior but the effect also not significant.

In summary, all demographic factors had a low value (Unstandardized B coefficient) on B2, and the significance was >0.05. This means that all demographic factors have no significant influence on respondents' recyclable-waste separation behavior.

3. B3 (Obeying Waste Rules in Japan)

The table below showed regression result for separating recyclable waste behavior.

Table 13 Demographic Factor in Obeying Waste Rule Regression Result

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	5.546	.414		13.395	<.001		
	gender	-.011	.140	-.004	-.077	.939	.930	1.076
	living period	.002	.001	.072	1.246	.214	.890	1.123
	age range	-.123	.095	-.072	-1.290	.198	.949	1.054
	last education	.088	.062	.079	1.426	.155	.956	1.046
	income	.094	.058	.093	1.628	.104	.907	1.103
	no of residents	.030	.066	.025	.458	.647	.980	1.020

a. Dependent Variable: B3

Based on Table 13, a constant value of 5.546 with significance <0.001 means that when the demographic factors are zero (not functioning), the result of agreeing to obey waste rules in their environment is still high. Regarding the result, gender have B -0.011 means man tends to do less behavior. But since the sig (p-value) is 0.939, more than 0.05, this factor is not significant. Living period has beta of 0.002 and sig 0.214 means even though the effect is the slightly positive, the effect is not significant. Age range has beta of -0.123 and sig 0.198 means while higher age range give negative effect, the effect is still not significant. Last education has beta of 0.088 and sig 0.156, means higher education range give positive effect, the effect is also not significant. Income has beta of 0.094 and sig 0.104 means the higher income, more likely do behavior but the effect is not significant too. No of residents in the home/apartment has beta 0.030 and P value 0.647 means that more resident number, more likely do the behavior but the effect also not significant. All demographic factors had a low value (Unstandardized B coefficient) on B3, and

the significance was >0.05. This means that no demographic factors had a significant influence on respondents' obeying rules on waste management behavior.

6.2.2 Extended Model of Theory of Planned Behavior to Waste Separation Behavior

This subsection explains how the extended TPB model influences the waste separation behavior. The first analysis was Model Fitness, to evaluate how well the statistical model represented the observed data. The second analysis was a Path Analysis to examine the direct and indirect relationships between variables. Both analyses conducted using the quantitative *structural equation modelling* (SEM) method with Amos software.

6.2.2.1 Model Fitness and Path Analysis for Proposed Conceptual Model

In Structural Equation Modelling (SEM), model fit refers to how well a statistical model fits the observed data. There are several criteria used to assess model fit, which are generally categorized into the following Goodness-of-Fit Indices*: absolute, incremental, and* parsimonious.

A. Absolute Fit Indices.

It assesses the extent to which a model directly represents data without comparing it to other models. For this purpose, the Root Mean Square Error of Approximation (RMSEA) was used**.** RMSEA $\leqslant$ 0.05, considered a good fit; value between 0.05 and 0.08, considered an acceptable fit; and RMSEA $\geqslant$ 0.10, considered a poor fit.

B. Incremental Fit Indices.

The model was compared with the baseline model (independent model).

1. **CFI (Comparative Fit Index)**

   CFI values range from 0 to 1, with values above 0.90 generally indicating a good fit. A CFI of 0.939 suggested a good model fit.

2. **TLI (Tucker-Lewis Index)**

   Like CFI, values close to 1 indicate good fit. A value of 0.926 was within an acceptable fit.

C. **Parsimonious Fit Indices**.

This assesses the simplicity of the model. For this purpose, CMIN/DF was used as the ratio of chi-square to degrees of freedom. Values between three and five are generally acceptable. Values less than 3 were considered a good fit.

Based on goodness-of-fit criteria, the proposed conceptual model was tested using Confirmatory Factor Analysis (CFA). Below is the result of the model and goodness of fit.

Table 14 Goodness of Fit Proposed Conceptual Model

Measure	Estimate value	Result
RMSEA	0.070	Acceptable fit
CFI	0.911	Acceptable fit
TLI	0.896	Not a good fit
CMIN/DF	795.594/301=2.643	A good fit

As shown in Table 14, the proposed model has RMSEA value of 0.070. The value of RMSEA less than 0.10 considered an acceptable fit. CFI value of 0.911, which is more than 0.9 considered acceptable fit. TLI of 0.896, which is less than 0.9 considered not a good fit. The last is CMIN/df which is 2.643. This value is between 2 and 5, so it is considered a good fit. In summary, from four categories of goodness of fit, one of them is not a good fit. Therefore, the estimated value indicates that the model is not a good fit, the current conceptual model needs to be adjusted.

For this, a low correlation value for some variables was deleted and insignificant paths were deleted from the model. The path deletion method was carried out by considering the loading factor according to Hair et al. (2006). Because the number of samples is 336 (more than 250 but less than 350), the loading factor (standardized estimate) below 0.35 will be deleted. The results of each estimate in the path analysis are presented below.

Table 15 Standardized Regression Weights of Proposed Conceptual Model

Path			Estimate	S.E.	C.R.	P	Standardized Estimate	Result
I	**<---**	**A**	**.254**	**.097**	**2.621**	**.009**	**.319**	**Significant, but β < 0.35. Can be hold theoretically.**
I	<---	SN	-.059	.046	-1.277	.201	-.070	Not significant & β < 0.35 → delete
I	**<---**	**PBC**	**.401**	**.127**	**3.157**	**.002**	**.404**	**Strong and significant**

Path			Estimate	S.E.	C.R.	P	Standardized Estimate	Result
I	<---	RP	.099	.108	.923	.356	.094	Not significant & β < 0.35 → delete
I	<---	ST	.106	.065	1.614	.107	.140	Not significant & β < 0.35 → delete
B	<---	PH	.064	.045	1.436	.151	.068	Not significant & β < 0.35 → delete
B	**<---**	**I**	**.507**	**.114**	**4.443**	*******	**.362**	**Strong and significant**
B	**<---**	**PBC**	**.715**	**.120**	**5.957**	*******	**.515**	**Strong and significant**

Based on table 15, path from A to I has standardize estimate of 0.319 and P-value of 0.009. Because P-value is less than 0.05, this path is significant. Path from SN to I has standardize estimate of -0.070 and P-value of 0.201. Because P-value is more than 0.05, this path is not significant. Path from PBC to I has standardize estimate of 0.404 and P-value of 0.002. Because P-value is less than 0.05, this path is significant. Path from RP to I has standardize estimate of 0.094 and P-value of 0.356. Because P-value is more than 0.05, this path is not significant. Path from ST to I has standardize estimate of 0.140 and P-value of 0.107. Because P-value is more than 0.05, this path is not significant.

Path from PH to B has standardize estimate of 0.068 and P-value of 0.151. Because P-value is more than 0.05, this path is not significant. Path from I to B has standardize estimate of 0.362 and P-value of less than 0.001. Because P-value is less than 0.05, this path is significant. Path from PBC I to B has standardize estimate of 0.515 and P-value of less than 0.001. Because P-value is less than 0.05, this path is significant. Since paths from SN to I, RP to I, ST to I, and PH to B are not significant, these paths can be reconsidered to be deleted in the adjusted model. While paths from A to I, PBC to I, I to B, and PBC to B are all maintained because of the significance. The result of goodness of fit and estimate of every path are shown in this figure 11.

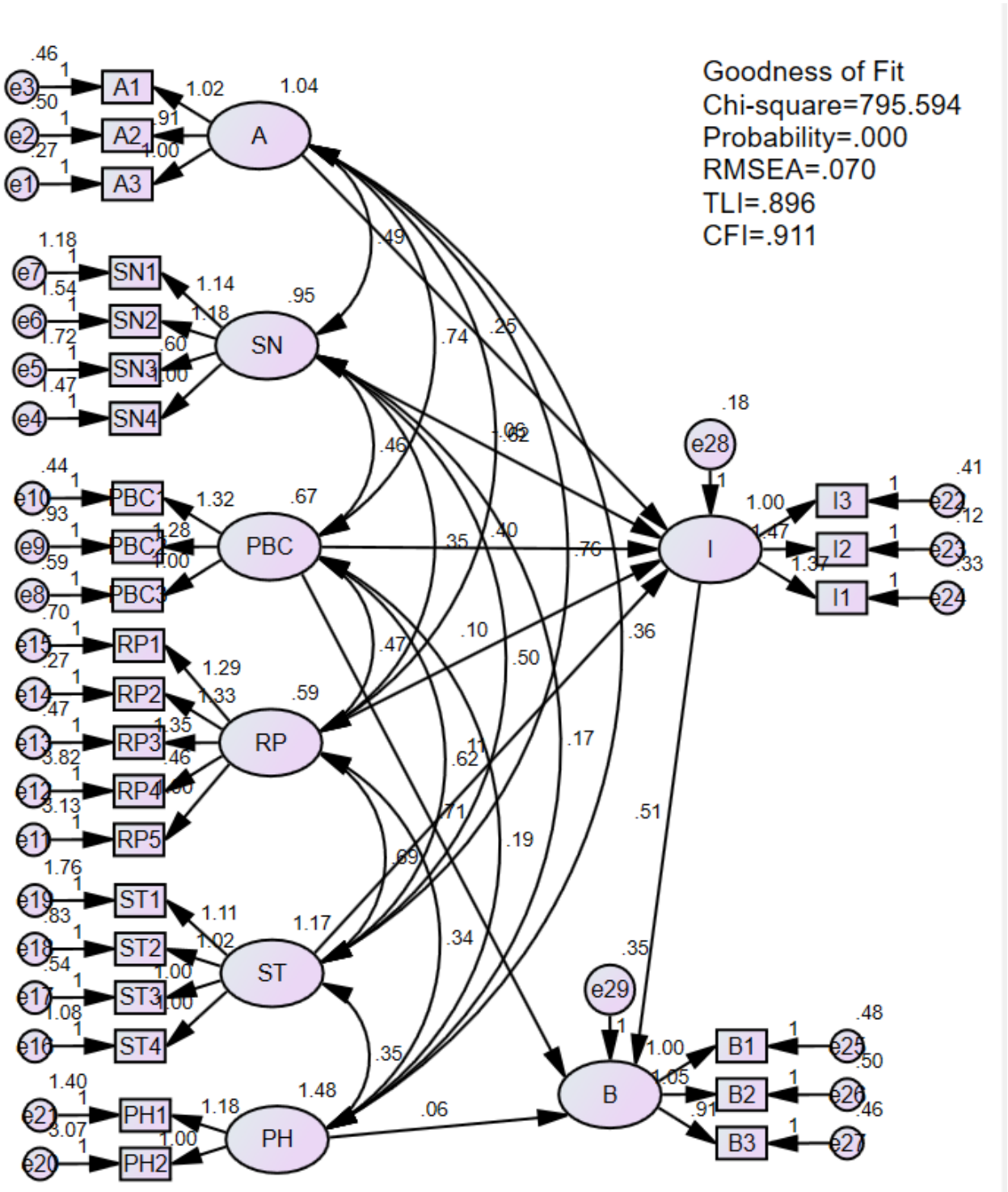

Figure 11 Proposed Conceptual Model CFA Result

6.2.2.2 Model Fitness and Path Analysis for Adjusted Conceptual Model

Based on Tables 14 and 15, adjustments were made to the conceptual model to make the model fit it by deleting some insignificant factors. The path from perceived behavior control (PBC) to both intention and behavior is strong and significant; thus, they are maintained. The path from attitude to intention is weak but significant. Because attitude is the basis of the TPB model, it can be maintained. The path from subjective norms to intention was deleted because of weak and insignificant relationships. The path from extended factors, namely rules and policy, and past habits are all deleted due to weak and insignificant relationships. The path from system trust is maintained since the p-value is marginal, and there is support from the interview data. Here is the goodness of fit for the adjusted conceptual model.

Table 16 Goodness of Fit Adjusted Conceptual Model

Measure	Estimate value	Result
RMSEA	0.079	Acceptable fit
CFI	0.950	A Good fit
TLI	0.937	Acceptable fit
CMIN/DF	295.175/96=3.075	Acceptable fit

As shown in Table 16, the adjusted model has RMSEA value of 0.079. RMSEA value between 0.05 and 0.08 is considered an acceptable fit, therefore this model is an acceptable fit. CFI value of 0.950, which is more than 0.95 is considered a good fit. TLI of 0.937, which is more than 0.9 is considered an acceptable fit. The last is CMIN/df which is 3.075. This value is between 2 and 5, so it is considered an acceptable fit. In summary, from four categories of goodness of fit, all of them are considered an acceptable fit. Therefore, the current conceptual model does not need to be adjusted. The next figure showed the current conceptual model.

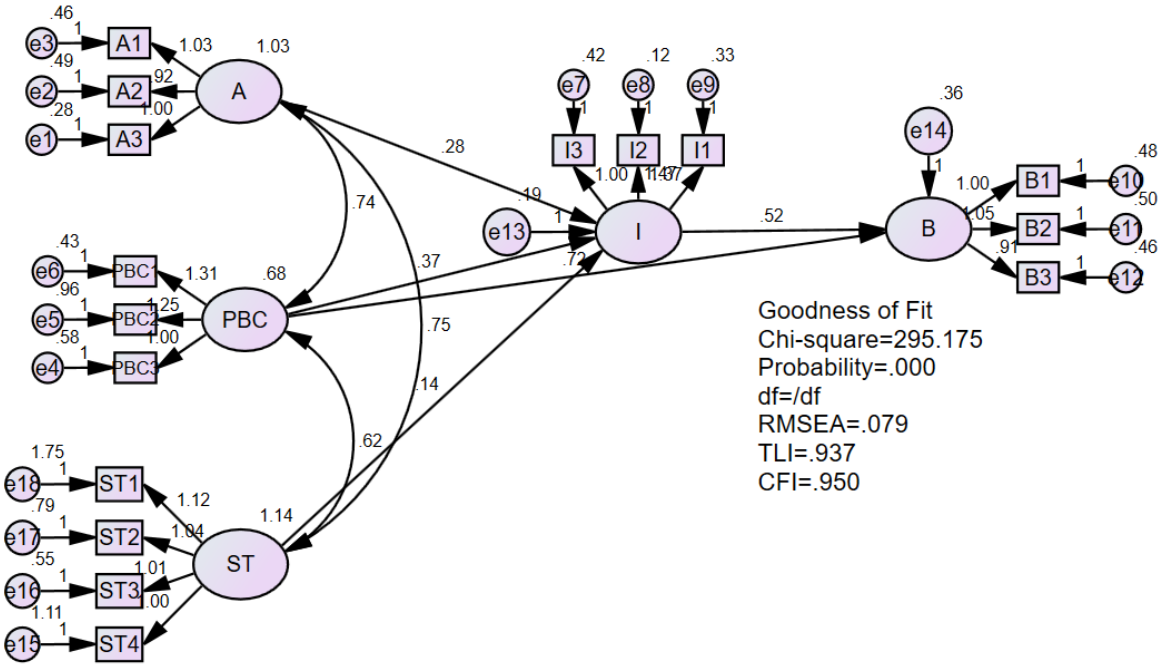

Figure 12 Adjusted Conceptual Model

Based on the new adjusted model, here is the standardized regression weight of the model.

Table 17 Standardized Regression Weights of Adjusted Conceptual Model

Path			Estimate	S.E.	C.R.	P	Standardized Estimate	Result
I	<---	A	0.282	0.092	3.057	**0.002**	**0.353**	**Strong and significant**
I	<---	PBC	0.372	0.121	3.086	**0.002**	**0.378**	**Strong and significant**
I	<---	ST	0.137	0.046	2.966	**0.003**	**0.18**	**Weak and significant**
B	<---	I	0.52	0.117	4.455	***	**0.37**	**Strong and significant**
B	<---	PBC	0.722	0.122	5.899	***	**0.523**	**Strong and significant**

Based on table 17, path from A to I has standardize estimate of 0.353 and P-value of 0.002. Because P-value is less than 0.05, this path is significant and have strong influence. Path from PBC to I has standardize estimate of 0.378 and P-value of 0.002. Because P-value is less than 0.05, this path is significant and has strong influence. Path from ST to I has standardize estimate of 0.18 and P-value of 0.003. Because P-value is less than 0.05, this path is becoming significant even though has weak relationship. Path from I to B has standardize estimate of 0.37 and P-value less than

0.001. Because P-value is less than 0.05, this path is significant and has strong influence on B. Path from PBC to B has standardize estimate of 0.523 and P-value of less than 0.001. Because P-value is less than 0.05, this path is significant and has strong influence.

The revised SEM model, with improved model fit, confirms that Attitude, Perceived Behavioral Control, and Trust in the System significantly predict the Intention to separate waste. Furthermore, Intention and PBC strongly influence actual waste separation behavior. These findings affirm the robustness of the TPB framework in this immigrant context and highlight the pivotal role of institutional trust. Integrating Trust as an additional construct enhances the explanatory power of TPB, particularly in contexts where individuals must navigate unfamiliar systems and regulations.

6.2.3 Hypotheses Result

Based on Table 9-Table 17, Hypothesis were tested using regression analysis included in SEM. Table 18 below is the summary of hypotheses testing result.

Table 18 Hypotheses Result for TPB Model

The Hypothesis:	P-Value	Result	Interpretation
Hypothesis 1 (H1): There are significant change on waste behavior of Indonesian immigrants in Japan before and after coming to Japan	**<0.001**	**supported**	**rejected null, accept H1**
Hypothesis 2 (H2): Attitude has influence on waste separation intention.	**0.002**	**supported**	**rejected null, accept H2**
Hypothesis 3 (H3): Subjective norm has influence on waste separation intention.	0.201	not supported	accept null, reject H3
Hypothesis 4a (H4): Perceived behavior control has influence on waste separation intention.	**0.002**	**supported**	**rejected null, accept H4**
Hypothesis 4b (H5): Perceived behavior control has influence on waste separation behavior.	***	**supported**	**rejected null, accept H5**
Hypothesis 5 (H6): Rules influence waste separation intention.	0.356	not supported	accept null, reject H6
Hypothesis 6 (H7): System trust influence waste separation intention.	**0.003**	**supported**	**reject null, accept H7**
Hypothesis 7 (H8): Past habit influence waste separation behavior.	0.151	not supported	accept null, reject H8

Hypothesis 8 (H9): Waste separation intention influence waste separation behavior.	***	**supported**	**rejected null, accept H9**

In table 18, H1, H2, H4, H5, H7 and H9 were supported by quantitative result, while H3, H6, and H8 were rejected due to statistically insignificant. The interpretation of each hypothesis is shown below.

Hypothesis 1 (H1): There are significant change on waste behavior of Indonesian immigrants in Japan before and after coming to Japan

With P-value for each pair are less than 0.001, null hypothesis is rejected, and we accept H1 that there is significant change on waste behavior of Indonesian immigrants in Japan before and after coming to Japan. This finding suggests that the new environment in Japan, including stricter regulations and a more structured waste management system, has triggered significant behavioral changes. This indicates behavioral adaptation to local norms and systems. This finding was supported by interview results with 9/10 participants stated they started to separate waste after living in Japan. 1 participant also feel supported to separate waste after living in Japan.

Hypothesis 2 (H2): Attitude has influence on waste separation intention.

With P-value 0.002, less than 0.05, null hypothesis is rejected, and we accept H2 that Attitude has influence on waste separation intention. Positive attitudes toward waste separation, such as seeing it as an important or responsible act, encourage immigrants to have a strong intention to separate their waste. This aligns with the Theory of Planned Behavior (TPB), which states that attitude is the primary determinant of intention. This finding was supported by interview results which 10/10 participants stated the importance of waste separation such as clean air or recycling importance.

Hypothesis 3 (H3): Subjective norm has influence on waste separation intention.

With P-value 0.201, more than 0.05, null hypothesis is accepted, and we reject H2. Subjective norm has no influence on waste separation intention. Immigrants may not feel social pressure or influence from their social environment (family, friends, community) regarding waste separation behavior. This could be due to the lack of a strong Indonesian community or a lack of cross-cultural

communication regarding local norms. This finding was somewhat contradicted by interview results which 10/10 participants stated their environment support them to do waste separation and even 3 participants get guidance because wrong schedule. However, since 8/10 stated no guidance from the Indonesian community can be a reason of the inexistence of social pressure.

Hypothesis 4a (H4): Perceived behavior control has influence on waste separation intention.

With P-value 0.002, less than 0.05, null hypothesis is rejected, and we accept H4 that Perceived behavior control has influence on waste separation intention. This aligns with the Theory of Planned Behavior (TPB), which states that perceived behavior control is the primary determinant of intention.

Hypothesis 4b (H5): Perceived behavior control has influence on waste separation behavior.

With P-value less than 0.001, null hypothesis is rejected, and we accept H5 that Perceived behavior control has influence on waste separation behavior. When immigrants feel capable of separating waste (for example, because they understand the categories or feel they have sufficient time/space), they are more likely to have the intention to do so and are more likely to do so. This suggests that PBC influences not only intentions but also direct actions in the context of repeated or habitual behavior. This also aligns with the Theory of Planned Behavior (TPB), which states that perceived behavior control is the primary determinant of intention. This finding was supported by interview results which 6–7 have positive response to PBC. Even though rest cited technical difficulties especially electronics. While despite the difficulties, they still do the behavior.

Hypothesis 5 (H6): Rules influence waste separation intention.

With P-value 0.356, more than 0.05, null hypothesis is accepted, and we reject H6. Rules and policy have no influence on waste separation intention. Although Japan has strict rules, immigrants may not understand or feel connected to them as immigrants may not include as rules makers. They may also perceive rules as external obligations rather than internal motivators.

Hypothesis 6 (H7): System trust influence waste separation intention.

With P-value 0.003, less than 0.05, null hypothesis is rejected, and we accept H7 that system trust has influence on waste separation intention. When immigrants believe that the waste

management system is working well (e.g., it's not remixed, and waste is recycled), they are more likely to participate. This highlights the importance of transparency and communication from the government/waste management. It also supported by interview finding that most participants believe on Japan waste management system.

Hypothesis 7 (H8): Past habit influence waste separation behavior.

With P-value 0.151, more than 0.05, null hypothesis is accepted, and we reject H8. Past habit has no influence on waste separation behavior. Although respondents had previously been separating waste in Indonesia, their current behavior was more influenced by the new context in Japan. This suggests that old habits don't always persist in new environments, and that adaptation is more prevalent. It also supported by interview finding that 9/10 started to separate their waste only after living in Japan.

Hypothesis 8 (H9): Waste separation intention influence waste separation behavior.

With P-value less than 0.001, null hypothesis is rejected, and we accept H9 that waste separation intention has influence on waste separation intention. This is the core result of the TPB—intention as a primary predictor of actual action. When immigrants have strong intentions, they are more likely to act despite obstacles.

6.3 Lessons Can Be Learned from the Japanese Waste Separation System that Could Be Applied to Improve Practice in Indonesia

As hypothesis result in 6.2, while attitude influences waste separation intention, in terms of actual behavior and the intention itself, perceived behavioral control is the focus. In line with the interview results, some interventions based on the hypothesis results could be applied to improve practice in Indonesia.

Perceived Behavioral Control (PBC).

PBC not only influences intention, but also actual behavior, thus raising the PBC the most important thing. As PBC indicates person ability to sort, “The more people feel empowered to sort, the more likely they are to do so.” Based on the results and interview data in Appendix 2, the following interventions can be performed:

1. Create simpler and clearer waste categories. For example, start with simple categories: organic (food) and non-organic (dry) (P08), and create a guide in Indonesian with visual examples (P01, P07).
2. Provide labels, brochures, and visual explanations in multiple languages (including regional languages) to enhance communication and ease waste separation.
3. Show real-world examples: videos, infographics, and demonstrations of waste separating Practice.
4. Create a simple app that can be accessed by everyone to show where their waste goes
5. Provide waste facilities in public places (P05)
6. Building a structured and modern waste management system: trucks, collection points, etc. (P10)

Attitude

A positive attitude toward waste significantly influences the intention to separate waste. Based on the results and supported by the interview data, some interventions could be conducted.

1. Engage local influencers to promote the "wise separation" message.
2. Educate the public about the importance of waste separating and its environmental impact (P01, P02, P03, and P08), which can be incorporated into elementary and junior high school curricula.
3. Use social media, flyers, and visual campaigns to reach the public (P03, P07)
4. Involve the community in outreach and mentoring (P01, P07)
5. Promote separating from the village level to build habits from the start (P07)

Raising Intention

Strong intentions tend to be followed by concrete action. Therefore, the interventions that could be performed were as follows.

1. Encourage village waste banks to become a local economic activity (P07) or the community to make public commitments (e.g., we separate stickers, MOU with recycling companies, third parties).
2. Visual reminders were used on trash bins (colors, labels, and pictures).
3. Small incentives or competition between neighborhood associations (RW), campuses, and schools.

Additional Suggestions from Interview

Based on Appendix 2, additional suggestions were made outside the TPB factors.

1. Regulation and Enforcement
    - Implement strict sanctions for littering (P06)
    - Increase waste management budgets and system transparency so that people know where their waste is being taken (P02)
2. Incentives and Motivation
    - Show immediate benefits such as points at supermarkets or rewards for proper separating (P09)

Suggestion for Japan

Almost all participants stated the need for clear guidelines in Indonesian and visual examples to support their waste separation habits correctly. Some also suggest that Japan should consider simplifying the categories or system orientation upon arrival (P03, P04) and reduce plastic use, as not all plastics can be recycled (P10).

VII DISCUSSION

This chapter discusses the key findings of the study by integrating the results from both quantitative and qualitative analyses and linking them to the theoretical framework and existing literature. This study aims to provide a comprehensive understanding of how Indonesian immigrants in Japan adapt their waste separation behavior, what factors influence this behavior, and what lessons can be learned to improve waste management practice in Indonesia.

7.1 Relevance of Behavior Change After Living in Japan

The Wilcoxon Signed-Rank Test revealed significant improvements in the three behavioral indicators after the respondents migrated to Japan which was past behavior (PB) and current behavior (B):

- **PB1 < B1**: Daily food waste separation improved significantly.
- **PB2 < B2**: Daily recyclable waste material separation showed marked improvement.
- **PB3 < B3**: Compliance with waste-related rules increases.

These findings demonstrate that Indonesian immigrants adopt more sustainable waste behavior after moving to Japan. The improvement in behavior across all three variables (B1, B2, and B3) indicates that formal regulations in Japan are more successful in influencing behavior than previous experiences in Indonesia. This highlights the importance of a combination of clear rules, consistent education, and a social environment that encourages participation.

This behavior change is supported by interview finding. Participants P01, P03, and P10 confirmed that they did not separate waste properly in Indonesia but adapted quickly in Japan because of clear instructions and fear of penalties. This aligns with Tang (2020), who found that environmental immersion in host countries influences migrants' pro-environmental behavior, and Fan et al. (2019), who emphasized the role of strict regulations in shaping individual Practice.

However, although it is not found in the interview, the relatively high number of "Ties" (around 20–30% of total respondents) across all three pairs of variables also indicates that not everyone changes—suggesting that while the system is a significant influence, individual factors such as attitudes, understanding, and language barriers remain relevant. The study by Tram (2021) may have similarity in their case, which he found there were no statististical differences between Vietnamese immigrants in New Zealand and Vietnamese live in Vietnam in the terms of

environmental concern and behavior. The interview failed to capture participants who have no changes in their daily waste behavior.

Since most respondents improved their behavior after living in Japan, their experiences can be used as a basis for learning to improve the waste management system and culture in Indonesia. This finding is supported by some studies about immigrants' pro-environmental behavior such as a study of immigrant's environmental values (Lovelock, Jellum, Thompson, & Lovelock, 2013). They revealed there was no significant differences in the environmental value between immigrants and native-born New Zealanders, which means either assimilation or acculturation of their value from the natives into immigrants.

7.2 Relevance of TPB Findings to Literature Studies and Interview Finding

The SEM results using the extended Theory of Planned Behavior model revealed the following:

- **Perceived Behavioral Control (PBC)** significantly influences both intention and actual behavior.
- **Behavioral Intention** significantly influenced waste behavior.
- **Attitude** significantly influence waste intention.
- **System trust** had a weaker, but still significant, effect on intention.
- **Subjective norms**, **rules**, and **past habits** were not statistically significant.

These results highlight that behavioral change is driven more by personal capability and intention than by external social pressure or past habits. The Theory of Planned Behavior (TPB) which shows that attitude and perceived behavioral control (PBC) play an important role in influencing immigrants' intention to separate waste, but subjective norms do not have a significant effect, is consistent with several previous studies, but also contradicts several other studies. The new factor of system trust which comes with weak effect but still significant on intention is also found in other studies.

Support for Findings (Attitude and PBC Dominant)

As the primary factors of TPB, the significant influence from attitude and perceived behavioral control to intention is certain. These findings are supported by interview results. All participants expressed strong positive attitudes toward waste sorting, often describing it as essential for cleanliness and health. P04, P05, and P09 explicitly linked their waste separation

motivations to moral responsibility. For PBC, while some respondents found the system easy to follow, others mentioned difficulties, such as unclear brochures, too many categories, and language barriers. P01, P02, P04, and P10 reported confusion owing to Japanese-only instructions and overly detailed separation categories. Santoso and Farizal (2019) and Niha et al. (2022) supports this finding since they also found both major factors are significant in influencing Indonesian waste behavior in Indonesia.

However, in immigrant's context, some found attitude also significant because immigrants have their own environmental value that they bring from home country. This finding is supported by research by Kim & Moon (2012), which emphasized the importance of environmental values as a reflection of attitudes in shaping the pro-environmental behavior of Korean immigrants in the US. They showed that although immigrants were aware of environmental risks, this did not automatically influence their behavior. Instead, personal values and beliefs about the environment were more motivating for actions such as waste separation and reducing consumption. Furthermore, research by MacGregor et al. (2019) showed that Somali immigrants in the UK engaged in sustainable practice not because of social pressure, but because of cultural values and previous experiences in their home country—reflecting internalized attitudes and perceived control based on a background of resource scarcity.

In Indonesian immigrant case, before coming to Japan, the environmental value is ambiguous due to cultural practice that usually happen to produce more waste than needed. Since the attitude in Japan are relatively high, Indonesian may reflect on their attitudes and intents to do waste separation to maintain the new environment they live in.

Contradictions in Subjective Norm

Conversely, the insignificance of subjective norm in the TPB model contradicts several studies, such as Barr et al. (2001) and Thomas & Sharp (2013) (in Knickmeyer, 2019), who stated that social pressure, influence from family or neighbors, and local community expectations can be powerful drivers of environmental behavior. It also diverges from several Indonesian-based TPB studies, where subjective norms are significant, particularly in community-based systems such as waste banks (Ulhasanah and Goto, 2018; Soesanto et al., 2021).

In other studies, this finding is supported by Santoso and Farizal (2019) that subjective norms have no significant effect on either waste intention or behavior in the most populated

Indonesian cities. The insignificant role of subjective norms may reflect respondents' experiences as immigrants who lack strong local community networks. Moreover, interviews revealed that many immigrants do not feel they belong to a community that supports waste separation. Instead, they feel supported from the environment they live in such as neighborhood, friends, or family. Participants P01, P02, and P04 mentioned that they rarely interacted with neighbors and received no guidance from others in waste sorting. This indicates that social norms are not formed due to weak social cohesion and minimal community participation.

Qualitative interviews confirmed that while Japanese neighbors followed rules, active encouragement or guidance from the community was rare. It is further supported by Uhlas (2019), who explained that communication regarding waste separating to new immigrants in Sweden was uneven, resulting in the failure to form collective social norms within the immigrant community.

The Absence of The Influence of Rules and Past Habit on Waste Separating Intention in Rule Strict Country

Rules and past habit were found to be insignificant in this model. This finding is unique, considering that some participants (P01, P08) stated that compliance with regulations in Japan is worthy of praise. This contradicts the findings of Ulhasanah and Goto (2018), who stated rules as the highest predictors in encouraging waste behavior, and Tang (2020), who found rules to be significant in the case of immigrants.

One theory that supports this finding is Cultural Tightness-Looseness Theory by Gelfand, et al., (2011). This theory distinguishes cultures based on the extent to which social norms are tightly or loosely enforced. Countries like Japan and Germany are considered to have "tight" cultures, where violations of norms—including waste management—can result in social and even legal sanctions. Meanwhile, many immigrants' countries of origin such as Indonesia may come from "loose" cultures with more flexible norms. When immigrants from loose cultures come to tight cultures, they may experience cultural dissonance in terms of adherence to rules, especially if there is no socialization or community support. This suggests that the mere existence of rules is not sufficient to drive changes in intention, especially when these rules are not understood or internally accepted by individuals.

Compliance with waste management is also influenced by informal social sanctions, such as supervision by neighbors or the community. Elinor Ostrom (1990) , in theory of collective action,

explains that the successful management of shared resources (including waste) depends heavily on community-based monitoring systems and social sanctions, not just formal regulations. Therefore, if immigrant communities do not have strong community structures or access to local communities, these social pressures and collective norms will be ineffective, weakening compliance with waste management regulations.

Conversely, trust in the waste management system (system trust) has been shown to positively influence intention. When individuals believe that the system works effectively and transparently, they feel that their participation will yield tangible results. This is in line with a study by Hu et al. (2021) in Japan, which stated that although international students understood the separation rules, they were not fully convinced of the system's effectiveness, and therefore did not always behave as expected. It was also supported by all interview participants that they believed the waste management system works in Japan, even though some of them do not put 100% trust.

The last factor, the lack of effect of past habits may indicate that immigrants' adaptation to Japan's waste management rules and environment is rapid and continuous. All participants also expressed discomfort when they saw people not properly separating their waste. This indicates that new habits have formed, replacing the pre-migration habit of careless waste separation.

7.3 Theoretical and Practical Implications

From a theoretical standpoint, the findings suggest that TPB alone may be insufficient to explain changes in immigrant behavior. The absence of significant effects for social norms, rules, and past habit indicates the need to incorporate elements of acculturation (Berry, 1997) and knowledge transfer models (Argote & Ingram, 2000). This leads to the proposition of a Hybrid Knowledge Transfer Model, in which behavioral changes occur through:

- Environmental immersion (adapting to rules and systems through exposure),
- Observation-based learning, and
- Personal motivation is rooted in perceived behavioral control.

From a practical perspective, the Japanese system demonstrates the power of structured environments to foster behavioral change. For Indonesia, this suggests that improving infrastructure, rule clarity, and enforcement could lead to more sustainable waste behavior, even without strong community engagement.

7.4 Summary

The discussion reveals that Indonesian immigrants in Japan significantly improve their waste separation behavior due to environmental and institutional factors. Perceived behavioral control was the most influential factor, supported by strong behavioral intention. While attitude contributes, subjective norms and system-level variables appear to be less influential in immigrant contexts. These findings support the development of a hybrid theoretical framework that combines TPB with acculturation and informal knowledge transfer theories.

VIII CONCLUSION

8.1 Summary

From 1950, 8.3 billion metric tons of plastics were produced, but only 9% of them has been recycled (National Geographic, 2018). Driven by open dumping, it led to pressing global waste crisis. In Indonesia case, the problem is only 60% of overall waste can be carried by government to the final disposal, coupled with the operational challenges faced by waste banks in Indonesia. Despite their potential, many waste banks fail due to low participation and improper waste separating at the community level. While Indonesia faces challenges, Japan is renowned for its strict and efficient waste separation systems. Indonesian immigrants may encounter environment that influences their waste behavior. By learning from these behavioral shifts, the study seeks to understand the waste separation behavior of Indonesian immigrants in Japan, with an emphasis on understanding their practice through the lens of the Theory of Planned Behavior (TPB).

The main goal is to analyze what factors influence waste separation behavior among Indonesian immigrants in Japan using mix method approach by: testing the TPB components (Attitude, Subjective Norm, Perceived Behavioral Control) and an additional factor such as Rules, Trust in the System, and Past habit through a quantitative survey, and conducting qualitative interviews to explore deeper sociocultural explanations behind the behavior.

In the quantitative phase, a structured questionnaire was distributed among Indonesian immigrants in Japan. Analysis used Structural Equation Modeling (SEM) and Wilcoxon Signed-Rank Test to compare behavioral changes before and after migration. After analysis, qualitative phase began with in-depth interviews with selected respondents to capture challenges and adaptation processes. The results were then compared with current literature on immigrant environmental behavior and cross-cultural waste Practice.

From the quantitative results, it was found that:

- Attitude and Perceived Behavioral Control (PBC) significantly influence intention.
- Subjective Norm, Rules, was not a significant predictor on intention
- Past Habit was not a significant predictor on behavior.
- System trust was significant to intention.
- Perceived Behavioral Control (PBC) and intention are significant to behavior

Wilcoxon test showed that behavior changes positively after migration, especially in separating food waste and recyclable items, due to stricter Japanese regulations. From the qualitative analysis, it was discovered that many immigrants lack proper community support or clear guidance on how to separate waste in Japan. Cultural values from Indonesia are mixed—some respondents brought environmentally conscious values, but many were unfamiliar with strict separation rules. The findings align partially with the TPB, especially on attitude and perceived behavioral control, but contradict the typical role of subjective norms in influencing intention. The lack of visible social norms and rules reinforcement in immigrant communities likely explains this discrepancy. Cultural gaps, language barriers, and limited access to local information reduce immigrants' ability to internalize host country Practice.

This suggests the TPB needs to be contextually extended when applied to immigrant populations, by integrating cultural adaptation theory, acculturation models, and environmental trust frameworks. Comparison with similar studies in the UK, US, and New Zealand further validated this approach. Several key lessons have emerged from this study.

- Environmental design can drive behavioral changes. Japan's waste management system uses clear instructions, visual guides, and enforced collection rules, which implicitly educate and shape daily behavior.
- Social norms are context-dependent. While they are strong in Japan, they are largely absent within Indonesian immigrant communities, suggesting that local enforcement and community engagement are necessary for social norms to function.
- Behavior can change without formal education or rewards/incentives, especially when people are immersed in an environment where the expected behavior is visible and consistent.

8.2 Research Contribution

As mentioned in section 7.3, this study has several theoretical and practical implications.

For policy:

Serves as study which identified main factors in immigrants waste behavior, utilizing the factors and suggestion from the immigrants as a basis for making public policy is something that is possible to do.

- Japan's system can serve as a model for embedding behavioral changes through system design. However, as the number of immigrants is increasing in Japan, providing necessary communication media, such as multilanguage brochures, can help immigrants to follow waste procedures more easily.
- As many participants mentioned that Indonesia does not have a proper waste management system, it may consider integrating environmental cues and public infrastructure improvements rather than relying only on campaigns. As perceived behavior control accounts for the majority of intention and behavior, creating an easy-to-separate perception and environment is the most important aspect.

For theory:

As an extended version of TPB still cannot explain behavioral change alone, especially in the context of immigrants, the TPB may need extension or combination from other theories; for example, acculturation theory and knowledge transfer mechanisms provide complementary insight into immigrants' perspectives.

For practice:

Based on the findings from Japan, several key points can be adopted in the context of waste management in Indonesia:

1. Focus on behavioral control (PBC):

   Japan provides an accessible waste separation procedure. Indonesian government needs to provide easily accessible and understandable guidelines, including visualization of waste categories, labeling, and digital applications.
2. Education on the environmental and economic impacts of waste separating needs to be strengthened in the formal education system and social media.
3. Even though rules are formed to express the need for waste separation, and some influencers have expressed pro-environmental behavior, the intentions must be facilitated into action. Indonesians must provide systems and infrastructure in place to enable people to realize their intentions, such as separating stations at home, in neighborhood associations (RTs), and in public places.

8.3 Research Limitations and Future Directions

While this study provides valuable insights, it is not without limitations. Some research limitations that can be addressed to improve the quality of future research are as follows.

1. Sampling Bias

   The respondents were recruited mostly from online immigrant groups or university networks, which may overrepresent younger, educated, or more digitally literate individuals. This may not reflect the broader Indonesian immigrant population in Japan, especially older, low-income, or undocumented migrants. This study covers 40 of the 47 prefectures in Japan. As cities in Japan have different rules, perceptions of waste separation standards may be different.

2. Self-Reporting Bias

   The use of self-reported data in the survey may introduce social desirability bias—participants may have over-reported environmentally positive behaviors.

3. Cultural Blind Spots

   The questionnaire and interview design were framed from the researcher's own cultural lens (Indonesian–Japanese context). It may overlook deeper nuances, particularly in migrants with multicultural backgrounds or those who lived in third countries before Japan.

4. Limited Generalizability

   The findings are specific to Indonesian immigrants in Japan and may not be generalizable to other immigrant groups with different cultural or religious values.

5. Language Constraints

   Some respondents had difficulty understanding either the English or academic Indonesian terms used in the questionnaire, despite translation efforts. This may affect the reliability of their responses.

6. Short Duration of Residency:

   Most respondents had been in Japan for fewer than five years. Longer-term immigrants may exhibit different levels of acculturation and behavioral adaptation that this study did not capture.

To address these limitation, future work could track new immigrants and include broader age groups and regions to strengthen generalizability, including method to gain knowledge without heavy relying on self-reporting studies.

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Appendix 1 Framework Matrix Analysis

Participant ID	Attitude	Subjective Norm	PBC	System Trust	Intention	Behavior	Relevant Quote
P01	Positive	Implicitly positive.	Difficult due to language barrier	Positive	Positive	Active after coming to Japan	"Discipline and law adherence in Japan is good, especially for schedule and rules."
P02	Positive. Believe that system help.	Friends and neighborhood support it, but no Indonesian community.	Difficult due to categories number. Confused if the waste not in the brochure.	Positive due to clean air and environment in Japan.	Positive	Not active in Java, active in Bali and Japan.	"Electronic or cosmetics waste type are difficult to understand"
P03	Positive. Now annoyed if someone littering.	Ever given input on how to dispose of waste.	Nonburnable waste and waste code are hard to understand	80% believe that system works.	Positive, but Japan waste system is hard to understand	Positive after coming to Japan	"Waste separation system make people think twice before buying"
P04	Positive since it is eco-green.	Positive	Challenges as too much waste categories	Overall positive but not for big waste such as wardrobe	Positive	Active after coming to Japan	"Import products are hard to separate since they have no label"

Participant ID	Attitude	Subjective Norm	PBC	System Trust	Intention	Behavior	Relevant Quote
P05	Positive. it's important to recycle	Feel support from neighborhood but not community	Positive. Brochure is easy to understand	Positive	Positive	Active after coming to Japan.	"Electronic waste is a challenge"
P06	Positive	Positive.	Positive	Positive	Positive	Active after coming to Japan	"Community need sanction to people who disobey the rules"
P07	Positive	Positive. There is reminder if gathering happened.	Positive	Positive. Especially in Toyohashi, there is onsen from incinerator.	Positive	Active after coming to Japan	"In Indonesia, the division of waste types is not as detailed as in Japan."
P08	Positive	Positive. Husband supports.	Positive	Positive after seeing the collection point.	Positive	Active after coming to Japan	"Calendar and brochure help after husband."
P09	Positive since by recycling can help the limited source	Working environment helps. Ever received input because there was a	Positive. But the information and access are limited.	Positive. More confident because Japan is indeed very clean.	Positive	Knew before coming to Japan, but active only	"I'm quite confident in Japan's system, considering the upstream process,

Participant ID	Attitude	Subjective Norm	PBC	System Trust	Intention	Behavior	Relevant Quote
		violation from foreigner in supermarket.				after arrival.	although I've never seen it downstream."
P10	Positive	Ever get reprimanded as throwing waste in wrong day.	Positive but hard to understand as too much detail.	70% believe. Hard to say why it is not 100%.	Positive	Active after coming to Japan	"The hard part in Japan is in cleaning the waste before throwing."

Appendix 2 Suggestion from Participants

Participant ID	Relevant Note and Suggestion
P01	In Indonesia, even though there was wastebin, they still littering. For challenge, they need time to understand the waste category and it only written in Japanese. Suggestion: (1) to create guidance in Indonesian language with example and need community to help people in understanding the waste separation rules. (2) To educate people in Indonesia how important waste management is.
P02	The main difference in Indonesia is no system where plastics packaging needs to be clean before throwing it to waste bin. Suggestion: (1) Need education into why the waste need to be separated/sorted which can instill motivation (2) In Indonesia, need to increase waste management budget since open dumping is still used, and the facilities are lacking for household. Second, it is to increase system transparency so societies can monitor the waste flow and increase the motivation.
P03	Suggestion: (1) After coming to Japan, they always mention that waste system in Japan is complicated so do not pile up shopping waste (2) Use media social to spread system. Show the environmental damage to make people ashamed of litter
P04	Suggestion: Need *seikatsu* orientation since arrival and for hope for awareness in Indonesia
P05	Suggestion: Provide waste facilities in public spaces in Indonesia
P06	Suggestion: Imposing strict sanctions on people who litter in Indonesia
P07	Suggestion: (1) Share flyer in Indonesian, or socialization in communities (2) In Indonesia, need to have simple waste separation system from villages, to build habit so villages can manage their own waste bank that profitable for each.

P08	In Indonesia, the waste is still mixed. Suggestion: (1) For Japan, try to separate waste starts from 2 categories: food waste and dry waste. (2) For Indonesia, socialization is needed to make societies aware of waste.
P09	Suggestion to create examples of direct action include providing information about recycling cardboard and getting points at big supermarkets, and other benefits that can be obtained by helping to protect the environment by separating waste.
P10	Difference: Indonesia there is no waste management system Suggestion: (3) For Japan, reduce the use of plastics packaging since not all are recycled. (4) For Indonesia, provide structured waste management system such as modern waste truck, collection point, and other facilities.