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Determinants of Household Participation in Solid Waste Segregation: A case study in Depok, Indonesia

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# Determinants of Household Participation in Waste Segregation: A case study in Depok, Indonesia

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# Summary

Solid waste management practice is a matter of concern for public health and environmental protection and has become a major challenge in most developing countries. Improper waste management can bear adverse consequences on public health, environment, and natural resources. Many governments have been implemented several strategy in dealing with solid waste in a sustainable way, and recycling is one of them. However, a recycling program can only be successful if the community support and actively participate in it, and as the largest stakeholder, households have important role especially in waste source segregation. Therefore, it can be argued that households' participation, especially in source segregation, is essential in the successfulness of recycling activity.

Depok have been implemented recycling programme to deal with solid waste problem since 2006. A source separation from the source is introduced in this recycling programme. Therefore, households participation is essential. However, recent survey held in 2011 and 2015 have showed low household participation and there are only 1% increase of household participation in waste segregation from 32% in 2011 into 33% in 2015 (Health Agency City of Depok, 2015).

In general, many researches have focusing to enhance in studying household participation in waste recycling programme with the objectives to enhance their participation. However, most of the researches that have been done were based on the psychological perspective. Recent studies have shown that situational factors need to be incorporated, as recycling also relies on practical issues rather than only on psychological motivations. Accordingly, this research incorporated both approaches that include psychological and situational factors to understand household participation in waste source segregation.

This research aimed to understand the influence of psychological and situational factors on household participation in waste source segregation within Depok Waste Recycling Programme. By doing so, we hope to find the conditions and kind of interventions which may enhance cooperation for the implementation of Depok recycling program.

Survey is chosen as the strategy of this research. Questionnaire, interview, and field observation is used as research instruments. A total of 176 respondents for the questionnaire was obtained. As analysis tools, either independent T-test or Chi-square test was used in order to differentiate household participation in waste segregation. This research also used binary logistic to analysis which psychological and situational factors influence household participation. Binary logistic analysis was used because the dependent variable was designed in dichotomous variable based on the household self-reporting response on waste segregation practice.

The research finds that household participation could be distinguished by psychological and situational factor. In term of psychological factor, household participation can be distinguished by their attitude towards waste segregation, subjective norms, and perceived easiness. In term of situational factor, both groups can be distinguished by their perception regarding facility quality, source of information regarding recycling programme, concrete knowledge about the type of recyclables material, and the importance of monetary incentives. Additionally, in term of demographic attributes, both groups can be distinguished by family income, and level of education between the two groups. Further finding, only external subjective norms and perceived capability, number of source information regarding recycling

programme, knowledge of waste type, and the presence of children under ten years old, significantly influences household participation in waste source segregation.

# Keywords

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# Abbreviations

| | |
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| IHS | Institute for Housing and Urban Development |
| ISWM | Integrated and Sustainable Waste Management |
| RT | Rukun Tetangga. A neighbourhood association consists of several numbers of households. |
| RW | Rukun Warga. A community association which consist of several neighbourhood association or RT. |
| SWPU | Solid Waste Processing Unit |
| CAD | Cleaning Agency of Depok |
| TPB | Theory of Planned Behaviour |
| ISB | Model of Infrastructure-Service-Behaviour |
| PCB | Perceived Behavioural Control |
| OMP | Organic Meeting Point, a secondary storage/bin for organic waste |
| HdSO | Households do not Segregate Waste at Source |
| HSO | Household Segregate Waste at Source |

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# Chapter 1: Introduction

## 1.1. Background

Solid waste management practice is a matter of concern for public health and environmental protection and has become a major challenge in most developing countries. Compared to high-income countries, the amount of solid waste per capita produced by urban residents of developing countries is less, but the capacity of the developing countries to collect, process, dispose and reuse it in a cost-effective way is limited (Khajuria, Yamamoto, et al., , 2008). The collection rates in urban areas in developing countries are often in a range of 10-70% (UN-Habitat, 2008). Moreover, the type of waste disposal is open and illegal dumping which lack of proper environmental pollution control and monitoring (Henry, Yongsheng, et al., 2006, UN-Habitat, 2008, Shekdar, 2009, Rajput, Prasad, et al., 2009). Furthermore, insufficient collection and disposal system in developing countries contribute to the deterioration of the urban environment and lead to a health hazard to urban populations, uncollected solid waste is burned in the yard, or dumped in waterways causes flooding and subsequent spread of water-borne diseases. As the consequence, UN-Habitat (2008) stated that the diarrhoea rates and prevalence of acute respiratory infections are twice and six times higher respectively in cooperation between areas in the same cities with a regular waste collection.

Furthermore, population growth, rapid development, rises on community living standards, and urbanization lead to increase in the volume of generated solid waste. The World Bank (2012) reported that there were only 13% of the world population living in the urban areas in 1900 and produced less than 300,000 tonnes waste per day, while in 2000, it increased by 49% and produced more than 3 million tonnes waste per day, and predicted to increase up to 55% by 2025 and produce 6 million tonnes waste per day. A recent report from United Nations (2014) showed that the continuing urbanization and population growth would increase urban population up to 66% by 2050, and nearly 90% of the increase will concentrate in Asia and Africa, with Indonesia being the fourth biggest contributor to the proliferate of urban population by 2050. This development poses a substantial implication, as solid waste is mostly an urban problem and as urbanization increases, solid waste generation accelerates (Hoornweg and Bhada-Tata, 2012).

The above condition also reflected of what is happening in Indonesia. By 2035, Indonesia's population is predicted to grow from 250 million to 305 million, and two third of them will live in urban areas compared to the current 50% (National Statistics Agency, the Republic of Indonesia, 2013). Increasing urbanization poses a challenge for the solid waste management in Indonesia that, despite being given more attention from city managers is still in a poor state (ADB, 2013). A survey in 2013 showed that the municipal services only covered 24,9% household solid waste, the remaining 75,1%, either burned individually (50,1%), disposed illegally (20,1%), or buried in the ground (3,9%), and only in small amounts being composted (0,9%) (Ministry of Health - the Republic of Indonesia, 2013). Additionally, most of the local government solid waste management is still practiced conventionally by transporting waste directly to the disposal site. Moreover, 99% of disposal site in Indonesia operated as open dumping (Coordinating Ministry for Economic Affairs, the Republic of Indonesia, 2013). On the other hand, there are several problems related to environmental issues and public health arising from inadequate solid waste management in Indonesia. Among others are high level of plastic waste generation and floods caused by illegal waste disposal activity. Plastic waste share as the largest amount of non-organic material in Indonesia (14% of total waste

production) and most of the plastic waste is non-biodegradable (2008) which can lead to soil pollution. Waste dumped in unauthorized areas frequently end up in waterways, causing floods during the rainy season, as well as polluting waterways and coastal waters (Pasang, Moore, et al., 2007). Moreover, open dumping operated disposal sites also pose safety issues and health problems, for example, a case of a landslide at Bandung disposal site in February 2005, which killed at least 40 people, and self-combustion occurred at Bantar Gebang disposal site in 1999 causing inhabitants living around the disposal site suffered from haze and odour.

Besides low service coverage, as mentioned before, limited final disposal site also becomes a problem that needs to be addressed by the local government in Indonesia due to difficulties to find a new disposal site for replacement or improvement because of public rejection, land availability and land price (Kardono, 2007). Regarding this, Farrelly and Tucker (2014) argue that the most suitable and economical practice to cope with these problems be to minimize waste generation. Reuse and recycling likely to be preferable methods when considering waste composition and financial constraint due to the high cost of other option, such as energy recovery methods (Chivakidakarn, 2008). Additionally, source segregation is a useful method for waste minimization, recycling enhancement and disposal efficiency improvement (Zhang, Che, et al., 2012). Moreover, a sustainable solid waste management should minimize disposal through open dumping and should try to maximize recovery options through segregation at the source and the promotion of reuse, recycle, compost of as many waste materials as possible before incineration or disposal (Klundert and Anschütz, 2001). The National Government has incorporated a change of paradigm into waste minimization as part of the mandate of Law No. 18/2008 on Waste Management in the form of solid waste medium-term plan for the period of 2015-2019. This medium-term plan has set a 20% target of the solid waste reduction[1] in 2019 through 3R (reduce, reuse, recycle) programs (Ministry of National Planning, the Republic of Indonesia, 2015). Nevertheless, waste minimization and recycling rate in Indonesia is still low, where various recycling process only reduce 0,80% of waste generated (Coordinating Ministry for Economic Affairs, the Republic of Indonesia, 2013).

Communities generally perceive that solid waste is the sole duty and responsibility of local authorities, and they are not obliged to contribute (Guerrero, Maas, et al., 2013). However, as the largest stakeholder in waste management, households play important roles in waste management such as engaging in separation at source, using more re-use of waste materials within the households and participating in activities to keep the environment clean (Joseph, 2006). Involving households by understanding their concerns, preferences, knowledge, and behaviour are essential for the local government, in parallel with the effort to provide municipal solid waste infrastructure, to achieve integrated municipal solid waste management (Chung and Lo, 2004). Keramitsoglou and Tsagarakis (2013) pointed out that the success of household recycling programs is strongly affected by their engagement in the source segregation process. Accordingly, household cooperation in waste separation plays a substantial role in the successfulness of recycling activities (Dai, Gordon, et al., 2015).

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[1] The target set to reduce 20% from waste generation in 2019, which predicted in amount of 68 million ton per year.

## 1.2.    Depok Waste Recycling Programme

Depok is one of a major city in West Java Province, also part of Jakarta Metropolitan Area (JMA). As part of JMA, development rate in Depok is high which lead to high population growth. During 2005-2013, population growth rate in Depok is 4,16%, second largest in West Java Province (West Java Province Statistical Agency, 2013). Like other cities in Indonesia, Depok also faces problems related to high population growth, among others, solid waste management. Based on Depok Sanitation Whitepaper Document[2] (2012), 1.47 million people in Depok generated waste of 4.265 m3/day, 63.43% comes from residential areas, 22.01% from markets, 8.91% from shops and services, 5.64% from public facilities and industrial areas, while the Government of Depok is only able to cover 45.81% of total solid waste generated. Furthermore, the existing disposal site is already running at full capacity, as the lifetime was planned until 2011. The replacement disposal site is located outside Depok and will operate in 2017, managed by the Provincial Government of West Java as a regional disposal site. Depok once had been given a predicate by the Ministry of Environment in 2005 as Indonesia's dirtiest city[3], due to poor solid waste management. The has rejected Government of Depok efforts to extend the existing disposal site capacity because of environmental pollution and bad odour (Dewi, 2008). High waste generation and limited disposal site capacity have encouraged the government of Depok to implement a waste minimization strategy since 2006, and one of the efforts conducted through The Waste Recycling Programme. The Government of Depok expected this program to reduce reliance on existing disposal site gradually by processing garbage directly at the source.

The Waste Recycling Programme in Depok was launched in 2006 and implemented with the principle of 4R-P, reduce, reuse, recycle, replace, and participation. During 2006 until 2012, The Government of Depok has constructed 37 Solid Waste Processing Units (SWPU) at the sub-district level to reduce waste by turning organic waste into compost. Initially, the SWPU was designed to accept mix waste, but longer time and more effort to segregate mix waste had resulted the SWPU could not deal with the incoming waste stream, trash piling up around the SWPU generating bad odour and lead to community rejection (Grahanida, 2012). Incorporation of the waste bank[4] since 2012 gradually changed the SWPU operational procedure. The SWPU only accepts organic waste, while the waste bank at the community level assigned to accept non-organic material. Until 2016, there were 32 units Organic SWPU and 482 unit waste banks throughout Depok.

As the system changed, each household within the Organic SWPU service coverage area is required to segregate their waste into three categories, organic, non-organic and residue. Segregated waste placed in separate storage within the house premises. Particularly for the organic waste, each household needs to carry it either individually or organized through a local community organization (RW/RT[5]) into certain collecting points which will be collected by municipal workers at a certain frequency and carried to the Organic SWPU for further processing into compost. On the other hand, the waste bank will recycle the non-

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[2]   This document gives overview on sanitation condition of respective municipality.
[3]   The Ministry of Environment annually awarded Adipura Trophies to cities whose success in environmental management and maintaining city cleanliness in certain cathegory. Depok had been given the lowest score in 2005 in big city cathegory.
[4]   Waste Bank was initiated by local community. The waste bank concept is to collect and recycle non-organic waste, manage in a way of conventional bank and in return customers get money from their waste deposit.
[5]   RT (Rukun Tetangga) is a neighbourhood associations consists of several numbers of households, while RW (Rukun Warga) is a community associations which consist of several RT. The number of households within one RT, and the number of RT within one RW is vary depend on the location/city.

organic waste. Eventually, only residual waste (un-recyclables material such as baby diapers) is expected to be carried to the final disposal site. Regarding this, an awareness campaign, named "Sorting Movement", has been started since 2012 as an effort to change household behaviour in dealing with their waste, especially to segregate waste at source.

The recycling program being implemented by The Government of Depok needs the active participation of the community due to the waste segregating process from the source (Municipal Planning Agency, Government of Depok, 2012). Consequently, households' participation in source segregation becomes an essential part of this program.

## 1.3.    Problem Statement

In general, public authorities are accountable for promoting the solid waste management system and encouraging the community to participate. However, in the end, it is the community who decide whether to participate or not, because they are the active agents of the system. Therefore, to enhance community's participation, it is important to recognize their cultural/religious beliefs and practice, occupation, income and expenditure patterns, access to infrastructure service, gender and age, which in turn will influence their behaviour (Joseph, 2006).

Some scholars have pointed out that household's involvement is essential in the successfulness of recycling activity (Keramitsoglou and Tsagarakis, 2013, Dai, Gordon, et al., 2015). For example, several different systems with high efficiency for organic waste treatment have been applied in countries such as The Netherlands, Austria, Sweden, Germany and Spain, and all these systems have in common is that the efficiency reduced tremendously without the participation of households in the initial act of source-segregating (Bernstad, 2014). Moreover, the total amount and the quality of material recycled is influenced by the degree of source segregation to recover recyclables material from mixed waste (Hoornweg and Bhada-Tata, 2012). In Depok case, as the SWPU still accepted mix waste, the workload in processing organic waste into compost becoming increasingly onerous due to the fact the existing workforce, must perform not only organic waste composting but also waste segregation. As the consequence, only 40,85 m3/day organic waste has been reduced (turn into compost) out of 213,5 m3/day potential composting capacity through the existing SWPU (Sahwan, 2012). In the other hand, longer time and more effort to segregate mix waste had resulted the SWPU could not deal with the incoming waste stream, trash piling up around the SWPU generating bad odour and lead to community rejection (Grahanida, 2012).

As the system gradually changed, followed by some efforts to increase household's participation in the Depok Waste Recycling Programme through, for example, awareness campaigns, community cleanliness competition, freeing solid waste service charges[6] for residential categories, the Government of Depok would expect an increase in households participation in waste source segregation. However, an Environmental Health Risk Assessment (see figure 1.1) survey held in 2011 and 2015 have revealed insignificant increase on household participation in waste source segregation.

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[6]    The government of Depok is by freeing solid waste service charges for residential categories since January 2015, based on local regulation No. 5/2014 about Waste Management. This service charge elimination is conducted with the aim to obligate the community to segregate their waste at source and those who do not segregate, will be excluded from formal garbage collection services.
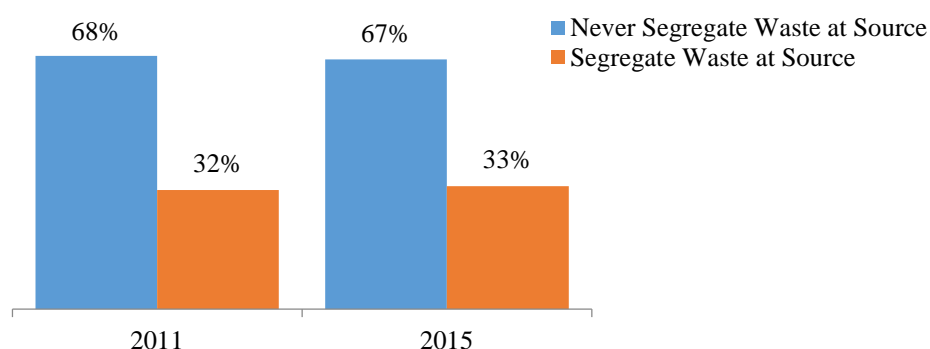
**Chart 1 Household Waste Segregation Practice (Health Agency City of Depok, 2015)**

In the other hand, the decision to participate in waste segregation has been addressed in various studies. These studies mainly based on the psychological point of view which suggests that it is possible to predict actual waste separation behaviour based on attitude, subjective norm and perceived behavioural control (Tonglet, Phillips, et al., 2004). However, Ghani (2013) argues that waste segregation demand substantial efforts as households need to sort, prepare and store the waste material. Consequently, the decision to segregate waste is likely to be complex and need to take several factors into consideration. Timlett (2008) argues that waste source segregation participation can be influenced not only by psychological factors, but also situational factors such as physical infrastructure, service provision, incentives, information and knowledge, and demographics attributes. Therefore, given the low household participation, it is important to understand which variables (psychological and situational) influence household to participate in waste source segregation.

## 1.4.    Research Objective

Based on the problem statement above, the objective of this research, therefore, is to understand the influence of psychological and situational factors on household participation in waste source segregation within Depok Waste Recycling Programme. By doing so, we can find the conditions and kind of interventions which may enhance cooperation for the implementation of Depok recycling program.

## 1.5.    Research Question

Main research question: "To what extent do psychological and situational factors influence household participation in waste segregation in Depok waste recycling programme?"

Sub research question:

1.   What is the Depok recycling programme characteristics?
2.   How do psychological factors influence household participation in waste segregation?
3.   How do situational factors influence household participation in waste segregation?

## 1.6.    Significance of the Study

Recycling is a key to achieving sustainable waste management in which aiming, over the long-term, reductions in municipal solid waste. As mentioned earlier, Depok recycling program needs active participation from the households. Hence, a better understanding of

factor influencing household participation in source segregation would improve the performance of the system, which at the end, aimed at reducing the reliance of landfilling. This research will also provide inputs to local government in designing a variety of strategies based on these factors, which aimed to increase participation rate. Furthermore, this research also relevant as the government of Depok targeting to reduce 20% of generated waste in 2021 through waste recycling program in its Medium Term Development Plan (2015-2021) from the baseline condition of 9,7% in 2015 (Municipal Planning Agency, Government of Depok, 2015)

On the other hand, Depok recycling program gives an interesting case, since it was designed for all type of household waste, and in the same time required household participation in source segregation in order to succeed. While the recycling program in another city, although involved household participation to segregate particular type of waste at source, it majority runs on a voluntary basis (i.e., waste bank). On the other hand, the recycling program in some cities were done by built an intermediate treatment facility to accept mix waste from the household. This facility process the waste by segregating it, and only unusable material goes to the disposal site. However, many of this kind of facility fail because they rely on extracting materials from mixed waste (Liebenberg, 2007). Furthermore, Depok has incorporated both methods, the waste bank, and the treatment facility. The difference is, as far as researcher knowledge, Depok is the only local government in Indonesia that requires all type of waste need to be segregated at the household level, and this approach has been legalized under their local regulation. Therefore, this research will contribute providing empirical literature on household participation in source segregation within an integrated municipal recycling program. In Addition, this research will also contribute in a pratical way for programme replication in other cities in Indonesia.

## 1.7. Scope and Limitations of the Study

The research focuses on waste segregation in the household level. Therefore, the definition of waste is limited to household waste, which consists of organic waste, non-organic waste, and residual waste. The reason for this is that Depok recycling program only dealing with household waste and household participation is the focus of this research. This research particularly tries to understand the influence of psychological and situational factor on household participation in Depok waste recycling program.

There were several limitations to the quantitative phase of this study. Classification of households participation in waste segregation was based upon self-reported response. Another preferable measure, such as direct observation, was beyond the scope of this research. In the other hand, This research only focused on urban neighbourhood within the coverage of one SWPU due to limitation in data collection time. The available time for data collection was limited to one month, conducted during the fasting month and national holiday of Idul Fitri (one week holiday) which reduced the available time for data collection.

# Chapter 2: Literature Review

## 2.1.    Introduction

This section will review literature related to the recycling program and household waste segregation behaviour. The chapter starts with Integrated and Sustainable Waste Management (ISWM) concept to provide an overview of waste recycling program as part of the waste system element which further explained in the second section. The third section focuses on understanding factors influencing household participation in waste segregation, both from the psychological and situational point of view, as it is playing an important role in the recycling program. Different behaviour models, such as Model of Altruistic Behaviour, the Theory of Planned Behaviour (TPB), and Attitude-Behaviour-Context (ABC) have been widely used to understand the factors that make people recycle. Thus, the Theory of Planned Behaviour (TPB) was chosen for a practical reason as it is the most popular approach in studying recycling behaviour. However, these models are mainly based on the psychological point of view. Given the importance of the situational factor that also influence recycling behaviour, the inclusion of the Infrastructure and Service concept within the Infrastructure Service Behaviour (ISB) Model in this research will add better tools in understanding household recycling behaviour, especially in waste segregation at source. Based on the theories and concepts, this chapter finally builds a conceptual framework that forms the basis for this research.

## 2.2.    Integrated and Sustainable Waste Management (ISWM)

Solid waste management has become a major challenge in many cities, especially in developing countries (Khajuria, Yamamoto, et al., , 2008, UN-Habitat, 2008). Improper waste management can bear adverse consequences on public health, environment, and natural resources (Klundert and Anschütz, 2001). Increasing amounts of solid waste each year makes it difficult to create a solution to the problems it creates (Gómez, Meneses, et al., 2009). In addition, the solution should be economically efficient, environmentally effective, and socially acceptable (Klundert and Anschütz, 2001, Marshall and Farahbakhsh, 2013).

Marshall and Farahbakhsh (2013) pointed out only a few models of the solid waste management that address the interconnectedness of socio-cultural, economic, environmental, and technical spheres. Among others, the introduction of ISWM[7] has shed light by framing and supporting good practice and the inclusion of all stakeholders in planning and decision-making, which acknowledges three important dimensions in waste management; waste system elements, stakeholders, and sustainability aspects (Scheinberg and de Vreede, 2008).

The word 'integrated' in ISWM indicates a variety of activities and actors that operate the system on many levels; it also refers to the linkages between system elements, not only technical but also legal, institutional and economic to be functionally (Scheinberg and de Vreede, 2008). On the other hand, the words "sustainable" refers to two criteria, firstly, relevant and feasible to the local conditions, and secondly, capable of maintaining itself over time without depleting the resources it needs (Klundert and Anschütz, 2001).

Klundert and Anschütz (2001) pointed out that ISWM encourages the development of a waste management that is convenient to the environment, economy and society (sustainability

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[7]    Developed in the mid-1980s by WASTE, a Dutch NGO, and WASTE's South partner organizations.

aspects). Economic affordability requires that the costs of waste management systems be acceptable to the community served. Environmental effectiveness requires that managing waste reduce environmental burdens, regarding both the production of emissions and the consumption of resources, while social acceptability requires that the waste management complies with the needs of the local community, and mirrors the values and priorities of society.

Serve as a foundation of ISWM concept is the waste management hierarchy. The waste management hierarchy is a policy tool on how ISWM concept can be used to determine the form of waste system elements to support sustainability aspects. The hierarchy places the greatest emphasis on strategies and programs 'up the hierarchy' through waste reduction, reuse, recycle and recovery, with treatment and disposal as the least preferred option" (Hoornweg and Bhada-Tata, 2012, UN-Habitat, 2008, Diaz, Savage, et al., 2005). In other words, a sustainable waste management should minimize disposal through open dumping and should try to maximize recovery options through segregation at the source and the promotion of reuse, recycle, compost of as many waste materials as possible prior to incineration or disposal (Klundert and Anschütz, 2001).
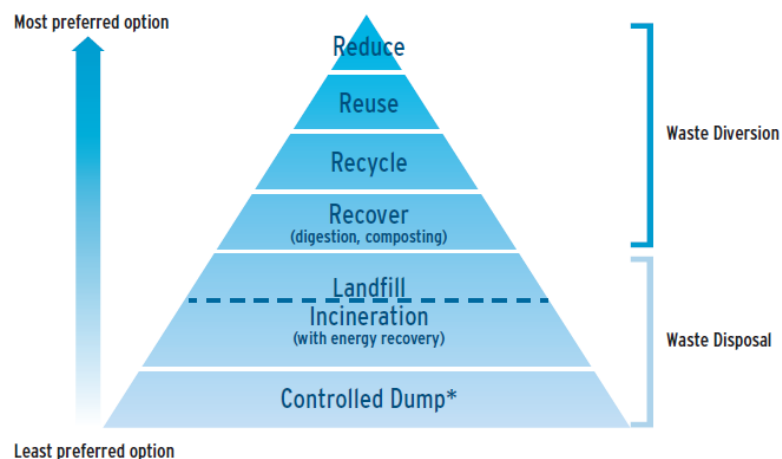


**Figure 1 Waste Management Hierarchy, Source (Hoornweg and Bhada-Tata, 2012)**

To sum up, solid waste is an unavoidable product of civilization. From the days of earliest society, human and animals have used the earth resources to support their existence and to discard their wastes. Consequently, solid waste cannot entirely be removed, but solid waste unfavourable impacts on the environment due to traditional waste management, namely landfilling, can be minimized. There are several technological options, in which potentially more sustainable methods to divert solid waste commonly destined for landfilling, such as energy production through incineration, organic waste composting, and material recovery via recycling. However, given the majority of solid waste in developing countries comprises of organic material, composting is being considered as a method to minimize waste destined for landfilling (Troschinetz and Mihelcic, 2009). In addition, due a costly capital investment, transforming material through recycling is likely to be preferable methods rather than via incineration for energy recovery (Chivakidakarn, 2008, Oliveira and Rosa, 2003).

### 2.3.    Waste Recycling Programme

Morgan (2009) argues that recycling can be seen as a way to recover reusable material to create new products. In some context, composting, especially to produce fertiliser, also can

be considered as part of recycling activity (Larney, Sullivan, et al., 2006). Effective recycling activities are based on capturing remaining value within the material, preparing it for new use and selling it so that they can be transformed or used to make new products (Scheinberg and de Vreede, 2008). Eventually, the sole objective waste recycling programme is to divert resources from landfill and to minimise the amount of residual waste which later on requires treatment or disposal.

There are various types of recycling programs available nowadays. Based on its collection scheme, a common approach, is a drop-off and curbside recycling programme. In a drop-off scheme, the community as the waste producers requires taking their recyclable material in strategically located facilities (such as neighbourhood containers or recycling station), waste collection is provided from this containers to the treatment facility. In a curbside scheme, collection services to collect recyclable material are provided by the municipal authority to the households, at varying frequency throughout the month (i.e. twice a week). Collection is usually done by personnel using specific vehicles to collect household waste in certain containers acceptable by the municipality. Another type of recycling programs which basically using drop-off system is a voluntary recycling initiative. This recycling programme was initiated by a volunteer group which set up a temporary drop-off centre and transport material to a recyclable buyer. A voluntary organisation, such as NGO's, individual or educational institution may play a role to started this initiative. Saphores et al. (2006) pointed out that drop-off recycling scheme is less costly compared to the curbside scheme, as this scheme use less labour and transportation costs because these costs are shifted to the recyclers. Therefore, recycling program based on a drop-off recycling scheme is widely implemented by local governments (Sidique, Lupi, et al., 2010).

In term of the material stream, there are two main recycling flows. The first flow, recyclable materials are segregated at source and collected by collectors, each material types might be collected at the same time or have a different collection schedule. The second flow, materials are segregated and recycled after collection by the municipal authority. Additionally, as long as the materials have economic value, they are likely to be collected by the informal sector either from the source, transfer point or disposal site, as it provides a livelihood opportunity to them (Matter, Dietschi, et al., 2013).

Regarding the informal recycling activity, UN-Habitat (2008) pointed out that in developing countries, this informal recycling contributes to municipal solid waste management by reclaiming materials with economic value from the main waste flow and in turn, save the city 15-20% of its waste management budget by reducing quantities of waste to be collected and disposed. Nevertheless, informal recycling sector is lack recognised for its benefaction to the municipal solid waste management (Matter, Dietschi, et al., 2013). However, this issue is beyond the scope of this research as it more focuses on household participation under municipality recycling programme.

Notwithstanding the types, a recycling program can only be successful if the community support and actively participate in it. However, Keramitsoglou and Tsagarakis (2013) pointed out that municipal authorities traditionally imposed a top-down recycling program without engaging public participation in the decision-making process regarding particular implementation components, such as kind of materials the community willing to recycle, what collection scheme would be more convenient and what financial instrument would result in a sustainable recycling scheme. Although local government is legally responsible for solid waste management, but they cannot work on their own to deliver this responsibility.

Those who do so, are likely to fail. Accordingly, active participation of others stakeholder is essential.

Stakeholders in waste management commonly consist of three categories, which are primary, secondary and external stakeholders (Snel and Ali, 1999). In a waste recycling programme, the primary stakeholders are households which receiving the services and at the same time have a specific role in the programme. The secondary stakeholders are government (municipalities), national/state government departments, CBOs, NGOs, donor agencies, small entrepreneurs and private waste collectors, and waste pickers. They play an intermediary role and may have a significant effect on the programme outcome. The external stakeholders do not directly involve in the waste recycling programme but may have an effect on it, for example, itinerant waste buyers, and middle-men.

As the largest stakeholder in the waste recycling programme, households play important roles such as engaging in segregation at source, storing waste properly and taking waste out for collection by the municipalities or its agents on the designated days (Joseph, 2006). Regarding segregating waste at source, Libenberg (2007) pointed out that segregation at source is the foundation for an effective resource recovery. This author also states that many of recycling facility are likely to fail because they rely on extracting materials from mixed waste. Therefore it can be argued that households involvement, especially in source segregation, is essential in the successfulness of recycling activity.

Unfortunately, most of the households perceive solid waste management as an issue to collect waste, and then take it out of sight, which overlooks the potential of recycling to reduce amounts of waste from waste generation to recovery and final safe disposal or treatment (Matter, Dietschi, et al., 2013). Moreover, Joseph (2006) argues that household awareness and participation in waste reduction, segregation and recycling needs to be enhanced. Promoting waste segregation can be done through a mixture of several measures, among others, service provision, knowledge improvement, financial incentives and awareness campaign which can lead to a better households participation.

Furthermore, the local government needs to understand how to maximise and sustain household participation to realise the potential benefits of the recycling program. However, Timlett and Williams (2008) pointed out that household participation in a recycling programme is widely based on a voluntary basis. In addition, Ghani (2013) argues that participation in recycling programme demand substantial efforts, as households need to sort, prepare and store the waste material. Accordingly, enhancing household participation is challenging as it demands behavioural change.

## 2.4. Understanding Household Waste Segregation Behaviour

Previous research on waste recycling has mainly dealt with environmental psychology, which focused on attitude approaches analyses. Tucker (2001) pointed out that most of the researches that have been done to determine the factors that make people recycle were based on the psychological perspective. Different behaviour models, such as Model of Altruistic Behaviour, the Theory of Planned Behaviour (TPB), and Attitude-Behaviour-Context (ABC) Model have been applied to understand and explain the recycling behaviour (Schwartz, 1977, Ajzen, 1991, Stern, 2000). Among others, Azjen's Theory of Planned Behaviour (TPB) is the most popular approach in studying recycling behaviour because it offers a theoretical framework that applicable in understanding the recycling behaviour (Ioannou, Zampetakis, et al., 2011, Tonglet, Phillips, et al., 2004). However, these models are more focus on the

psychological point of view and do not incorporate situational factors which could facilitate or restrict recycling behaviour.

Recently, research has amplified comprehension of the factors of recycling behaviour, and the results so far have shown the need to incorporate situational variables in behaviour models, as behaviour also relies more on practical issues rather than only on psychological motivations (Barr and Gilg, 2007). Timlett and Williams (2008) introduce a new model, Infrastructure-Service-Behaviour (ISB), which try to incorporate situational factor as the predictor of recycling behaviour. They argue that situational factors can make individuals questioning the value of certain behaviour as they are locked into a certain situation, it will indicate that they may start feeling there is no point to behave in certain ways (Timlett and Williams, 2008). For example, a particular type of housing with lack of any external storage space for waste leads to recycling participation less to happen (Williams, 2006). Therefore, it can be argued that a meaningful change without addressing situational factors will be difficult.

Despite TPB has been used in some studies investigating recycling behaviour, given the importance of the situational factor that also influence recycling behaviour, the inclusion of the Infrastructure and Service concept within the ISB Model in this research will add better tools in understanding household recycling behaviour, especially in waste segregation at source. The following section will include the description of the Theory of Planned Behaviour (TPB) and Model of Infrastructure-Service-Behaviour (ISB) to understand waste segregation behaviour from both psychological and situational point of view.

### 2.4.1. The Theory of Planned Behaviour (TPB)

According to the TPB, behaviour is predicted based on the individual's intention to act in a particular way. Accordingly, to predict individuals intention to do something, we need to understand three specific factors. Firstly, Attitude, which is the individual's perception towards the behaviour, either positively or negatively. Secondly, Subjective Norm, which is individual's perception to conduct certain behaviour based on the existence of social pressure. Thirdly, Perceived Behavioural Control (PCB), which is the individual's perception of own capability to conduct certain behaviour. Individual's beliefs determine attitude that the behaviour will produce a certain outcome, while subjective norm is determined by their perception of how favourable other people think about certain behaviour. Additionally, perceive behavioural control is determined by their perception regarding the difficultness to conduct certain behaviour by the controllability of the performance of that behaviour. These factors further explained in subsection 2.4.3.

Adjusting these three "predictors" will increase the possibility of an individual's intention to perform a specific action and consequently increase the possibility that an individual will actually do it. As a general rule, the more favourable the attitude, subjective norm, and the greater the perceived control, the stronger individual's intention to conduct the behaviour in question (Ajzen, 1991).

Despite the TPB being widely used in behavioural research, it has been commonly discussed whether the theory of planned behaviour captures all aspects that could be important to predict and explain recycling behaviour. Waste segregation behaviour demand substantial efforts as households need to sort, prepare, store and transport the waste material, not to mention considering extra time and energy it needed (Ghani, Wan Azlina Wan Ab Karim, Rusli, et al., 2013, Bruvoll, Halvorsen, et al., 2002, Vining and Ebreo, 1990). Consequently, the decision to separate waste is likely to be complex and need to take several factors into

consideration. Several researchers suggested that additional variables should be incorporated into the model to explain recycling behaviour (Tonglet, Phillips, et al., 2004). Some researcher have included, demographic attributes (Ioannou, Zampetakis, et al., 2011), and situational factor (Zhang, Huang, et al., 2015, Ghani, Wan Azlina Wan Ab Karim, Rusli, et al., 2013, Tonglet, Phillips, et al., 2004) into the theory in order to show other possible factor that likely to influence recycling behaviour. Furthermore, according to Azjen (1991), this theory is open to the inclusion of additional variables if it can provide a significant proportion of the variance in intention or behaviour after the theory's current variables have been put into account.

### 2.4.2. Model of Infrastructure-Service-Behaviour (ISB)

As described earlier, the majority of the research on recycling have been based on the psychological point of view (Tucker, 2001). In real life, individuals do not decide the way they behave in isolation; rather they are bounded by the surroundings where they act. Bernstad (2014) pointed out that convenience and the availability of certain infrastructure are necessary to make households participate in waste recycling. Additionally, Timlett and William (2008) argue that situational factors are known to have significant influence in the success of a recycling scheme but on the other hand, most of the researchers have overlooked the importance of this factor.

The ISB model, therefore, tries to capture the importance of both: situational as well as the behavioural variables and the relationship between the two of them. By adopting this model in this research, we try to extend our focus on explaining household waste segregation behaviour not only on the psychological variable as the behavioural models provide but also on external factors. In this model, Timlett and Williams (2008) divided factors that influence recycling behaviour into Situational (Infrastructure and Service) and Psychological factors (Behaviour), where further can be described as follow:

a. Infrastructure: It includes the built environment, products and objects (e.g. buildings, bins, collection vehicles, waste (composition) packaging, recovery facilities, incinerators, landfill, recycling reprocessing facilities, and technologies).

b. Service: It includes the systems, providers, and enablers that allow people to participate in a particular practice (e.g. collections (method and frequency), communication materials, role of crews, perception of service provider and customer service, penalties, economic incentives, markets for reusable and recyclable materials).

c. Behaviour: It relates to the people and disposition towards the environmental practice (e.g. values, attitudes, knowledge, personalities, lifestyles, awareness, social status and norms).

In the ISB model, interventions could be made in the form of Infrastructure, Service, and Behaviour (all or some) to enhance recycling activity, which at the end will increase recycling performance.

### 2.4.3. Factors Influence Participation in Waste Segregation

After considering the TPB and the model ISB, it was decided to divide various factors that influence participation in waste segregation into psychological and situational factors. The following will discuss these factors further.

## A. Psychological Factor

The psychological factors were derived from The Theory of Planned Behaviour (TPB). For the scope of this research, all factors under TPB such as attitudes, subjective norms, and perceived behavioural control were incorporated. However, adjustment has been made in term of perceived behavioral control.

### Attitude towards Behaviour

In general, attitudes towards certain behaviour determines whether the individual agrees or against to behave in a certain way (Do Valle, Rebelo, et al., 2005). To illustrate, individuals form attitudes about behaviour by connecting it to certain outcomes or another attribute such as cost incurred by conducting the behaviour. Because the attributes that connected to the behaviour are already considered positively or negatively, we automatically and concurrently obtain an attitude towards the behaviour. In other words, if an individual believes the behaviour burdensome and have unfavourable consequences, the attitude about that specific behaviour will be more likely to be negative and vice versa (Ajzen, 1991). Therefore, the intended behaviour likely less to happen because of individual's negative attitude towards the behaviour and vice versa.

In term of recycling, De Young (1989) stated that there was no significant difference in attitude between those who participate and who do not participate in recyling activity, both groups have basically the same attitudes toward recycling.

Regarding the influence of attitude on recycling participation, a research conducted in Malaysia by Ghani et al. (2013) found that positive attitude towards waste separation is the main predictors towards households intentions to separation waste at home. Another research conducted in Guangzhou, China by Zang et al., (2015) also found that positive attitude influence households' intentions to involve in paper recycling. On the contrary, Nguyen et al., (2015) on research conducted in Hanoi, Vietnam, regarding waste separation behaviour of household solid waste found that attitude was not significantly influenced households' waste separation behaviour.

### Subjective Norms

Subjective norms relate to how other people or individual's reference groups think about the behaviour and whether their perspective influences the individual to behave in a certain way (Ajzen, 1991). In other words, people will likely engage in certain behaviour if their reference groups believe it is the appropriate thing to do.

In term of recycling, Do Valle et al., (2005) pointed out that possible sources of this social pressure could come from internal reference (family member) or external reference (neighbours, friends, or the community) (Do Valle, Rebelo, et al., 2005). Furthermore, this author also noted that recycling program characteristic could influenced the degree of social pressure upon individuals, for example, a door-to-door collection system gives more social pressure since to identifying and have a sense of who or how many households separate or not separate their waste is much easier. However, Vining and Ebreo (1990) stated that there was no significant difference in social pressure between those who participate and who do not participate in recycling activity.

Regarding the influence of subjective norms on recycling participation, Barr and Ford (2003) found that social pressure was essential in predicting recycling behaviour. This author further pointed out that social pressure from external reference might be due to the placement of

personal bin outside the property in a curbside recycling scheme that enables one's to be easily identified as recycling participant by others. On another study, Le and Yamasue (2013) research also shown that subjective norms, especially from internal reference, were the second strongest predictor of recycling behaviour intention. This author further pointed out that the study result might related to the way Vietnamese household perceived electronics as a family belonging. Thus their disposal behaviour is strongly influenced by family members.

On the contrary, Ioannou et al. (2011) found that subjective norm from external reference did not influence recycling behaviour intention, as the person who conducts the behaviour is anonymous or invisible to others due to the large block neighbourhood flats in an urban area and the drop-off scheme was implemented. Zang et al., (2015) also found that the social pressure from reference groups was relatively weak in influencing people's recycling behaviour intentions. In addition, in a more advance drop-off recycling system in Sweden, Hage et al. (2009) found that household recyclers likely not to be influenced either by internal or external pressure. This condition might relate to the condition that the recycling programme is well established, and people have accustomed to the behaviour over time.

*Perceived Behavioural Control*

According to Azjens (1991), perceived behavioural control refers the individual's belief as to how easy or difficult to conduct the behaviour by the controllability of the performance of that behaviour. However, Trafimow et al., (2002) argues that "easy-difficult" perception and "under my control/not under my control" perception is not the same concept. This author also propose that perceive difficulties or easiness is the better predictor of most behavioural intention rather than perceived control. Therefore, this reserarch only observe perceived behavioural control as individual's perceived difficultness or easiness in recycling.

In term of recycling, De Young (1989) pointed out that there was a significant difference regarding perceived difficulty in recycling, where those who do not participate in recycling tend to perceive recyling as more difficult rather than those who participate in recycling activity. In addition, Bordero (1995) also found that non-recycler expressed recycling was more time consuming and need more space rather than recycler. Furthermore, Tucker (2001) also found that non-recycler tends to perceive recycling activity demands high skill, need more space, and take up a lot of time rather than recycler.

Regarding the influence of attitude on recycling participation, Ittiravivongs (2012) found that individual's perceived lack of recycling capabilities had become a significant barrier in participating in recycling activity, while individual's perceived time availability and space availability found out to be not significantly influence recycling participation.

**B.    Situational Factor**

Individuals sometimes limited by the situation surrounding them which eventually influence the way they behave. From the ISB Model, it has been identified that individual's personal situation such as access to infrastructure and service, information regarding recycling program, knowledge of the different type of waste need to be segregated, incentives/rewards for recycling and demographic attributes may hamper or facilitate their participation in recycling activity. The following will further discuss these factors.

### Service Provision (Infrastructure and Service)

Service Provision may include collection system, like the presence, location, proximity, type, size and hygiene of the waste containers, and the specific characteristics of the recycling collection system (Lane and Wagner, 2013).

Vining and Ebreo (1990) pointed out that providing curbside collection system has become an effective way to increase the community participation in recycling activity. More effort is needed in a drop-off scheme rather than a curbside scheme, as the households required to transport their waste to a recycling depot.

In a drop-off recycling scheme, location, proximity, presence and hygiene of the waste containers is essential rather than the in the curbside scheme as the recycler have to deposit and transport their waste on their own. Sin-Yee and Sheau-Ting (2016) found that an area with well-equipped recycle bins within accessible distance can increase participation in the recycling program, as further, they pointed out that the greater the accessibility of the recycle bins, the higher the possibility the community to segregate waste. The Similiar finding also sought from Saphores et al. (2006), this author stated that proximity to the drop-off facility increased recycling activity. Therefore, the selection for an adequate location for recycle bin is essential to obtain high collection rates. In general, community needs as well as area size, determined the distance to the recycle bin. On the other hand, recycling bin should be visible and easy to recognise. A clear indication of accepted materials will help to avoid undesirable materials deposition. Additionally, Duffy and Verges (2009) found that the presence of specialised recycling container improves recycling compliance.

The collection system and infrequent or irregular collection may also influence household participation. Infrequent or irregular collection cause the households to store their segregated waste for some time, especially in the curbside scheme, which means the households will need a bigger space to store their waste. Hoornweg and Tata (2012) stated that collection frequency is an important aspect under municipality's control, and no more than weekly collection is necessary from the health point of view. However, in several cities, more frequent collection might be needed due to culture and habituation reason (e.g. a three–times per week is offered for residential area in Shanghai).

Furthermore, Vining and Ebreo (1990) stated that those who do not participate in recycling activity often predicated the recycling programme convenience as an important issue. In addition, Bordero (1995) argues that, those who do not participate in recycling activity also perceived service provision being provided by the municipalities as inadequate, which might become the justification of their lack of inaction.

### Information on Recycling Programme

Information regarding recycling programme may aim to disseminate the waste collection process, type of waste need to be segregated, and location of recycling containers or bin. On the other hand, information regarding recycling programme may also aim to make the households understand the benefits of the recycling system. The availability of this information may not only increases the motivation of people to participate but also contributes to a better waste segregation activity and waste deposition.

Vicente and Reis (2008a) suggests that information is one of the most important factors to encourage participation and receiving information through direct means has a positive effect on the household participation. Information can be delivered to the household trough general

mass media such as television, radio, and newspapers. It can also be delivered through direct communication, i.e. the local communication activities through local information sessions to explain how and what to recycle, posters in the neighbourhoods showing how and what to recycle, and distribution of calendars and brochures with calendar and waste collection times.

Furthermore, Vining and Ebreo (1990) stated that recyclers might receive more information about recycling than non-recyclers, or they might have found out about recycling from more sources than non-recyclers. Additionally, Iyer and Kashyap (2007) showed that information has an important role in a consistent performance of recycling behaviour.

### Knowledge of Different Type of Waste to Segregate

Vining and Ebreo (1990) argued that the difference between individuals who do not participate in recycling and the one that participates be on their level of specific recycling knowledge. This author also further pointed out that those who involve in recycling have more knowledge about type of recyclables material.

Barr and Gilg (2007) noted that *concrete* knowledge such as knowing what and where to recycle became a significant prerequisite for behaving in an appropriate manner, it would also be a significant barrier to action if levels were low. Furtermore, Do Valle et al. (2005) found that specific knowledge in term of individual's understanding of the different classes of materials and proper disposing procedures influence their recycling behaviour. This author also concluded that individual's who are received more information regarding recycling program are those who also have higher specific knowledge.

### Incentives/Rewards

Incentives/rewards refer to anything offered in acknowledgement of effort, service, or achievement (Amini, Ahmad, et al., 2014). Incentives/Reward may be in the form of free waste bags, free bins, vouchers, or monetary payment given by government or service providers for recycling or separating recyclable materials at home. However, majority of incentives/rewards in the recycling programmes was in the form of financial incentives.

Harder and Woodard (2007) found that financial incentives schemes increased participation rates by 10–20% in 3 months after a series of medium-scale trials on various voucher-based incentive schemes for household recycling carried out in the UK. While Timlett and Williams (2008) also found that incentives-based program increase participation in the recycling collection scheme and reduce inclusion of non-targeted materials. Additionally, Shaw and Maynard (2008) found that financial incentives such as household-specific Council Tax rebate potentially increase household recycling participation.

However, a study by Allen et al. (1993) on the effect of coupon incentives on aluminium recycling, found that financial rewards did influenced recycling frequency, but could not modify recycling behaviour in the long run. Other studies also show that financial incentives such as lotteries reward on random recycler do not lead to long-lasting behaviour change (De Young, 2000).

Furthermore, Vining and Ebreo (1990) found that those who do not participate in recycling tend to perceive that monetary incentives and rewards are important. On the contrary, De Young (1989) stated that there was no significant difference between those who participate and who do not in recycling on their perception regarding the importance of monetary incentives.

*Demographic attributes*

The various studies that assessed the importance of demographic attributes in recycling participation has inconsistent or contradictory results. Barr (2007), Vining and Ebreo (1990), Akil et al., (2015) and Saphores et al. (2006) found that age has significant influence to recycling participation, these authors found that those in older age groups were more likely to recycle. However, Do Valle et al. (2005) pointed out to the contrary. Furthermore, Oskamp et al. (1991) stated that age does not discriminate those who participate in recycling activity and those who do not.

In term of gender, both Do Valle et al. (2005), and Sidique et al. (2010) found that gender does not influence recycling participation. On the contrary, Vining and Ebreo (1990) found that that gender could influence recycling participation, as women are more likely to recycle than men.

Turning to education, Saphores et al. (2006) found that higher education influence willingness to recycling, on the contrary, Do Valle et al. (2005) pointed out that education does not influence recycling participation. Furthermore, Vining and Ebreo (1990), Oskamp et al. (1991) stated that education level does not differentiate those who participate in recycling with those who do not participate.

Vining and Ebreo (1990) found that family structure influence participation in recycling, where smaller family size tends to recycle more. On the other hand, Sidique et al. (2010) found that the bigger household size increases recycling participation. However, Do Valle et al. (2005) pointed out that family structure does not influence recycling participation. Furthermore, Tucker (2001) pointed out that there was no significant difference between recycler and non-recycler in term of household size.

Regarding family income, Sidique et al. (2010) found that higher household income increase recycling participation. On the contrary, Do Valle et al. (2005) pointed out that economic status does not influence recycling participation. Furthermore, Tucker (2001) pointed out that there was no significant difference between recycler and non-recycler in term of social class.

On another study, Oskamp et al. (1991) noted that presence of children does not differentiate between being a recycler or not. On the contrary, Vicente et al. (2008b) in Portugal, found that the presence of children contributes to household recycling participation. However, this recycling programme was specifically targeting children as an important recycling motivators within the households. It uses communication campaign to disseminate recycling messages via radio and television which targeting and involving children in the process.

## 2.5. Conceptual Frameworks

The literature review chapter has provided enough understanding to construct a conceptual framework for this research.

Solid waste management practice is a matter of concern for public health and environmental protection and has become a major challenge in most developing countries. Improper waste management can bear adverse consequences on public health, environment, and natural resources. Many governments have been implemented several strategy in dealing with solid waste in a sustainable way, and recycling is one of them. On the other hand, a recycling program can only be successful if the community support and actively participate in it and as the largest stakeholder in the waste recycling programme, households have important role

especially in waste source segregation.Libenberg (2007) pointed out that segregation at source is the foundation for an effective resource recovery. This author further mention that many recycling facility are likely to fail because they rely on extracting materials from mixed waste. Therefore it can be argued that households participation, especially in source segregation, is essential in the successfulness of recycling activity.

In general, many researches have focusing to enhance in studying household participation in waste reycling programme with the objectives to enhance their participation. Tucker (2001) pointed out that most of the researches that have been done to determine the factors that make people recycle were based on the psychological perspective. Recent researches have shown that situational factors need to be incorporated in behaviour models, as behaviour also relies more on practical issues rather than only on psychological motivations. As Bar and Gilg (2007) pointed out that behaviour also relies on practical issues rather than only on psychological motivations. Therefore, in this research, to understand household participation in waste source segregation, both approach that include psychological and situational factors is combined.

To sum up, this research will focus on explaining the influence of psychological and situational factors towards household participation in waste segregation at source. The psychological variable attained from The Theory of Planned Behaviour (Ajzen 1991), which consists of attitudes, subjective norms, perceived easiness. On the other hand, the situational factor was derived from the Model of Infrastructure-Service-Behaviour (ISB) (Timlett and Williams, 2008), which consists of service provision, information regarding recycling program, knowledge of the different type of waste need to be segregated, incentives/rewards for recycling and demographic attributes. Figure 2.3 shows two groups of factors were observed to influence this participation, namely psychological and situational factors.
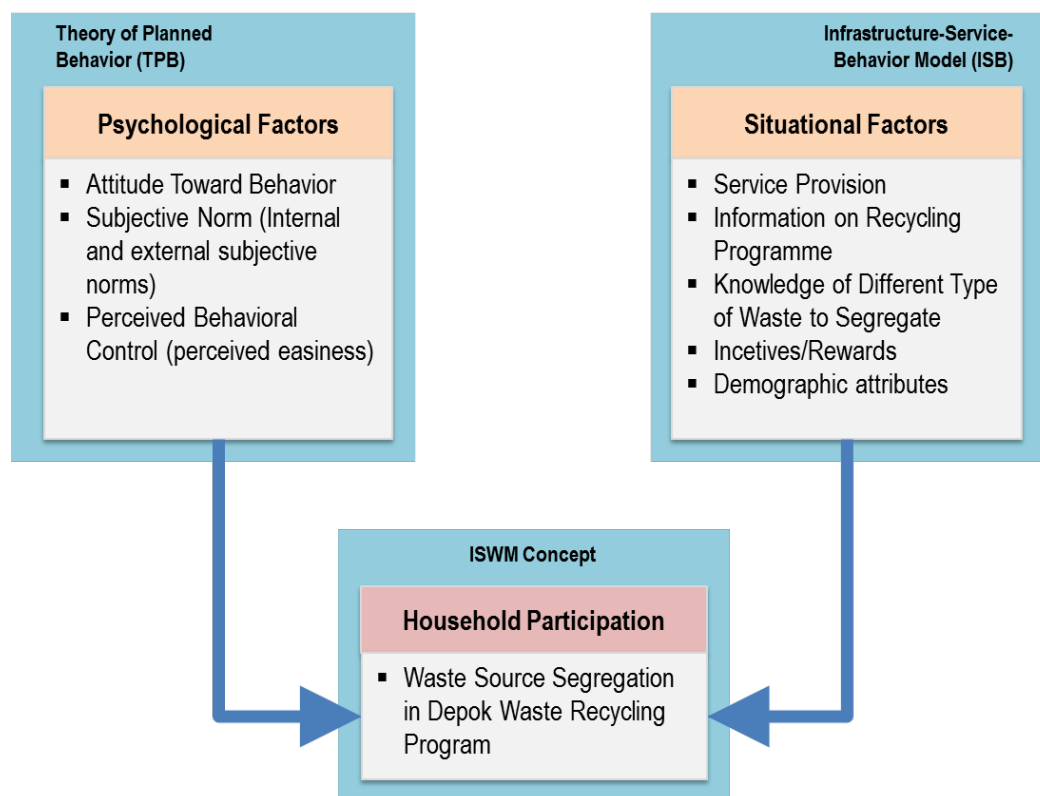


**Figure 2 Researcher Conceptual Frameworks**

# Chapter 3: Research Design and Methods

This chapter provides the research methodology used to answer the research questions in this study. It started by operationalization of concepts through the definition of variables and indicators measurement in which helps to meet the research question. Then, the research strategy on how this research carried out was described. Data collection methods and instrument, alongside with sampling methods was presented. Furthermore, challenges and strategy regarding validity and reliability for this research were highlighted. Finally, the way the data was analyzed in order to arrive at the answer to the research question was provided.

## 3.1. Operationalization: Variables and Indicators

In this subsection, variables and indicators that were used for this research are presented. However, the variables taken into account in this research is firstly defined as follow.

### 3.1.1. Definition of Variables

*Psychological Factors*

Psychological factor consists of Attitude toward behaviour, Subjective Norm, and Perceived easiness. Attitudes determine whether the individual is in favour or against to behave in a certain way. If an individual believes the behaviour burdensome and have unfavourable consequences, the attitude about that behaviour will be more likely to be negative and vice versa. Subjective norm relates to how favourable other people or their reference groups think about the behaviour and whether their perspective influences the individual to behave in a certain way. In other words, people will likely engage in certain behaviour if their reference groups believe it is the appropriate thing to do (peer pressure). Subjective norm was further divided based on the source of peer pressure, which is internal (family member or people living in the same house) and external group (friends, neighbour or other important people but not residing in the same house). As for the Perceived easiness refers to individual's perception regarding easiness to conduct certain behaviour.

The influence of psychological factor towards household participation in waste source segregation was measured using several statements on a 5-point Likert scale. Statements to measure Attitude was adapted from Ghani et al. (2013) and Tonglet et al. (2004), while Subjective Norm was adapted from Ghani et al., (2013), and Knussen and Yulle (2008). Additionally, statements to measure PCB was adapted from Ittiravivongs (2012); Tonglet et al. (2004); and Ghani et al. (2013).

*Situational Factors*

Situational factors consist of service provision, information on the recycling programme, knowledge of different type of waste to segregate, incentives/rewards, and demographic attributes. Service Provision refers to recovery facilities (the SWPU and Waste Bank), and collection system, such as the presence, proximity, location, hygiene, type and size of the MSW containers, including the collection methods and frequency. Information recycling programme refers to whether the households are being provided sufficient information, such as waste collection process and collection frequency. Knowledge refers to whether the households understand or able to differentiate the waste type, in which, will be accepted by

the system. Incentives/rewards refer to anything offered in acknowledgment of effort, service, or achievement (either in the form of free waste bag, free bins, vouchers, or monetary payment), for segregating waste at source. Demographic attributes refer to number of family member, family income, and the presence of child is used. Others factors under demographic attributes such as, age, gender, and education were associated with the one who in charge of waste related activity within the household, a separate question was asked to the respondent to identify who in charge of waste related activity within the household.

The influence of Service provision towards household participation in waste source segregation was measured by distance to recycling facilities (which is Organic SWPU and Local Community Level Waste Bank), distance to communal recycling bin (Organic Recycling Bin/ Organic *Meeting point* and Waste Bank Collection Point) and frequency of waste collection. Information was measured as number of source of information available to the households regarding Depok waste recycling program. Knowledge was measured using an index based on correct categorization on the type of waste to segregate. Incentives/reward was measured as number of incentives/reward received by the household for segregating waste at source. Additionally, some statements adapted from Ittiravivongs (2012), was used to measure household perception regarding service provision, information availability, and influence of incentives/rewards on a 5-point Likert scale.

### *Household Participation in Waste Segregation*

Source Segregation is fundamental to the success of Depok recycling program. This system needs a high participation of the households, as shown in conceptual framework (figure 2.3), household participation within Depok recycling program in this research is defined as their involvement in segregating waste at source. In Depok recycling program, each household is required to segregate waste in three categories, organic, non-organic, and residual waste. Each type of waste need to be disposed in different secondary storage, also have different collection frequency. The collection frequency for organic, non-organic, and residual waste is every two days, once per one week or per two weeks, and every three days respectively.

In order to avoid bias measurement if using the weight of each segregated waste as respondent response value to their participation in the recycling programme, additionally, as the dependent data observed was dichotomous in nature (participate or not participate in waste segregation), this research self-reporting method to measure household participation in waste segregation. De Young (1989) stated that it is not unusual for survey respondent to be categorized based on their self report. Furthermore, this author in his research classified the respondents as a recycler if and only if it had used the curbside recycling service at least once during the observation periode of three months and non-recycler if never used the service at all. Additionally, Vining and Ebreo (1990) also categorizes a recycler as respondents who stated that they had recycled some material within the past year and the non-recycler who stated not done at all on self-reporting response.

By utilizing a self-reporting methods, the possible response for household waste segregation participation used binary scale; 1 = if the households participate in waste segregation and 0 = for not participate in waste segregation at source. Some researcher, such as Ittiravivongs (2012), Knussen and Yulle (2008) had adopted a similar method. Furthermore, it decided to use how they usually dispose each type of waste as a complement to binary self-reporting method to identify household participation in practicing waste segregation at source. Although we acknowledge that frequency of recycling will be more suitable to use, the dicision to use disposal practice of the household based on information available in

measurement instrument. If the household commonly dispose each type of waste in the designated secondary storage, by mean using the recycling collection service, these households will be consider as participating in waste source segregation activity.

### 3.1.2. Operationalization

The operationalization of this research described based on theoretical framework discussed in the previous chapter, also based on definition and measurement of variables in the previous subsection. The following table displays the theory, concept, variable, and indicators used in this research.

**Table 1 Operationalization**

| Theory /Concept | Variable | Factors | Indicator | Scale of Measurement | Data Collection Methods |
|---|---|---|---|---|---|
| Theory of Planned Behaviour (TPB) | Psychological Variables | Attitude towards waste segregation *) | Sense of responsibility | Ordinal, Likert scale | Questionnaire to HH Interview to selected HH |
| | | Internal subjective norm *) | How family member view on waste segregation | | |
| | | External subjective norm *) | How neighbours view on waste segregation | | |
| | | Perceived easiness *) | Perceived easiness in term of capabilities to segregate waste | | |
| | | | Perceived easiness in term of time availability to segregate waste | | |
| | | | Perceived easiness in term of space availability to segregate waste | | |
| Infra-structure-Service-Behaviour Model (ISB) | Situational Variables | Service Provision | Distance to recycling facility | Nominal | Questionnaire to HH Observation |
| | | | Distance to communal recycling bin | | |
| | | | Frequency of waste collection | | |
| | | | Collection system | Nominal | Interview with Local Government (LG), SWPU Coordinator and Waste Bank (WB) Leader Observation |
| | | | SWPU service & facilities | | |
| | | | Waste Bank service & facilities | | |
| | | | Type of waste handling and Methods | | |
| | | | Perception on adequacy of service provision | Ordinal, Likert scale | Questionnaire to HH |
| | | Incentives/ Rewards | Number of incentives/ rewards received | Ratio | Questionnaire to HH |
| | | | Perception of the influence of incentives/rewards | Ordinal, Likert scale | Questionnaire and Interview to HH |
| | | | Type of incentives/ rewards for waste source segregation | Nominal | Questionnaire to HH Interview with LG, SWPU Coordinator, and WB Leader |

| Theory /Concept | Variable | Factors | Indicator | Scale of Measurement | Data Collection Methods |
|---|---|---|---|---|---|
| | | Information of the recycling programme | Number of source of information available | Ratio | Questionnaire to HH |
| | | | Perception on the adequacy of information | Ordinal, Likert scale | Questionnaire and Interview to HH |
| | | | Methods of information dissemination | Nominal | Questionnaire to HH Interview with LG, SWPU Coordinator, and WB Leader |
| | | Knowledge of different type of waste to segregate | Correct categorization of items to segregate | Nominal | Questionnaire to HH |
| | | Demographic attributes | Age (person in charge of waste activity within HH) | Ratio | Questionnaire to HH |
| | | | Household size | Ratio | |
| | | | Presence of child | Ratio | |
| | | | Level of Education (person in charge of waste activity within HH) | Ordinal | |
| | | | Family Income | Ratio | |
| ISWM | Participation in Source Segregation | | Binary choice model (1= participate in waste segregation; 0 = not participate segregate) | Nominal | Questionnaire and Interview to HH |

*Source: Author, 2016*
*) Measured by several statements using Likert scale as suggested by the author of the TPB

## 3.2.    Survey as the Research Strategy

This research is aiming to understand which factors influence household participation in waste source segregation within Depok recycling program, which in this regard, most of the household in Depok do not segregate their waste at source (see Chapter 1.3). There are many factors may influence household participation in waste source segregation. However, this research only focused on the psychological and situational factors as have been described earlier in the literature review. According to the purpose of this research, survey as the research strategy is assumed to be appropriate.

A survey is a type of research which tries to obtain a comprehensive phenomenon in over time and/or space (Verschuren, Doorewaard, et al., 2010). Survey is a research methodology that gathering standardized data from many respondents regarding their perception, opinion or attitudes toward certain subject or topic. Furthermore, surveys can be classified based on the research objective or time dimension (Johnson, 2001). Based on research objectives, a survey could be exploratory, explanatory, descriptive and predictive. An exploratory survey aims to discover or explore certain phenomena, while descriptive survey aims to describe certain phenomenon without further manipulation. A predictive survey aims to be able to produce accurate prediction over certain phenomena. On the other hand, an explanatory survey goal is to explain a phenomenon by looking at the relation between variables. Based on time dimensional, surveys consists of cross-sectional research, longitudinal research, and retrospective research. A cross-sectional survey collects data only on a single point of time,

while longitudinal research collects data at more one point in time which enables the researcher to make a comparison between time. On the other hand, retrospective survey collects data by looking backwards in time to be able to make a comparison between present and past phenomenon reflected in the data set.

A survey can give advantages, such as the researcher will acquire a broad overview and will reach generally valid statements, and a large number of research units enables all kinds of statistical relationships (Verschuren, Doorewaard et al., 2010. Furthermore, depending on how they are structured and analysed, surveys can present both quantitative and qualitative data. On the other hand, limitation of survey research lies in its inflexibility during data collection, which there will be little to be done once the questionnaire is already set up and deployed to th respondents. Moreover, the main concern for using survey as research strategy is the depth explanation over certain phenomenon (Verschuren, Doorewaard, et al., 2010). However, given the knowledge about the subjects to research are numerous and/or widespread, a pinpoint of other research findings will give a better explanation of the research result.

To sum up, in order to to be able to explain the influence of the psychological and situational factors on household participation in waste source segregation within Depok recycling program, an explanatory survey using cross-sectional approach was appropriate.

### 3.3. Data Collection Methods

This research used a combination of primary and secondary data collection. Data for this research mainly collected from primary sources such as questionnaire and semi-structured interview.

### 3.3.1. Primary Data Collection

Primary data collection used questionnaire, semi-structured interview, and observation.

*Questionnaire*

In this research, the Questionnaire mainly used close-ended questions with several open-ended questions. The Questionnaire was divided into seven section, the first section regarding households demographic and social-economic status. The second section regarding household waste management practice, within this section, self-reporting household waste segregation behaviour was asked. The issue of internal validity regarding self-reporting approach is discussed further in section 3.6. The next section regarding service provision, availability of incentives/rewards, accessibility to information regarding Depok waste recycling program and knowledge of the type of waste need to be segregated, and incentives received, was asked respectively. The last section was asked regarding households psychological factors.

The Questionnaires were distributed to the households during the second weekend of the field work with the help of local community leader (RW). The questionnaire then collectively collected by the local neighbourhood leader (RT) before returned to the researcher. It took at least two weeks until the questionnaire were filled by all respondent.

### Semi-structured Interview

Semi-structured interviews targeted two kinds of information, the first regarding the implementation Depok recycling program, and the second regarding household participation in waste source segregation.

Regarding the implementation Depok recycling program, respondents was chosen based on their knowledge and information on the programme. Government officer from Depok Cleaning Agency, Depok Waste Bank Community Coordinator, Local Community Organization Leader (RW/RT), and Local waste collector was interviewed regarding role and responsibility, policy support, incentives, communication strategy to disseminate information regarding Depok Recycling Programme, and the operational and technical aspects, such as recovery facility and collection system. Additionally, Coordinator of the SWPU, Local Community Waste Bank Leader was interviewed regarding the daily operational of the SWPU and Waste Bank respectively.

On the other hand, to obtain information regarding households' participation in waste source segregation, four households consist of those who segregate and those who do not segregate waste at source was interviewed during the fieldwork. Households who participate in waste source segregation mainly chosen based on the recommendation from local community leader (RW). Households who do not participate was chosen based researcher convenience on their availability to become respondents, as it turned out during the fieldwork, those who do not participate were willing to fill the questionnaire but reluctantly interviewed.

### Observation

Observation was used to document of solid waste recovery facilities operation in the neighbourhood such as SWPU and Local Waste Bank, the presence and condition communal collection bin, and waste collection system. In addition, the observation also used to document household waste source segregation practice.

Observation regarding solid waste recovery facilities operation was conducted at the same time while interviewing the Organic SWPU coordinator and Local Waste Bank Leader. Regarding waste collection system, observation was conducted by following the SPWU collection officer while circulating the neighbourhood to collect organic waste, as for the residual waste collection, the researcher stationed in one of the residual secondary storage. However, the collection system for the non-organic waste was not observed directly by the researcher, but obtained from the Local waste bank leader, because the waste bank operation was stopped temporarily during the Ramadhan. On the other hand, observation regarding household waste source segregation practice was conducted at the same time wile interviewing with the households.

Furthermore, the result of the observation and interviews of respondent was cross-checked with the answers from questionnaires as part of the triangulation data technique. Note and recording the events through photographs or other means have been done and stored by the researcher.

### 3.3.2. Secondary Data Collection

The secondary data was used as data validation and an extra source of information to complement primary data. Thus it was selected in related to the research topic. Data on policy support, operational and technical aspects, solid waste statistical information, was tried to

obtain through related agency website or visiting the agency directly. Secondary data sources and types could be seen in the following table.

**Table 2 Secondary Data**

| Kind of Data | Source | Type |
|---|---|---|
| RPJMD 2016 – 2021 (Depok Medium-term Plan) | Municipal Planning and Development Agency (MPPDA) of Depok | Document |
| Depok Solid Waste Master Plan | Cleaning Agency of Depok | Document |
| Depok Sanitation Whitepaper  Document | MPPDA of Depok | Document |
| Neighbourhood profile document | Statistical Agency of Depok / Sub-district Office | Document |
| SWPU and Waste Bank Profile | Cleaning Agency of Depok | Reports |
| Recycling Programme Guideline | Cleaning Agency of Depok | Reports |

Source: Author, 2016

All the secondary data was collected directly from the related agency. Unfortunately, Depok Solid Waste Master Plan and Recycling Programme Guideline could not be collected during the field survey due to still in revision status.  However, as a replacement, information regarding Depok recycling program information was obtained through an interview with the Cleaning Agency of Depok officer.

### 3.3.3.  Sample Size and Selection

This research uses two different sampling techniques to collect quantitative and qualitative data. Quantitative data was obtained through questionnaire.

Stratified random sampling was used for the questionnaire. This technique was used because a sampling frame was created based on some criteria for two categories of respondents group, which are Households who segregate waste or do not segregate waste at source, and draw a random sample from each group (Neuman, 2006).

Due to time limitation, the location of research was assigned within the coverage one Organic SWPU. The Permata Regency Organic SWPU was then chosen as one of the first SWPU to change the operational procedure, which only accepted organic waste. Furthermore, the advantage to select this area of study was due to the characteristics of settlement covered by the SWPU. The coverage area consisted of two settlements type, a planned residential area, and an urban village or *kampung*. The population of household within Permata Regency Organic SWPU was 2.990 households[8]. However, the number of households who participate in waste segregation and whom don participate was unknown to the researcher, yet the researcher equally divided between the two groups in order to make a comparison. Number of samples was counted by using Slovin's formula (1960) as follow:

$$n = \frac{N}{N.d^2 + 1}$$

Where,
N      = Number of population
n      = Number of sampling
d      = margin error

---

[8] Based on Ratu Jaya Sub District Profil, 2015.

This research used confidence level 92% with a marginal error of 8%. Based on this formula, a minimum of 147 households (~ 150 HH) as sample for the research was obtained.

On the other hand, combined non-probability sampling was used for the qualitative data. Convenience sampling was used for gathering data from households who do not participate in waste source segregation, as it turned out during the fieldwork, those who do not participate were majority reluctantly to be interviewed. On the other hand, single purposive sampling was used for gathering qualitative data from interview with the rest of the respondent. The respondent was selected based on their knowledge and information regarding the Depok recycling program. Table 3.3 summarized number of samples required for this research.

**Table 3.3 Total Sample Size**

| Category of Respondent | Sample Size | | | Sampling Technique |
|---|---|---|---|---|
| | Question-naire | Inter-view | Total | |
| Households (participate in waste segregation and do not segregate proportionally) | 150 | - | 150 | Stratified Random Sampling |
| Selected Households (do not participate in waste source segregation) | | 3 | 3 | Convenience sampling |
| Selected Households (participate in waste source segregation) | | 3 | 3 | Purposive sampling |
| The Cleaning Agency of Depok | - | 2 | 2 | |
| Organic SWPU Coordinator | - | 1 | 1 | |
| Local waste bank leader | - | 3 | 3 | |
| Local community leader | - | 2 | 2 | |
| Local waste collector | - | 1 | 1 | |
| Total | 150 | 15 | 159 | |

Source: Author, 2016

However, up to 200 questionnaires were distributed, and additional three respondents (from initially 12) were interviewed, resulting in 176 valid questionnaires and a response rate of 88 %.

## 3.4. Validity and Reliability

External validity refers to whether the findings are able to be generalized on other similar situation, while internal validity relates to the extent of the data and information can be measured in the right way.

Regarding internal validity, there was a challenge in this research that needs to be addressed. Due to time limitation, questionnaire with the self-reporting method on household waste segregation behaviour was chosen. Some researcher, such as Ittiravivongs (2012); Knussen and Yulle (2008) had adopted a similar method. In self-reporting methods, it is widely known that there is a tendency of difference response between what people state will do and what they actually do. For example, Price (2001) found that more people were observed not recycling even they say that they would recycle. Therefore, it can be argued that people tend to exaggerate their recycling behaviour, as it is perceived as a good thing to do. One way to cope with this challenge this researcher adopts the strategy used by Tucker (2001) in understanding home composting behaviour. In order to get a valid answer on home composting behaviour, this researcher uses *garden size* as a surrogate question to validate the self-reporting home composting behaviour. In our research, we asked how they store and

dispose their waste as validation of the self-reporting methods, especially for those who reported doing waste segregation at source. The household self-reporting respond of doing waste segregation at source was considered as valid respond if they stored their waste in separated bin and disposed their waste in separate designated secondary storage in the neighbourhood. Another method to increase internal validity in this research was done through a triangulation method. The result of the selective households' interview was compared to the result of the self-reporting questionnaire to check whether there was mismatch information.

Regarding external validity, it is important the sample size and selection of the sample have to be representative. Although it has been a challenge due to the limited time for data collection, a high response rate has been achieved using random sample selection for quantitative data collection. Additionally, the selection of concept, which has been used by previous researchers in studying recycling behaviour, can be seen as a way to ensure external validity. Therefore, by using a representative number of sample also concept being used by the previous research, the result should able to be generalized to other condition with the same schemes of the Depok recycling programme. In which the Depok recycling programme incorporated both the waste bank, which is basically a voluntary basis, and the treatment facility, with all type of waste, need to be segregated at the household level.

Reliability was defined by consistency and accuracy in variable measurement. Reliability of the research will be obtained by forming the data collection instrument, both questionnaire and interview guide as clear as possible. The researcher will use reference from previous researchers to develop questionnaires. Additionally, a pilot testing survey will be conducted among fellow students in which do not have deep information about the intended studies to avoid bias or ambiguity; this approach is chosen to identify inconsistency of the construct before actually distribute the questionnaire to the respondent in Depok.


## 3.5. Data Analysis Methods

This research was conducted using quantitative analysis. SPSS 22 was used to help to process the quantitative data. In addition, Qualitative data from the semi-structured interview was analysed manually by looking to the content of discussions with respondent and further used in the form of quotation or opinion to strengthen the quantitative analysis findings. In the other hand, charts, graphs, and tables were also used to make it easier for analysis. Observation data such as photo were included to support the analysis.

Furthermore, the quantitative data from questionnaires in this research was analysed using both descriptive and statistical analysis, as follow.

### 3.5.1. Descriptive Analysis

Descriptive analysis was used to identify the characteristics of Depok recycling programme, especially in term of the operational and technical aspects, incentives and communication strategy to disseminate information regarding the recycling programme. This analysis was based on the comprehension that in real life, individuals do not decide the way they behave in isolation; rather they are bounded by the surroundings where they act.

However, only describe the operational and technical aspects, the waste collection system, incentives and communication strategy being implemented can not merely be used to justify

households participation in waste source segregation. Therefore, further statistical test was applied.

### 3.5.2. Statistical Test

In order to differentiate both household participation in waste segregation in relation to the psychological and situational factors, either independent T-test or Chi-square test was used. The criterion to choose the most appropriate statistical test to use was based on the data type of each factor. Factor analysis was also conducted to verify the measurement for the psychological factor, which used several statements. Under the factor analysis, these statements were summed and then a reliability analysis was run to test the reliability of the new measure.

The following table shows statistical test used to observed the differences in participation among households in relation to the psychological and situational factors.

**Table 3 Statistical test used**

| Factors | Indicators | Data type | Statistical Test |
|---|---|---|---|
| Attitude toward waste segregation | Sense of responsibility | Ordinal data, measured using several statements on Likert scale | • Factor analysis, using Cronbach alpha to test the reliability<br>• Independent T-test |
| Internal subjective norm | How family member view on waste segregation | | |
| External subjective norm | How neighbours view on waste segregation | | |
| Perceived easiness | Perceived easiness in term of capabilities to segregate waste | | |
| | Perceived easiness in term of time availability to segregate waste | | |
| | Perceived easiness in term of space availability to segregate waste | | |
| Service Provision | Distance to recycling facility | Nominal data | • Crosstab<br>• Chi-square test |
| | Distance to communal recycling bin | | |
| | Frequency of waste collection | | |
| | Perception on adequacy of service provision | Ordinal data, measured using several statements on Likert scale | • Factor analysis, using Cronbach alpha to test the reliability<br>• Independent T-test |
| Incentives | Number of incentives received | Ratio | Independent T-test |
| | Perception of the influence of incentives | Ordinal data, measured using several statements on Likert scale | • Factor analysis, using Cronbach alpha to test the reliability<br>• Independent T-test |
| Information on the recycling programme | Number of source of information available | Ratio | Independent T-test |
| | Perception on the adequacy of information | Ordinal data, measured using several statements on Likert scale | • Factor analysis, using Cronbach alpha to test the reliability<br>• Independent T-test |
| Knowledge of different type of waste to segregate | Correct categorization of items to segregate | Nominal | Independent T-test |

| Factors | Indicators | Data type | Statistical Test |
|---|---|---|---|
| Demographic attributes | Age (person in charge of waste activity within HH) | Ratio | Independent T-test |
| | Household size | | |
| | Presence of child | | |
| | Family Income | | |
| | Level of Education (person in charge of waste activity within HH) | Ordinal | ▪ Crosstab<br>▪ Chi-square test |

Source: Author, 2016

Furthermore, in order to explain which psychological and situational factors influence household participation in waste segregation, a regression analysis, especially binary logistic analysis was used. Variables in logistic regression were estimated using the Maximum Likelihood (ML) method. As such, the analysis assesses the relationship between various factors and the households' participation in waste segregation.

The dependent variable was designed in dichotomous dummy variable based on the household self-reporting behaviour of waste segregation, which segregates waste at source or not. Dummy variable need to be created for categorical variables. The basic model for binary logistic analysis can be seen in the following formula.

$$\frac{LogP_i}{(1 - P_i)} = \beta_0 + \beta_1 X_1 + \beta_i X_i + e$$

Where,

$P_i$ = 1 if the households participate in waste segregation
$P_i$ = 0 for otherwise
$X_1$ = Independent variables
$\beta_0$ = Constant
$\beta_i$ = Coefficient of independent variables
$e$ = Error or disturbance
$i$ = 1,2,3,…..n

The independent variables of this model were attitude toward waste segregation, subjective norms, perceived easiness, age, education level, household size, family income, number of children under ten years old, incentives, information on recycling programme, knowledge about type of waste to be segregated, and distance to the communal bin. Most of the variables were derived from literature review.

# Chapter 4: Research Findings

## 4.1. Introduction

This chapter presents the major findings from data collection process. We divided this chapter into three section. The first section aims to provide a background of the Depok recycling program as also aim to answer the first sub research question on the characteristics of Depok recycling program. After this, a brief description regarding respondents information and their waste management practice was provided. The second section mainly analysed which psychological and situational factors differentiate household participation in waste segregation, while the third section analysed the influence of psychological and situational factors regarding their participation in waste source segregation, which trying to answer the second and third sub-research question.

## 4.2. Background to the City of Depok



**Figure 3 The Cityof Depok (Source: googlemap)**

Depok is located directly in south of Jakarta, the Capital City of Indonesia, and becoming part of Jakarta Metropolitan Area (see Map 4.1). The city is divided into 11 Districts and further divided into 63 Sub-Districts. Depok is one of major city in West Java Province and covers an area of 200.29 square kilometres, which 61% of the area is built environment with the majority of residential area land use (57.7%). Based on the 2015 census, the city had a population of 2.1 million with a growth rate of 3.57% and a density of 10,515 persons per square meters. The population is predicted to growth steadily into more than 2.5 million people in 2021 and almost 3 million people in 2025. One of the major contributors to the population growth is the fact that Depok role for supporting Jakarta economic development which provides a strategic location for the residential area for those who work in the capital city. As the population increase, consequently, a greater volume of waste is generated.

In 2012, Depok generated a total of 4.265 m3/day waste, 63.43% of it came from residential areas, 22.01% comes from the markets, 8.91% comes from shops and services, and 5.64% came from public facilities and industrial areas (Municipal Planning Agency, Government of Depok, 2012). The number of waste generated is expected to increase as the population is growing, and it was estimated a number of 6.213 m3/day waste generated in 2015. On the other hand, there is only one disposal site in Depok. This disposal site was built in 1984 and planned to be operated until 2011, but still being used until now. The Disposal site has around 11,2 Ha, with 5,1 Ha allocated for landfilling which consists of three pools, The A pool (2,1 Ha), The B pool (2,4 Ha) and the C pool (0,6 Ha). This existing disposal site is already running at full capacity, both the A and C pools have been closed since 2012 and left the B pool to accept all waste generated in Depok. The Government of Depok once tried to extend

the existing disposal site capacity, but this effort has been rejected by surrounding neighbourhood community due environmental pollution and bad odour (Dewi, 2008).

High waste generation and limited disposal site capacity have encouraged the government of Depok to implement a waste minimization strategy since 2006, and one of the efforts conducted through The Waste Recycling Programme. During 2006 until 2012, The Government of Depok has constructed 37 Solid Waste Processing Units (SWPU) at the sub-district level. One unit of SWPU is designed to serve several neighbourhood communities up to 3.000 Households. The Government of Depok expected this program to gradually reduce reliance on disposal site by processing garbage directly at source by turning organic waste into compost.

Initially, the SWPU was designed to accept mix waste, but longer time and more effort to segregate mix waste had resulted the SWPU could not deal with the incoming waste stream, trash piling up around the SWPU generating bad odour and lead to community rejection (Grahanida, 2012). Since 2012, when the waste bank was incorporated, the system has been gradually changed. The SWPU only accepts organic waste, while the waste bank at the community level assigned for the non-organic material. Until 2016, there are 32 SWPU that has been shifted into an Organic SWPU. This system changed has been legalized under the local regulation No. 5/2014 about Waste Management.

## 4.3. Implementation of Depok Recycling Programme in the Area of Study

The selected area of study was within the coverage of Permata Regency Organic SWPU which covers three communities (RW) and 22 neighbourhoods (RT), with 2,991 households. The Permata Regency Organic SWPU itself was built in 2008 and became one of the first SWPU to change the operational procedure, which only accepted organic waste. The area of study also covered by 11 local waste bank.

The recycling programme in Depok requires each household to segregate waste at the source into three type of waste, namely, organic, non-organic and residual waste. Based on the waste type, the treatment facility, and collection system has been designed to accept the waste material stream from the household. The Organic SWPU have been assigned to accept and process organic waste, while the waste bank has been assigned to accept the non-organic waste. On the other hand, residual waste was transported directly to the disposal site.

Recycling programme implementation within the study area can be divided into two conditions based on the secondary collection service they received. The first condition is where the neighbourhoods segregated received residual waste collection service, and the second condition is where the neighbourhoods do not receive residual collection service. In the first condition (see figure 4), each waste is sorted into three types and stored separately. Segregated waste is brought to secondary storage within the neighbourhood, the organic waste, and non-organic waste is taken individually by the household to the organic *meeting point* and local waste bank respectively, while the residual waste is collected and transported to the residual *meeting point* by the local waste collector employed by the local community organization (RW/RT). From the secondary storage, the organic waste is collected three times per week by the SWPU employee and transported to the Organic SWPU for composting, while the residual waste is collected twice per week by municipal collection vehicle and transported to the disposal site. In the other hand, the non-organic waste from the local waste bank is collected at the frequency of once to twice per week by the *central* waste bank officer.
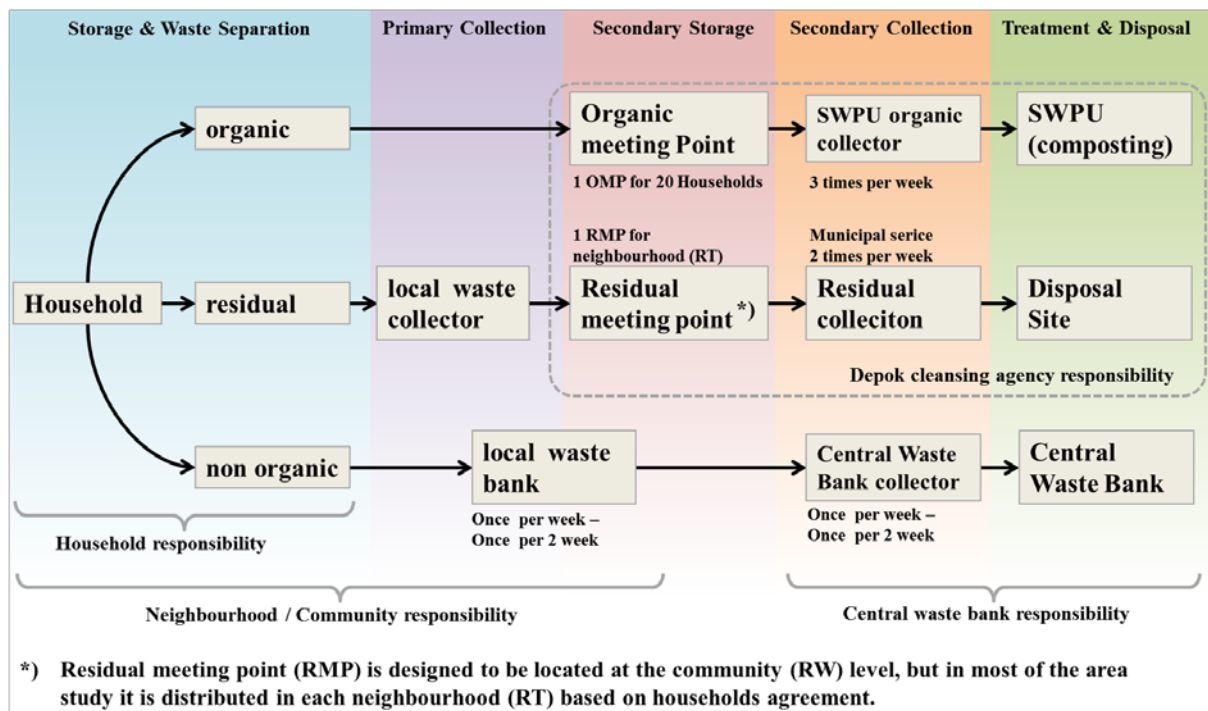
**Figure 4 The flow of household waste within neighbourhood with residual service coverage**

On the other hand, not all the neighbourhoods segregated their waste or disposed their waste in the designated secondary collection. In this neighbourhoods, the residual collection service from the municipal officer is absent due to contamination in the residual *meeting points*. Therefore, the local neighbourhood organization (RT) hired private collector to collect residual waste alongside with the mixed waste and transported it to the final disposal site (see figure 5). The condition whether one neighbourhood receives or not receive residual collection service discussed in the next subsection.



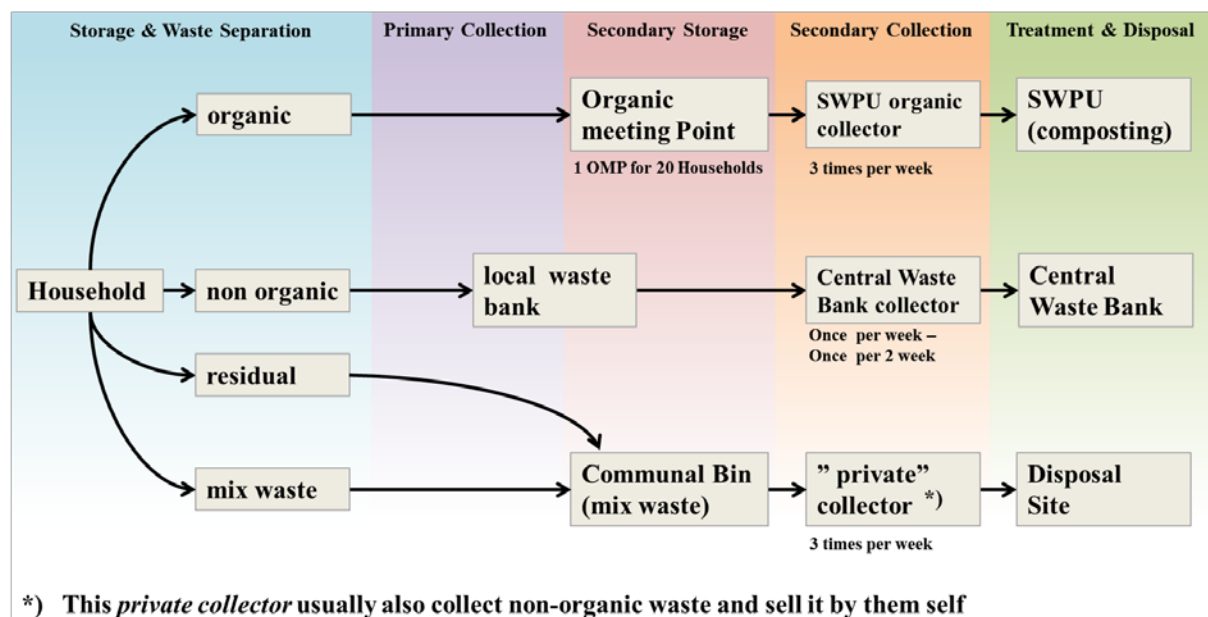**Figure 5 The flow of household waste within neighbourhood without residual service coverage**

Regarding more detailed programme characteristics, the operational and technical aspects, incentives, information dissemination and stakeholder involvement will be further described in the following subsection

### 4.3.1. Operational and Technical Aspects

### A.      Type of Waste Accepted

The household organic waste accepted by the Organic SWPU consists of two types, kitchen waste, and garden waste. Kitchen waste contains only materials such as foods, fruit residue, remain or leftovers of waste food, fish and animal bones, etc. Garden waste mainly consists of leaves and tree trunks. The Garden waste is further used in the SWPU as the main compound of the composting process. Type of non-organic material accepted by the local waste bank is decided based on the coordination with the higher level waste bank. Non-organic waste is defined as waste material with some value that can further enter the recycling stream, which usually consist of paper (printed paper, newspapers, magazines, cardboard, etc.), glass container, plastic products (plastic bottles, plastic containers, and others, except plastic bags), tetra pack containers and rubber tyre. On the other hand, residual waste consists of other wastes that not belong to organic waste and cannot be recycled, such as diapers, women sanitary napkins, non-recyclable paper (tissue, toilet paper, receipt paper, etc.), this kind of waste will be transported directly to the disposal site.

### B.      Storage System

*Primary Waste Storage*

Primary waste storage is placed within the house premises, and it is under each household responsibility to provide such storage. There is no standardized storage being promoted to store segregated waste except for the organic waste. The Cleaning Agency of Depok (CAD) to store organic waste promotes small plastic bucket, but it can be found other storage type being used to store their organic waste. Materials such as plastic bags, carton box are used to store non-organic waste; this kind of waste is usually stored inside the house to avoid scavenger taking the valuable waste. On the other hand, different type of large plastic bucket and trash can are used to store residual waste (see figure 6).

| Type of Storage used to store Organic waste | Type of Storage used to store Non-Organic waste | Type of Storage used to store Residual waste |
|---|---|---|



**Figure 6 Different Storage Type at the Household level**

*Secondary Waste Storage*

The secondary storage is used to store segregated waste, especially organic waste and residual waste temporarily before being collected by the municipal officer. The secondary storage is named *meeting point* by the CAD and under their responsibility to provide such facility. The location of each *Meeting point* is coordinated between the Cleaning Agency and Local Community Organization (RW/RT), usually placed in main street accessible by the collection vehicle. Organic *Meeting point* is provided at least one *Meeting point* for 20

**Figure 7 Organic Meeting Point, left with warning sign and right without warning**

households within the neighbourhood. Residual *Meeting point* is provided at least one unit in one community, but in most of the area, it is distributed in each neighbourhood (RT) based on households agreement. However, residual *meeting point* only available within the neighbourhood which majority of the households already segregated their waste. In this neighbourhood, communal waste bin for mix waste is still being used. On the other hand, there is no *meeting point* provided for the non-organic waste. Each household commonly delivers this waste type directly to the waste bank available in the neighbourhood on the collection day.

The organic *meeting point* is basically a large plastic bucket coloured in grey, (see figure 7), provided to contain organic waste from households for several days until being pick up by the SWPU collection officer. At the collection days, the SWPU collection officer will take the plastic bucket to the SWPU and replace with empty and clean bin. Regarding organic *meeting point*, the specification of the bin is standardized for the entire neighbourhood. Some organic *meeting points* are given a sign name to avoid some irresponsible people to put other than organic material in by the local community organization (RW/RT), while many other is commonly found without any warning sign.

## C.     Collection System and Transportation

### *Primary Waste Collection*

The household waste collection consists of two phases, the first phase or the primary collection is from the household to the *meeting point*, while the secondary collection is from the *meeting point* to the designated disposal/treatment facility according to the waste type.



**Figure 8 Commonly used hand cart for primary collection**

The primary waste collection from the households to *meeting point* is under the responsibility of the local community organization (RW/RT). In daily practice, under the coordination of the neighbourhood leader (RT), households collectively hire local person to collect and transport waste from each household to the *meeting point* using a handcart (see figure 8). The local worker mainly only collects and transport residual waste, while organic and non-organic waste is required to be transported individually by each household to the organic *meeting point* and local waste bank in the neighbourhood respectively. Household is not permitted to dispose residual waste directly to the residual *meeting point* to avoid contamination of another type of waste, in which municipal worker will not collect the contaminated residual waste. The frequency of waste collection from door-to-door was discussed among the households.

### *Secondary Waste Collection*

The secondary collection is under the responsibility of the CAD and the SWPU for residual waste and organic waste respectively. However, waste collection service is only provided for the community (RW) that already segregated their waste. The designated *meeting point* have

to be free of another type of waste. Otherwise, the waste will not be collected. This information was perceived during the interviews with the CAD.

*"we can stop the (collection) service, it is allowed under our local regulation, for households who do not want to segregate, the CAD is authorized to stop the (collection service)."*

*Officer of the CAD.*

However, the discontinuation of waste collection service was not always to stop all the service. Discretion could be made; only residual waste collection service was terminated. This condition is made when there are households within the community willing to segregate their waste (especially organic waste), but others still do not want to segregate. The indicators of the existence of households which were willing to segregate their waste (especially organic waste), was based on the organic waste weight trend from each organic *meeting point* within the neighbourhood, as all organic waste from each *meeting point* was weighted and recorded by the Organic SWPU officer. The following information was perceived during the interviews with the CAD.

*"they (the local community (RW/RT)) hire private waste collector, but we see some households segregate their waste. Thus, we come, we collect the organic waste (through the Organic SWPU) and on the other hand, the residual waste is collected by the private waste collector, so (at the moment) this combination is possible."*

*Officer of the CAD.*

In the neighbourhood without residual waste collection service from the CAD, the neighbourhood leader (RT) usually employed *private waste collector* to collect mixed waste from each household and communal bin and transported them to the disposal site. This neighbourhood is not covered by residual waste collection service from the CAD due to the condition that the *meeting point* is still contaminated with another type of waste. This information was perceived during the interviews with the local community leader.

*"... i will honest with you, many people in my neighbourhood still do not want to segregate their waste, so they just dispose the waste all at once (in the communal bin designated for residual waste). On the other hand, the government do not want to collect it". "Therefore, here we (partially) self-manage our waste."*

*Local neighbourhood leader (RT)*

As for the secondary collection for the non-organic waste from the Waste Bank is coordinated with the Depok Waste Bank Community. This waste bank community is independently transporting and managing the non-organic waste from their local level waste bank member. The cooperation between the CAD and the Depok Waste Bank Community to manage non-organic waste has been established since 2012.

### Waste Collection Frequency and Transportation

Secondary collection for each of segregated waste is based on certain collection frequency and has their own transportation vehicle. Organic waste is collected every two days by the Organic SWPU collection officer from the organic *meeting points* to the SWPU for composting purpose using moto-truck with 1,5 m$^3$ container capacity. The CAD officer

**Figure 9 Left: truck for collecting residual waste.
Right: moto-truck for organic waste**

collects residual waste from residual *meeting point* and the SWPU every three days and transported directly to the Final Disposal Site using dump truck with 6-8 m³ container capacity. The residual waste dump truck is operated by the CAD officer and served city-wide level under certain route, schedule and collection frequency, while the organic moto-truck served within one Organic SWPU coverage also under certain route, schedule, and collection frequency (see figure 9). On the other hand, non-organic waste is collected from the waste bank at the community level based on appointment, usually on weekly or biweekly collection frequency using small pick-up operated and owned by Depok Waste Bank Community. Waste transportation is designed to have its vehicle to avoid the segregated waste mixed at some point.

## D. Recovery Facility Operation

### The Organic SWPU

There one Organic SWPU in the study area with the coverage area or community up to 3.000 Households. This Organic SWPU daily operation mainly divided into two categories, which is organic waste collection and composting process. The composting process in the Organic SWPU is using the *open windrow* system. An *open windrow* system is a method using natural aeration process. The organic waste, which will be composted, is mix with decayed leaves (contained with fungus) and then piled, this piled of waste then reverse under certain frequency to control the temperature and humidity.



**Figure 10 Process of sorting organic material**

The procedure within the Organic SWPU is as follow. Firstly, organic waste transported to the SWPU is weighed and recorded. Secondly, the incoming waste is put on the sorting table to manually remove non-organic material such as cotton buds, tissue, plastics bags, cigarettes, etc., (see figure 10). Thirdly, the organic waste is put into the chopping machine and weighted, after being weighted, the organic waste then mixed with decayed leaves with the composition of 1 kg organic waste and 1 kg of decayed leaves, and then piled to start the decomposition process. Each pile is labelled with date, the temperature and humidity are monitored. The composting process took an average of 3,5 months.

### The Local Waste Bank

There is no minimum standard for number people served by one waste bank, but usually one neighbourhood (RT) should have at least one waste bank ar at least a minimum one waste bank for a community (RT). There are 11 local waste bank in study area distributed in three community (RW) consists of 22 neighbourhoods (RT).

Local waste bank opens weekly or biweekly, on Saturday or Sunday, during the time when most of the households are off from work. On the scheduled day and hour (usually started by 9 am), the households come to deliver their waste in separated condition. Each of the households is required to sort their non-organic materials in several ways in a clean condition.

The incoming waste, firstly, weighted based on the waste type and further put in different storage. The local community level waste bank officer contact the Depok Waste Bank Community officer to pick up the waste. Every household that deposits their non-organic waste to the local community level waste banks receives an account book which record number of waste deposit and money value, this money value usually withdraw in a certain interval of time depends on agreement. Each of the local level waste bank has their secondary collection schedule from the Depok Waste Bank Community, commonly, the secondary collection schedule is in the same day with the local waste bank operation day.

### 4.3.2. Incentives within Depok Recycling Programme

The use of incentives in Depok recycling programme was based on the local regulation No.5/2014 about Waste Management. This local regulation Management stated that the government no longer impose any charge for organic or residual waste collection from *meeting points* to the Organic SWPU and Disposal site.

> *"the removal of collection retribution, in order to omit households excuse (to not segregate the waste at source) because already paying the service, (to say that) it is government obligation. (Based on local regulation) this is shared obligation."*
>
> *Officer of the CAD.*

Furthermore, based on interview, the waste collection service retribution exemption have other purposes which is to enable the local community organization (RW/RT) to have a fiscal space for organizing solid waste service and facility within their neighbourhood. The following information was perceived during the interview.

> *"if previously each households retribution becoming service charge, now we do not take it, but it is managed by this local community organization (RW/RT) in order to finance initiatives such as pay collection officers in their respective neighbourhood."*
>
> *Officer of the CAD.*

From the fieldwork, the local neighbourhood leader (RT) still collects service charge from the household. The difference from previous practice, this service charge is not paid to the government, instead, being used only to manage waste service within the neighbourhood, for example, paying the local waste collector or provides communal bin / *residual meeting point*. Therefore, the amount of service charge is usually lower than before.

However, there are other kind of incentives/rewards given to the households for segregating their waste from the source, which is financial incentives in term money in return for recyclables material, free waste bin and free compost. Incentives in term of money in return for recyclables material was given by the local waste bank, while the CAD gave the free waste bin. On the other hand, free compost was given by the Organic SWPU.

### 4.3.3. Information Dissemination

Information dissemination is aimed to accustomed household regarding waste recycling program. This information dissemination is part of the awareness campaign, named "Sorting Movement", which has been initiated since 2012 as an effort to change household behaviour in dealing with their waste, especially to segregate waste at source. The CAD is responsible for information dissemination. However the waste banks community also has become

important partner of the agency to disseminate the waste recycling program and conduct training on how to segregate waste to the households. In the community level, Local community organization and SWPU officer also involve raising community awareness.

Based on the interview, information regarding waste recycling program mainly delivered to the household by direct communication, for example through dissemination by the CAD, local community meeting, womens group meeting and, posters in the neighbourhoods showing how and what to recycle.

### 4.3.4. Stakeholder Involvement

Tere were six stakeholders involved in the program implementation within the area of study, detailed role of each stakeholder will be further described in the following section.

### A.    The Cleaning Agency of Depok (CAD)

The main stakeholder in Depok Waste Recycling Programme is the CAD. Based on local Regulation No 5/2014 about Waste Management, the agency responsible for coordinating service provision and regulating solid waste management. Regarding the waste recycling program, this agency is responsible for providing facilities such as waste storage at the secondary level (*meeting points* for the organic and residual waste), SWPU unit, secondary waste collection services and waste transportation.

Within the study area, the CAD provides Organic SWPU and organic *meeting points*. The CAD did not provide residual *meeting points* since the local community organization decided to distribute the residual *meeting points* in each neighbourhood (RT). Therefore the neighbourhood arranges themselves to provide this *meeting point*.

### B.    Organic Solid Waste Processing Unit (SWPU) Operator

Organic SWPU operator works under the coordination of the CAD. The main responsibility of this unit is to provide organic waste collection service and turned organic waste into compost. Another responsibility, especially the Organic SWPU Coordinator is to involve in the information dissemination effort actively.

### C.    Local Waste Collector and the *Private* Waste Collector

The local waste collector employed by the neighbourhood leader (RT) to collect and transport waste from each household to the *meeting point*. The local worker mainly only collects and transport residual waste as the household is not permitted to dispose residual waste directly to the residual *meeting point* to avoid contamination of another type of waste, in which municipal worker will not collect the contaminated residual waste. The local waste collector has an important role in implementing the *no segregate-no collection service* as they collect waste from door-to-door. However, this is not as easy as it is perceived, as their salary practically comes directly from this household member.



**Figure 11 Private waste collector, collecting mix waste**

In the neighbourhood where there is no residual waste collection service from the CAD, the neighbourhood leader (RT) usually employed *private waste*

*collector*. This *private waste collector* collected mixed waste from each household and communal bin and transported them to the disposal site.

## D. Local Waste Bank and Woman Community Group

Waste bank assigned to accept non-organic material from the households by the CAD. Waste bank[9] in Depok consists of two levels, the one in the local community level and the district level. Each District has a central waste bank that coordinates the local level waste bank, for example, in term of waste collection and transportation. In the local level, the majority of the waste bank organized under woman community group. As it mostly runs on a voluntary based, the local waste bank usually faces lack of equipment and operational cost, furthermore, this local waste bank usually, does not have a permanent place to run their operation.

## E. Local Community Organization (RW/RT)

Local community Organization is responsible for facilitating the availability of waste storage at each household, provide collection vehicle to transport waste from each household to the *meeting point*, establish local level waste bank and ensure disciplined waste segregation activity in the neighbourhood. Regarding waste segregation at the household level, the role of the local community leader (RW/RT) is essential to implement the no segregate no collection policy, as this role could become a dilemma during the implementation. The following information was perceived from the interview with the local community leader (RW/RT).

> *"(for me), hopefully in the future, this kind of sanctions could be minimized. Otherwise, it could later become a social problem. yaa ... for example, if (their) waste is not collected, our neighbourly relation could become difficult. I often think that garbage is dirty, do not let its management raises the opportunities of difficult neighbourly relations."*
>
> *Local community leader (RW/RT).*

## F. Households

Household participation is one key factor in the successfulness of the recycling program in Depok. Each household is responsible for providing personal waste storage, perform waste segregation at source and actively involved in the waste recycling program within the neighbourhood. However, not all the households within the study area were segregating their waste at source.

### 4.3.5. Discussion: Depok recycling program characteristics in relation to household participation

Based on the material stream and secondary collection system, Depok recycling programme basically is a drop-off recycling programme. In a drop-off scheme, the community as the waste producers requires taking their recyclable material in strategically located facilities (such as neighbourhood containers or recycling station), and waste collection is provided from this containers to the treatment facility.

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[9]  Until 2016, there were 482 unit waste banks throughout Depok, while in the study area there were 11 local waste bank.

In a drop-off system, Sin-Yee and Sheau-Ting (2016) pointed out that an area with well-equipped recycle bins within accessible distance can increase participation in the recycling program, as further, they pointed out that the greater the accessibility of the recycle bins, the higher the possibility the community to segregate waste. In Depok recycling programme, the organic *meeting point* is located within an acceptable distance to the household, in which this secondary storage is provided at least one *meeting point* for 20 households within the neighbourhood. There are no secondary storage for the non-organic material, the households need to transport their waste to either 11 local waste bank available in study area. This waste bank distributed in three community (RW) and serves a total of 22 neighbourhoods (RT), which means the number is still lack. Therefore, some households might need more effort than the others to transport their non-organic waste to the nearest local waste bank.

On the other hand, in a drop-off scheme, presence and hygiene of the waste containers also essential. Duffy and Verges (2009) found that the presence of specialized recycling container improves recycling compliance. Specialized waste containers/*meeting point* used in Depok recycling program is only found for the organic waste. However, this *specialized* container is basically a bucket with low plastic quality. Moreover many of this *meeting points* is commonly found without any warning sign which in this case will is needed to avoid some irresponsible people to put in other than organic waste material. On the other hand, as pointed before, there is no secondary storage for the non-organic waste as the households need to transport the waste directly to the local waste bank.

In term of residual and organic waste collection provided by the municipality and SWPU repectively, the area of study is already provided with adequate collection frequency based as Hoornweg and Tata (2012) arguments that the municipality should provide collection frequency for no more than weekly collection. However, non-organic waste collection is not oganized under municipal service but the waste bank. The local waste bank and the waste bank community have thier own collection mechanism and schedule. Unlike the organic waste and residual collection that serve the households every two day and three days per week repectively, this waste bank operates majority once per two week. In addition, the local waste bank also only operates at the same day of collection day. Therefore it may cause the households need to store their recyclables for some time, which implies a bigger space needed to store the recyclable material.

Within the study area there are incentives use to increase household participation in the recycling program, such as, financial incentives in term money in return for recyclables material, free waste bin and free compost. Incentives in term of money in return for recyclables material was given by the local waste bank, while the free waste bin was given by the CAD. On the other hand, free compost was given by the Organic SWPU. The government also impose collection service retribution exemption based on local regulation No.5/2014 about Waste Management for households that segregate waste at source. However the influence of incentives on recycling participation is divided. Authors such Harder and Woodard (2007), Timlett and Williams (2008), and Shaw and Maynard (2008) found that financial incentives potentially increase household recycling participation, on the other hand, authors such as Allen et al. (1993) and De Young (2000) pointeed out that incentives did influenced recycling frequency but do not lead to long run behaviour change. Therefore further analysis regarding whether incentives within the area of study influence or differs among households still need to be done.

Vicente and Reis (2008a) suggests that information is one of the most important factors to encourage participation and receiving information through direct means has a positive effect

on household participation. Furthermore, Vining and Ebreo (1990) stated that recyclers might receive more information about recycling than non-recyclers, or they might have found out about recycling from more sources than non-recyclers. Within the study area, information regarding wate recycling program mainly delivered to the household by direct communication, for example through dissemination by the CAD, local community meeting, womens group meeting and, posters in the neighbourhoods showing how and what to recycle. However, whether the information have either covers all the households or being adequately provided still need further analysis.

Furthermore, both treatment facility (Organic SWPU and local waste bank) in the recycling program is strictly do not want to receive other than prescribed waste material type. Additionally, residual waste will only be collected by the municipal agency if the residual *meeting point* uncontaminate with other type of waste material. Therefore the responsiblity to coordinate any measure in the neighbourhood to increase household participation lies heavily to the local community leader. In this case, the effort to increase household participation so far have been done through the community meeting or woman group. On the other hand, the policy of no segregate no collection might work in the secondary level, but in the primary level it could become a dilemma during the implementation as it might raises the opportunities of difficult neighbourly relations, which in fact, also under the community leader responsibility.

As discussed above, there are several factors regarding recycling scheme implemented in Depok, especially in the study area that might have different effect among household. On the other hand, recycling programme characteristic may also rise psychological factor which in turn could have different effect to the household. For example, Ioannou et al. (2011) pointed out that a drop-off scheme give less social pressure (subjective norm) for people to recycle the person who participate or not participate is invisible to others.

However, whether these factors arises from the recycling program characteristic have differentiate, as well as influenced households participation, it still need further analysis. Section 4.5 and 4.6 will mainly cover this issue.

## 4.4.    Description of the Sample

The respondents were categorized into households participate in Depok waste recycling program, which is those who segregate waste at source (HSO), those who do not participate or do not segregate waste at source (HdSO). The categorization based upon self-reporting approach gathered from the questionnaire. The reason for using this approach and internal validity issue regarding self-reporting approach discussed briefly in the section 3.1.1 and section 3.6 respectively. Further data also gathered from the households regarding how do they usually disposal each type of waste practice to distinguish their level of participation in source segregation. Those who self-reported as participate in source segregation and usually dispose each type of waste in the each designated place were considered as taking part in the programme.. On the other hand, those who self-reported as do no participate were considered as it is.

### 4.4.1.  Waste Disposal Practice

As described in the section 4.3.1, each household is required to store their segregated waste in separate storage (in the household level) and dispose them in the designated secondary storage within the neighbourhood. From 176 respondents, 103 households or 58.5% reported

as segregate waste at source and 73 households or 41.5% reported as do not segregate waste at source.
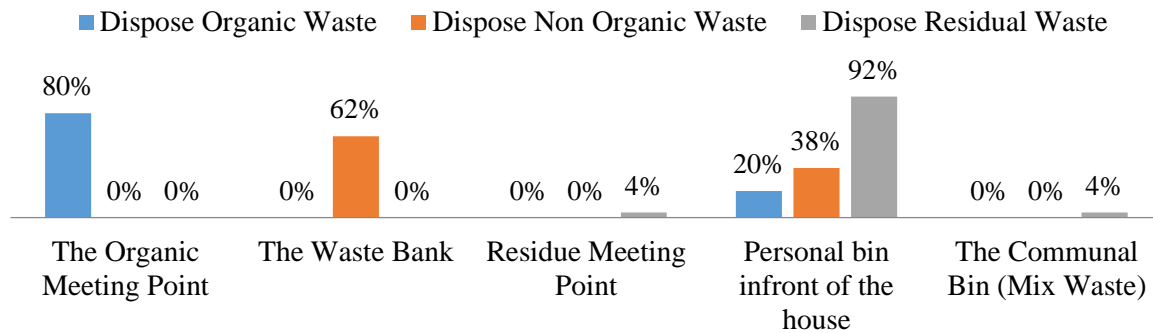


**Chart 2 Location of waste disposal of household self-reported as participating in source segregation.**

Chart 2 shows that majority of the household who self-reported as participating in waste source segregation dispose their waste in the designated place. However there are 20%, 38%, and 92% household disposed organic waste, non-organic waste and residual waste respectively, in the personal bin in front of the house. Regarding the practice of disposing organic waste into personal bin in front of the house might be due to the possession of separate personal bin for organic waste before transported to the organic *meeting point* at the organic waste collection day. While household dispose their non-organic waste to the personal bin in front of the house could relate to the fact that the local waste collector worker also collects non-organic waste.

> *"I also collect dry waste (non-organic waste from the household) (for myself)..., every two weeks there will be someone to pick up that (non-organic waste) from my house".*

> *Local waste collection worker*

Regarding the practice of disposing residual waste to the personal bin may relate to the households restriction for disposing residual waste directly into the residual *meeting point* to avoid waste contamination in some of the neighbourhoods which already received residual waste collection service from the CAD. Moreover, all household who self-reported as participating in waste source segregation has separate bin/container to store their waste within the house premises (see chart 3). Therefore, these households were further categorized as households who segregate waste at source (HSO) group.



**Chart 3 Measure to store segregated waste of household self-reported as participating in source segregation**

On the other hand, Chart 3 shows household who self-reported as not participating in waste source segregation majority dispose their waste (mix waste) either in the personal waste bin (62%), in the mix waste communal bin (32%) and dumped or burned in the available open space (7%) (see chart 4). These households was further categorized as households who do segregate waste at source (HdSO) group.
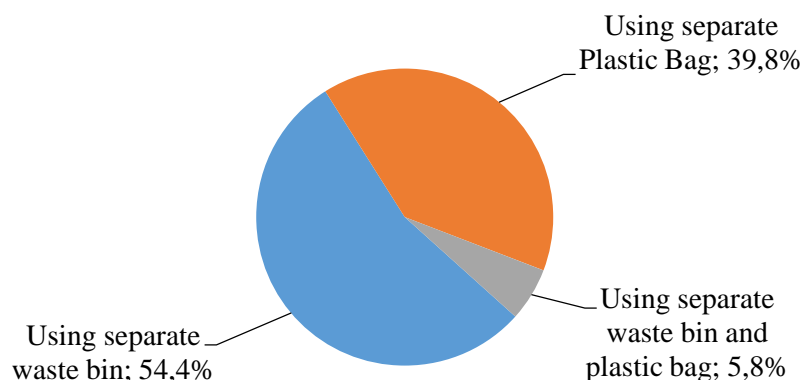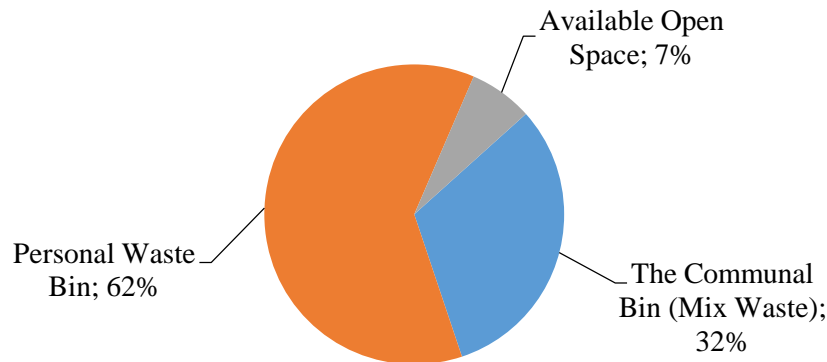


**Chart 4 Location of waste disposal of household self-reported as not participating in source segregation**

### 4.4.2. Demographic Information

Based on categorization as described earlier, demographic information was gathered from each household group. Demographic information, in term of household income, size, the presence of child were gathered directly from the respondents, while in term of age, gender, household roles, employment status, and education level were gathered regarding household member whom in charge of waste management.

The average household income of the HSO group was Rp 10,434,951 (SD=6,460,327) while the HdSO group average income was Rp 6,208,219 (SD=5,267,899). Regarding household size, the HdSO group were mostly comprised of 3 – 4 people (65.8%) as well as the HSO groups (63.1%). Majority the households within HdSO group living without children under ten years old (56.2 %), on the contrary, the households within the HSO group living with children under ten years old (57.3%).

The following data describe household member whom in charge of waste management within the family. The average age in the HdSO group was 38 years old (SD=9.6), while in the HSO group was 39 years old (SD=8.6). Majority is classified as not working/retired, 64.4% in the HdSO group and 74.8% in the HSO group. There were 99.0% and 93.2% female, predominates by mother 98.1% and 90.4%, in the HSO group and HdSO group respectively. This has been as expected, as female member of the family, especially mother, commonly did the activity in relation with waste segregation. Even though mother predominates as the one in charge of waste management practice, the house helper usually also assigned to segregate and/or to set out the waste.

> *"..usually, it is me (in charge of waste segregation).. helped by house helper in my house".*

> *Household segregate waste at source, housewife.*

In term of education level, it shows that half of the household member in charge of waste management in the HSO group majority of family member in charge of waste management had university degree or high education (63.1%), while in the HdSO group majority had low education (65.8%).

**Table 4 Distribution of Respondents**

| Item | HdSO | | HSO | |
|---|---|---|---|---|
| | N | % | n | % |
| Household size | 73 | 100.0 | 103 | 100.0 |
| 1 – 2 people | 8 | 11,0 | 9 | 8,7 |
| 3 – 4 people | 48 | 65,8 | 65 | 63,1 |
| > 4 people | 17 | 23,3 | 29 | 28,2 |
| Presence of child under 10 y | 73 | 100.0 | 103 | 100.0 |
| No child under 10 y | 41 | 56.2 | 44 | 42.7 |
| 1 - 2 Childs | 27 | 37.0 | 55 | 53.4 |
| > 2 Childs | 5 | 6,8 | 4 | 3,9 |
| Household  member in charge of waste management | | | | |
| Gender | 73 | 100.0 | 103 | 100.0 |
| Male | 5 | 6.8 | 1 | 1.0 |
| Female | 68 | 93.2 | 102 | 99.0 |
| Household role | 73 | 100 | 103 | 100 |
| Father | 1 | 1.37 | 0 | 0.0 |
| Mother | 66 | 90.41 | 101 | 98.06 |
| Other adult | 6 | 8.22 | 2 | 1.94 |
| Level Education | 73 | 100.0 | 103 | 100.0 |
| Low Education | 48 | 65.8 | 38 | 36.9 |
| High Education | 25 | 34.2 | 65 | 63.1 |
| Employment status | 73 | 100.0 | 103 | 100.0 |
| Not Working/Retiree | 47 | 64.4 | 75 | 72.8 |
| Civil servant/ Private employee | 13 | 17.8 | 17 | 16.5 |
| Self-Employee | 9 | 12.3 | 8 | 7.8 |
| Student | 4 | 5.5 | 3 | 2.9 |

## 4.5. The Difference of Households Participation in term of Psychological and Situational Factors

This section mainly analysed whether there was a difference regarding psychological and situational factors between household within the HdSO and HSO group, before further analysed the influence of each factor regarding their participation in which will be discussed in the last section of this chapter.

### 4.5.1. Psychological Factors

This section discusses the differences in participation in waste segregation between the HdSO and HSO group regarding the psychological factors, which is attitude, subjective norms and perceived easiness, between the HdSO and HSO group. In order to analyse whether there is a significant difference regarding psychological factors among HdSO and HSO groups, an independent T-test was used. However, factor analysis was performed first to group the

statements within each factor. The statements within each factor were summed to form a measure of that factor, and then a reliability analysis was run to test the reliability of the new measure. A coefficient greater than 0.7 score indicates the new measure is reliable.

## A.      Attitude towards waste segregation

Attitude towards waste segregation tested using three statements on five points Likert scale to indicate their level of agreement. These statements were used to identify whether the households agree or against waste source segregation. Given the fact that the waste recycling program has been started since 2006, recycling and waste segregation was not a new issue in Depok. Both group majority shows a positive attitude towards waste segregation.

As shown in Chart 5, most of the households within either the HSO groups or the HdSO group, answered strongly agree or agree with all three statements. From the interview, we also can not see the difference of attitude in both groups. However, the households in the HdSO group only considered the effect waste segregation regarding neighbourhood cleanliness, which is the effect in their immediate environment, while the households in the HSO group considers the effect of waste segregation even further. The following information was perceived during the interviews.

*"we will have a cleaner neighbourhood."*

*Household not segregate waste at source, housewife.*

*"it is good ... it is very good indeed. In humanity, we care for others. Secondly, we must remember our children related to water pollution. I feel pity for our neighbours living around Cipayung (final disposal site), the garbage is piling up.. they are exposed to pollution and odour".*

*Household segregate waste at source, housewife.*
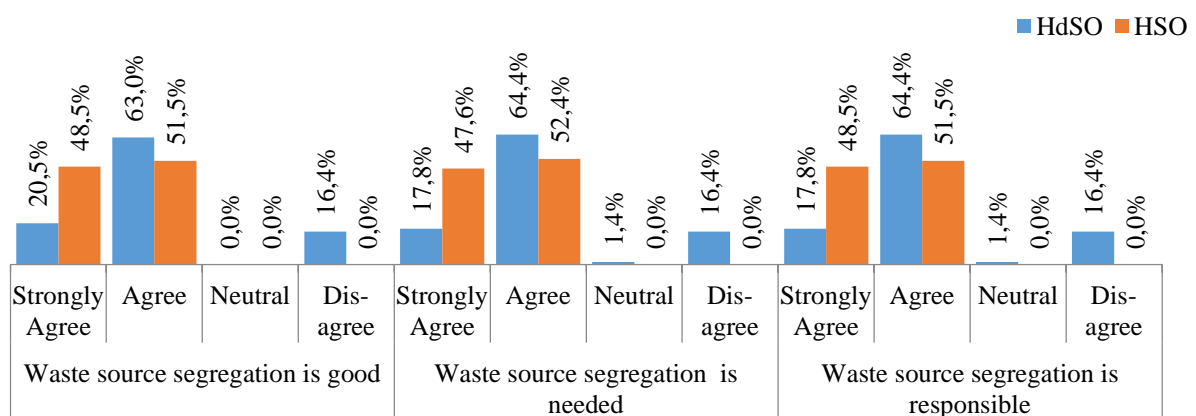


**Chart 5 Agreement regarding attitude toward waste segregation statements.**

Independent T-test result (Table 5) was used to analyse the difference of attitude on both group further and it turned out that this test indicates a significant difference regarding attitude towards waste segregation between the HdSO group (M=3.85, SD=0.91) and HSO group M=4.48, SD=0.48), t(101) = 0.02, p < .05. The HSO group had a higher attitude score compared to the HdSO group, which means that the households within this groups had a higher sense of responsibility in waste segregation.

**Table 5 Factor reliability and statistical test for Attitude towards waste segregation**

| Factor / Statements | α | HdSO (n=73) | | HSO (n=103) | | *t* | *p* |
|---|---|---|---|---|---|---|---|
| | | *M* | *SD* | *M* | *SD* | | |
| Attitude towards waste segregation | | | | | | | |
|    Waste source segregation is good | .989 | 3.85 | .91 | 4.48 | .48 | -5.40 | .00* |
|    Waste source segregation is needed | | | | | | | |
|    Waste source segregation is responsible | | | | | | | |

α = Reliability coefficient

* Significant at *p<.05*

## B.      Subjective Norms

Subjective norms were tested using four statements on five points Likert scale to indicate their level of agreement. These statements were used to identify the presence of social pressure towards waste source segregation either from family (internal reference), or neighbours and the community (external reference).

As shown in Chart 6 and 7, there was a different response regarding the presence of social pressure to segregate waste at source either internally or externally between these two groups. Within the HSO groups, the households acknowledge the presence of both source of social pressure as the majority the answer were either strongly agree or agree, while in the HdSO group we can see a high disagree response to all statements regarding internal or external social pressure. The following information was perceived during the interviews. It showed that the households within the HdSO group did not receive any external pressure from the neighbours around them.

*"Nobody gives comment (whether I segregate waste or not)."*
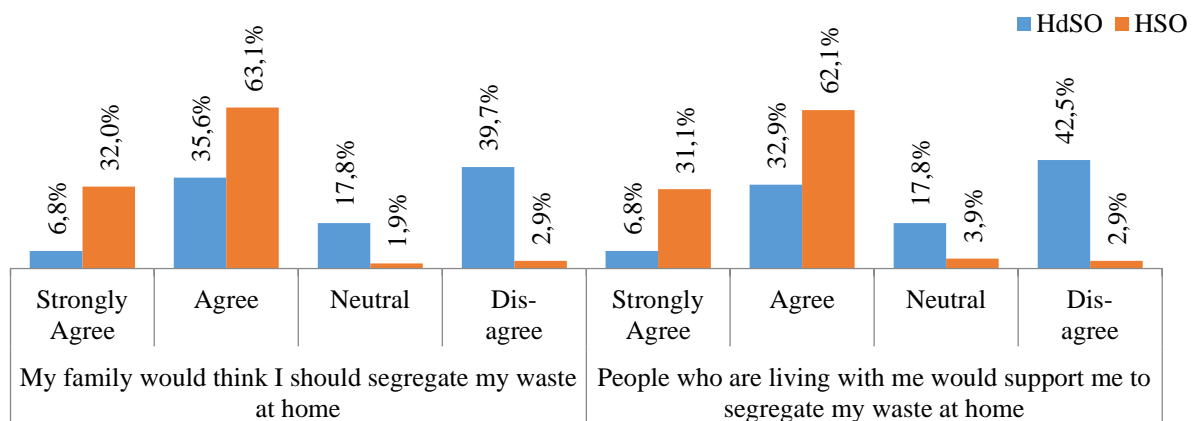
*Household not segregate waste at source, housewife.*



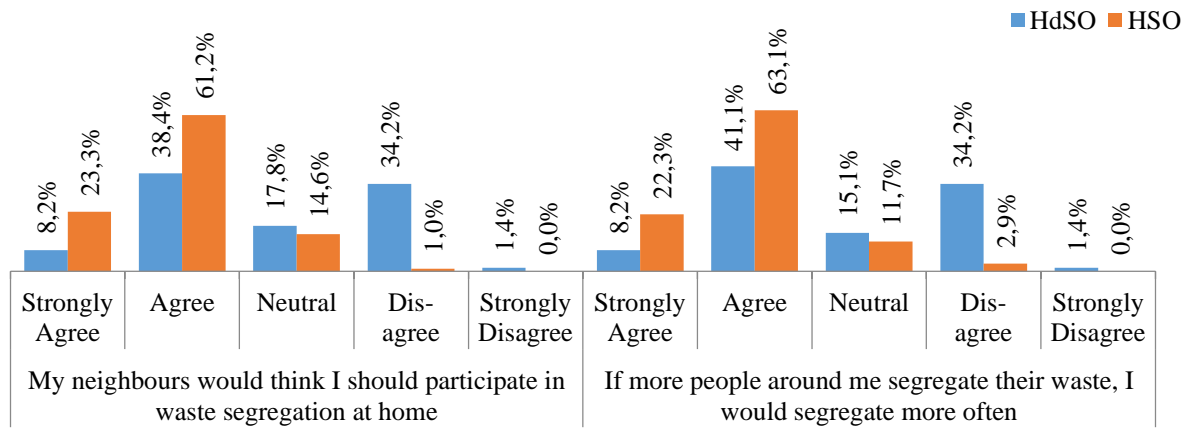**Chart 6 Agreement regarding internal subjective norms statements.**

**Chart 7 Agreement regarding external subjective norms statements.**

The Independent T-test result (Table 6) indicates that there was significant difference regarding internal subjective norm between the HdSO group (M=3.07, SD=1.00) and the HSO group (M=4.23, SD=0.62), t(111) = 0.00, p < .05. The test also show significant difference regarding external subjective norm between the HdSO group (M=3.19, SD=1.01) and the HSO group (M=4.06, SD=0.63), t(111) = 0.00, p < .05. In other words, households within the HSO groups were likely to feel the presence of social pressure to participate in waste source segregation either internally or externally rather than the households within the HdSO group.

**Table 6 Factor reliability and statistical test for Subjective norm**

| Factor / Statements | α | HdSO (n=73) | | HSO (n=103) | | t | p |
|---|---|---|---|---|---|---|---|
| | | M | SD | M | SD | | |
| Internal subjective norms | | | | | | | |
| My family would think I should segregate my waste at home | .972 | 3.07 | 1.00 | 4.23 | 0.62 | -8.76 | .00* |
| People who are living with me would support me to segregate my waste at home | | | | | | | |
| External subjective norms | | | | | | | |
| My neighbours would think I should participate in waste segregation at home | .935 | 3.19 | 1.01 | 4.06 | 0.63 | -6.47 | .00* |
| If more people around me segregate their waste, I will segregate more often | | | | | | | |

α = Reliability coefficient

* Significant at *p<.05*

## C.    Perceived Easiness

Perceived easiness was tested using three statements using on five points Likert scale to indicate their level of agreement for each perceived easiness in term of capabilities to segregate waste, perceived easiness in term of time availability to segregate waste and perceived easiness in term of space availability to segregate waste respectively. These statements were used to measure household perception regarding the easiness to conduct certain waste source segregation regarding their capabilities, available space to store segregated waste and time to segregate waste.

From the Chart 8 to 9 below, it was perceived by majority of the household within the HSO groups that that waste segregation is easy, and not troublesome. They also perceived to have the capability to segregate waste at source. Furthermore, they perceived that space availability to store segregated waste, and time availability to segregate waste was not an issue to them. On the other hand, majority of the households within the HdSO groups perceived the opposite. However, several numbers of households within the HdSO groups perceived that waste segregation is easy, not space, and time-consuming.
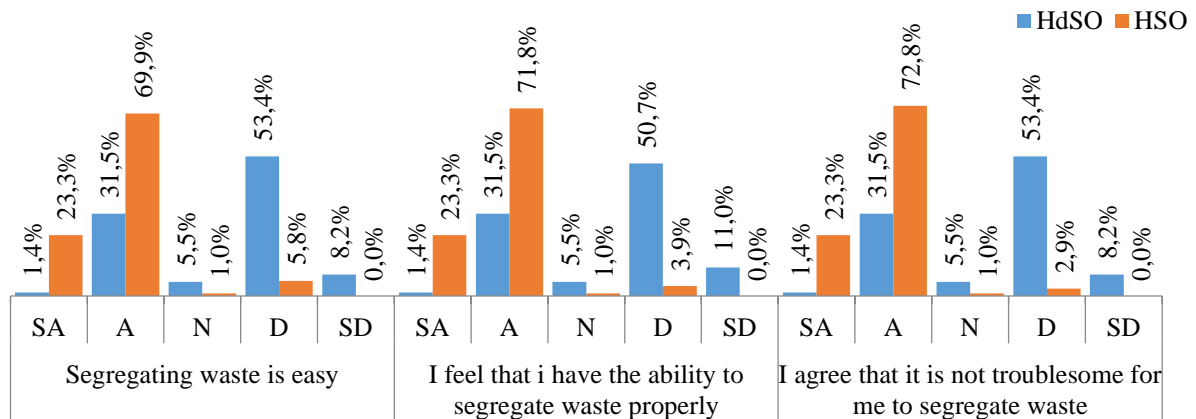


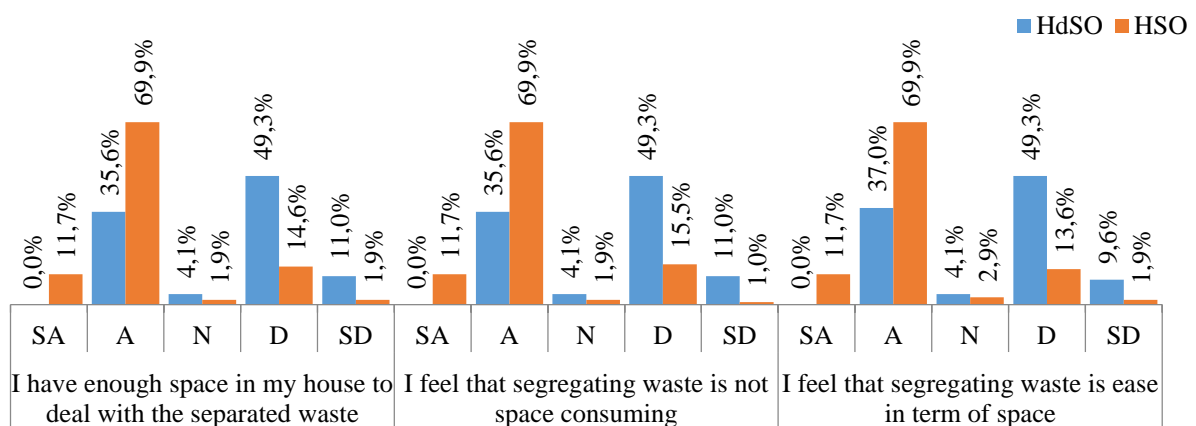**Chart 8 Agreement regarding perceived capabilities statements**



**Chart 9 Agreement regarding perceived space availability to store segregated waste statements**
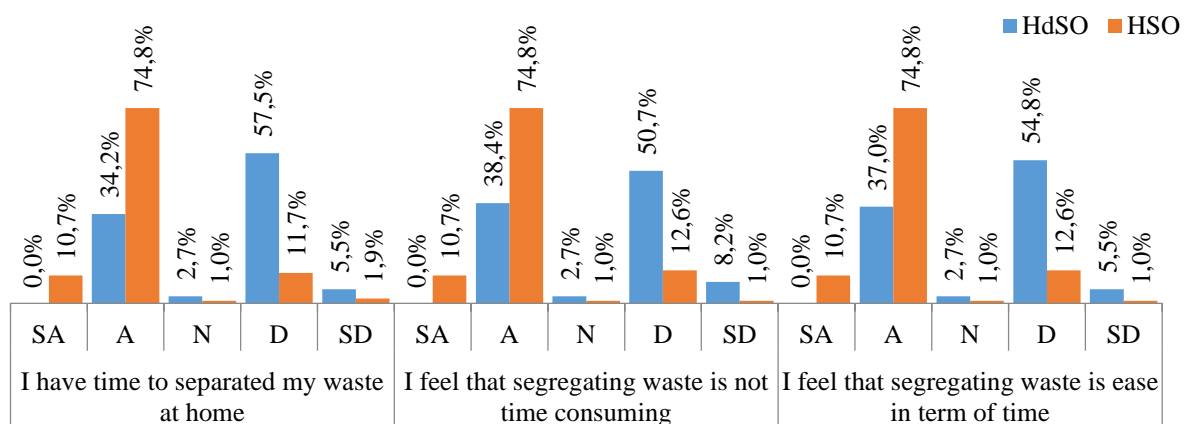


**Chart 10 Agreement regarding perceived time availability to segregate waste statements**

The Independent T-test was used to analyse whether there was a difference of these factors between both groups. The result (Table 7) indicates that there was significant difference regarding perceived capabilities, space and time availability respectively. The HdSO group had lower perceived easiness in term capability to segregate waste at source (M=2.63, SD=1.06) compared to the HSO group (M=4.14, SD=0.59), t(111) = 0.00, p < .05. They also had lower perceived easiness in term of space to store segregated waste (M=2.66, SD=1.06) compared to the HSO group (M=3.75, SD 0.87), t(135) = 0.00, p < .05; and lower perceived easiness in term time availability to segregate waste (M=2.69, SD=1.01) compared to the HSO group (M=3.81, SD=0.82), t(134) = 0.00, p < .05.

The following information shows that households within the HSO groups perceived waste segregation as easy, furthermore, it also shows that space availability to store segregated waste was not an issue to the households within this group.

> "..in my opinion, it is easy..., Initially it was a bit difficult. I also do not feel it need much space."

> Household segregate waste at source, housewife.

**Table 7 Factor reliability and statistical test for Perceived easiness**

| Factor / Statements | α | HdSO (n=73) | | HSO (n=103) | | t | p |
|---|---|---|---|---|---|---|---|
| | | M | SD | M | SD | | |
| Perceived capabilities to segregate waste | | | | | | | |
|   Segregating waste is easy | | | | | | | |
|   I feel that i have the ability to segregate waste properly | .988 | 2.63 | 1.06 | 4.14 | 0.59 | -10.96 | .00* |
|   I agree that it is not troublesome for me to segregate waste | | | | | | | |
| Perceived availability of space to store segregated waste | | | | | | | |
|   I have enough space within my house to deal with the separated waste | | | | | | | |
|   I feel that segregating waste is not space consuming | .984 | 2.66 | 1.06 | 3.75 | 0.87 | -7.21 | .00* |
|   I feel that segregating waste is ease in term of space | | | | | | | |
| Perceived availability of time to segregate waste | | | | | | | |
|   I have time to separated my waste at home | | | | | | | |
|   I feel that segregating waste is not time-consuming | .985 | 2.69 | 1.01 | 3.81 | 0.82 | -7.77 | .00* |
|   I feel that segregating waste is ease in term of time | | | | | | | |

α = Reliability coefficient
* Significant at *p<.05*

### 4.5.2. Situational factors

This section discusses the differences in participation in waste segregation between the HdSO and HSO group regarding the situational factors, which consist of service provision, information regarding recycling programme and knowledge regarding type of waste, incentives and demographic attributes.

### A.  Service Provision

The operational and technical aspects of the recycling program within the study area have been described in subsection 4.3.1. As for this part, further discussion in term of the difference of distance to the communal recycling bin (both organic *meeting point* and local Waste Bank) and frequency of waste collection (at the secondary level) for the organic and non-organic waste will be provided. The decision to not included the distance to the residual *meeting point* and Organic SWPU due to the technical aspect in the study area, in which, the households were not allowed to directly disposed their residual waste into the residual *meeting point*. On the other hand, the organic waste was mainly disposed to the organic *meeting point* first rather transported directly to the Organic SWPU. In addition, each household was required to disposed both their organic and non-organic waste directly to the organic *meeting point* and waste bank respectively.

The organic *meeting point* was designed to cover 20 households per one communal bin. Therefore, the distance to the organic meeting point was categorized into two group, under 100 meter, and over 100 meters. In the other hand, one waste bank was designed to cover one neighbourhood (RT). Therefore the distance to the local waste bank was categorized into two group, under 200 meter, and over 200 meters. From the Chart 11 below, it showed that majority of the house distance to the organic meeting point of within the HdSO group was over 100 meter (72.6%) while the HSO group was the opposite. In the other hand, the house distance to the local waste bank within the HSO group was under 200 meter (78.6%) while the HdSO were almost equally divided over the distance of under 200 meters (45,2%) and over 200 meters (54,8%).
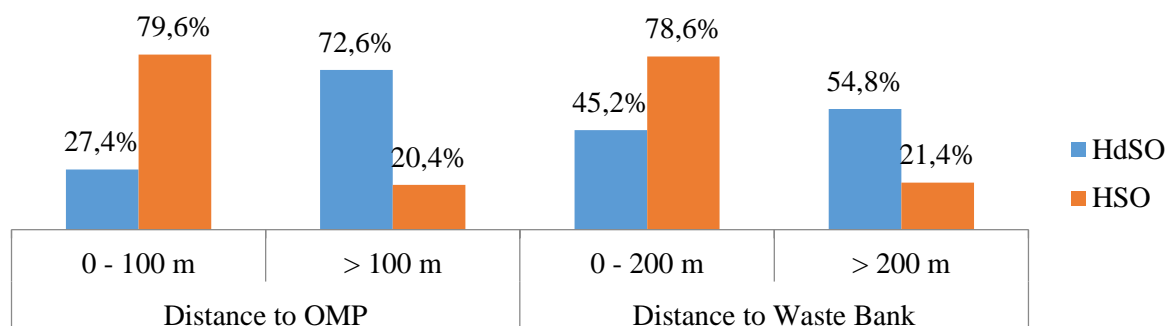


**Chart 11 Distance to Organic meeting point and Local waste bank**

Chi-square test was used to analyze the difference distance to the organic *meeting point*, and local waste bank between the two group and it found that the distance was significantly different between the two groups ($\chi^2(1, N = 176) = 47.79$, p = .00 and $\chi^2(1, N = 176) = 20.93$, p = .00, for the distance to organic meeting point and local waste bank respectively).

In term of frequency of secondary waste collection, the non-organic collection frequency was related to the operational time of the local waste bank. In the study area, the operational time of the local waste bank was either one per two weeks or once per week. Therefore, at this

time, the household could deliver their non-organic waste to the local waste bank. In the other hand, the collection frequency of the organic waste was designed once for every two days. This frequency was maintained to run steadily to avoid complaint from the households. The following information was perceived from the interview with the organic SWPU coordinator.

*"routine once every two days the organic waste is collected from the organic meeting point. If one day we cannot (collect the waste), we borrow... for example if the moto-truck is broken down, we borrow (from other SWPU). Otherwise, the collection timetable will change. If one day we are not able to collect the waste, there will be other areas with collection frequency over three days. The people will protest, because of the bad odour."*

*Organic SWPU Coordinator*

In order to analyse whether there is a significant difference regarding perception regarding facility quality and collection frequency adequacy between this groups, several statements was asked on five points Likert scale. Independent T-test was used to analyse whether there was a difference of perception between both groups. The test result (Table 8) indicates a significant difference of perception between this groups. The HSO group had a higher perception score on facility quality (M=3.83, SD=0.90) compared to the HdSO group (M=2.97, SD=1.17), t(129) = 0.00, p < .05. Similarly, the HSO group also had a higher perception score on collection frequency adequacy (M=3.60, SD=0.82) compared to the HdSO group (M=3.21, SD=0.82), t(130) = 0.00, p < .05.

**Table 8 Statistical test for perception over facility quality and collection frequency adequacy**

| Factors | HdSO (n=73) | | HSO (n=103) | | t | p |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | | |
| Facility quality | 2.97 | 1.17 | 3.83 | 0.90 | -5.25 | .00* |
| Collection frequency adequacy | 3.21 | 1.05 | 3.60 | .82 | -2.68 | .00* |

* Significant at *p<.05*

Although there were different perception regarding facility quality and collection frequency adequacy between this groups, Chart 12 below shows that majority of the household agree that they have been provided with satisfied recycling facility and reliable collection frequency.
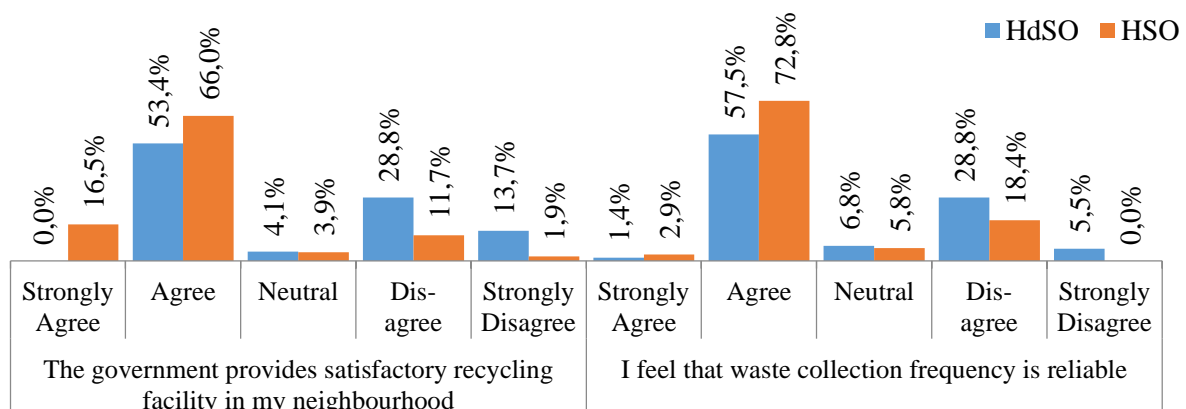


**Chart 12 Agreement regarding perception over facility quality and collection frequency**

## B.    Information Regarding Waste Recycling Programme

Information such as waste collection process, type of waste need to be segregated and location of recycling containers is one factor to encourage participation. Information can be delivered through general media or direct means such as direct communication. Based on Chart 13, information regarding waste recycling programme majority came from woman groups in the neighbourhood (43%), secondly came from community meeting (24%). Another source of information was dissemination from the CAD (13%), the *whats app* group (13%) and information board (8%). From the data, it depicted the important role of woman groups and community meeting to disseminate information within the neighbourhood.
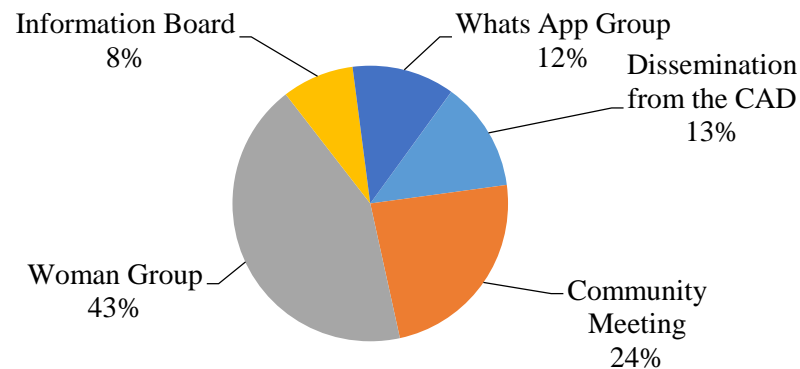


**Chart 13 Source of Information**
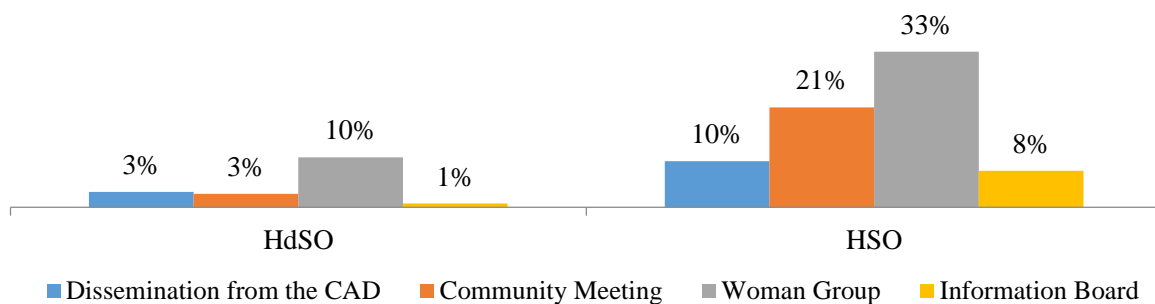


**Chart 14 Source of information received by group**

However, not all households in both groups received information regarding waste segregation. More households within the HSO group was provided with information regarding waste segregation rather than in the HdSO group, a percentage of 88% compare to 53% respectively (see Chart 15).
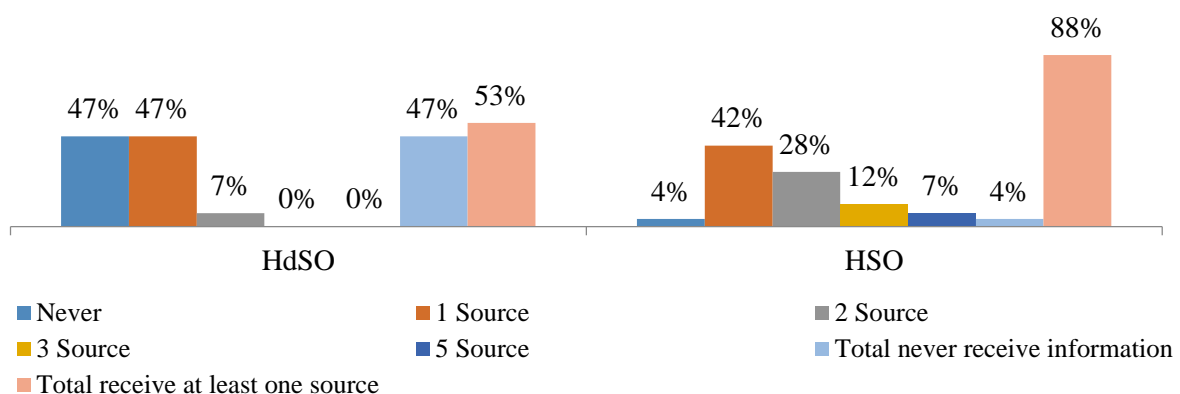


**Chart 15 Number of source of information**

One reason for household within the HdSO group receives less information regarding waste recycling programme might relate to their reluctantly to attend any formal meeting or dissemination on waste recycling issue. Chart 14 shows that only 3% and 10% households within the HdSO group receive information from the community meeting and woman groups respectively compared to 21% and 33% households within the HSO group receive information from the same source. This following information was perceived from the interview with the Organic SWPU coordinator which basically showed that it was difficult to invite people in a formal way to disseminate information regarding waste management issue in the neighbourhood.

*"if we formally invite the people..., nobody will show up. We once, here, gave door prizes, so that people gather, but once their back home.... hahaha., yeah our goal was at least to let the citizens heard (the information), it was already good if they came (fulfilled the invitation). If we give formal invitation regarding waste segregation, they wouldn't come".*

*Organic SWPU Coordinator*

Independent T-test was further used to analyse the difference of source of information regarding waste segregation between these groups. The result showed a significant difference of source information. The households within HSO group had a higher source of information (M=1.99, SD=1.27) compared to the households within the HdSO group (M=0.60, SD=0.61), $t(155) = 0.00$, $p < .05$.

Regarding perception on waste segregation information provided, Chart 16 below, shows that majority of the household within the HSO group agree that they had been provided with satisfied information regarding waste segregation and recycling program, while the households within the HdSO groups was almost evenly divided between agree and disagree regarding information being provided in the neighbourhood.
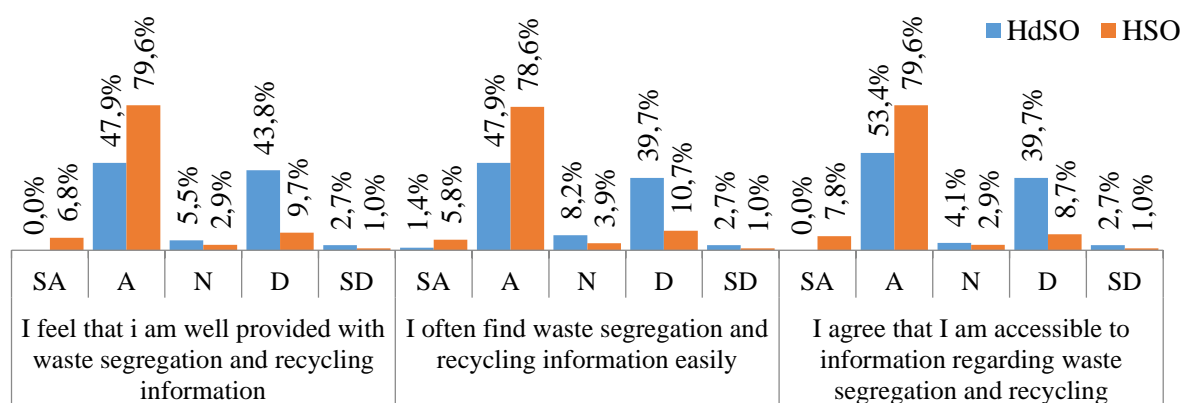


**Chart 16 Agreement regarding perception over information availability**

Another Independent T-test was used to analyse whether there was a difference of perception between both groups using several statements on Likert scale. A factor analysis was performed first to group the statements and then a reliability analysis was run to test the reliability of the new measure. A coefficient greater than 0.7 score indicates the new measure is reliable. The test result (Table 9) indicates that there was significant difference regarding perception on information availability between the HdSO group (M=3.04, SD=0.97) and HSO group M=3.81, SD=0.72), $t(125) = 0.00$, $p < .05$. The HSO group had a higher score on

perception regarding information availability compared to the HdSO group, which means that the households satisfied with the information regarding waste segregation and recycling program availability in the neighbourhood.

**Table 9 Factor reliability and statistical test for information availability**

| Factor / Statements | α | HdSO (n=73) | | HSO (n=103) | | t | p |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | M | SD | M | SD | | |
| Perception on information availability | | | | | | | |
| I feel that i am well provided with waste segregation and recycling information | | | | | | | |
| I often find waste segregation and recycling information easily | .969 | 3.04 | .97 | 3.81 | .72 | -5.72 | .00* |
| I agree that I am accessible to information regarding waste segregation and recycling | | | | | | | |

α = Reliability coefficient
* Significant at *p<.05*

Combined with the previous test result, the household within the HSO group had a higher access to the information source or on the other hand involved in the community meeting or woman group. Therefore, they were more satisfied with the availability of information regarding waste segregation and recycling program in the neighbourhood because majority of information regarding recycling program was disseminated through this meeting. The following information from the interview strengthening this condition, the local community leader stated that the information regarding the recycling programme have been distributed in the neighbourhood through community meeting and woman groups.

*"We have women group in the neighbourhood. Within this women meeting, information (regarding waste segregation) continuously delivered. We also have whats app group, almost all (in the group)."*

*Local community leader (RW)*

*"here, once a month we have a community meeting (including women groups meeting), during this meeting we can share and delivers all information (including waste segregation)".*

*Households segregate waste at source, housewife*

On the other hand households in the HdSO group seems reluctantly involve or attend the community meeting or womans group rather than household within the HSO. Therefore they received less information..

*"i once heard about that (waste segregation), but I rarely attend a community meeting (including women groups meeting). I have lots things to do".*

*Household does not segregate waste at source, housewife*

## C.    Knowledge regarding different type of waste to segregate

Knowledge especially knowing what type of waste needs to be segregated could become a significant barrier to participate in a recycling program. In order to analyse differences in knowledge regarding the type of waste need to be segregated, ten questions were asked. Responses to these questions then sum to create an index for knowledge regarding the type of waste. As shown in Chart 17, the majority of households within the HSO group (92.2%) correctly answer the entire question, while households within the HdSO group more diverse in answering the question.
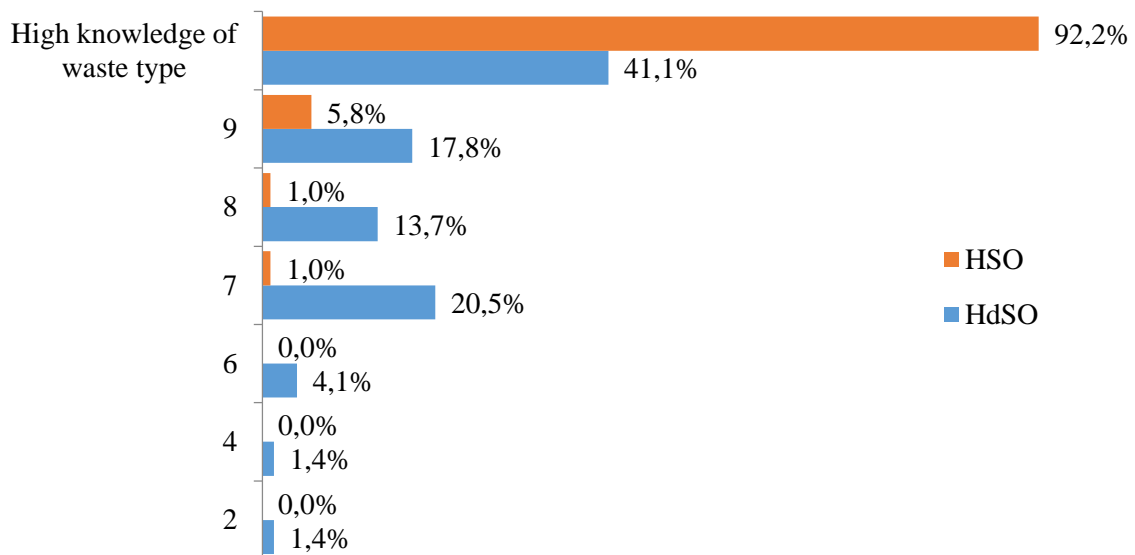


**Chart 17 Knowledge regarding different type of waste**

Independent T-test was used to analyse whether there was a significant difference between both groups. The test result indicates that there was significant difference knowledge regarding the type of waste between the HdSO group (M=8.58, SD=1.61) and HSO group M=9.89, SD=0.41), t(78) = 0.00, p < .05. The households within the HSO group has a higher score compared to the households within the HdSO group which means that the HSO group were more familiar with the different type of waste accepted by the recycling system.

## D.    Incentives on Waste Segregation

As shown in Chart 18, incentives/rewards were present in return for segregating waste at source. The majority of incentives/rewards were free bin (44%), secondly were money in return for recyclables (36%), reduction in collection charges (17%) and free compost (3%). However, there was no certain mechanism in the neighbourhood for giving incentives/reward to the households for segregating their waste at source except incentives in the form of money for recyclables. For example, as have been discussed in subsection 4.3.1, free service charge for segregating waste at source based on local regulation No. 5/2014 about Waste Management, among others, was intended to give fiscal space for local community organization (RW/RT) to deliver the service in which under their responsibility (for example; paying local waste collector salary). Therefore, it can still be found that the local community organization (RW/RT) still collects service charge from the households. However, the amount of service charge was usually lower than before. In addition, the free bin was only given once during the dissemination from the CAD or distributed through the local community leader to several households who did not attend the dissemination. While free

compost was given to the household if the household themselves ask for it by coming to the organic SWPU with their bag or container, as it perceived from the following interview.

*"the households can come and take it (compost) for free, under one condition, they have to bring their containers from home."*

*Organic SWPU Coordinator*
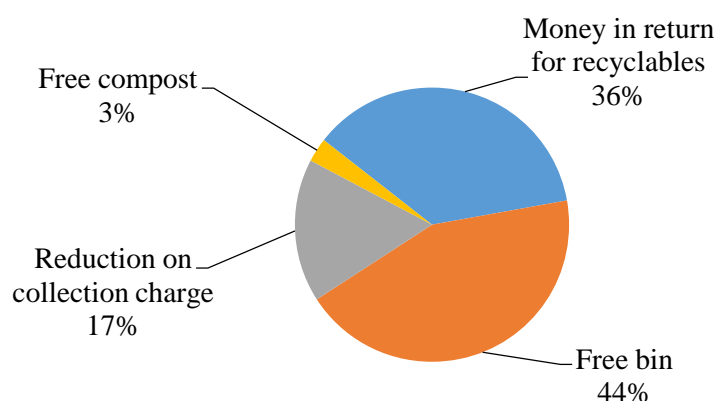


**Chart 18 Type of incentives/rewards**
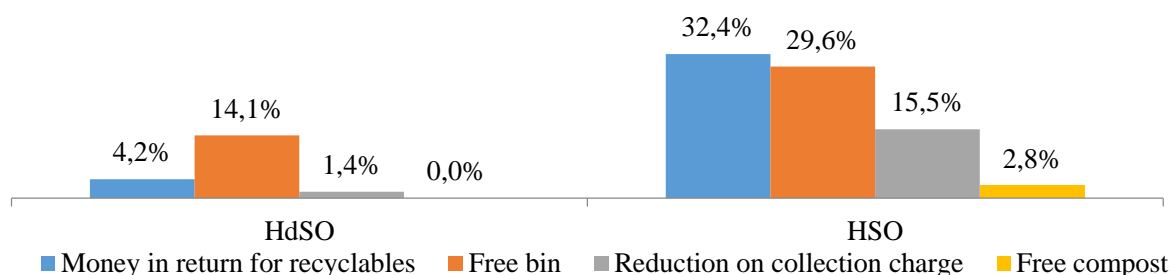


**Chart 19 Type of incentives/rewards received by groups**

The result of Chart 18 and 19 also somehow strengthen this condition where there was no certain mechanism in the neighbourhood for giving incentives/reward to the households for segregating their waste at source except incentives in the form of money for recyclables.

There were a very small number of households reported received incentives in term of free compost or reduction on collection charge. As to obtain free compost, the households need to go to the Organic SWPU, which in some case need more effort, not to mention the household might reluctantly visit such *smelly* place. While reduction of collection charge might relate to technical issue to apply, as the community leader might have less information on which households who segregate waste and which do not segregate, which somehow reflected in the data (see Chart 19) that there were 1,4% households in the HdSO groups reported receiving a reduction on collection charge. This condition was perceived during the information, that incentives to reduce collection service charge is still being planned, and one way to differentiate who will get this incentive will be based on their involvement in the waste bank activity as each waste bank member have their own account book.

*"here.. We have a plan to free the waste collection fees...the monthly dues. Especially for those that already continuous (segregate waste) and give their non-organic waste to the waste bank. It can be in the form of monthly dues deductions".*

*Household segregate waste at source, housewife*

On the other hand, incentives in term of money for recyclables were given in clear mechanism by the local waste bank. Every household that deposits their non-organic waste to the local level waste banks receives an account book that records the weight of recyclables material deposit and money value. This money value usually withdraw in a certain interval of time depends on agreement.

Independent T-test was applied to identify the importance of incentives/rewards especially in term of monetary incentives between these groups using several statements on Likert scale. A factor analysis was performed first to group the statements and then a reliability analysis was run to test the reliability of the new measure. A coefficient greater than 0.7 score indicates the new measure is reliable. The test result (Table 10) indicates that there was no significant difference regarding perception on the importance of monetary incentives/rewards between both groups. Data from the Chart 20, also shows that both households in the HSO and HdSO group perceive incentives as less important.

**Table 10 Factor reliability and statistical test for the importance of incentives/rewards**

| Factor / Statements | α | HdSO (n=73) | | HSO (n=103) | | t | p |
|---|---|---|---|---|---|---|---|
| | | M | SD | M | SD | | |
| Perception on the importance of monetary incentives/rewards | | | | | | | |
| I agree that free waste collection charge makes me want to segregate my waste | .873 | 3.69 | .81 | 3.45 | .90 | 1.77 | .07 |
| I feel that additional income from recyclable material make me want to segregate my waste | | | | | | | |

α = Reliability coefficient

* Significant at *p<.05*
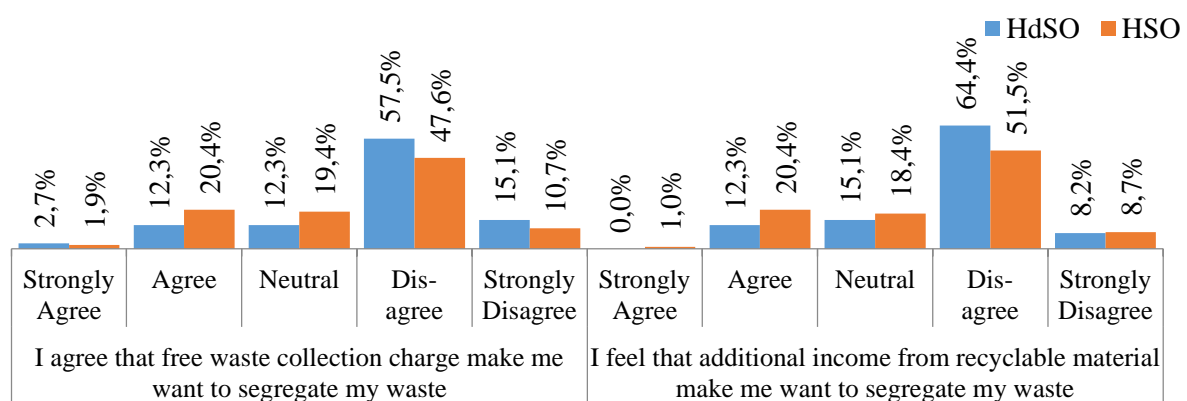


**Chart 20 Perception on the importance of monetary incentives/rewards**

A further test was also applied to analyse the difference number of incentives/rewards received between these groups. Regarding non-monetary incentives/rewards, it decided to add them as a type of incentive being given to the households even though free bin was only given once and free compost was only given if the households asked for them. From the Chart 21 below, it was perceived that majority of the household within the HdSO and HSO group never received any incentives/reward (82.2% and 57.3 respectively). Only small number of households within the HdSO group received incentives (17.8%) which we assumed majority was free bin as they might attend dissemination from the CAD or obtained

through the local community leader. On the other hand, within HSO groups there were 42.7% households received incentives/rewards, with 31.1% received one type of incentives and 10.7% received two type of incentives.
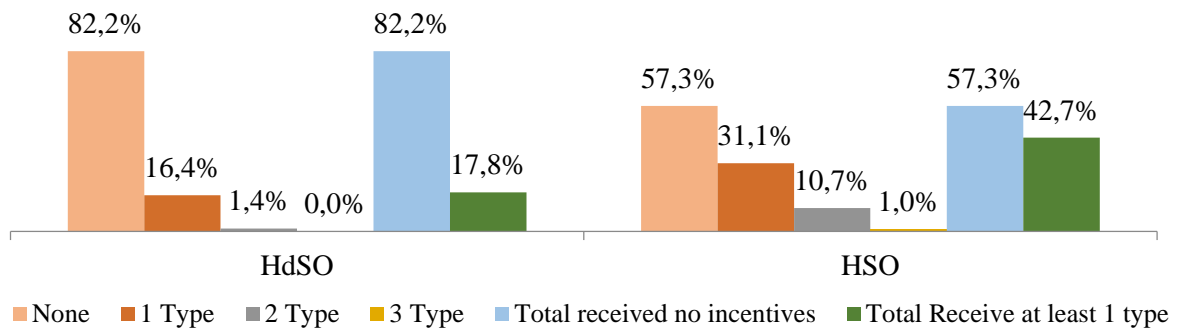


**Chart 21 Number of incentives/rewards received**

Continuing with the analysis to explain whether there was a difference on number of incentives received by the households within the HdSO group and HSO group, an Independent T-test result showed a significant difference number of incentives/rewards received between both groups. The households within HSO group received higher number of incentives/reward received (M=0.55, SD=0.72) compared to the households within the HdSO group (M=0.19, SD=0.43), t(169) = 0.00, p < .05.

## E.    Demographic attributes

Demographic characteristic, in term of household income, size, the presence of child were gathered directly from the respondents, while in term of age, and education level was gathered regarding the household member who in charge of waste management. Gender was excluded in this research as the majority of the household member who in charge of waste management in both groups was female (see Table 4).

In order to analyse whether there is a significant difference in terms of demographic attributes among HdSO and HSO groups, Independent T-test was used to analyse the difference of age, family income level, household size and presence of child under 10 years old, while the Chi-square test was used to analyse the difference of level of education. The result of the statistical test can be seen in the following table.

**Table 11 Statistical test for demographic attributes**

| Factors | HdSO (n=73) | | HSO (n=103) | | $t$ | $p$ |
|---|---|---|---|---|---|---|
| | $M$ | $SD$ | $M$ | $SD$ | | |
| Age | 38.08 | 9.66 | 39.48 | 8.67 | -1.00 | .31 |
| Family Income - Rp. | 6.208.219 | 5.267.889 | 10.434.951 | 6.460.327 | -4.77 | .00* |
| Household Size | 3.92 | 1.14 | 4.01 | 1.08 | -.54 | .58 |
| Presence of Childs under 10 years old | .78 | 1.03 | .84 | .87 | -.43 | .66 |
| Level of Education (%) | 100.00 | | 100.00 | | | |
| Low Education (%) | 65.80 | | 36.90 | | $p=.00*$ | |
| High Education (%) | 34.20 | | 63.10 | | | |

* Significant at *p<.05*

The statistical result (Table 11) indicate that there was no significant difference regarding the age of the household member in charge of waste management practice, household size, and the presence of child under ten years old between the HdSO and HSO group respectively. On the other hand, there was a significant difference regarding family income and level of education between the two group. The Independent T-test result showed that the HdSO group had lower family income (M=6.208.219, SD=5.267.889) compared to the HSO group (M=10.434.951, SD=6.460.327), t(170) = 0.00, p < .05, while in term of the presence of child under ten years old, the result showed that the HSO group had higher presence of child (M=.84, SD=.87) compared to the HdSO group (M=.78, SD=1.03), t(138) = 0.04, p < .05. On the other hand, Chi-square test result showed that majority of household member in charge of waste management practice within the HSO had university degree or high education compared to the HdSO group which majority had a low educational background ($\chi2$(1, N=176) = 14.24, p = .00).

### 4.5.3. Discussion: Comparing participant (HSO) and non-participant (HdSO) in waste source segregation within Depok recycling program

Regarding psychological factor, this research found that there was a significant difference regarding attitude towards waste segregation between the household within HdSO group and the household within the HSO group, in which, the HSO group had a higher attitude towards waste segregation. This finding is in contrast to De Young (1989) findings which stated that both recyclers and non-recyclers have the same attitudes toward recycling.

Furthermore, this research found a significant difference regarding subjective norms, either internally or externally between the households within the HdSO group and the households within the HSO group. The households within the HSO groups feel the presence of more social pressure to participate in waste source segregation rather than the households within the HdSO group. This research finding was in contrast to Vining and Ebreo (1990), as this author stated that there was no significant difference in social pressure between those who participate and who do not participate in recycling activity.

As for perceived easiness, this research is in accordance with De Young (1989), Bordero (1995) and Tucker (2001) finding. These author found that there was significant difference between those who participate and who do not participate in recycling in term of perceived skill, time and space needed in recycling activity, as our research found that the households within the HdSO group had lower perceived easiness interm of their capability to segregate waste, space to store segregated waste, and time availability to segregate waste compared to the HSO group respectively.

Regarding situational factors, the availability of with well-equipped and accessible recycle bins in a drop-off system is important, as in this system the households is required to transport their waste to this facility themselves. Accordingly, the presence of recycling bin both in term of number and distance could ber perceived differently among housholds, with those who do not participate in recycling activity will tend to perceive it as inadequate. Within the study area, there was a significant difference regarding the distance to the secondary collection facility (organic *meeting point* and local waste bank) between both groups, where the households within HdSO group majority have a higher distance rather than the HSO group. As for secondary level waste collection frequency, the difference between both group was not analyzed because in the drop-off system, the secondary collection from the municipality is not provided directly to the household, but only from secondary storage to the treatment facility. This study also found that household within the HSO group have a

higher perception regarding facility quality and secondary collection frequency adequacy compared to the HdSO group. This finding was in accordance with Bordero (1995), as this author pointed out that recycler tends to perceive service provision being provided positively than non recycler. However, before making conclusion that the HdSO group perceived facility quality and secondary collection frequency as inadequate, we also found that majority of households in both group agree that they have been provided with adequate facility and reliable secondary collection frequency.

In term of information regarding recycling program, this research found that the households within HSO group had a higher source of information and more satisfied with the information regarding waste segregation and recycling program availability in the neighbourhood compared to the households within the HdSO group. This finding is in accordance with Vining and Ebreo (1990) research. This author stated that recyclers might receive more information about recycling than non-recyclers, or they might had found out about recycling from more sources than non-recyclers. The households in the HSO group had higher access to information due to their involvement in the community meeting or womans group. On the contrary, the household within the HdSO group receives less information regarding waste recycling programme might relate to their reluctantly to attend any formal meeting or dissemination on waste recycling issue, as majority of information regarding recycling program was disseminated through this community meeting and women group.

Vining and Ebreo (1990) pointed out that those who involve in recycling have more knowledge about the type of recyclables material. Consistent with these authors, this research found that the households within the HSO group were more familiar with the different type of waste accepted by the recycling system. Further combination with the finding that household within the HSO group also receives higher source of information, this research finding also consistent with Do Valle et al. (2005) result. This author pointed out that that individual's who is received more information regarding recycling program are those who also have higher specific knowledge in term of individual's understanding of the different classes of materials.

As for incentives, the largest number given to the household was in term of monetary incentives, comprises of money in return for recyclables, reduction in collection charges. Oher type of incentives was Free bin and Free compost as non-monetary incentives. Free bin shares a high number of incentives given to the household. However, this incentives is only given once during the dissemination from the CAD or distributed through the local community leader to several households who did not attend the dissemination. While free compost only given to the household if the household themselves ask for it by coming to the organic SWPU, therefore it comprises very small share received by the households. In Addition, monetary incentives are given regularly in nature. One's will be given money in return for recyclables and reduction in collection charges if the household participate in the recycling program. Nevertheless, given the condition that monetary incentives, especially money in return for recyclables already have a rather established mechanism, this study found that there is no significant difference regarding the importance of monetary incentives between both groups.

Furthermore, either household in HSO or HdSO group perceives that monetary incentives are less important. This result is in line with De Young (1989) findings. On the contrary, this research is in contrast with Vining and Ebreo (1990) findings. Vining and Ebreo (1990) found that those who do not participate in recycling tend to perceive that monetary incentives and rewards are important. In our study area, the perception of less important of monetary

incentives could be related to the condition that those who do not participate might perceive that money in return for recyclables is too small to compare with the effort need to be done. On the other hand, those who participate might perceive another thing as more important rather than monetary reason.

Turn to demographic attributes; this research found that there is no difference regarding the age of the household member in charge of waste management practice, and household size, and the presence of child under ten years old between the HdSO and HSO group respectively. In term of age, this research was in support to Oskamp et al (1991), where this author pointed out that age was not differentiate recycling participation. In term of household size, this research found that there is no difference between both groups, which in accordance with Tucker (2001) finding. Furthermore, majority household member in both groups is equal or less to 4 people which fall into small family categorize. Therefore, this condition is in contrast to Vining and Ebreo (1990) finding, as they pointed out that smaller family size tends to recycle more. As for the presence of children, this finding is in accordance with Oskamp et al (1991) findings, as that presence of children does differentiate both groups.

On the other hand, there was a significant difference regarding family income, and level of education between the two group. In term of family income, household in the HSO group who participate in source segregation have higher average income than households in the HdSO group; this findings is in accordance with Sidique et al. (2010) research. Turning to the level of education, majority household member in charge of waste management practice within the HSO group held a university degree and within the HdSO was the opposite. This finding is in accordance with Saphores et al (2006) findings.

As discussed above, there are several factors that differentiate both groups. However, whether these differences leads or influence their participation, it still needs further analysis. The following section will mainly cover this issue.


## 4.6.    Factor influences households participation in waste segregation

The previous section has provided analyses regarding factors differentiate household participation in waste segregation. The first part of this section will analyze which factor influence household participation. Thus, a binary logistic regression (Logit model) was used. The second part of this section will further discuse the binary logistic regression results to answer the second and third sub research question.

### 4.6.1.  Binary Logistic Analysis

Variables in logistic regression were estimated using the Maximum Likelihood (ML) method. As such, the analysis assesses the relationship between various factors and the households'participation in waste segregation. The dependent variable was designed in dichotomous variable based on the household self-reporting response on waste segregation practice.

The independent variables of this model were attitude toward waste segregation, subjective norms, perceive easiness, incentives, information on recycling programme, knowledge about type of waste to be segregated, distance to the communal bin, age, education level, household size, family income, and number of children under ten years old. Most of the variables were derived from literature review. The following table shows variable used in the binary logistic regression. Dummy variable need to be created for categorical variables.

**Table 12 Binary logistic regression variables**

| Variables | Description |
|---|---|
| Dependent variable | |
| Waste segregation behaviour | Household participation in waste segregation (0 = Segregate waste at source, 1 = Do not segregate waste at source) |
| Independent variable | |
| Attitude | Household attitude towards waste segregation (5 = Strongly Agree, 1 = Strongly disagree) |
| Internal subjective norm | Family view regarding waste segregation (5 = Strongly Agree, 1 = Strongly disagree) |
| External subjective norm | Neighbours view regarding waste segregation (5 = Strongly Agree, 1 = Strongly disagree) |
| Perceived capabilities | Household perceived easiness interm of their capability to segregate waste (5 = Strongly Agree, 1 = Strongly disagree) |
| Perceived space | Household perceived easiness interm of space availability to store segregated waste (5 = Strongly Agree, 1 = Strongly disagree) |
| Perceived time | Household perceived easiness interm of time availability to segregate waste (5 = Strongly Agree, 1 = Strongly disagree) |
| Incentives | Number of incentives received |
| Information | Number of source information |
| Knowledge of waste type | Household knowledge of type of waste index (0 = Low knowledge, 10 = High knowledge) |
| Age | Household member in charge of waste age |
| Family income | Family income per month (Rp.) |
| Household size | Number of people living in the household 0 ≤ 4 people (*), 1 = > 4 people |
| Children under ten years old | Number of children under ten year old within the household |
| Education | Education level of household member in charge of waste age 0 = Low education (*) 1 = High education (hold university degree) |
| Distance to organic meeting point | 0 = 0 - 100 meter (*), 1 = > 100 meter |
| Distance to Waste Bank | 0 = 0 - 200 meter (*), 1 = > 200 meter |

(*) reference group in dummy variable

The result of Chi-square test of homogeneity of the model was found significant ($\chi^2$(df=16) = 177.10, p = .00) which mean that the distribution of household participates in waste source segregation and who do not participate is not homogenous and shows a significant relationship between dependent and independent variables.

The result of Hosmer & Lemeshow test of the goodness of fit is p=0.198 (>.05) which suggest that the model is a good fit to the data, and there is no real difference between predicted and observed results, the model also able correctly classifying 85,4% of the outcome. On the other hand, the independent variables' Standard Error (S.E) value are less than 5.0 and no independent variables have a correlation more than 0.7, which mean there is no multicollinearity between independent variables in the model.

**Table 13 Logistic regression analysis for variables predicting household participation in waste source segregation**

| Variables | B | S.E. | Wald | df | Sig. | Exp(B) |
|---|---|---|---|---|---|---|
| Attitude towards waste segregation | 1.430 | 0.818 | 3.06 | 1 | 0.08 | 4.179 |
| Internal subjective norm | -0.393 | 0.622 | 0.40 | 1 | 0.53 | 0.675 |
| External subjective norm | 1.053 | 0.523 | 4.06 | 1 | 0.04* | 2.866 |
| Perceived capability | 1.419 | 0.685 | 4.29 | 1 | 0.04* | 4.132 |
| Perceived space | 0.351 | 0.558 | 0.40 | 1 | 0.53 | 1.421 |
| Perceived time | -0.194 | 0.712 | 0.07 | 1 | 0.79 | 0.824 |
| Distance organic *meeting point* (1) | -1.340 | 0.808 | 2.75 | 1 | 0.10 | 0.262 |
| Distance to waste bank (1) | -0.995 | 0.929 | 1.15 | 1 | 0.28 | 0.370 |
| Incentives | -0.510 | 0.811 | 0.40 | 1 | 0.53 | 0.600 |
| Information | 2.077 | 0.807 | 6.62 | 1 | 0.01* | 7.983 |
| Knowledge of waste type | 1.498 | 0.413 | 13.14 | 1 | 0.00* | 4.472 |
| Age | -0.037 | 0.042 | 0.77 | 1 | 0.38 | 0.964 |
| Family income | 0.000 | 0.000 | 0.50 | 1 | 0.48 | 1.000 |
| Children under 10 years old | -0.976 | 0.495 | 3.89 | 1 | 0.05* | 0.377 |
| Education(1) | -0.012 | 0.960 | 0.00 | 1 | 0.99 | 0.989 |
| Household size(1) | -0.349 | 0.933 | 0.14 | 1 | 0.71 | 0.705 |

* Significant at *p<.05*

As shown in Table 13, only external subjective norms and perceived capability (under the psychological factors), the presence of children under ten years old, number of source information regarding recycling programme, and knowledge of waste type (under situational factors) significantly influences the likelihood of households to participate in waste source segregation. Other psychological and situational factors are not significant ($p>.05$). Number of source information have become the strongest predictor of household participation in waste segregation with knowledge of waste type as the second strongest, and the presence of children under ten years old have become the weakest predictor.

### 4.6.2. Discussion: Factor influences households participation

The result of some factor is inconsistent with some empirical studies regarding psychological factors. Ghani et al. (2013) study in Malaysia found that attitude was the main predictors of household waste segregation participation. However, this research finds that attitude does not influence household participation in waste segregation even though there was a significant difference in attitude towards waste segregation between household in the HdSO group and household in the HSO group. In addtion, this also might related to the condition that the household in both group majority have a positive attitude towards waste segregation.

In term of subjective norms, this research found that internal subjective norms not significantly influence household participation. Only external subjective norms that influence household participation in waste source segregation. Based on the logistic regression result, the households who experience external pressure to segregate waste are 2.9 times more likely to actually participate in the waste source segregation.

Regarding the influence of external subjective norms, this research has difference finding than other research done in the same recycling scheme. Ioannou et al. (2011) found that social pressure from external reference was absent due to the anonymity of the person who

conducts the behaviour, in which was in line with Do Valle et al., (2005) statement that a drop-off scheme gave less pressure for the same reason.

However, the reason external subjective norms has significantly influence waste segregation participation within the study area might be due to the existence of waste bank system within the neighbourhood. The waste bank system might enable one's to be identified as a recycler or participating in waste segregation by others. Thus, those who do not become the waste bank member, in another word could be identified as a non-participant in the recycling program. Moreover, being visible or able to see others participation does not always mean in physical state, but could also be in non-physical state through the use of social media, which in this term through the *whats app* group among the neighbourhood. As communication regarding waste segregation among households through this media could also arise external pressure. The following information was derived from the interview; it shows how the *whats app* group have been used to communicate proper disposal practice within the recycling programme.

> *"if we found some contamination, for instance, plastic is thrown on the organic meeting point, we take a picture and share it in the whats app group. We found this..., this should not be done".*

> *Local community leader (RW)*

In addition, the availability of woman group and community group in the neighbourhood, which conducts a regular meeting at least once a month, could also be perceived as the source of external pressure, as this meeting has become a channel to encourage household to participate in waste source segregation. In brief, aforementioned medium available in the study area might have influence one's perception regarding the beliefs that other people think he or she should participate in waste segregation activity.

As for perceived easiness, this research only found that perceived easiness interm of capability to segregate waste influence household participation in waste source segregation. The finding is in accordance with Ittiravivongs (2012) research. Using the same three factors, this author also only found individual's perceived easiness in term of recycling capabilities that significantly influence participation in recycling activity. Neither individual's perceived easiness in term time availability to segregate waste or space availability to store segregated significantly influence recycling participation. Furthermore, individuals will likely to act based on the easiness of certain action. Therefore it might be the reason that perceived easiness in term capability to segregate waste positively influence household participation in waste source segregation. As the more the individual's perceive that he or she has the capabilities to segregate waste, the more he or she will participate in waste segregate. Which in this research, the logistic regression result shows that the household who perceived that they have the capabilities to segregate waste are four times more likely to actually participate in waste source segregation.

Regarding service provision, in a drop-off system, Sin-Yee and Sheau-Ting (2016) and Saphores et al (2006) found that participation increase with the availability of with well-equipped and accessible recycle bins. However, this study finds that the distance to the communal bin (organic meeting point) and waste bank do not significantly influence household participation. The reason might be that organic *meeting points* have covered all neighbourhoods and generally located at a walking distance, which is set at least one organic *meeting point* for 20 households. In addition, the local waste bank to accept non-organic

waste also within walking distance even though it still lack in number. Moreover, the non-organic waste is considered easy to dispose as the local waste collector also collect this material to be sold on his own. Further reason might relate to the findings that households within both groups agree that they have been provided with satisfied recycling facility and reliable collection frequency.

Regarding information, this research found that information is significantly influence household participation in waste segregation, to be percise, the household who participate in waste source segregation have receive information from more source rather than those who do not participate in waste source segregation. This finding was in accordance with Vining and Ebreo (1990) research. There are five sources of information regarding recycling programme available, and the binary logistic regression result shows that those who likely have more access to these source of information, are eight times more likely to participate in waste segregation at source.

In term of knowledge, especially regarding the type of waste to be segregated, has significantly influence households participation in waste segregation. This result was consistent with the findings of Barr and Gilg (2007) and Do Valle et al. (2005). These authors noted that particular knowledge in term of individual's understanding of the different classes of materials was a significant prerequisite to participate in recycling activity. The more the individual's know the type of material, the more he or she segregate the waste. In another word, individuals will likely to participate if they know what kind of material is accepted by the system. Which in this research, the logistic regression result shows that household who have a knowledge of the waste type need to be segregated is four times more likely to participate in waste segregation.

As for incentives, previous authors have a different conclusion on their influence in recycling. Harder and Woodard (2007), Timlett and Williams (2008) and Shaw and Maynard (2008) found that incentives, especially in monetary term increase participation. However, others author such as Allen et al. (1993) and De Young (2000) found the opposite. This research was in accordance with the later condition. It might relate to the condition that there was no certain mechanism in the neighbourhood for giving incentives/reward to the households for segregating their waste at source except incentives in the form of money for recyclables from the local waste bank. However, either household in HSO or HdSO group perceives that monetary incentives are less important, which might become the reason why incentives was not significantly influenced household participation in waste source segregation.

Turn to demographic factor, this research found age, education level, and family income do not significantly influence household participation in waste source segregation, in which was in accordance with Do Valle et al. (2005) and Oskamp et al. (1991), which stated that these factors do not influence participation in recycling activity. In addition, this research also found that household size does not significantly influence household participation in waste source segregation whereas Do Valle et al. (2005) also pointed out the same.

On the other hand, in term of the presence of children, this finding is in relation to Vicente et al. (2008b). However, in this research, the influence of children in the family negatively influence participation, while in Vicente et al. (2008b) finding in Portugal, the influence was the opposite. The reason might to the condition that this recycling programme was specifically targeting children as an important recycling motivators within the households. It uses massive communication campaign to disseminate recycling messages via radio and television which targeting and involving children in the process.

The reason behind this finding might relate to the condition that children under ten years old still needs more attention from their parents, especially from the mother. This condition might cause mother have to perform more effort to segregate waste at source. The following information shows that mother tends to perceive that segregating waste becomes more burdensome as they have little children in the house.

*"it must be sorted first, boxes, plastic, cans, also need to be cleaned first. It must be clean (in order to be accepted by the waste bank). So, because I am busy, ya..... I have little children as well".*

*Households do not segregate waste at source, housewife*

In addition, in our study area, even within the households that self-reported as participating in waste segregation, it was the mother who trying to encourage others family member, especially their children to segregate waste at source and not the opposite, as found by Vicente et al. (2008b) in Portugal. The following information was derived from the interview, and it supports this condition.

*"Initially it was a bit difficult, let alone gets the children accustomed to sort the waste. However, once i give an example, eventually they know and accustomed. I also told them the benefits of waste segregation."*

*Household segregate waste at source, housewife.*

Therefore, it strengthens the finding that the presence of children was negatively influenced household participation. In another word, their presence was more likely inhibit household to participate in waste source segregation and not the opposite. Which in this research, the binary logistic regression result, shows that the household who live with children under ten years old is 0.4 times less likely to participate in waste source segregation.

# Chapter 5: Conclusion and Recommendation

## 5.1.  Conclusion

Since 2006, Depok has been implemented recycling programme to deal with the solid waste problem in a more sustainable way. In recent years, to increase the system effectiveness, they gradually change the programme mechanism form initially accept mix waste into only accept segregated waste from the households. As the largest stakeholder as well as the largest waste producer, households participation, especially in waste source segregation, become essential in the successfulness of this recycling program. However, recent survey held in 2011 and 2015 have showed low household participation and there are only 1% increase of household participation in waste segregation from 32% in 2011 into 33% in 2015 (Health Agency City of Depok, 2015).

In general, many researchers have focused on studying household participation in waste recycling programme with the objectives to enhance their participation. Tucker (2001) pointed out that most of the researches that have been done to determine the factors that make people recycle were based on the psychological perspective. Recent studies have shown that situational factors need to be incorporated, as recycling also relies on practical issues rather than only on psychological motivations. Therefore, both approach that includes psychological and situational factors were combined in this research. Furthermore, this research tried to understand to what extent these factors influence households participation in the Depok recycling program.

Firstly, we tried to figure out what differentiate between the household who participate and the household do not participate in waste segregation. Based on our findings and analysis, we can conclude that households who participate in waste source segregation and households that do not participate in waste source segregation are differ in both psychological and situational factors.

In term of the psychological factor, both groups were significantly different in all factors. Both groups can be distinguished by their attitude towards waste segregation, internal subjective norms or external subjective norms, and perceived easiness. Those who participate in waste source segregation have a higher attitude which in contrast to De Young (1989) findings, which stated that both recyclers and non-recyclers have the same attitudes toward recycling. Those who participate in waste source segregation also feel the presence of more social pressure to participate in waste source segregation which in contrast to Vining and Ebreo (1990) finding, as this author stated that there was no significant difference in social pressure between those who participate and who do not participate in recycling activity. Those who participate in waste source segregation also perceived to have a higher easiness in term of capabilities, time and space needed in recycling activity which in accordance with De Young (1989), Bordero (1995) and Tucker (2001) finding.

In term of situational factor, both groups can be distinguished by their perception regarding facility quality, number of source of information regarding recycling programme, *concrete* knowledge about the type of recyclables material, and the importance of monetary incentives. Those who participate in waste source segregation have a higher perception regarding facility quality which in accordance with Bordero (1995) finding. Those who participate in waste source segregation also have receive more information about recycling from more sources,

have more knowledge about the type of recyclables material and tend to perceive that monetary incentives and rewards are less necessary which in accordance with Vining and Ebreo (1990) finding. Additionally, in term of demographic attributes, both groups can be distinguished by family income, and level of education between the two group. This research found that the households who participate in waste source segregation have higher average income and higher level of education which in accordance with Sidique et al. (2010) and Saphores et al (2006) finding respectively.

Secondly, we tried to understand which psychological and situational factors influence household participation. Eventhough household who participate in waste segregation and do not participate in waste segregation could be distinguished in several factors. However, based on logistic regression analysis, only external subjective norms and perceived capability (under the psychological factors), the number of source information regarding recycling programme, knowledge of waste type, and the presence of children under ten years old, (under situational factors) significantly influences household participation in waste source segregation.

In a drop-off recycling system, social pressure usually less likely to happen because the participation is invisible to others. Ioannou et al. (2011) finding strengthen this condition. However, given the availability of several measures to identify the household who participate or do not participate in waste segregation within the study area, the external pressure was found to be a significant influence to household participation in waste segregation. Therefore, in a drop-off system, it is important to encourage those who do not participate in waste segregation to become more exposed to external pressure.

In accordance with Ittiravivongs (2012), this research found that perceived capability to segregate waste influence household participation in waste source segregation. It is clearly evidence that the households who perceived to have the capability to recycle will likely to participate in waste segregation. Therefore, any attempt to increase the perception of easiness to conduct waste source segregation among the household will be essential.

Turning to information regarding recycling programme, Vicente and Reis (2008a) suggests that information is one of the most important factors to encourage participation and receiving information through direct means has a positive effect on the household participation. However, the challenge lies in delivering this information to the non-participant, as they found to be reluctant to involve or attend the formal measure of information dissemination.

Barr and Gilg (2007) noted knowing what to recycle became a significant prerequisite for participation as well as become significant barrier if the levels were low. Less knowing what to recycle might due to the inactive of the non-participant to seek information. Furthermore, Do Valle et al. (2005) pointed out that individual's who are received more information regarding recycling program are those who also have higher specific knowledge. Taken together with the effort to disseminate information, household specific knowledge could also be improved.

As for the presence of children under ten years old, this research found that it negatively influence household participation in waste segregation. The presence of little children seem to become barrier for recycling within the household. However, it is possible to include children to motivate the household as the source of internal pressure to segregate waste. This attempt has been found significantly influence household participation in recycling in Vicente et al. (2008b) research conducted in Portugal.

Furthermore, households are in general agree with the concept of waste segregation based on their attitude. The majority of the households have a positive attitude towards waste segregation, even though there was a significant difference between the households in both groups. Therefore is not why the households have to segregate waste at source, but rather how one is to carry out the activity. This is only possible if the households could receive more information regarding recycling programme, thus knowing how, where and what material should be segregated. Therefore the perceive of easiness could be increased.

## 5.2. Recommendation

At the last section of this chapter, this research provided several recommendations to increase households participation in waste segregation.

Information regarding reycling programmes that includes collection process, waste material need to be separated, and where the waste should be disposed could increase household participation. Therefore, these information should be provided sufficiently to all households, as it proved to be the strongest influence in household participation. Lack of information could lower households' perception of easiness in the process of waste segregation. However, regarding non-participant reluctant to attend or involved in the formal invitation, such as trough community meeting or woman group, another way to deliver the information should be found. Informal measure to deliver the information, such as trough religius leader or traditional leader, could also be tried.

On the other hand, the statistics of the quantities collected or waste reduced trough the recycling programme and households participation should also be provided publicly. This will increase the perception that there are already many households participating in the programme and the programme effectiveness to reduce waste going to the disposal site. Therefore, it will help to increase the social pressure to participate in the waste segregation activity. In addition, it is also important to promote waste segregation among childrens in schools to contradict the negative influence of their presence in the family, and in the same way, could help to increase internal pressure to participate in waste segregation.

Lack of disincentive for not segregate waste at source implemented by local community leader, for example, excluded from the primary waste collection, could also influence the decision to not participate in waste segregation. However, the community leader should be equiped with better instrument and legal standing by the local government to implement such disincentive mechanism. On the other hand, the local government have already impose disincentive by not providing secondary waste collection service for the community that do not segregate waste at source. However, there are local community leader that choosing the easiest solution by contracting a private waste collector. Therefore, any conditon that enables this option should be minimized, such as, not letting unsegregated material enter the final disposal site.

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# Annex 1: Research Instruments

## Annex 1A. Questionnaire for Household

I am a student of the Erasmus University, Rotterdam. I am currently conducting an academic research related to waste management in Depok. In contrast to other cities in Indonesia, Depok City has implemented waste management policy that involves the community to segregate waste at source, which requires active participation. Therefore, we need your opinion regarding this issue. Data and information that we collect will be kept confidential and only be used for academic purposes. Thank you for your help and time given to complete this questionnaire.

A. Socio Demographic and Socio Economic

1. Name :
2. Which description fits this residence ? [   ] Owner-occupied   [   ] Rental
3. Including yourself, please complete the following information :

| Family Members (relation to respondent) | Age | Gender | Education Background | Occupation *) | Hours spent per week for Occupation **) | Monthly Income |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Occupation type *)
1 Unemployed/retired
2 Student
3 Civil servant/SOE officer
4 Private employees
5 Merchant
6 Entrepreneurial
7 Others, please specify : ...............

Hours spent per week for occupation **)
1 None
2 Student enrol part time
3 Student enrol full time
4 Employed part time (1 – 20  hours/week)
5 Employed full time (21 – 40 hours/week)
6 Employed more than full time (41+ hours/week)
7 Others, please specify : .......................................

B. Household Waste Segregation and Disposal Practice

4. Do you segregate your waste in your house ?,
   [   ] Yes   [   ] No;  if YES, please answer Q5, to Q9. If NO, please answer Q10 to Q13
5. How often do you segregate your waste per week ?
   [   ] Every day          [   ] Every 3 day          [   ] Every 5 day
   [   ] Every 2 day        [   ] Every 4 day          [   ] Every 6 day
6. How do you store your segregated waste in your house ?
   [   ] Using separate waste bin      [   ] Using separate plastic bag    [   ] Others, please specify : ........
7. How many days do you spend storing your segregated waste in the house before dispose it ?

| Type of Waste | Dispose immediately | 1 day | 2 – 3 days | 4 – 5 day | 6 – 7 day | > 1 week |
|---|---|---|---|---|---|---|
| Organic | [   ] | [   ] | [   ] | [   ] | [   ] | [   ] |
| Non-Organic | [   ] | [   ] | [   ] | [   ] | [   ] | [   ] |
| Residue | [   ] | [   ] | [   ] | [   ] | [   ] | [   ] |

8. Where do you <u>commonly</u> dispose your segregated waste in your neighbourhood ? (choose one option for each type of waste)

| Type of Waste | To the SWPU | To the Organic Waste Communal Bin | To the Waste Bank | To the Waste Bank Collection Point | To the Communal Bin (Mix Waste) | Put in personal bin placed in front of the house (Door-to-door collection) |
|---|---|---|---|---|---|---|
| Organic | [  ] | [  ] | [  ] | [  ] | [  ] | [  ] |
| Non-Organic | [  ] | [  ] | [  ] | [  ] | [  ] | [  ] |
| Residue | [  ] | [  ] | [  ] | [  ] | [  ] | [  ] |

9. Who is <u>commonly</u> in charge of segregating, and transporting the waste on collection days ? (you can choose from this option; (1) Father, (2) Mother, (3) Children, (4) House Help, (5) Other Adult, or (6) Anybody available on collection day)

| In Charge of <u>Segregating</u> Waste | In Charge of <u>Transporting</u> waste |
|---|---|
| Organic : [  ] | Organic : [  ] |
| Non Organic : [  ] | Non Organic : [  ] |
| Residue : [  ] | Residue : [  ] |

10. Please rate the greatest obstacle to <u>not segregate</u> your waste at house ? (1 = greatest obstacle to 5 = less obstacle)

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Do not know which categorize to segregate | [  ] | [  ] | [  ] | [  ] | [  ] |
| Do not know where to take the segregated waste | [  ] | [  ] | [  ] | [  ] | [  ] |
| Takes too much time to segregate waste | [  ] | [  ] | [  ] | [  ] | [  ] |
| Takes too much space to store segregated waste | [  ] | [  ] | [  ] | [  ] | [  ] |
| Takes too much effort to segregate waste | [  ] | [  ] | [  ] | [  ] | [  ] |
| Others do not segregate their waste | [  ] | [  ] | [  ] | [  ] | [  ] |
| Do not believe in it | [  ] | [  ] | [  ] | [  ] | [  ] |
| No facility | [  ] | [  ] | [  ] | [  ] | [  ] |
| I already pay the service charge | [  ] | [  ] | [  ] | [  ] | [  ] |
| Others, please specify :..................................................... | [  ] | [  ] | [  ] | [  ] | [  ] |
| ..................................................................................... | [  ] | [  ] | [  ] | [  ] | [  ] |

11. Please rate the most important factors which will <u>motivate you to start segregate</u> waste at your house ? (1 = most important to 5 = less important)

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| More information about waste segregation | [  ] | [  ] | [  ] | [  ] | [  ] |
| More reliable waste collection frequency | [  ] | [  ] | [  ] | [  ] | [  ] |
| Provide monetary incentives for recyclables | [  ] | [  ] | [  ] | [  ] | [  ] |
| Provide non-monetary incentives (free bin, etc.) | [  ] | [  ] | [  ] | [  ] | [  ] |
| Punishment for not segregate waste | [  ] | [  ] | [  ] | [  ] | [  ] |
| Provide more facility, specify : ........................................ | [  ] | [  ] | [  ] | [  ] | [  ] |
| Others, please specify :................................................... | [  ] | [  ] | [  ] | [  ] | [  ] |
| ..................................................................................... | [  ] | [  ] | [  ] | [  ] | [  ] |

12. How do you <u>commonly</u> dispose your waste in your neighbourhood ?
[  ] Put in the Communal Bin (Mix Waste)　　　[  ] : ............................................
[  ] Dispose in available open space　　　　　　[  ] : ............................................
[  ] Others, please specify : ............................　[  ] : ............................................

13. Who is <u>commonly</u> responsible for taking care the waste in the house ?
[  ] Father　　　　　　[  ] Children　　　　　　[  ] Other Adult
[  ] Mother　　　　　　[  ] House Help　　　　　[  ] Others, please specify : ............................

---

C. Service provision

14. Which one(s) of the following facility and service, known to you, is available in your neighbourhood ? (you can select more than one)
[  ] SWPU　　　　　　　　　　　　　　[  ] Waste Bank Collection Point
[  ] Organic Waste Communal Bin　　　[  ] Residue Collection
[  ] Waste Bank　　　　　　　　　　　[  ] Communal Bin (Mix Waste)

15. Based on your opinion, do you think those facilities is adequate? [   ] Yes  [   ] No;
    if NO, please specify what kind of facilities still need to be added ?
    1. ...................................................        3. .................................................
    2. ...................................................        4. .................................................
16. Is there door-to-door primary waste waste collection services available in your neighbourhood?
    [   ] Yes  [   ] No;
    if YES, please specify how the practice of this service?
    [   ] Under RT Coordination, segregated waste collection     [   ] By private collector, mixe waste collection
    [   ] Under RT Coordination, mix waste collection            [   ] Others, Please specify: ............................
    [   ] By private collector, segregated waste collection      [   ] .................................................................
17. Do yo pay for waste collection service every month? [   ] Yes  [   ] No;
    if YES, how much do you pay? Rp. ....................................
18. What is the distance from your house to the following facility in your neighbourhood ?

| Distance / Type of Facility | Not Available | ≤ 100 m | 101-200 m | 201-300 m | 300-400 m | 401-500 m | > 500 m |
|---|---|---|---|---|---|---|---|
| SWPU | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Communal Bin (for organic waste) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Waste Bank | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Waste Bank Collection Point | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| Communal Bin (Mix Waste) | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

19. What is the frequency of waste collection in your neighbourhood?

| Type of Waste | Do not Know | Not Available | Every day | 2 days/ week | 3 days/ week | Once/ week | Others (Please specify) |
|---|---|---|---|---|---|---|---|
| Organic | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] :........................ |
| Non-Organic | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] :........................ |
| Residue | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] :........................ |

20. Based on your opinion, do you think the collection frequency adequate? [   ] Yes  [   ] No;
    if NOT, based on your opinion, what is the adequate collection frequency interval?

| Waste Type | Collection Frequency, Please specify |
|---|---|
| Organic | : ............................................................... |
| Non Organic | : ............................................................... |
| Residue | : ............................................................... |

21. Based on your opinion, please mark your agreement/disagreement towards the following statement regarding the service provision in your neighbourhood.

|  | Strongly Disagree | Disagree | Agree | Strongly Agree | Not Sure |
|---|---|---|---|---|---|
| The government provides satisfactory recycling facility in my neighbourhood | [ ] | [ ] | [ ] | [ ] | [ ] |
| I feel that recycling facility is convenient to access | [ ] | [ ] | [ ] | [ ] | [ ] |
| I feel that waste collection frequency is reliable | [ ] | [ ] | [ ] | [ ] | [ ] |
| If government provide more facility, I would segregate more often | [ ] | [ ] | [ ] | [ ] | [ ] |
| If the waste collection frequency is more reliable, I would segregate more often | [ ] | [ ] | [ ] | [ ] | [ ] |

D. incentives/Rewards

22. As far as you know, will any incentives/rewards be given for segregating waste at house ?  [   ] Yes  [   ] No
    if YES, Please specify what kind of incentives/rewards will be given for segregating waste (you can select more than one)
    [   ] Money in return for recyclables            [   ] Free collection charge
    [   ] Free bin                                   [   ] Others, Please specify : ..........................
    [   ] Free plastic bag                           [   ] : .............................................................

if YES, Who / which institution will give that incentives/rewards ? (you can select more than one)
[   ] Cleansing Agency of Depok       [   ] Others, Please specify : ......................................
[   ] SWPU       [   ] : .............................................................................
[   ] Waste Bank       [   ] : .............................................................................

23. Have you ever received any incentives/rewards for segregating waste at house ?
[   ] Yes  [   ] No
if YES, Please specify what kind of incentives/rewards you have ever received for segregating waste (you can select more than one)
[   ] Money in return for recyclables       [   ] Free collection charge
[   ] Free bin       [   ] Others, Please specify : ......................................
[   ] Free plastic bag       [   ] : .............................................................................
if YES, Who / which institution gave you that incentives/rewards ? (you can select more than one)
[   ] Celansing Agency of Depok       [   ] Others, Please specify : ......................................
[   ] SWPU       [   ] : .............................................................................
[   ] Waste Bank       [   ] : .............................................................................

24. Based on your opinion, please mark your agreement/disagreement towards the following statement regarding incentives/rewards for segregating your waste ?

| | Strongly Disagree | Disagree | Agree | Strongly Agree | Not Sure |
|---|---|---|---|---|---|
| I agree that incentives/reward could make me segregate my waste | [   ] | [   ] | [   ] | [   ] | [   ] |
| Incentives/reward is a factor make me segregate my waste | [   ] | [   ] | [   ] | [   ] | [   ] |
| I agree that free waste collection charge make me want to segregate my waste | [   ] | [   ] | [   ] | [   ] | [   ] |
| I feel that additional income from recyclable material make me want to segregate my waste | [   ] | [   ] | [   ] | [   ] | [   ] |

E. Information

25. Have you heard or seen any information about waste segregation or recycling activity in your neighbourhood ?
[   ] Yes  [   ] No

If YES, what was the medium of information have been used in your neighbourhood ? (please rank from the most frequently used, 1 = most frequently used to 8 = less used)
[   ] Dissemination from related Agency       [   ] Information Board in Public Facility (i.e mosque)
[   ] Local community meeting       [   ] Others, Please specify : ......................................
[   ] Women's group       [   ] : .............................................................................
[   ] Pamflet / Brochure       [   ] : .............................................................................

26. If you want learn more about waste segregation and recycling, how would you prefer the information come from ? (please rank from the most prefer measure, 1 = most preferable to 8 = less prefer)
[   ] Dissemination from related Agency       [   ] Information Board in Public Facility (i.e mosque)
[   ] Local community meeting       [   ] Others, Please specify : ......................................
[   ] Women's group       [   ] : .............................................................................
[   ] Pamflet / Brochure       [   ] : .............................................................................

27. Based on your opinion, please mark your agreement/disagreement towards the following statement regarding the availability of waste segregation and recycling information in your neighbourhood.

| | Strongly Disagree | Disagree | Agree | Strongly Agree | Not Sure |
|---|---|---|---|---|---|
| I feel that i am well provided with waste segregation and recycling information | [   ] | [   ] | [   ] | [   ] | [   ] |
| I often find waste segregation and recycling information easily | [   ] | [   ] | [   ] | [   ] | [   ] |
| I agree that I am accessible to information regarding waste segregation and recycling | [   ] | [   ] | [   ] | [   ] | [   ] |

F. Knowledge

28. Have you been ever involved in any training about waste segregation or recycling ?
[   ] Yes   [   ] No

29. Based on your knowledge, please mark the following items into the most appropriate categorization (choose only one categorization)

| | Non-Organic | Organic | Residue |
|---|---|---|---|
| Plastic bags | [   ] | [   ] | [   ] |
| Plastic bottles/containers | [   ] | [   ] | [   ] |
| Glass bottles/jars | [   ] | [   ] | [   ] |
| Cardboard boxes | [   ] | [   ] | [   ] |
| Papers | [   ] | [   ] | [   ] |
| Cloth | [   ] | [   ] | [   ] |
| Alumunium cans | [   ] | [   ] | [   ] |
| Food scraps | [   ] | [   ] | [   ] |
| Diapers | [   ] | [   ] | [   ] |
| Women sanitary napkins | [   ] | [   ] | [   ] |

G. Pyscholgical Variable

| | Please mark your agreement/disagreement to the statement using the following scale | Strongly Disagree | Disagree | Agree | Strongly Agree | Not Sure |
|---|---|---|---|---|---|---|
| 30. | Attitude : | | | | | |
| | In my opinion, waste segregation at home is good | [ ] | [ ] | [ ] | [ ] | [ ] |
| | In my opinion, waste segregation at home is needed | [ ] | [ ] | [ ] | [ ] | [ ] |
| | In my opinion, waste segregation at home is responsible | [ ] | [ ] | [ ] | [ ] | [ ] |
| 31. | Subjective Norms : | | | | | |
| | My family would think I should segregate my waste at home | [ ] | [ ] | [ ] | [ ] | [ ] |
| | People who are living with me would support me to segregate my waste at home | [ ] | [ ] | [ ] | [ ] | [ ] |
| | My neighbours would think I should participate in waste segregation at home | [ ] | [ ] | [ ] | [ ] | [ ] |
| | If more people segregate their waste, I would segregate more often | [ ] | [ ] | [ ] | [ ] | [ ] |
| 32. | Perceive Behavioural Control : | | | | | |
| | Segregating waste is easy | [ ] | [ ] | [ ] | [ ] | [ ] |
| | I feel that i have the ability to segregate waste properly | [ ] | [ ] | [ ] | [ ] | [ ] |
| | I agree that it is not troublesome for me to segregate waste | [ ] | [ ] | [ ] | [ ] | [ ] |
| | I have enough space in my house to deal with the separated waste | [ ] | [ ] | [ ] | [ ] | [ ] |
| | I feel that segregating waste is not space consuming | [ ] | [ ] | [ ] | [ ] | [ ] |
| | I feel that segregating waste is ease in term of space | [ ] | [ ] | [ ] | [ ] | [ ] |
| | I have time to separated my waste at home | [ ] | [ ] | [ ] | [ ] | [ ] |
| | I feel that segregating waste is not time consuming | [ ] | [ ] | [ ] | [ ] | [ ] |
| | I feel that segregating waste is ease in term of time | [ ] | [ ] | [ ] | [ ] | [ ] |

**Annex 1B. Interview Guide**


**Interview Guide with Selected Household (segregate their waste at source)**

1. Do you segregate your waste ?
2. Can you tell me how do you segregate your waste ?
3. How often do you segregate your waste ?
4. How do you store your segregated waste ?
5. How many days do you spend storing your segregated waste in the house before dispose it ?
6. Where do you commonly dispose for each type of your segregated waste in your neighbourhood ?
7. Who is commonly in charge of segregating, and transporting for each of the waste type on collection days ?
8. Can you tell me what facilities available in your neighboorhood ? is it adequate ?
9. How far are you from these facilities ? is it accessible ?
10. How is your segregated waste being collected in your neighbourhood ?
11. What is the frequency of waste collection in your neighboorhood ? is it reliable ?
12. What do you thing about the system being conducted in your neighbourhood ?
13. What do you think need to be improved ?
14. Is there any incentives/reward will be given for segregating waste at house ?
15. What is your opinion about incentives/reward for segregating waste at house ?
16. Do you think there is enough information about waste segregation and recycling in your neighbourhood ?
17. What is your opinion regarding the information that should be provided for you ?
18. Do you think waste segregation is a good thing to do ?
19. How is your family opinion regarding waste segregation ?
20. How is your neighbours opinion regarding waste segregation ?
21. What do you think in term of easiness for you to segregate your household waste ?
22. What do you think in term of space needed in your house to store your segregated waste ?
23. What do you think in term of time for you to segregate waste ?
24. Do you have any other comments ?


**Interview Guide with Selected Household (not segregate their waste at source)**

1. Do you segregate your waste ?
2. What discourage you to segregate waste at your house ?
3. What factors will motivate you to start segregate waste at your house ?
4. How do you commonly dispose your waste ?
5. Can you tell me what facilities available in your neighboorhood ? is it adequate ?
6. How far are you from these facilities ? is it accessible ?
7. What is the frequency of waste collection in your neighboorhood ? is it reliable ?
8. What do you thing about the system being conducted in your neighboorhoud ?
9. What do you think need to be improved ?
10. If that being provided, Will that motivate you to start segregating waste ?
11. If Not, what else will motivate you to start segregate waste at your house ?
12. Is there any incentives/reward will be given for segregating waste at house ?
13. What is your opinion about incentives/reward for segregating waste at house ?
14. Do you think there is enough information about waste segregation and recycling in your neighbourhood ?
15. What is your opinion regarding the information that should be provided for you ?
16. Do you think waste segregation is a good thing to do ?
17. How is your family opinion regarding waste segregation ?
18. How is your neighbours opinion regarding waste segregation ?
19. What do you think in term of easiness for you to segregate your household waste ?
20. What do you think in term of space needed in your house to store your segregated waste ?

21. What do you think in term of time for you to segregate waste ?
22. Do you have any other comments ?

## Interview Guide with SWPU Coordinator

1. Where do you get your organic waste from ?
2. What collection methods do you use to collect organic waste ?
3. Is it often that you receive non-segregated waste ?
4. How much time do you spend on cleaning non-segregated waste that you receive ?
5. Do you spend less time on processing segregated waste ? could you give figures in comparison
6. What are the difficulties in working with non-segregated waste ?
7. Are you involved in public awareness/education for enhancing waste source segregation ?
8. What efforts do you do to encourage household to segregate waste from the source ?
9. Are there any incentives you give to the households for the segregated waste ?
10. If Yes, what kind of incentives ? based on your opinion, does it effective ?
11. If No (or you think the current incentives is not enough), what do you think will encourage household to segregate waste from the source, and who should do that ?
12. Do you have any other comments ?

## Interview Guide with Waste Bank Leader

1. Where do you get your non-organic waste from ?
2. What collection methods do you use to collect non-organic waste ?
3. Is it often that you receive non-segregated waste ?
4. How much time do you spend on cleaning non-segregated waste that you receive ?
5. Do you spend less time on processing segregated waste ? could you give figures in comparison
6. What are the difficulties in working with non-segregated waste ?
7. Are you involved in public awareness/education for enhancing waste source separation ?
8. What efforts do you do to encourage household to segregate waste from the source ?
9. Are there any incentives you give to the households for the segregated waste ?
10. If Yes, what kind of incentives ? based on your opinion, does it effective ?
11. If No (or you think the current incentives is not enough), what do you think will encourage household to segregate waste from the source, and who should do that ?
12. Do you have any other comments ?

## Interview Guide with Local Community Leader

1. Can you tell me how the mechanisms of recycling programme in the neighbourhood ?
2. Who are the stakeholder involves in the recycling programme in the neighbourhood ?
3. Are you involved in public awareness/education for enhancing waste source segregation ?
4. What kind of information dissemination regarding recycling programme commonly used in the neighbourhood ?
5. What efforts do you do to encourage household to segregate waste from the source ?
6. Is there any punishment for those who do not segregate waste at source ?
7. Are there any incentives you give to the households for the segregated waste ?
8. If Yes, what kind of incentives ? based on your opinion, does it effective ?
9. If No (or you think the current incentives is not enough), what do you think will encourage household to segregate waste from the source, and who should do that ?
10. What challenges do you face regarding waste segregation in the neighbourhood ?
11. Do you have any other comments ?

## Interview Guide with Local Waste Collector

1. Can you tell me how do you collect and transport the waste in the neighbourhood?

2. What type of waste do you collect and transport ?
3. Where do you dispose the waste ?
4. Is it often that you found non-segregated waste ?
5. What challenges do you face in your opeartion ?
6. Do you have any other comments ?


**Interview Guide with Local Government (Cleansing Agency of Depok)**

1. Since when the IWPS Program was initited ?
2. What motivate the Government to initiate the IWPS Program ?
3. What is the target of the IWPS Program ?
4. How does the IWPS Program mechanism work ?
5. How does the Government Socialize the IWPS Program ?
6. What are the main challenges to the IWPS Program ?
7. Does Government of Depok freeing the service charge for household ? Since When ? and How does the mechanism work ?
8. Is there any negative consequences for the freeing service charge policy to current waste service ?
9. How do you finance the program ?
10. Does the households whom do not segregate will be exclude from the formal collection service ? can you explain more ?
11. What efforts do the government does to encourage household to segregate waste from the source ?
12. What are the main challenges to increase Household participation particularly in waste segregation at source ?
13. Are there any incentives the government provide to the households for segregating waste ?
14. If Yes, what kind of incentives ? Based on your opinion, does it effective ?
15. If Not effective, what are the problems ?
16. Do you have any other comments ?

### Annex 1C. Binary Logistic Regression Result

## Block 1: Method = Enter

**Omnibus Tests of Model Coefficients**

|        |       | Chi-square | df | Sig. |
|--------|-------|-----------|----|------|
| Step 1 | Step  | 177,103   | 16 | ,000 |
|        | Block | 177,103   | 16 | ,000 |
|        | Model | 177,103   | 16 | ,000 |

**Model Summary**

| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
|------|------------------|---------------------|---------------------|
| 1    | 61,746$^a$       | ,634                | ,854                |

a. Estimation terminated at iteration number 8 because
parameter estimates changed by less than ,001.

**Hosmer and Lemeshow Test**

| Step | Chi-square | df | Sig. |
|------|-----------|----|------|
| 1    | 11,068    | 8  | ,198 |

**Contingency Table for Hosmer and Lemeshow Test**

|        |    | SEGRE_OK = HdSO | | SEGRE_OK = HSO | | |
|--------|----|----------|----------|----------|----------|-------|
|        |    | Observed | Expected | Observed | Expected | Total |
| Step 1 | 1  | 18       | 17,993   | 0        | ,007     | 18    |
|        | 2  | 18       | 17,927   | 0        | ,073     | 18    |
|        | 3  | 18       | 17,249   | 0        | ,751     | 18    |
|        | 4  | 13       | 13,103   | 5        | 4,897    | 18    |
|        | 5  | 5        | 4,809    | 13       | 13,191   | 18    |
|        | 6  | 0        | 1,325    | 18       | 16,675   | 18    |
|        | 7  | 0        | ,486     | 18       | 17,514   | 18    |
|        | 8  | 1        | ,099     | 17       | 17,901   | 18    |
|        | 9  | 0        | ,008     | 18       | 17,992   | 18    |
|        | 10 | 0        | ,000     | 14       | 14,000   | 14    |

**Classification Table$^a$**

| Observed |       |      | Predicted | | |
|----------|-------|------|-----------|------|-----------|
|          |       |      | SEGRE_OK  | | Percentage |
|          |       |      | HdSO      | HSO  | Correct |
| Step 1   | SEGRE_OK | HdSO | 67     | 6    | 91,8    |
|          |       | HSO  | 4         | 99   | 96,1    |
|          | Overall Percentage | |   |      | 94,3    |

a. The cut value is ,500