Doctoral Dissertation

Impacts of Information Provision on Preferences for Infrastructures and Public Services Improvements: Randomized Conjoint Field Experiments in Indonesia

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Abstract

Information provision is commonly used to increase knowledge and awareness, which can, in turn, influence citizens to support public policy. Thus, information is considered as a policy instrument that can be used to influence behavioral change. There is no underlying theoretical basis in categorizing information types; thus, in principle, we consider that any type of treatment contains information to be delivered to the targeted population. Providing information is relevant in developing countries because of its low-cost and immediate impacts.

The main objective of this study is to estimate the impacts of information provision on the preferences of households toward infrastructure and public services improvements in Indonesia. Provision of adequate infrastructure and public services in developing countries remains a significant challenge. Notably, infrastructure is important for socio-economic development. This study was carried out in Surabaya (a representative of urban area) and Gili Gede (a representative for small and remote island), Indonesia. The type of information used in this research is related to information strategies. The experiment was conducted in a randomized field trial. The preferences were elicited using the stated preference method through randomized conjoint analysis. This method involves primary surveys in which respondents choose among hypothetical alternatives.

The dissertation consists of six chapters. Chapter 1 presents the research background, motivation, framework, objective, significance, and outline of the dissertation. Chapter 2 describes the literature review and methodology. The three analytical chapters are Chapter 3, Chapter 4, and Chapter 5. Chapter 3 tested the impacts of negative information related to government performance on preference changes toward infrastructure provision in a small and remote island. Gili Gede was selected as a case study of remote islands in Indonesia. The results show that providing information on past failed projects related to water and electricity provision led to diminishing preferences for the new hypothetical infrastructure projects, particularly the water attribute. The number of samples was 429 households. The findings suggest that providing negative information leads to a slightly decreased preference for the water supply attribute. The results of the heterogeneous analysis show that bridges are preferred by households without boat

ownership. In terms of gender, females prefer health services, water supply, and quick electricity provision, but they are more likely to refuse the additional payment.

Chapter 4 examined the impacts of pecuniary and non-pecuniary information on the stated preferences and willingness to pay (WTP) for an improved waste collection and disposal program. Surabaya was selected as a case study of an urban area in Indonesia. The number of samples was 900 households. The results show that the pecuniary information increased the willingness to pay by 20.5% relative to that of no information, while the non-pecuniary information had a positive impact on the non-organic separation attribute. The non-pecuniary information decreased the WTP by almost 7% relative to that of no information, suggesting that there is a trade-off between preference for non-organic separation and additional monthly payment for an improved waste collection and disposal program.

Chapter 5 investigated the impacts of a brief descriptive message on the stated preferences and willingness to pay (WTP) for an improved water supply service. The study area was Surabaya. The brief descriptive message containing information on the daily water requirement for each person and household monthly expenditure on drinking water (gallon water) was presented to respondents in Surabaya city. The number of samples was 800 households. The results show that providing information influenced preferences for tap water quality, no supply interruption, and response to customer complaints. The information also influenced the respondents to be more likely to refuse a payment attribute in addition to the current monthly water bill. In addition, providing the information led to a slight increase in the WTP (by 4.77%) relative to that of no information.

Chapter 6 summarized the main findings of this study. Overall, the provision of one-shot information is still effective, provided that the content is specific and relevant to the purpose. Policy implications are formulated by considering the results of this study. First, the government might consider using simple and low-cost interventions, such as information provision to enhance support for public policy. Second, the government should consider the package that is influential in formulating policy related to improved provision of infrastructure and public services. This study also recommends areas for future studies based on the limitations and findings of this study. Since this study examined the impacts of information interventions on the stated preference of households, it cannot represent the real behavior of households. This study used simple information interventions, such as one-

shot information provision strategies, and did not examine the long-term effect of the interventions; thus, further tests of whether the impact of information is long-lasting are advised.

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Table of Contents

List of Tables

List of Figures

List of Abbreviations

AMCE	Average Marginal Component Effect
CVM	Contingent Valuation Method
DCE	Discrete Choice Experiment
IDR	Indonesian Rupiah
PDAM	Local-Owned Water Company (*Perusahaan Daerah Air Minum*)
RCA	Randomized Conjoint Analysis
RCT	Randomized Controlled Trial
RP	Revealed Preference
SP	Stated Preference
USD	United States Dollar
WTP	Willingness to Pay

Chapter 1. Introduction

1.1. Background

Information provision is defined as an intervention where people are provided with information about environmental problems, information on the opinions or behavior of others, or information that can help them to take action (Abrahamse & Matthies, 2012). Information provision is commonly used to increase knowledge and awareness, which, in turn, can influence citizens to support public policy (Abrahamse & Matthies, 2012; Delmas, Fischlein, & Asensio, 2013).

Providing information is an alternative approach to enhancing support for a new public policy. Kumar, Post, & Ray (2018) argued that information-based intervention of public policies relied on the assumption that providing information to citizens leads to improvement of public quality services. Schultz (2002) explained that providing information is useful in certain conditions, such as introducing a new program, changing an existing program, or if there is a complexity of procedures.

Provision of adequate infrastructure and public services in developing countries remains a significant challenge, particularly due to a rapidly growing population, low investment, and bad governance. In fact, infrastructure plays a vital role in the physical and socio-economic development of society (Ibem, 2009). Examples of these critical infrastructures and public services include electricity, water supply, and waste management systems. Bunte & Kim (2017) have noted that budget constraint is one reason why governments must prioritize infrastructure provision. On the other hand, Petrick & Gramzow (2012) also mentioned that provision of public goods might not respond to individual preferences, as information about the true preferences of citizens is usually hard to obtain.

Thus, by providing information to citizens, it is expected that information can increase knowledge and, ultimately, change the preference of citizens to support improvement in infrastructure and public service provision.

1.2. Research Motivation

Information is increasingly used to influence preference or behavior toward certain choices. On the one hand, information is considered as a category of interventions (see De Young, 1993; Steg & Vlek, 2009; Osbaldiston & Schott, 2012; Varotto & Spagnolli, 2017), on the other hand, others considered information as a subcategory of interventions (Geller et al., 1982; Katzen & Johnson, 1987; Abrahamse, Steg, Vlek, & Rothengatter, 2005). Osbaldiston & Schott (2012) have argued that there is no underlying theoretical basis to categorize intervention. Thus researchers often create their own categories.

Although a few studies have indicated that information alone is not effective (e.g., Abrahamse et al., 2005; Schultz, 2002), other studies have reported that information could be effective. For example, Byerly et al. (2018) concluded that how this information is framed and communicated matters. Abrahamse et al. (2005) also pointed out that the effects of information seem to depend largely on its specificity. A study by Wadehra & Mishra (2018) using one-shot information provision found that providing information can influence the waste disposal behavior of households. Although some studies reported that providing monetary incentive has stronger impacts, Iyer & Kashyap (2007) reported that informational programs appear to have more long-term effects than incentive programs.

There is a substantial body of research on the impacts of information provision on public services. For instance, many studies have explored the impact of information strategies on electricity consumption or energy conservation behavior (e.g., Magat, Payne, & Brucato, 1986; Wilhite & Ling, 1995; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007; Allcott, 2011; Costa & Kahn, 2013). In addition, Delmas et al. (2013) reported the results of a meta-analysis on information strategies and energy conservation behavior in experimental studies conducted from 1975 to 2012. In the water field, researchers have often used messages containing certain information to test the impact of that information (e.g., Bennear et al., 2013; Ferraro & Miranda, 2013a; Brown, Hamoudi, Jeuland, & Turrini, 2017). In the waste field, most information strategy studies have focused on household recycling as part of the waste management system and have not addressed the entire waste management system, including collection and disposal (e.g., Rhodes et al., 2014; Chong, Karlan, Shapiro, & Zinman, 2015; Wadehra & Mishra, 2018).

Using information provision in developing countries is particularly relevant because of its low-cost and immediate impact. In developing countries, where information and resources are considered limited, it is important to provide informational interventions that are expected to change the preference of citizens for better infrastructure and public service provision. This study will test several types of information to assess preference changes for infrastructures and public services.

1.3. Research Framework

This study will discuss the impacts of information provision on preferences for infrastructures and public services. Preferences are considered similar to perceptions; that is the factor precedes behavior. The research framework is shown in Figure 1.1.

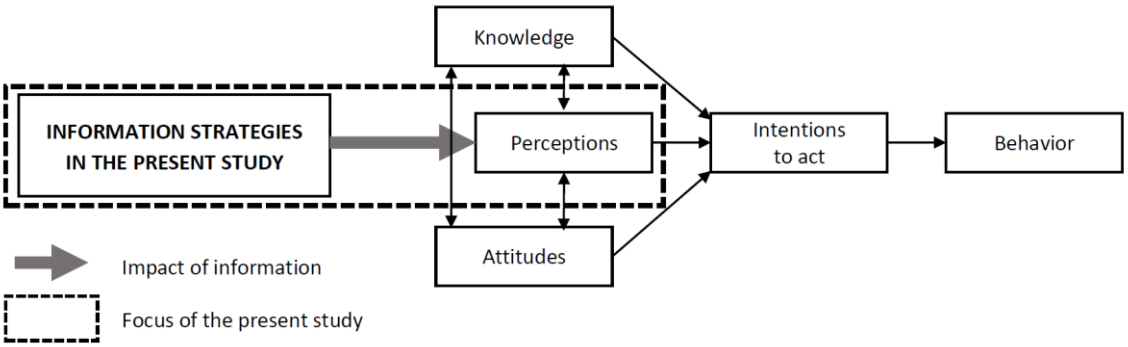


Figure 1.1. Research Framework
Source: Author

1.4. Research Objective

This research aims at estimating the impacts of information provision on the preferences of households toward infrastructure and public services. In detail, this research will answer the following questions:

1. Do the types of information impact the preferences of households differently?
2. Does heterogeneity exist in the preferences across the groups?

1.5. Research Significance

Given the extensive research on the impacts of information provision, there are some gaps that can be identified from previous research:

1. Using Randomized Controlled Trial (RCT) by utilizing one-shot information provision, which is considered low-cost, to provide immediate impact, and is relevant for developing countries.
2. Using Randomized Conjoint Analysis (RCA) to elicit the stated preference of policy toward infrastructures and public services, where previous research mostly used choice experiment or conventional conjoint analysis.
3. Extend the use of the randomized conjoint analysis to examine willingness to pay (WTP) for a new proposed program.

1.6. Outline of the Dissertation Report

This section outlines the research framework, as presented in Figure 1.2. The first chapter, Introduction, describes the background of the research, motivation, objective, and research significance. Chapter 2 describes the literature review related to information provision as an intervention aimed at behavioral change and the various methodologies. Chapter 3 discusses the impact of information provision on preferences toward infrastructure in a small and remote island. Chapter 4 analyzes the impact of information provision on preferences toward an improved household waste management system. Chapter 5 examines the impact of information provision on preference for an improved drinking water service. Chapter 6 provides general conclusions, policy implications, and limitations of this study.

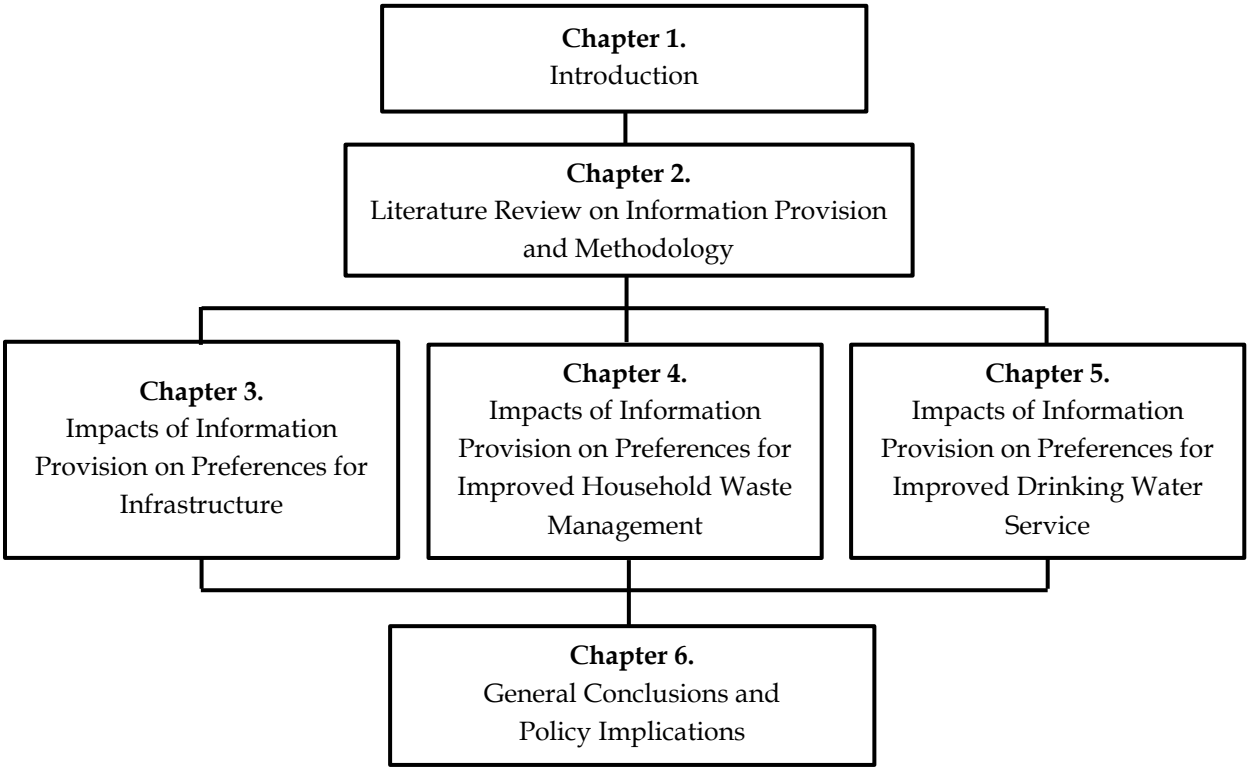


Figure 1.2. Outline of the Dissertation

Chapter 2. Literature Review

2.1. Information Provision as Intervention

Pro-environmental behavior can be changed through intervention. Information provision is considered an example of intervention. It is defined as an intervention where people are provided with information about environmental problems, information on the opinions or behavior of others, or information that can help them to take action (Abrahamse & Matthies, 2012). Information provision is commonly used to increase knowledge and awareness, which, in turn, can influence citizens to support public policy (Abrahamse & Matthies, 2012; Delmas et al., 2013).

Information provision is the most widely used intervention to promote behavior change (Abrahamse & Matthies, 2012). According to Schultz (2002), information provision has its roots in the so-called knowledge-deficit model, the assumption being that people do not know about a specific environmental problem, or they do not know about it in sufficient detail. Information provision aims to overcome this knowledge deficit.

The type of intervention that is discussed in this research is informational strategies, which can be considered as "soft measures". On the other hand, there are also "hard measures" or structural strategies, which refer to strategies that use incentive or technical alterations (Abrahamse & Matthies, 2012). Common examples of informational strategies include information provision, goal setting, commitment, prompting, and feedback. These examples are the most frequent informational strategies used in previous literature.

2.1.1. The Importance of Information Provision

Providing information is considered as "education" in a social marketing approach, which is rooted in the knowledge-deficit model, meaning that increasing knowledge will induce a change in behavior (Schultz, 2002). Despite the evidence of the effectiveness of information provision, this kind of intervention is still widely used because it is inexpensive.

Schultz (2002) argued that disseminating information can lead to a change in behavior in situations where lack of knowledge might be a barrier to action. Examples for these situations are:

1. *New program*. At the start of a new program, it is safe to assume that most people will not know the procedures for doing something, for instance, recycling.
2. *Changing an existing program*. When an established program is changed, the change should be accompanied by information. For instance, changes in the days of collection should be accompanied by information.
3. *Complexity of procedures*. Programs that require procedures that are complex or difficult to remember should regularly disseminate information.

2.1.2. Types of Informational Strategies

Abrahamse & Matthies (2012) stated that a number of field interventions had been designed, applying a wide array of behavior-change techniques to improve household recycling, which include information provision and educational campaigns, incentive or disincentive schemes, distribution of feedback and bins, and behavior modeling. Osbaldiston & Schott (2012) grouped the ten types of treatment (i.e. making it easy, prompts, justifications, instructions, feedbacks, rewards, social modelling, cognitive dissonance, commitment, and goal setting) into four larger sets: convenience, information, monitoring, and social-psychological processes. In principle, Osbaldiston & Schott (2012) argued that there is no underlying theoretical basis for these categories. Instead, they only presented them as a conceptual way of organizing the ten types of treatments. Steg & Vlek (2009) classified interventions into two types: informational strategies and structural strategies. Informational strategies include information, persuasion, social support and role models, and public participation. Structural strategies include the availability of products and services, legal regulation, and financial strategies.

2.2. Behavior and Preference Changes

Researchers have argued about whether behavior and preferences can be changed. One of the most frequent interventions used to influence behavior and preference changes is information provision. Although the effectiveness of information provision is uncertain, it is still widely used because it is inexpensive.

Information provision, which is rooted in knowledge-deficit theory, relies on the assumption that increasing knowledge will translate into a change in behavior (Schultz, 2002). Furthermore, by taking recycling as an example, Schultz (2002) explained that there are three hypotheses can be derived from this theory:

1. Knowledge about recycling will be correlated with recycling behavior.
2. Distributing educational materials containing information about recycling will lead to an increase in knowledge about recycling.
3. An increase in knowledge about recycling will lead to an increase in recycling behavior.

Despite the arguments on the ineffectiveness of information provision, some previous research has provided evidence that information has an influence in changing behavior (Madajewicz et al., 2006; Iyer & Kashyap, 2007; Wadehra & Mishra, 2018). A study conducted by Lindén, Carlsson-Kanyama, & Eriksson (2006) explained that information is one possible policy instrument that can be used to influence behavioral change.

2.3. Randomized Controlled Trial

Solomon et al. (2009) defined Randomized Controlled Trial (RCT) as a true experiment whereby participants are assigned by chance, following a pretest, to at least two conditions: An experimental treatment or intervention, and a control intervention used for purposes of comparison of outcomes. RCT is previously known to be frequently used in health issue research (medical treatments). Today, with the increase of determining policy effectiveness and practice interventions, RCT is increasingly being applied (Solomon et al., 2009). Furthermore, Solomon et al. (2009) explained that the intervention must be adequately developed so that researchers are able to distinguish two things, (1) type of intervention participants that will be randomized and (2) who will be randomized.

In the case of RCT, Solomon et al. (2009) mentioned that the intervention (versus control) is the independent variable, while the outcome is the dependent variable. The hypothesis captures the relationship of the intervention to specific theorized outcomes, which can be empirically tested. An important aspect is that the direction of the relationship should be explicit. An RCT is considered to provide a new and necessary service compared to the current condition. Furthermore, the randomization procedure can generate a scientific comparison of the effectiveness of the new intervention. Stock & Watson (2011)

explained that in a randomized controlled experiment, the treatment is assigned randomly to a control group and a treatment group. The random assignment eliminates the possibility of a systematic relationship between the treatment and control groups. Thus, it can be ensured that the treatment is the only source of the systematic difference.

Gertler et al. (2016) argued that the internal and external validity could be ensured through a randomized assignment of treatment. Internal validity refers to the condition where the impacts are estimated without influence from all possible confounding factors. Hence, we can consider it as the true impact of the program. When the results of impact evaluation are generalizable to the population of policy interest, it can ensure external validity. Therefore, the sample selection for the impact evaluation must represent the population of eligible units.

2.4. Randomized Conjoint Analysis

2.4.1. Estimation of Causal Effects on Choice Probabilities

The method of randomized conjoint analysis (RCA) was proposed by Hainmueller et al. (2014). This so-called randomized conjoint analysis is modified from conventional conjoint analysis, which was introduced by (Green & Rao, 1971), to an analytical method based on a potential outcome framework of causal inference (Neyman, 1923; Rubin, 1974). The randomized conjoint approach is a useful method for collecting stated preferences among hypothetical alternatives with multiple attributes. The full randomization of attributes and levels in the conjoint design enables the nonparametric estimation of the average marginal component effect of a given attribute value on agreement support (Hainmueller et al., 2014). Full randomization also ensures that individual respondent characteristics, attribute order, and other potentially confounding factors are approximately uniformly distributed across treatment conditions (i.e., choice sets), thus allowing for causal interpretations of the estimated effects.

There are two types of estimations on choice probabilities can be observed by using the new conjoint analysis. The first type is an internal choice probability; that is, when one policy is preferred to another policy, it is considered an internal choice probability. The second type is an external choice probability, that is, if a policy is preferred to the status quo, it is considered an external choice probability.

In conjoint analysis, respondents are shown a choice set offering several alternatives. Each alternative consists of a set of selected attributes and individual attribute levels. The choice set consists of two hypothetical alternatives that are set for an experiment. In addition, there is also a status quo that is put as an alternative. Therefore, each choice set has three alternatives, two hypothetical alternatives, and the current or status quo scheme. The order of attributes and attribute levels values are randomly assigned. Respondents are then asked to make a ranking among the three alternatives based on their preferences. The decision is made several times repeatedly for different choice sets.

To implement the estimations for the internal and external choice probabilities, the following model is applied:

$$E[Y_{ij}] = \beta_0 + \beta_c I_{ijc} + \sum_{l=1}^{l=n} \beta_l I_{ijl} \tag{2.1}$$

where $E[Y_{ij}]$ is the binary choice indicator of respondent i for alternative j^{th}, I_{ijc} and I_{ijl} is dummy vectors of price levels and attribute l^{th} levels, and β_c and β_l are vectors of the estimates of the AMCE. Because the unit of analysis is not the respondent, but each choice set of each respondent, there is a possibility that the observed choice outcomes are correlated. To avoid this bias, we used cluster robust standard errors at the respondent level.

2.4.2. Estimation of Willingness to Pay

The estimation of WTP in our research is not calculated independently; instead, the randomized conjoint analysis approach proposed by Hainmueller et al. (2014) allows us to partially identify the distribution of WTP and compute the lower bound of the average WTP for accepting the improved waste management policy. The detailed calculation is carried out based on Hninn, Kawata, Kaneko, & Yoshida (2017) and Kaneko, Kawata, & Yoshida (2016), who integrated the nonparametric point-identification of the distribution of welfare analysis by Bhattacharya (2015) with the observed data from the randomized conjoint experiment approach of Hainmueller et al. (2014). The assumptions follow Hninn et al. (2017) and comprise four non-parametric assumptions (monotonicity, continuity, boundary and rationality).

According to Hninn et al. (2017), monotonicity implies that no individuals prefer a higher individual policy burden, and continuity is a technical assumption to ensure the existence of the WTP. Boundary requires that (i) individuals do not prefer to implement a policy with the infinitely high cost, and (ii) must prefer to implement a policy with zero burdens. This assumption stems from the fact that all levels of attributes offered to the respondents will only improve the situation relative to the status quo and is necessary to ensure non-negativity. Finally, rationality requires consistency between real and stated preferences in the conjoint experiment. Then, the marginal WTP distribution can be identified as follows:

$$\hat{F}(c) = 1 - \bar{Y}_{ij|Cij=c} \tag{2.2}$$

where $\hat{F}(c)$ is the identification result of the marginal WTP distribution or the share of those having a WTP value of c or lower.

In the conjoint design, the lower bound is estimable because the boundary defines the lower bound of individual WTP as 0 (zero). However, our rational choice model does not provide the upper bound of individual WTP, and the upper bound cannot be identified. Thus, only the lower bounds of the average marginal WTP from the conjoint data can be identified using the following equations:

$$\underline{\hat{\mu}} = \sum_{i=0}^{n} c_i[\hat{F}(c_{i+1}) - \hat{F}(c_i)] \tag{2.3}$$

where c_i is the lower premium in the i^{th} threshold, and n is the number of threshold levels. The probability intervals of the marginal WTP distribution are rewritten as:

$$\begin{aligned} \hat{F}(p_1) &= 1 - \bar{Y}_{ij|c_{ij}=p_1} \\ \hat{F}(p_2) - \hat{F}(p_1) &= \bar{Y}_{ij|c_{ij}=p_1} - \bar{Y}_{ij|c_{ij}=p_2} \\ \hat{F}(p_3) - \hat{F}(p_2) &= \bar{Y}_{ij|c_{ij}=p_2} - \bar{Y}_{ij|c_{ij}=p_3} \\ 1 - \hat{F}(p_3) &= \bar{Y}_{ij|c_{ij}=p_3} \end{aligned} \tag{2.4}$$

We define the demand for a policy $\{a, c\}$, where a is the attribute and c is the cost, with information treatment w as follows:

$$D(a,c|w) = E\left[Y_{ij}\middle|a,c,w\right] \tag{2.5}$$

which can be marginalized as follows:

$$D(c|w) \equiv \sum_{a} D\,(a,c|w) \times f_a(a) = E\left[Y_{ij}\middle|c,w\right] \tag{2.6}$$

The last equality holds if $f_a(a)$ is specified as the joint uniform distribution.

In our conjoint survey, the demand function cannot be estimated globally. Alternatively, we estimate the demand for some costs as $\{c_0, c_1, c_2\}$, with $c_0 < c_1 < c_2$. The demand function provides rich information on the WTP distribution. For instance, the lower bound of the average WTP is defined as follows:

$$E_{min}[WTP|w] = c_2 \times D(c_2|w) + c_1 \times [D(c_1|w) - D(c_2|w)] + c_0 \times [D(c_0|w) - D(c_1|w)] \tag{2.7}$$

which can be reformulated as follows:

$$\begin{aligned} E_{min}[WTP|w] = {} & c_2 \times E\left[Y_{ij}\middle|c_2,w\right] + c_1 \times \left[E\left[Y_{ij}\middle|c_1,w\right] - E\left[Y_{ij}\middle|c_2,w\right]\right] \\ & + c_0 \times \left[E\left[Y_{ij}\middle|c_0,w\right] - E\left[Y_{ij}\middle|c_1,w\right]\right] \end{aligned} \tag{2.8}$$

Note that by using a subsample with w, $E[Y_i|c,w]$ can be estimated by using the following regression:

$$Y_{ij} = \beta_{0,w} + \beta_{1,w} \times c_1 + \beta_{2,w} \times c_2 + u_{i,w} \tag{2.9}$$

where $u_{i,w}$ is the error term, and $\beta_{0,w}, \beta_{1,w}, \beta_{2,w}$ are the parameters. With the estimated parameters, the lower bound of WTP can be calculated as follows:

$$E_{min}[\hat{WTP}|w] = c_2 \times \left[\hat{\beta}_{0,w} + \hat{\beta}_{2,w}\right] + c_1 \times \left[\hat{\beta}_{1,w} - \hat{\beta}_{2,w}\right] + c_0 \times \left[-\hat{\beta}_{1,w}\right] \tag{2.10}$$

The effect of changing from $w = 0$ to $w = 1$ is defined and estimated as follows:

$$\begin{aligned} & E_{min}\left[\hat{WTP}\,\middle|1\right] - E_{min}\left[\hat{WTP}\,\middle|0\right] = \\ & c_2 \times \left[\hat{\beta}_{0,1} + \hat{\beta}_{2,1}\right] + c_1 \times \left[\hat{\beta}_{1,1} - \hat{\beta}_{2,1}\right] + c_0 \times \left[-\hat{\beta}_{1,1}\right] - c_2 \times \left[\hat{\beta}_{0,0} + \hat{\beta}_{2,0}\right] - \\ & c_1 \times \left[\hat{\beta}_{1,0} - \hat{\beta}_{2,0}\right] - c_0 \times \left[-\hat{\beta}_{1,0}\right] \end{aligned} \tag{2.11}$$

Chapter 3. Impacts of Negative Information on Preferences for Infrastructure Provision on a Remote Island: A Field Experiment in Gili Gede

3.1. Introduction and Objective

The provision of public goods, such as transport infrastructure, access to education, and clean air, is an essential requirement for economic development in any given region (Petrick & Gramzow, 2012). Infrastructure can deliver major benefits in economic growth, poverty alleviation, and environmental sustainability, but only when it provides services that respond to effective demand (The World Bank, 1994). The term infrastructure refers not only to technical infrastructures, such as transport infrastructure, electricity, and water supply, but also social infrastructures, such as education and health facilities. However, provision of such infrastructure in a rural or remote area is commonly lacking. The condition can potentially worsen in small and remote islands. Unlike residents in other territories, islanders are usually faced with a lack of infrastructures and basic services due to geographical discontinuity (Fernandes & Pinho, 2017). Lack of government funding is often mentioned as a cause. This is in line with the statement of Bunte & Kim (2017), who argued that budget constraint is one of the reasons why governments must decide how to spend the available resources, and which type of public goods to provide.

Another problem that might arise is that provision of public goods by the government does not respond to individual preferences, as stated by Petrick & Gramzow (2012). These authors also mentioned that information about the true preferences of citizens is usually hard to obtain, as citizens might be unwilling or unable to voice their concerns. On the other hand, government decisions might be nontransparent for citizens.

Providing effective and reliable infrastructure to citizens is a persistent challenge for governments, particularly in developing countries, where resources are often limited (Davis, 2004). Governments must decide which infrastructure should be prioritized and how to best allocate the resources required. Budget constraints also create difficulties for governments in developing countries regarding maintaining public infrastructure. Therefore, many infrastructure projects constructed through funds from either the central

government or non-government organizations are damaged. This condition can lead to citizens distrusting a government's capability to provide new infrastructure.

Government performance has been extensively researched over several decades; however, little attention has been paid to the effect of providing such information on citizens' perceptions. James & Moseley (2014) measured government performance and tested the effects on citizens' perceived performance and satisfaction. These authors argued that providing information on public performance can facilitate informed citizen participation in control over local public services.

In marketing fields, positive or negative information is frequently used as an intervention to understand the perception or preference of customers. Despite a growing literature addressing the impact of information on customer behavior, there is no clear consensus about the impact of positive, negative, or balanced information in samples (Valente & Chaves, 2018). However, there is clear evidence that negative information is stronger or more influential than positive or negative information (e.g., Lee et al., 2008; Weisstein et al., 2017; Valente & Chaves, 2018). Similar to marketing fields, providing negative information in political fields, such as corruption, can lead to a decrease in election support (e.g., Chong et al., 2015).

The above-mentioned studies have motivated this research to use negative content of information related to past infrastructure development failures to understand whether this information influences the preferences toward infrastructure provision in a remote island, where infrastructure is mostly lacking. Understanding the citizens' preferences is important because the involvement of citizens in decision-making in infrastructure provision is considered as a form of public participation. This is because citizens can identify and prioritize infrastructure based on their needs (Ibem, 2009). This statement is also emphasized by Bunte & Kim (2017), who mentioned that tailoring the goods to citizens' preferences can ensure the resulting supply of public goods matches local demands.

The objective of this research is to examine the impact of negative information on the preference of households on a remote island toward infrastructure provision. The detail research questions are:

1. Does negative information diminish the preferences for infrastructure provisions, such as electricity and water supply?

2. How the preference for a bridge differs between households who have a boat and those that do not have a boat?

3.2. Literature Review

Small islands are often defined as those specks of 'land surrounded by water' which have approximately 10,000 km² or less in the area (Hess, 1990). However, Fernandes & Pinho (2017) argued that almost no consensus had been reached among researches regarding what should be the size limits of a small island. Some small islands are also remote or isolated. Remote islands are defined as islands where all sides are enclosed by the ocean, and a degree of regional independence is maintained while being economically subordinate in some manner to the mainland (Kawachi, 1968 in Matsumura & Miyoshi, 2018). Some aspects that characterize the situation of islands are limited resources and close social interactions (Ratter, 2018).

Understanding the preference for public goods or infrastructure on a remote island is essential for further development. Limited resources such as budget constraints affect how governments spend available resources and decide which type of public goods to provide. Notably, provision of public goods, such as transportation infrastructure, access to education, or clean air, is an essential requirement for economic development in any region. However, the provision of such infrastructure in rural and remote areas is commonly insufficient, and the condition can be worse on small and remote islands. Budget constraints of governments were argued to be the most common reason (Bunte & Kim, 2017).

The difference between a government's perspective and a community's needs also leads to infrastructure provision that does not respond to public preferences, and this can be true because infrastructure provision is usually legitimized through political mechanisms (Petrick & Gramzow, 2012). On the one hand, information about the true preferences of citizens is usually difficult to obtain because citizens might be unwilling or unable to voice their concerns; on the other hand, government decisions might be nontransparent for citizens (Petrick & Gramzow, 2012).

Researchers have demonstrated the role of infrastructure in economic growth and regional development. The supply of electricity is often mentioned as a crucial generator to

increase well-being because it has multiplier effects on human life. This statement is in line with the study by Best & Burke (2018), who argued that electricity provision could indirectly boost economic growth. In addition to electricity, the provision of a fresh water supply is also vital for daily life, and water availability is critical to support human well-being. In terms of social infrastructure, education facilities and health services are commonly considered significant factors that support daily life.

As previously mentioned, the true preferences of citizens are difficult to obtain. Either citizens are unwilling to voice their concerns, or there is no transparency in the government's decision-making. To understand respondents' perceptions or preferences in a certain condition, negative information is commonly used. Some examples can be found in the marketing and political fields.

Negative information is increasingly used to test its influence on customer behavior in the marketing field. Despite the results of extensive studies that have demonstrated the effect of positive online reviews on sales, negative reviews are found to be more influential in consumer decision-making (Bambauer-Sachse & Mangold, 2011; Lee et al., 2008; Sen & Lerman, 2007).

The existing literature shows that negative reviews about a product's performance lead to a negative attitude toward the product (Tang, Fang, & Wang, 2014). The intensity of the negative attitudes increases when there is a greater proportion of negative reviews (Lee et al., 2008; Weisstein et al., 2017). In their experimental research, Valente & Chaves (2018) also concluded that the proportion of negative reviews has stronger negative impacts on purchase decision for consumers with a purchase goal than those without.

Compared to positive reviews, negative reviews also have a stronger impact on consumers' price perceptions (Weisstein et al., 2017). This indicates that negative information is more influential than positive information. This statement is in line with previous research (Fiske, 1980; Maheswaran & Meyers-Levy, 1990), in which the authors have argued that consumers pay more attention to negative information than positive information because negative information is more diagnostic and informative for decision-making. The negative effect observed in practice and demonstrated by researchers can be explained by loss aversion in prospect theory, which posits that consumers are more sensitive to losses than gains (Kahneman & Tversky, 2007).

Few studies have used negative information in government performance and political fields. James (2011) conducted field and laboratory experiments in Exeter, the UK, using "information cues about local government performance" to evaluate their effects on citizens' perceptions of performance, satisfaction with services, and vote intention in the next local election. He found that a cue about relatively good performance raises citizens' perceived performance and satisfaction and information about relatively bad performance lowers citizens' perceptions of performance and satisfaction. However, direct effects on citizens' intention to vote for the local incumbent were not detected. In the political field, Chong et al. (2015) found that using negative information, such as incumbent corruption, decreased incumbent party support, and voter turnout. Nevertheless, to the best of our knowledge, there have been no studies using negative information to influence the public preferences toward new infrastructure projects.

3.3. Research Method

3.3.1. Study Area

Gili Gede is a small, remote island located near Lombok, the mainland. The island belongs to the Sekotong district, in West Lombok Regency, along with 11 other small islands. Gili Gede has an area of 317 Ha and comprises five villages: Gili Gede, Tanjungan, Labuan Cenik, Orong Bukal, and Gedang Siang. The island had approximately 437 households in 2017.

Gili Gede was inaugurated as an island village based on the Regent's Decree of Lombok Barat No.1542/82/BPMD/2010 in 2010. Similar to the economic and development potential of other Gili islands, Gili Gede has potential as a dive and beach destination. Gili Gede also has traditional rules (*adat*) and regulations (*awig–awig*), similar to those in Gili Trawangan (see Hampton & Jeyacheya, 2015). Gili Gede is designated as a tourist village, along with Gili Layar and Gili Rengit, which are proximally located.

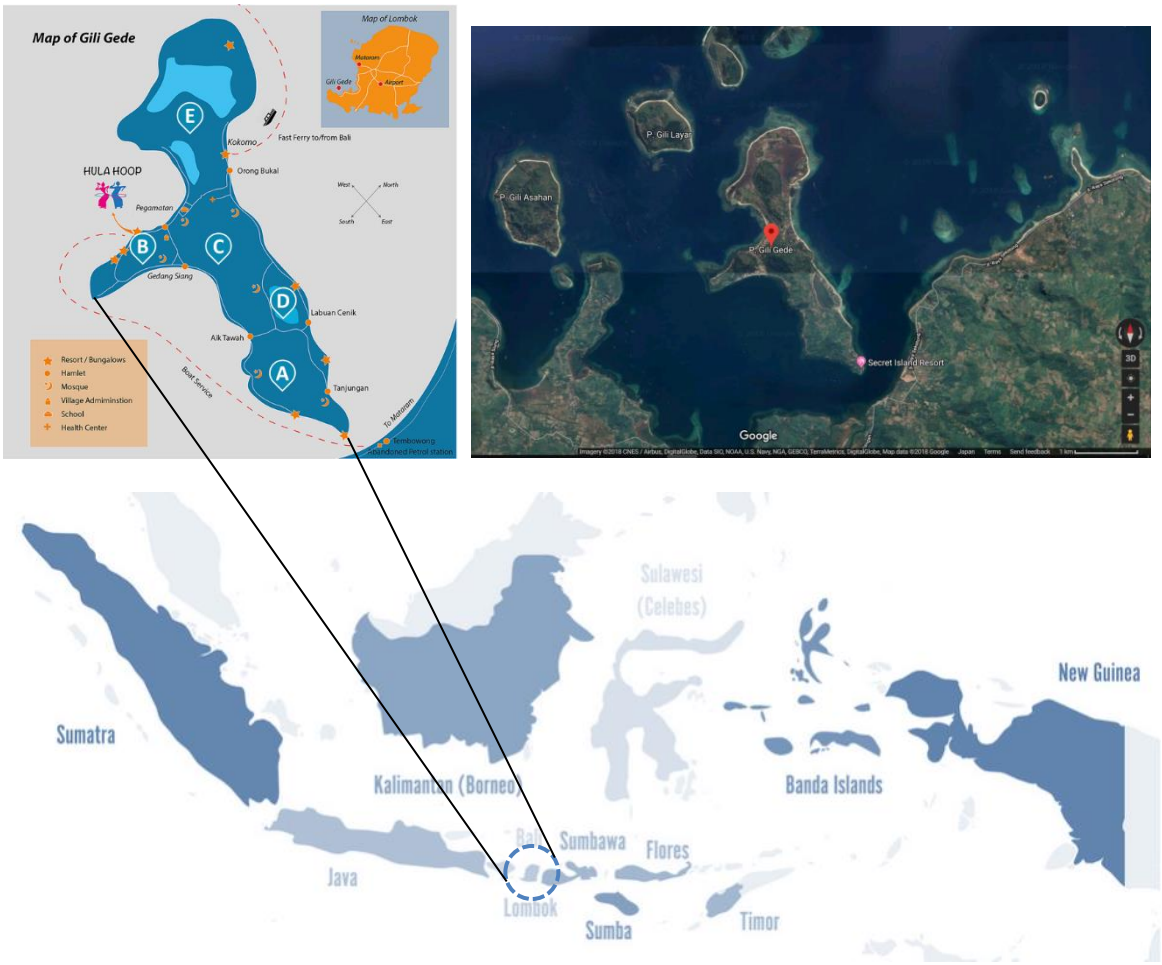


Figure 3.1. Map of the Study Area

The distance from the mainland to Gili Gede is approximately 700 m by boat. Within the villages, individuals commonly use all possible access modes, such as walking, motorbike, and boat. Road surfaces are either paved or earthen. Until the end of 2017, the main source of electricity was generators. Most of the solar panels that had been provided were broken. In particular, two villages sometimes obtain electricity from one resort, and other villages obtain electricity from shared generators. The electricity was available on average from 5 pm to 5 am. The most current news report indicated that since February 2018, electricity had been provided by the state-owned electricity company through an undersea cable network (Nugraha, 2018).

Figure 3.2. Accessibility in the Study Area
Source: Author

Water supply is also a problem on the island. No fresh water is available. Individuals mostly use a well with a depth of 5 m. Because the available water is mostly salty or brackish, individuals purchase bottled water or gallons for drinking purposes from the mainland. The central government had provided, through the Ministry of Maritime Affairs and Fisheries, a reverse osmosis facility, but the facility was damaged. Notably, one resort owned by a foreigner has a submarine pipeline to supply fresh water.

Figure 3.3. Water Supply in the Study Area
Source: Author

In terms of social infrastructure, the availability of education and health facilities was insufficient: one preschool was built in 2011; one elementary school and one junior high school (under one roof) were built in 1998, and one health center was built in 2010, and one midwife is available in the health center.

Figure 3.4. Education and Health Facilities in the Study Area
Source: Author

3.3.2. Sampling and Survey Implementation

The survey was conducted for 8 days, from September 10 to September 17, 2017. We implemented full household surveys for the five villages on Gili Gede island. Prior to the surveys, we trained seven surveyors. Before conducting the main survey, we also conducted a pilot survey. The data were collected using face-to-face interviews, with the help of computers. In total, 429 households were randomly assigned to whether they received information or not. The number of samples represents 98% of the population.

The questionnaire comprised two parts. The first part was the conjoint choice set, and the second part was the household survey data. The household survey data covered questions such as respondents' age, gender, marital status, educational attainment, family size, employment status, number of children and number of seniors in the family, family expenditure, and size of the *sosorohan* network. *Sosorohan* means family or relatives in the local language.

3.3.3. Experimental Design for Information Treatment

The information treatment was prepared in a written format. It contained information about the past infrastructure development failures in Gili Gede Island. Information regarding the failure of past infrastructure projects was collected from the staff of the village office. Four examples of past infrastructure development failures were mainly related to water supply provision and solar panel as an electricity source. The detail information treatment is presented in Figure 3.5.

List of failures of the past infrastructure development in Gili Gede Island:

- *Solar panel for several households provided by the Local Government/Regency*
- *Water desalination constructed by Ministry of Marine and Fisheries*
- *Rainwater harvesting at school provided by Japan Water Forum*
- *Water supply piping system provided by the Local Government*

Figure 3.5. Information Treatment

3.3.4. Conjoint Design for Infrastructure Provision

The first step in our conjoint design comprised of selecting a set of relevant attributes that could be used to elicit preferences of households for infrastructure provision on a

remote island. The selection of attributes was based on relevance to the regional growth of a remote island. This selection was also considered based on similar studies and our pilot survey. Finally, we proposed five attributes crucial for regional growth: the provision of electricity, water, health services, and bridges. We also include the monetary attribute (payment). Table 1 shows the attributes and attribute levels used in the survey.

Table 3.1. Attributes and Levels

No.	Attributes	Level 1	Level 2	Level 3	Level 4
1.	Electricity supply	YES (2018 -)	YES (2019 -)	YES (2020 -)	
2.	Water supply	YES (Desalinization technology)	YES (Pipe connection from Lombok)		
3.	Health service	NO (Current)	YES (Resident doctor)		
4.	Annual payment (IDR per month)	50,000	150,000	250,000	350,000
5.	Bridge	NO (Current)	YES		

The total number of observations in our conjoint experiment was 3,432 observations for 429 respondents (i.e., 429 respondents x 2 choice sets x 4 times repeated trials with a different combination of choice set = 3,432).

Before presenting the choice set to the respondents, the surveyors read the scenario to each respondent. The scenario is shown in Figure 3.6.

We would like to ask your preference on hypothetical basic infrastructure provision of Gili Gede island after 10 years except for electricity supply. You will be requested to make ranking among 3 alternatives, namely option A, option B and option C (status quo). Among the three options, the rankings are 1) the most preferable choice, 2) the second preferable choice and 3) the least preferable choice. The basic infrastructure provision is characterized by seven attributes, such as ***1) Electricity, 2) Drinking water, 3) Health service, 4) Bridge and 5) Monetary cont***

ribution of villagers in addition to current contribution*. The collected money from the villagers for the 10 years are all used for the infrastructure development, which is managed by (*Gili Gede Community Leader / Gili Gede Government Office). You will be asked to make rankings at four times repeatedly with*

Figure 3.6. Scenario

3.4. Results and Discussions

3.4.1. Descriptive Statistics

Information on the socio-economic characteristics consisted of age, gender, marital status, education, occupation, and last month expenditure. Results from the socioeconomic questionnaire showed that the respondents' mean age was 42 years, and 50.58% of respondents were females. More than 80% of respondents were married and had 1–4 family members. Regarding the highest education attainment, 27.04% of respondents had finished elementary school, and 26.57% were illiterate. For occupation, 37.3% of respondents were fishermen. Notably, 36.6% of respondents had monthly expenditures between IDR 1–2 million. Descriptive statistics for each group are presented in Table 3.2. To assess whether there was a substantial imbalance in households' characteristics between the treatment and control groups, we also conducted a t-test for mean differences and reported the results in the Appendix.

Table 3.2. Socio-economic characteristics

Socio-economic characteristics	N	All Groups		Without Info		With Info	
		Freq.	%	Freq.	%	Freq.	%
Gender	429						
Male		212	49.42	56	51.85	53	47.75
Female		217	50.58	52	48.15	58	52.25
Marital status	429						
Single		4	0.93	1	0.93	1	0.90
Married		354	82.52	96	88.89	86	77.48
Divorce		16	3.73	1	0.93	7	6.31
Widow		55	12.82	10	9.26	17	15.32
Education	429						
Illiterate		114	26.57	26	24.07	28	25.23
Not finished elementary school		75	17.48	18	16.67	19	17.12
Finished elementary school		116	27.04	31	28.70	25	22.52
Finished junior high school		80	18.65	25	23.15	23	20.72
Senior high school above		44	10.26	8	7.41	16	14.41
Occupation	429						
Fishermen		160	37.30	40	37.04	38	34.23
Farmers		8	1.86	1	0.93	2	1.80
Government officers		5	1.17	1	0.93	1	0.90
Private		53	12.35	7	6.48	16	14.41
Self-employed		50	11.66	12	11.11	12	10.81
Others		153	35.66	47	43.52	42	37.84

Socio-economic characteristics	N	All Groups		Without Info		With Info	
		Freq.	%	Freq.	%	Freq.	%
Expenditure (IDR)	429						
0-1,000,000		80	18.65	15	13.89	30	27.03
1,000,001-2,000,000		157	36.60	35	32.41	36	32.43
2,000,001-3,000,000		106	24.71	31	28.70	28	25.23
3,000,001-4,000,000		62	14.45	17	15.74	13	11.71
>4,000,000		24	5.59	10	9.26	4	3.60

Note: USD 1 is equivalent to IDR 14,000.

3.4.2. Causal Effects of Policy Attributes on the Choice Probabilities

Figure 3.7 shows a graphical explanation of the AMCEs of all attribute values for external and internal choice probabilities. Each solid dot represents a point estimator, and the horizontal bar illustrates the 95% confidence interval. The reference categories for each attribute are denoted by the solid dots along the vertical axis. The coefficient for external choice probability also showed that more than 95% of households supported the new policy rather than the status quo; thus, households are not satisfied with the current condition. The external choice probability showed that almost all attributes and levels did not have significant results.

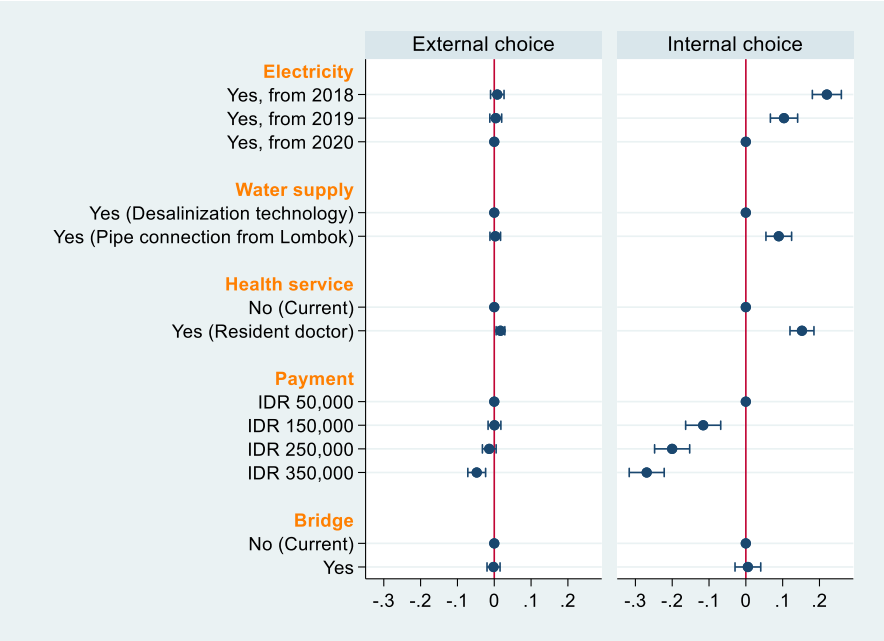


Figure 3.7. External and Internal AMCE for pooled samples

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% confidence intervals.

For the internal choice probability, all attributes had significant results, except the bridge attribute. Faster electricity provision was the most preferred attribute, followed by the existence of health service with the resident doctor. Water supply with pipe connection from the mainland (Lombok Island) also showed a significant positive result. The payment attribute showed a negative and significant result. The higher the payment, the more likely households were to refuse the payment. The additional monthly payment is considered a burden for households. Unexpectedly, the bridge attribute was not preferred by the households, although access to the island was one of the major challenges mentioned. The highest preference for electricity provision was reasonable because electricity plays a significant role in economic growth. This statement has also been highlighted by Best & Burke (2018) and Rathi & Vermaak (2018).

Table 3.3. Estimated effects on external and internal probabilities

Attribute	**Level**	**External**	**Internal**
Electricity	Yes, from 2019	0.0083	0.220***
		(-0.0093)	(0.0200)
	Yes, from 2018	0.0041	0.104***
		(-0.0082)	(0.0188)
Water supply	Yes (Pipe connection from Lombok)	0.0027	0.0894***
		(-0.0074)	(0.0177)
Health service	Yes (resident doctor)	0.0169***	0.152***
		-0.0060	(0.0166)
Payment	IDR 150,000	0.0006	-0.116***
		(-0.0089)	(0.0242)
	IDR 250,000	-0.0136	-0.200***
		(-0.0095)	(0.0243)
	IDR 350,000	-0.0476***	-0.269***
		(-0.0123)	(0.0242)
Bridge	Yes	-0.0020	0.00551
		(-0.009)	(0.0178)
	Constant	0.954***	0.410***
		(-0.0101)	(0.0229)
	Observations	3,432	3,432
	R-squared	0.01	0.102

Note: Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3.4.3. Impacts of Negative Information on Preferences for Infrastructure Provision

In this study, we provided participants in the treatment group with negative information (about the failures of past projects). The past projects' failures were mostly related to the water supply, which was provided by the local and central governments through an international organization. We expected that providing participants with negative information regarding the failures of past projects would influence their preferences toward new infrastructure projects, and specifically, the attribute in the conjoint design that relates to the given information.

Because the external choice probability did not show significant effects, we further presented the influence of negative information on the preferences toward new infrastructure policies in terms of internal choice probability.

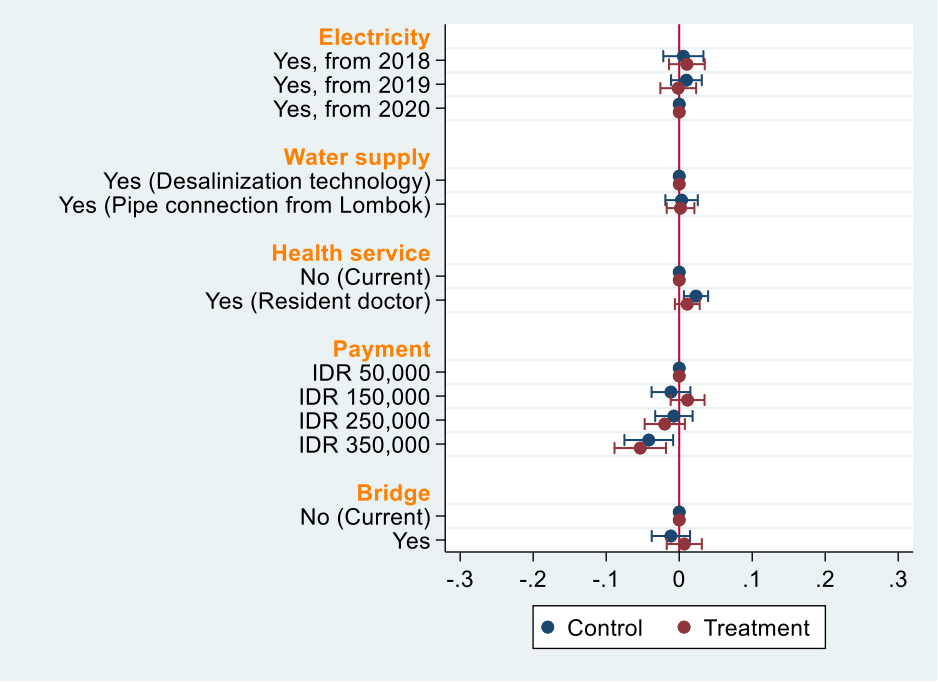


Figure 3.8. External Choice Probability based on Information Groups

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% confidence intervals.

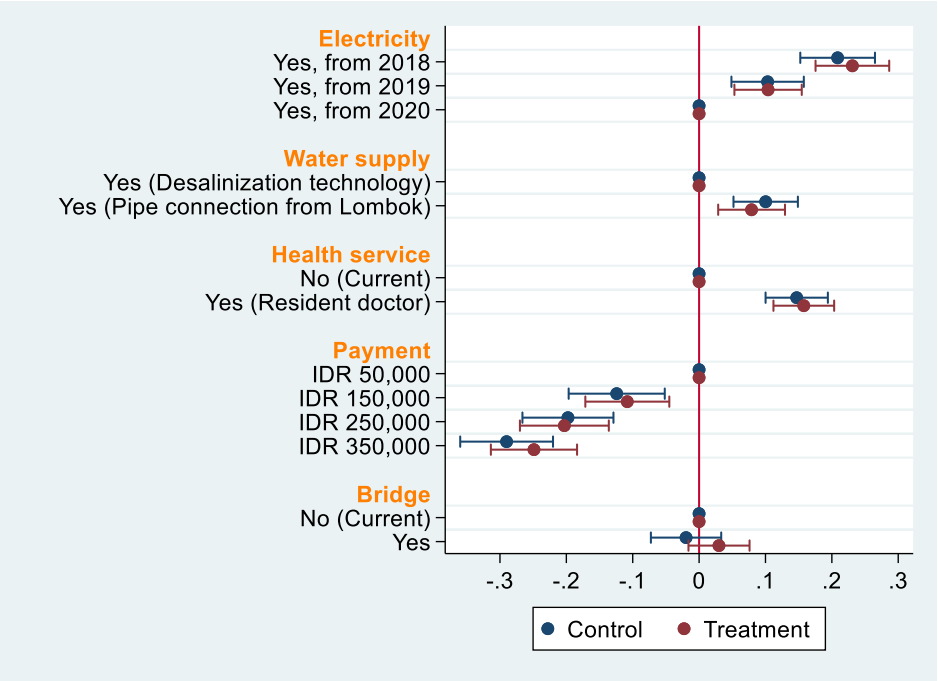


Figure 3.9. Internal Choice Probability based on Information Groups

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% confidence intervals.

Figure 3.8 and 3.9 show the internal AMCE by information groups. Because the provided information is related to the failure of water projects, as expected, it influences only the water supply attribute. The preference of households given negative information regarding the failure of water projects was not as high as the households not given negative information. Notably, the impacts of negative information on the other attributes are ambiguous.

3.4.4. Heterogeneity in Preferences

We also conducted a subgroup analysis to understand the heterogeneity of responses across households. We categorized the subgroup from the pooled sample and presented the heterogeneous analysis by boat ownership and gender. Figure 3.10 shows that households with boat ownership prefer the bridge attribute. The result can be explained by the individual interview with households who have a boat. Some of those households argued that if a bridge was constructed, they would lose a major source of

revenue. The result was also significant at the 95% confidence intervals. Households who did not own a boat did not prefer the bridge attribute; however, the result was insignificant.

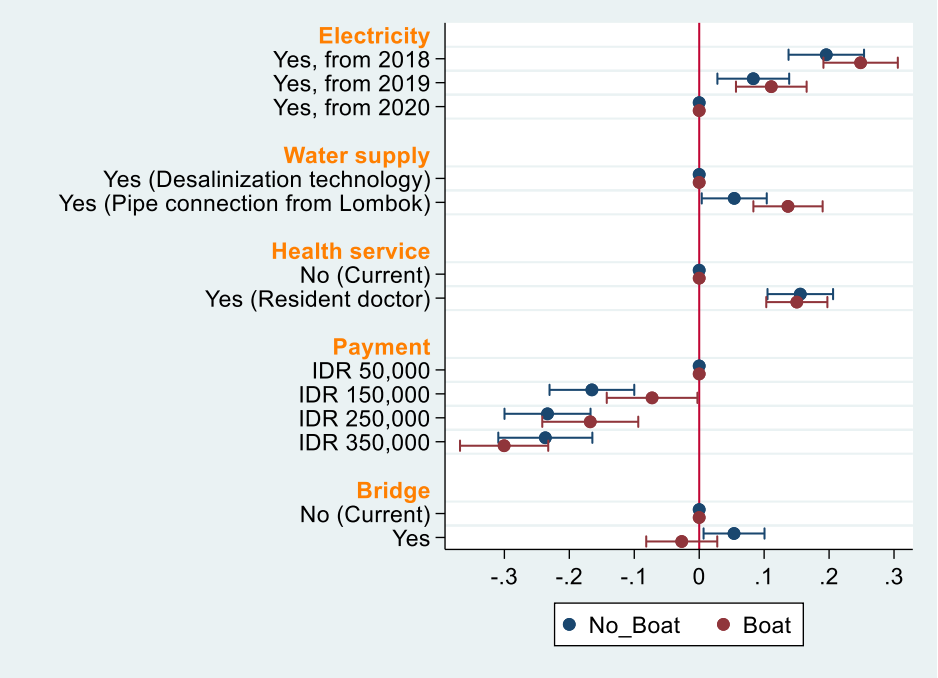


Figure 3.10. Heterogeneity based on Boat Ownership

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% confidence intervals.

Figure 3.11 shows heterogeneous preferences based on gender. Females prefer the faster provision of electricity, a water supply with a pipe connection from Lombok, and health services with a resident doctor. Females' preference for a bridge was positive but insignificant. For the payment attribute, females were more likely to refuse the additional payment for any attribute levels.

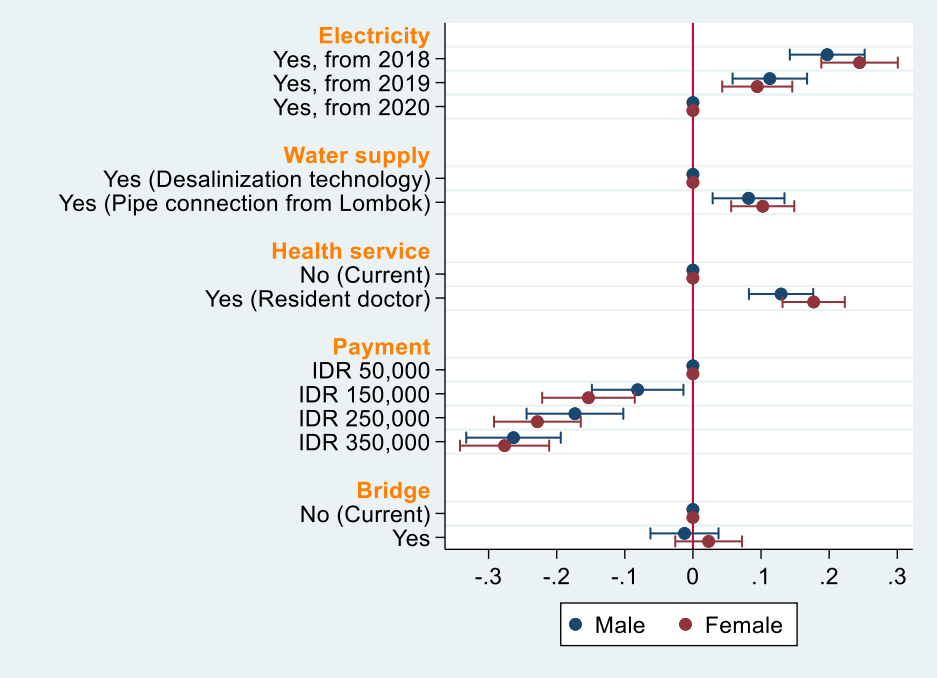


Figure 3.11. Heterogeneity based on Gender

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% confidence intervals.

3.5. Concluding Remarks

In this study, the impacts of negative information related to the failure of past infrastructure projects toward preferences for infrastructure provision were investigated. We conducted a field experiment in a small, remote island in a developing country, where the infrastructure is insufficient. The study site, *Gili Gede* island, has a limited supply of electricity, no fresh water supply, insufficient health services without a resident doctor, and limited modes of transportation to access the island. Several infrastructure projects such as electricity and water projects have been completed, but currently, all of the provided infrastructures are damaged because of poor maintenance. We used the information on the failures of past infrastructure projects from the staff of the village office. The failure of the projects is mostly related to water supply provision. The providers of infrastructure vary and include the local government, central government, and international organizations.

We randomly assigned the households into either a control group (received no information) or a treatment group (received negative information on past projects failure). To elicit the stated preferences for new infrastructure projects, we applied a randomized

conjoint analysis. The results from the pooled sample show that faster provision electricity is the most preferred attribute by the households, followed by health services and water supply with pipe connection from Lombok, the mainland. Additionally, the monthly payment attribute is considered a burden for the households, because it shows negative and significant results. Notably, households did not prefer a bridge to connect to the mainland, although accessibility is one of the problems the island's residents must manage. Providing negative information mostly related to the failure of water projects leads to diminished household preference toward the water supply attribute, but preferences for other attributes, such as the supply of electricity, health services, and a bridge, are not diminished. The impact of negative information on additional payment remains unclear.

We also observed heterogeneity in preferences across households for infrastructure provision. Although the result from the pooled sample shows that a bridge is not preferred by the households, the subsample analysis shows that households without boat ownership prefer a bridge to connect to the mainland. In terms of the gender subgroups, the results show that the preferences for the faster provision of electricity supply, health services, and freshwater supply are higher for females than for males.

This study was designed to investigate the impacts of negative information on the preferences toward infrastructure projects. In terms of directions for further research, because we used only simple negative information such as the failure of projects, further research could use quantitative information related to government performance or achievement regarding positive and negative information.

Chapter 4. Impacts of Information Provision for Pro-Environmental Behavior on Households' Preference for Waste Management Program in Surabaya

4.1. Introduction and Objective

Urbanization is a widespread phenomenon in both the developed and developing world. However, the environmental imsplications of urbanization differ between developed and developing countries (e.g., Poumanyvong and Kaneko, 2010). For example, the public services of municipal waste management in developing countries continue to be major challenges (Foo, 1997; Guerrero et al., 2013) and are typically inferior to those in developed countries. In urban areas of developing countries, there are many small, unofficial open-dumping sites adjacent to residential areas and garbage scattered on the streets (UN-HABITAT, 2010). Furthermore, the collected waste is often improperly and continuously accumulated at official dumping sites (UN-HABITAT, 2010). These phenomena occur primarily because less priority is given to waste management services by the municipal governments of developing countries than by those of developed countries; scarcities of financial and human resources are fundamental challenges for the local governments of developing countries (UN-HABITAT, 2010). Moreover, environmental unawareness and citizen non-adherence to waste management practices make the costs of waste management services significant (UNEP, 2009).

Appropriate and pro-environmental behaviors facilitate waste reduction, recycling and appropriate source separation, which can significantly improve the cost effectiveness of a waste management system. For example, the farther the distance people are willing to transport household waste to an intermediate collection station or the lower the frequency they are willing to have household waste be collected, the more efficient collection systems can be made (Jouhara et al., 2017). The more people implement recycling at home, the less land is required for final disposal sites (Sidique, Lupi, & Joshi, 2010). Thus, the cost implications of proactive waste management behaviors are not limited to daily operational costs but apply to the entire design of a waste management system, including physical infrastructure investments in the long term.

Owens and Driffill (2008) discussed how attitudes and behavior could be changed by using regulation, economic instruments and information provision. However, achieving such changes requires a comprehensive understanding of the attitudes and behavior to select the most effective strategy. Since capturing and measuring attitudes and behavior are costly, perception is often elicited as a proxy of attitudes or behavior in studies, as perception is believed to affect attitudes and behavior (e.g., Reibstein et al., 1980). Stated preference methods can be used to measure the perception and behavioral responses (Anciaes et al., 2018). These methods involve surveys where respondents choose among hypothetical alternatives.

A number of published papers have aimed to elicit the stated preferences of households regarding waste management programs. However, those studies have predominantly utilized the choice experiment method or conventional conjoint analysis based on random utility theory with parametric approaches (Jin, Wang, Ran, & Jianjun, 2006; Sakata, 2007; Yuan & Yabe, 2015). The present study adopts a new approach to conjoint analysis proposed by Hainmueller et al. (2014). Several studies applying the new approach by Hainmueller et al. (2014) have been conducted in the contexts of job preference and welfare measurements (Kaneko et al., 2016), water quality improvement (Hninn et al., 2017), migration policies (Hainmueller & Hopkins, 2015) and international environmental agreements (Bechtel & Scheve, 2013; Bernauer & Gampfer, 2015; Gampfer, Bernauer, & Kachi, 2014). However, to the best of our knowledge, no study has yet used randomized conjoint analysis in the context of waste management.

In this paper, we focus on information provisions that are expected to influence proactive environmental behaviors. We broadly categorize our information treatments into two types, pecuniary information and non-pecuniary information. To elucidate stated preferences regarding the entire waste management system as proxies of proactive environmental behaviors, we employ randomized conjoint analysis. The main objective is to examine the impact of pecuniary and non-pecuniary information for pro-environmental behavior on a household waste management program. The specific research questions are:

1. How does pecuniary information affect preferences for key elements of waste management services, such as the choice of intermediate and final processing technologies and details of the waste collection program, relative to the corresponding effects of non-pecuniary information?

2. How do the shifts in willingness to pay (WTP) for improvements in waste management services differ between the two types of information provision?

4.2. Literature Review

4.2.1. Overview of Waste Management Law in Indonesia

Since 2008, Indonesia has enforced a Waste Management Law. In this law, waste management is defined as a systematic, holistic, and sustainable activities included reducing and handling of waste. The types of waste that are regulated under this law are (1) household waste, (2) household-like waste, and (3) specific waste. Household waste refers to waste that is derived from household daily activities, excluding feces, and specific waste. Household-like waste is waste that is derived from commercial areas, industrial areas, special areas, social facilities, public facilities, and/or other facilities. Specific waste covers several categories, such as waste that contains hazardous and toxic materials, hazardous and toxic waste; waste derives from disaster, construction and demolition waste, waste that cannot be processed because no available technology exists, or waste that does not periodically occur.

Several regulations related to waste management have been issued, especially those which are related to household waste, such as:

1. Law No. 18 Year 2008 on Waste Management
2. Government Regulation No. 81 Year 2012 on Household and Household-like Waste Management
3. Regulation of Ministry of Public Works No. 3 Year 2013 on Implementation of Solid Waste Infrastructure in Household and Household-like Waste Management
4. Local Regulation of Surabaya No. 5 Year 2014 on Waste Management and Cleaning in Surabaya City.

In the waste management law, obligations related to waste management is written under Article 12, that stated everybody in the household waste management and household-like waste management has an obligation to reduce and handle waste based on environmentally sound management. In Article 13, it is stated that the management of settlement areas, commercial areas, industrial areas, specific areas, public facilities, and other facilities have an obligation to provide waste segregation facilities.

The issuance of the waste management law is then followed by the Government Regulation No. 81 Year 2012 concerning Household Waste and Household-like Waste Management.

4.2.2. Household Solid Waste Generation, Collection and Disposal

Waste management is considered a complex process because it involves many technologies associated with the control of generation, handling and separation, collection, transfer and transport, processing, and disposal of solid waste (Tchobanoglous & Kreith, 2002). Waste management systems covered several elements from waste generation and separation, collection, transfer and transport, treatment, recycling and final disposal (Guerrero et al., 2013).

In Indonesia, the community also has the responsibility for household waste management. In the waste management law, it is clearly stated that waste collection and transporting from household to temporary disposal site is the responsibility of the community, while local government has a responsibility to collect and transport waste from temporary disposal site to the final disposal site.

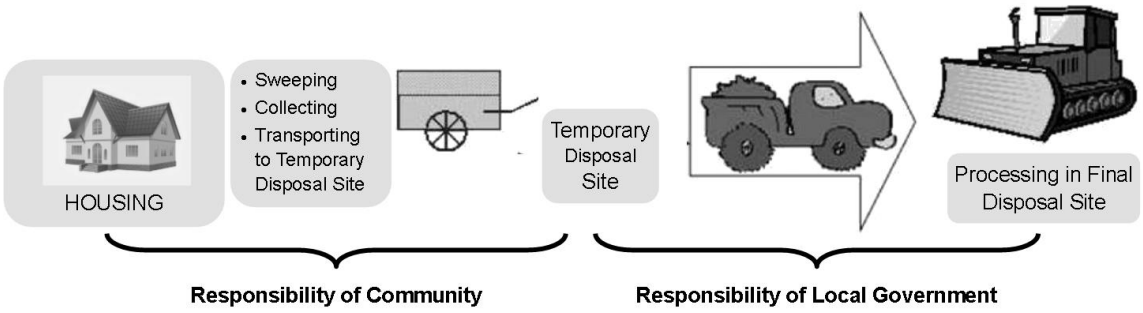


Figure 4.1. Responsibilities of Community and Local Government concerning Household Waste

4.2.3. The Obligation of Waste Reduction and Handling

The Law No. 18 Year 2008 mandated that waste management activities comprise the activity of (1) reduction and (2) handling. The reduction activities include three steps: (1) reduce/restriction of waste generation, (2) waste recycling, and (3) reuse. Those terms are known as 3R (reduce, reuse, and recycle). Whereas waste handling includes five activities, such as (1) segregation of waste based on type, quantity and/or waste characteristics, (2) collection in the form of picking up and transferring waste from the source to the temporary

collection site or to the integrated waste disposal site, (3) transportation in the form of carrying out waste from the source and/or from temporary collection site or from integrated waste processing site to the final waste processing site, (4) processing in the form of transforming the characteristics, composition, and the quantity of waste, and/or (5) final waste processing in the form of returning waste and/or the residue of previous processing safely to the environment media.

Waste separation at source is considered as a means to improve waste management (Jin et al., 2006). In addition, raising public awareness is also one of the effective methods for improving waste management (Song, Wang, & Li, 2016). Raising public awareness is a kind of community involvement, which is difficult to practice without proper waste management policy (Yang & Innes, 2007).

According to this Ministry Regulation, sorting of household waste is divided into at least five types, namely (1) waste containing hazardous and toxic materials as well as hazardous and toxic waste materials, (2) decomposable waste, (3) reusable waste, (4) recyclable waste, and (5) other waste. This shows that citizens must sort waste into at least five categories.

4.2.4. Costs of Solid Waste Management

Although the total waste transported to the final disposal facility is decreasing year on year, the budget and cost of waste management are increasing. The data concerning the cost is taken from the Development Plan of Surabaya from 2013 to 2017.

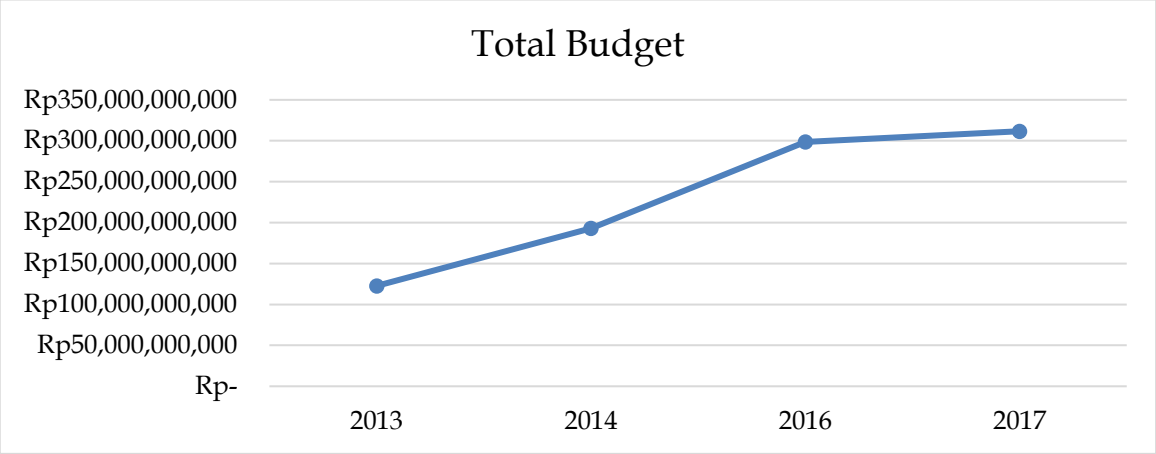


Figure 4.2. Total Budget for City Cleaning Management Program in Surabaya, 2013-2017

4.2.5. Citizens' Role in Public Policy Support

Policy support is defined as an individual's perspective or viewpoint to policies that are expressed through one's attitudes or behaviors (Wan, Shen, & Choi, 2017). Supporting government policies is considered as an example of indirect pro-environmental behaviors (Kollmuss & Agyeman, 2002). Therefore, gaining support from citizens is important because it can ensure the effectiveness of policy implementation (Rauwald & Moore, 2002). Wan et al. (2017) argued the importance of feasible policy-making because lack of public policy support will create a failure. In the case of environmental problems, support from citizens can contribute to the minimization of harmful effects on and protection of the environment (Rauwald & Moore, 2002; Wan et al., 2017). Thus, to gain a comprehensive understanding of the preferences of households that enhance public support for the policy is of utmost importance.

4.2.6. Informational Strategies on Environmental Issue

There are two strategies commonly used as an intervention in the individual pro-environmental behavior, namely informational strategies and structural strategies (Steg & Vlek, 2009). Informational strategies, in particular, are aimed at increasing knowledge, which will eventually change attitude and behavior. In addition, providing informational strategies about the environmental impact is considered an effective means to encourage conservation behavior (Delmas et al., 2013). In this paper, we focus on informational strategies as the intervention to change perceptions and awareness, which might, in turn, impact behavior changes.

Formulating an effective information provision could be challenging (Magat et al., 1986). The empirical evidence of information-based environmental strategies study indicates that the important differences in information effectiveness depend on the type of information provided and the context in which the information is communicated (Delmas et al., 2013). This argument is supported by Kurisu (2016), who stated that there are two factors that should be considered in the information provision (i.e., contents and methods).

Despite the accumulated experimental evidence on informational strategies, analyses of the effectiveness of such strategies have provided mixed results. A key issue is how to formulate the message and contents in ways that individuals can easily understand

and use in decision-making. Should the information be provided by engaging a single strategy or combined strategies? For example, Delmas et al. (2013) conducted a meta-analysis of experimental studies from 1975 to 2012 related to information strategies and energy conservation behavior. They found that non-monetary information strategies are more effective at inducing conservation behavior rather than monetary strategies. However, it remains unclear which informational strategies work best, as many experiments employ combined strategies.

4.3. Research Method

4.3.1. Study Area

Surabaya is known as the second biggest city in Indonesia. It is also known as the capital of East Java Province. Surabaya has a total area is 326 km^2 and, in 2015, had a population of 3,050,395. It consists of 31 districts and 154 sub-districts. Surabaya City has a landfill site (*Benowo* landfill site) in the western part of the city. The *Benowo* landfill site has an area of 37.4 Ha. Besides the landfill site, there are also 20 composting centers and 187 temporary collection sites.

The *Airlangga* sub-district was chosen as the study area because it is located in the city center. It covers an area of 1.16 km^2 and belongs to *Gubeng* District. The sub-district has eight neighborhood units and 73 neighborhood associations. The population in this sub-district is 20,806 (Central Bureau of Statistics, 2016) with a population density of 17,936 people/km^2.

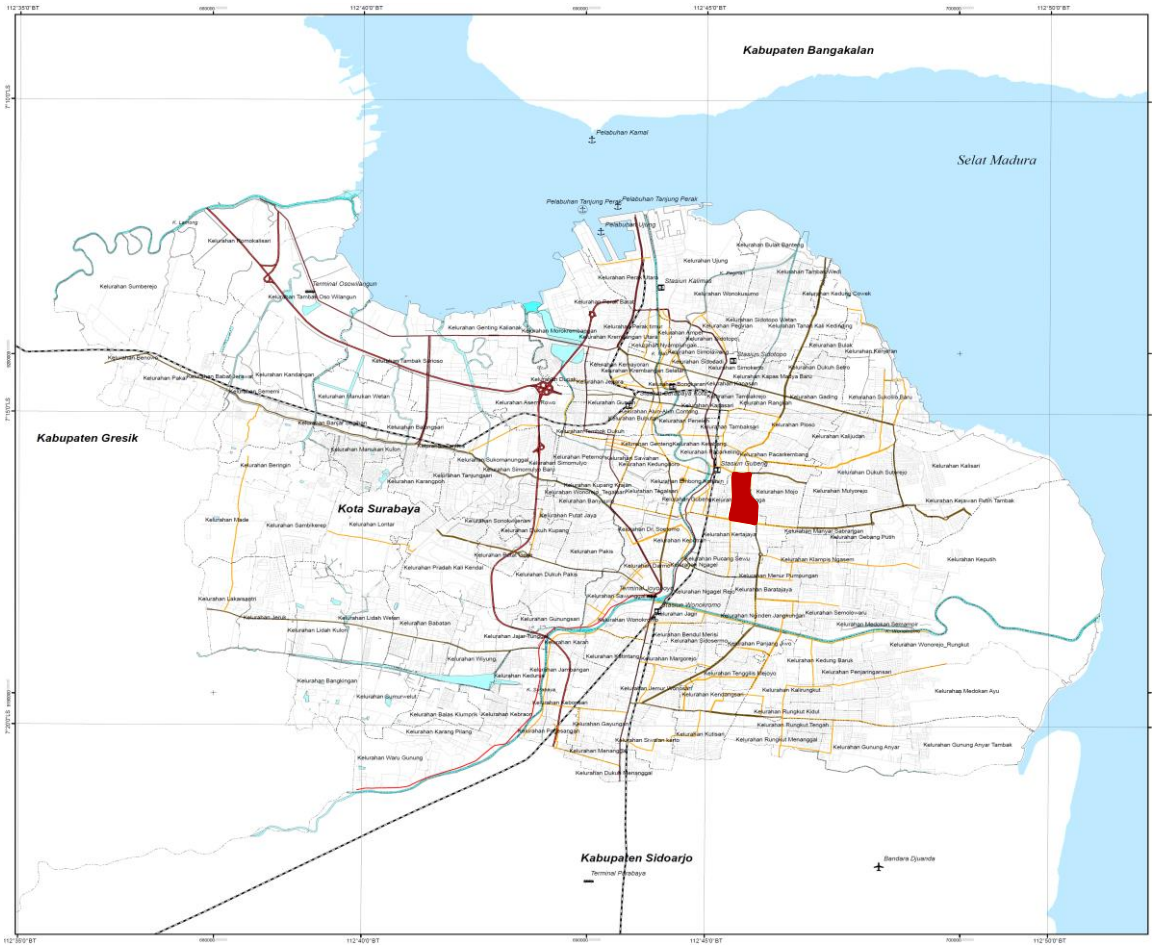


Figure 4.3. Map of Study Area

The current condition concerning the practice of household waste management in the study area is explained as follows: currently, there is no rule that regulates the collection time of organic waste at the nearest collection station. Waste can be brought into the nearest collection station at any time. Walking distance from households to the nearest collection station is varied. However, the average walking distance is approximately 5 to 15 minutes. Household waste collection from temporary collection stations is the responsibility of the city government, and it is done on a daily basis. Although the law concerning waste management stated the obligation of every person to do the waste separation, the practice has not yet been implemented. Most households are still mixing their waste. Intermediate processing technology in this paper refers to composting, recycling, and incineration. Composting has been practiced in the city, either by the city government or by a certain community. However, it has not been implemented throughout the city. Similar to

composting, the practice of recycling is still limited. Incineration is considered costly, and most of the household waste is organic waste so that the practice is also not widely implemented in the city. The city has only one final disposal site, that is considered as controlled landfill type. For the monthly payment, there exist two types of payment. The first one is retribution, which is paid to the city government and attached in the water bill. The second one is an additional payment that is paid to the head of the neighborhood unit for the service of waste collection from households to the temporary collection station.

4.3.2. Sampling and Survey Implementation

We selected Surabaya City because it is one of the cities in Indonesia with an advanced waste management system. The city has received recognition and several awards for environmental management. However, the whole waste management system is not yet perfect. For instance, waste collection and processing are still growing problems faced by the city. In this research, we would like to test the two different types of information for people who are considered more sensitive and responsive to the information treatment. The reason to select Surabaya City is that the households already have a certain level of awareness. By testing a new proposed policy/program in Surabaya, where citizens are more aware of environmental conservation than are the residents of other cities, it is expected that the new policy will gain support from the citizens.

To sample respondents in Surabaya City, we used several procedures compatible with the study's time, budget, and administrative constraints. We selected the *Airlangga* subdistrict from among 154 subdistricts in Surabaya City because it represents the mixed characteristics of Surabaya residents, including low-income to middle-income households. This subdistrict is also located in the city center. Some pilot activities related to waste management, such as the operation of a waste bank and composting house, also occur in this subdistrict. In *Airlangga* subdistrict, there are eight neighborhood units, with a neighborhood unit being the second lowest level of administration unit in Indonesia. We randomly selected three neighborhood units containing 12, 9 and 13 neighborhood associations, with a neighborhood association representing the lowest administrative unit. Since permission was required from each neighborhood association to perform the household survey, we were restricted to have full household sampling for the 35 neighborhood associations in the three neighborhood units. We implemented full

household sampling surveys for the 20 (four, six, and ten) neighborhood associations and obtained 900 household samples (342, 187, and 371 household samples). We randomized households into three groups: a control group (a group that received no information), a group that received pecuniary information, and a group who received non-pecuniary information.

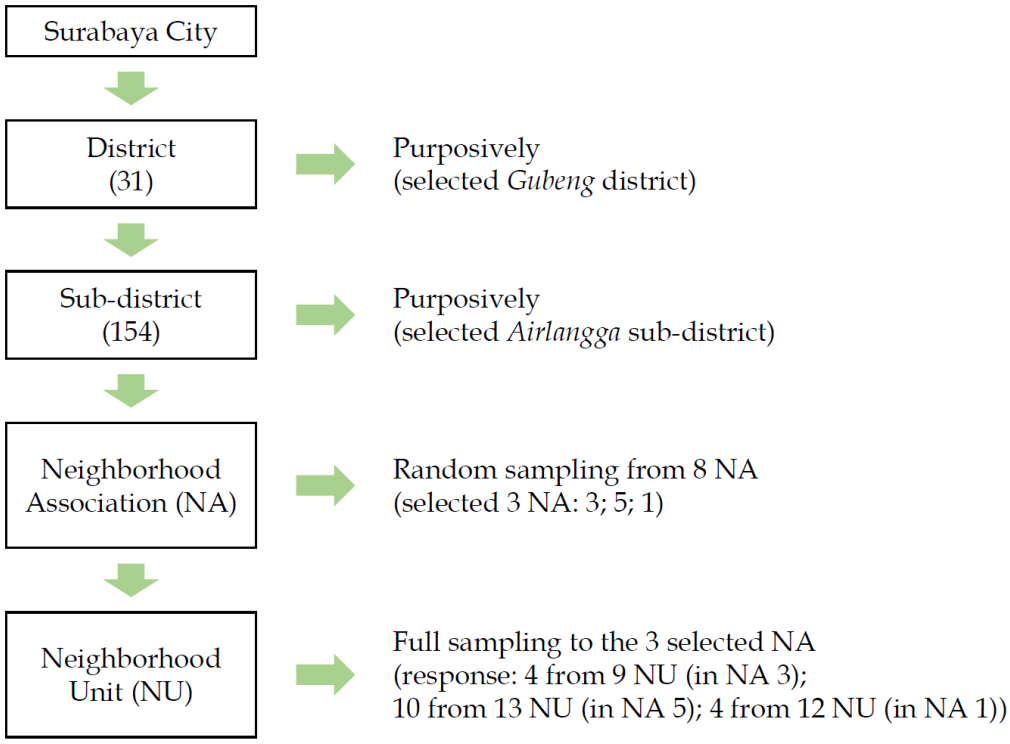


Figure 4.4. Sampling Strategy

Before conducting the surveys, the researchers trained nine surveyors. The purposes of the training were to provide the surveyors an understanding of how to administer the conjoint questionnaire, obtain cooperation from the respondents, and handle questions that might arise during the survey. The data was collected with face to face interviews.

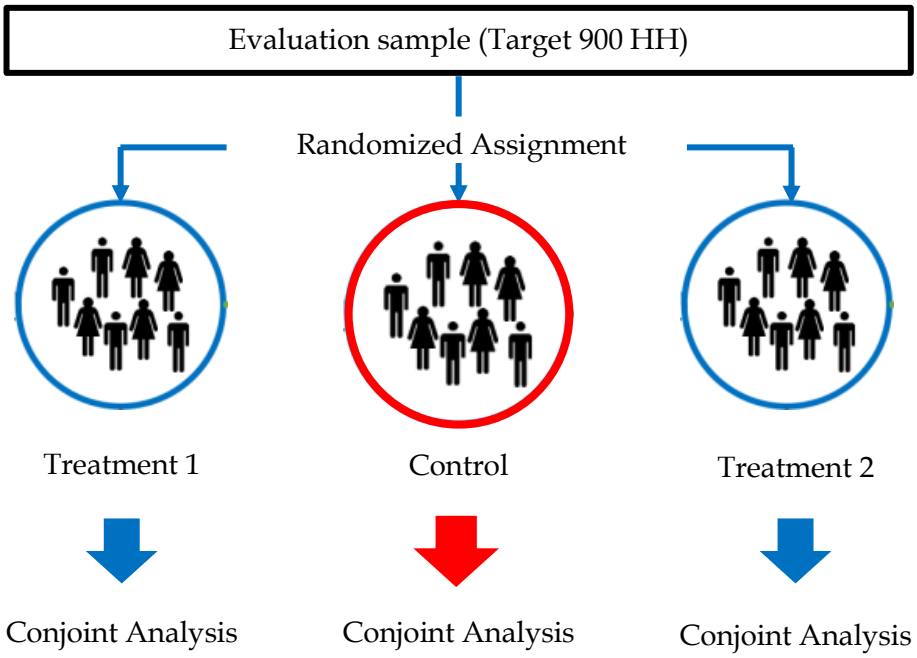
The questionnaire for this study was divided into two parts. The first part was the stated preference for each choice regarding the proposed policy. The second part was the household survey data. The household data consisted of three parts: (1) basic data, including name, gender, age and address; (2) socioeconomic characteristics, including housing status, length of stay, household head's level of education, household head's

occupation, monthly income and family members; (3) attitudes and behaviors of waste separation at the source; and (4) the current situation regarding the waste management service provided by the government, including *retribusi*/monthly payments and distance to the temporary disposal station.

The main survey was conducted from August 17 to August 30, 2017. Prior to our main survey, we conducted the pilot survey from August 13 to August 15, 2017, and obtained 20 respondents for each group (60 respondents total). The pilot survey results indicated that the respondents clearly understood the scenarios, information treatment, and choices.

4.3.3. Experimental Design for Randomized Controlled Trial

This study employs a randomized controlled trial (RCT) for the field experiment. A randomized controlled trial is also known as randomized assignment. Randomized assignment produces groups that have statistically equivalent averages for all their characteristics (Gertler et al., 2016). Furthermore, they argued that by having two groups that are similar in every way guarantees that the estimated counterfactual approximates the true value of the outcome in the absence of treatment, and that once the program is implemented, the estimated impacts will not suffer from selection bias. The randomized assignment also ensures both internal and external validity of the impact estimates, meaning that the estimated impact of the program is net of all other potential confounding factors and the evaluation sample accurately represents the population of eligible units.



Note:
Control: No Information
Treatment 1: Pecuniary Information
Treatment 2: Non-Pecuniary Information

Figure 4.5. Experiment Design of Randomized Controlled Trial

4.3.4. Experimental Design for Information Treatment

This section presents a description of how we developed the information contents as our treatments. We prepared two posters for the information treatments.

The first information treatment is regarded as a pecuniary information treatment and is presented in Figure 4.5. The poster consists of three major parts of information: (1) the current budget of the Surabaya City government, including total budget, total budget per household and budget for waste management per household; (2) future expected costs concerning landfill requirements under three different scenarios: business as usual (no change), lowering waste disposal by half, and doubling the amount of disposed waste; and (3) a question asking the respondent's willingness to contribute to saving money by reducing, handling, and sorting waste at the source.

The second information treatment is regarded as a non-pecuniary information treatment and is shown in Figure 4.5. There are various types of non-pecuniary information. We follow the classifications and examples of Kurisu (2016) to clarify the information we used to develop our non-pecuniary information poster. We select the three most effective strategies for inclusion in the poster in the non-pecuniary treatment due to space limitations. Those strategies are injunctive, personal norms, and procedural knowledge. The non-pecuniary poster has three parts of information: 1) a reminder that the proper handling and sorting of waste at the source is required by law, which is considered as injunctive norm; 2) a statement that waste reduction is the responsibility for all in the country is included as part of personal norms; and 3) information on how to dispose of household waste according to segregation category as procedural information. In Indonesia, household waste is categorized into two types: organic waste and non-organic waste. Non-organic waste is further divided into four types: reusable, recyclable, dangerous and hazardous, and other (residual). Each category of non-organic waste is clarified using examples, labels, and bin colors.

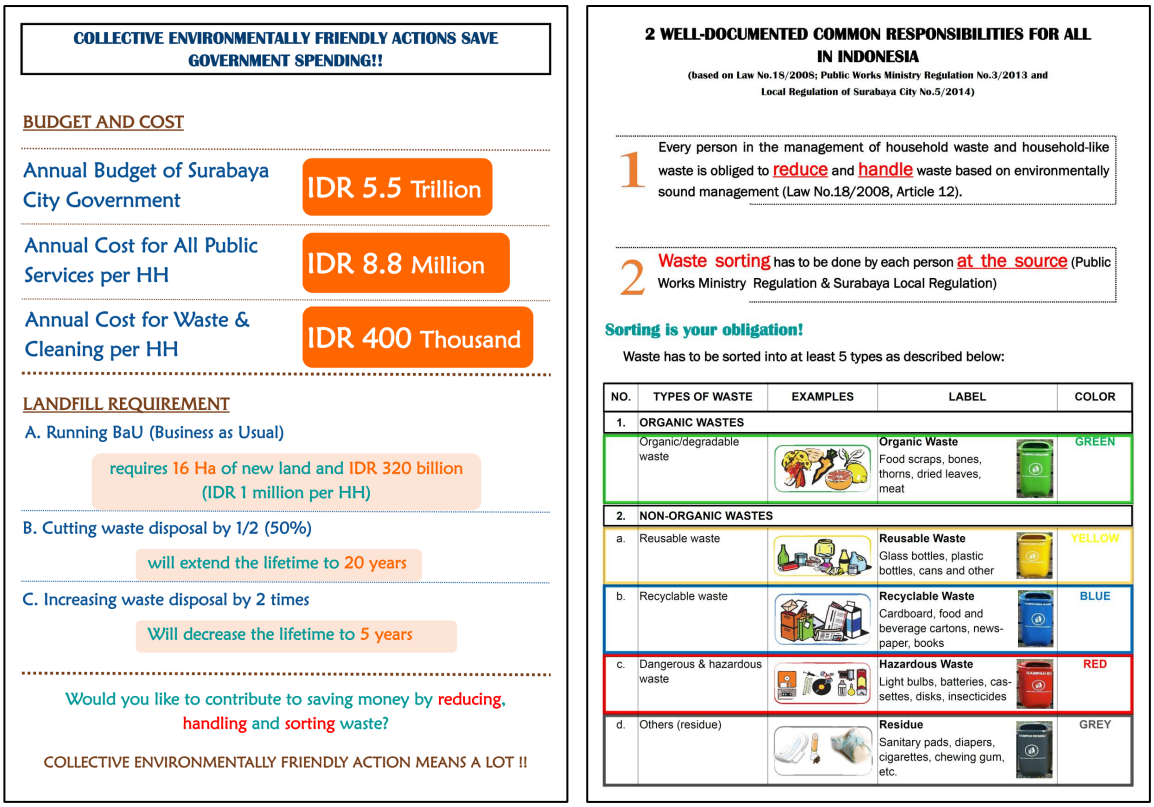


Figure 4.6. Pecuniary Information (left) and Non-Pecuniary Information (right)

4.3.5. Experimental Design for Conjoint Analysis

We use a conjoint experiment to elicit respondents' preferences on household waste management. The conjoint profile design has seven attributes, with levels that vary from two to four. The order and combinations of attributes and levels were fully randomized. The interviewer showed the respondents six randomly choice sets. The respondents then selected the preferable choice, by assigning number 1 as the most preferred choice, 2 as the second preferred choice, and 3 as the least preferable choice. A sample of choice set is shown in Figure 3.6.

Full randomization of attributes and levels in our design enables nonparametric estimation of the average marginal component effect of a given attribute value on agreement support (Hainmueller et al., 2014). Full randomization also ensures that individual respondent characteristics, attribute order, and other potentially confounding factors are approximately uniformly distributed across treatment condition (i.e., choice set), thus allowing for a causal interpretation of the estimated effect.

The design of attributes and levels for this study is discussed and compared with several previous types of research. The most frequent attributes used by several studies are collection time, frequency, cost of waste management (Othman, 2002; Sakata, 2007; Chu, Xi, Song, & Crampton, 2013; Yuan & Yabe, 2015).

Table 4.1. Comparison of Attributes from Previous Research

Attributes	Sources
Collection time	Yuan and Yabe (2015); Chu et al. (2013); Othman (2002)
Collection frequency	Yuan and Yabe (2015); Chu et al. (2013); Jin et al. (2006); Othman (2002)
Type/number of separations	Sakata (2006); Jin et al. (2006); Othman (2002)
Charge method	Sakata (2006)
Cost of MSWM (collection fee)	Chu et al. (2013); Sakata (2006); Jin et al. (2006); Othman (2002)
Location of collection containers (distance)	Chu et al. (2013)
Compensation	Yuan and Yabe (2015)
Instructor	Yuan and Yabe (2015)
Container	Yuan and Yabe (2015); Sakata (2006)

The selected attributes for our study are: (1) time restriction for bringing organic waste to collection station, (2) walking distance to the collection station, (3) frequency at which the city government collects waste from the collection station, (4) separation of non-organic waste for transport to the collection station, (5) implementation of intermediate processing technology, (6) final disposal technology, and (7) payment per month per household, including *retribusi*. The detail of selected attributes and levels is presented in Table 4.2.

Table 4.2. Attributes and Levels of Profiles

No.	Attribute	Levels			
		1	**2**	**3**	**4**
1.	Time restriction for bringing organic waste to the collection station	No restriction (any time)	3 days a week	One day a week	
2.	Walking distance to the collection station	5 minutes	>5-15 minutes	>15-30 minutes	
3.	Frequency with which the city government collects waste from the collection station	5 times a week	3 times a week	Once a week	
4.	Separation of non-organic waste for transport to the collection station	No separation	Reusable, recyclable, hazardous and other		
5.	Implementation of intermediate processing technology	None	Composting	Recycling	Incineration
6.	Final disposal technology	Controlled landfill	Sanitary landfill		
7.	Payment per month per household, including *retribusi*	IDR 96,000	IDR 192,000	IDR 288,000	

Note: USD 1 is equivalent to IDR 14,000

We choose rule for organic wastes to bring into a temporary collection station because we would like to introduce a new certain schedule that can generate more effective collection schedule. The levels of this attribute are no restriction (any time), 3 days a week and one day a week. Currently, waste is brought to the temporary collection site at any time (without restriction). The second attribute is walking distance to a temporary collection station. The current walking distance to the nearest collection station is between 5 to 15 minutes in average. The levels used in this attribute are less than 5 minutes, 5 to 15 minutes, and 15 to 30 minutes. The third attribute is frequency with which the city government collects waste from the temporary collection site. The factual condition is the government collects the way almost every day. In this attribute, we propose three levels, namely 5 times a week, 3 times a week, and once a week. We include the number of separations for non-organic wastes to bring into temporary collection station because according to the Public Works Ministry Regulation No.3 Year 2013, non-organic waste has to be separated into four types: reusable, recyclable, hazardous and others (residue). Therefore, the levels for this attribute are no separation and reusable, recyclable, hazardous, and others.

There are four levels proposed in the attribute of full implementation of intermediate processing technology: none, composting, recycling and incineration. Currently, the methods used for intermediate processing are composting and recycling through waste bank. However, some parts of the area are still not yet implementing intermediate processing facility, while incineration is considered very costly. The final disposal facility attribute has two types: controlled landfill and sanitary landfill. The city is currently implementing a controlled landfill system. After the enactment of Waste Management Act (18/2008), it was required that all open dump landfills must be either closed or upgraded to sanitary landfill by 2013. The last attribute is payment per month per household, in addition to retribution. Basically, the local government charges retribution monthly for each household through the water bill. Initially, the pilot survey used three levels of payment, IDR 48,000; IDR 96,000, and IDR 192,000. However, the results of the pilot survey revealed that the levels of payment did not strongly discourage the willingness to support the policy program. Therefore, we modified the range to IDR 96,000, IDR 192,000, and IDR 288,000.

The 1st trial		**Choice Code 261**	**Choice Code 390**	
Alternatives		**Choice A**	**Choice B**	**Choice C**
Attribute 1	Time restriction for bringing organic waste to the collection station	3 days a week	3 days a week	Current system is fine; no new system needed (Status quo)
Attribute 2	Frequency with which the city government collects waste from the collection station	5 times a week	3 times a week	
Attribute 3	Walking distance to the collection station	less than 5 minutes	5-15 minutes	
Attribute 4	Separation of non-organic waste for transport to the collection station	No separation	No separation	
Attribute 5	Payment per month per household, including *retribusi*	IDR 288,000	IDR 96,000	
Attribute 6	Final disposal technology	Sanitary landfill	Sanitary landfill	
Attribute 7	Implementation of intermediate processing technology	Recycling	Composting	
	Your Ranking ==>			

Figure 4.7. Sample of Choice Set

The scenario for the conjoint analysis is presented as follows:

Proper management of household wastes is an important public service. For designing better waste management system of Surabaya City for future, we will ask your preferences on hypothetical household waste collection and disposal system. You will be requested to make rankings among three alternatives: namely option A, option B and option C (Current status is fine and do not need new system).

Among the three options, the rankings are 1) the most preferable choice, 2) the second preferable choice and 3) the least preferable choice. The household waste collection and disposal methods are characterized by seven attributes such as 1) Time restriction for bringing organic waste to collection station, 2) Frequency at which the city government collects waste from the collection station, 3) Separation of non-organic waste for transport to the collection station, 4) Walking distance to collection station, 5) Implementation of intermediate processing technology, 6) Final disposal technology and 7) Payment per month per household in addition to retribusi, which is paid to the waste management department of Surabaya City Government.

You will be asked to make rankings at six times repeatedly with different alternatives of household waste collection and disposal system.

Figure 4.8. Scenario

4.4. Results and Discussions

4.4.1. Descriptive Statistics

The socio-economic characteristics of the households are shown in Table 4.3. Of the respondents, 67% were female and 33% were male. The ages of the respondents ranged from 18 to 34, 35 to 60, and above 60, which accounted for 12.7%, 68.8%, and 18.5% of respondents, respectively. The total years of the educational background of the household heads ranged from ≤ 9 years, 10 to 12 years, and > 12 years, accounting for 21%, 51%, and 28%, respectively. This means that half of the respondents hold senior high school level education. More than 40% of the household heads work in the private sector. For the length of stay, more than 60% of the households have been living in the area for > 20 years. Most of the respondents (>75%) have a family size of between one and four persons. The largest percentage of the respondents (50%) had a monthly income of < IDR 3,000,000, 37.64% earned a monthly income of between IDR 3,000,000 to 6,000,000 and 11.92% had an income higher than IDR 6,000,000.

Table 4.3. Socio-economic characteristics of the households

Socio-economic characteristics	Category	No of respondents	
		Freq.	Percent
Gender	Male	301	33.44
	Female	599	66.56
Age	18-34	114	12.67
	35-60	619	68.78
	>60	167	18.56
Household head years of education	≤ 9 years	186	20.71
	10 – 12 years	459	51.11
	> 12 years	253	28.17
HHH occupation	Civil servants	62	6.90
	Private	370	41.20
	Self-employed	266	29.62
	Retired	102	11.36
	Others	98	10.91
Length of stay	≤ 5 years	70	7.78
	6 – 10 years	108	12.00
	11 – 20 years	157	17.44
	> 20 years	565	62.78
Family members	1 – 4	692	77.15
	5 – 6	176	19.62
	> 6	29	3.23
Monthly income	< IDR 3,000,000	453	50.45
	IDR 3,000,000-6,000,000	338	37.64
	> IDR 6,000,000	107	11.92
Home Ownership	Self-owned	809	89.89
	Rented	91	10.11

Note: USD 1 is equivalent to IDR 14,000

4.4.2. Causal Effects of Policy Attributes on the Probability that Households Choose a Policy

Figure 4.8 shows the average marginal component effects of all attribute values. In general, households preferred non-organic separation for both the external and internal choice probabilities. The dots with horizontal bars denote point estimates from the AMCE for each attribute level, indicating the probability that the respondents would choose the improved waste management policy over the baseline level. The points without horizontal bars along the vertical axis indicate the reference category for each attribute.

Overall, the movements or shifts of the attribute levels were largely consistent for both external and internal choice probabilities. The magnitude was larger for internal choice. The effects of the attributes of time restriction, walking distance and collection frequency were nonsignificant. Although the result for the time restriction attribute was nonsignificant, each level showed a negative direction in the movement of the estimates, indicating that the households did not prefer time restrictions for bringing organic waste to the collection station. In comparison to current practice, waste can be brought to the temporary collection site at any time (i.e., no time restriction). Regarding walking distance to the nearest collection station, households preferred the optimal walking distance, i.e., >5 to 15 min. This result is in line with the current walking distance to the nearest collection station, which is between 5 and 15 min on average. Similar to the first attribute, households did not prefer less frequent organic collection. At present, the government collects waste from collection stations and conveys it to the final disposal site nearly every day. The payment attribute led to a significant decrease in public policy support. Only the attribute of final processing showed mixed results for the external and internal choices, potentially because the distinction between controlled and sanitary landfills was not well understood by the respondents. For the payment attribute, the sign of the estimates showed negative significant effects at both the 95% and 99.5% confidence intervals. The effect was somewhat similar for both the external and internal choice probabilities.

Among the attributes, non-organic separation, intermediate processing, and final processing had greater causal effects on choice probability than the other attributes, particularly for internal choice probability. These results indicate that proposing a new waste management policy that includes non-organic separation, intermediate processing, and final processing would be more preferred by the respondents. Of the most preferred attributes, the non-organic separation had the greatest magnitude. This result is in agreement with the findings of Czajkowski et al. (2014) who reported that people are willing to perform waste separation at the household level. This finding implies that instead of considering waste separation to be a public burden, households are more aware of the public benefits of waste separation. The constant value for the external AMCE was 79.8%, meaning that 79.8% of the respondents were willing to support the new proposed policy rather than the status quo.

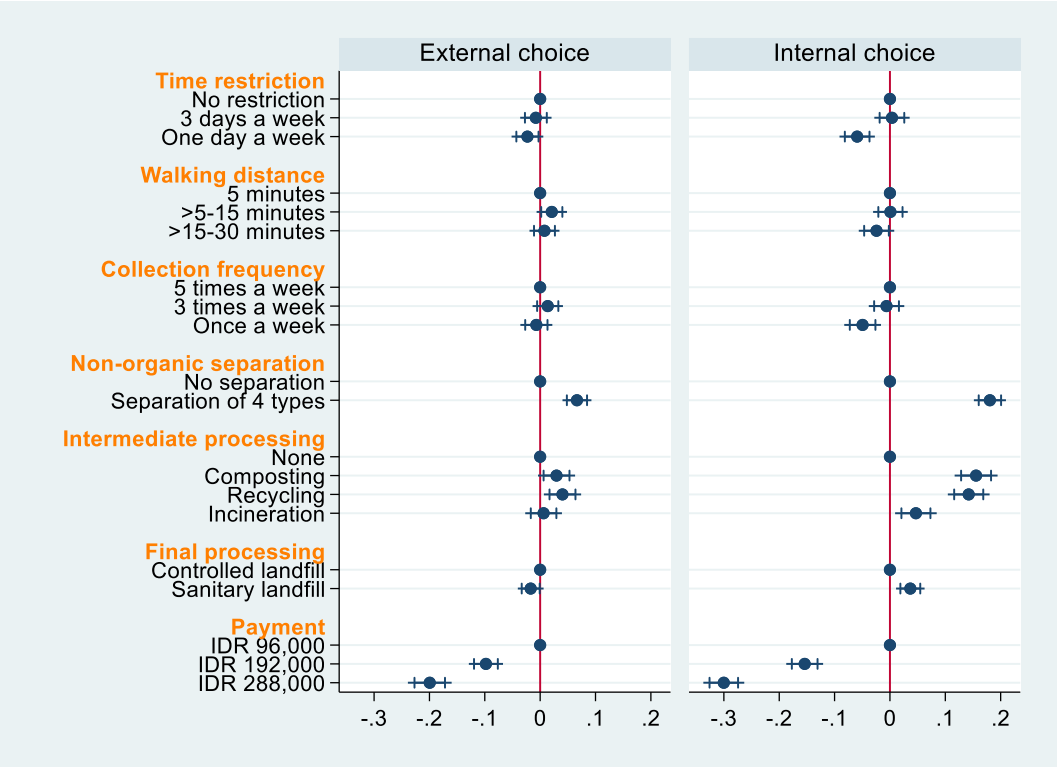


Figure 4.9. AMCE on External and Internal Choice Probabilities

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% and 99.5% confidence intervals.

The summation of the external choice probability also showed that the most popular waste management policy provides no restriction for the rule for organic wastes to bring into the collection station, 5 to 15 minutes walking distance to collection station, 3 times a week waste collection frequency of city government from collection station, separation for non-organic wastes into reusable, recyclable, hazardous and others, recycling for full implementation of intermediate processing technology, controlled landfill for final disposal technology and IDR 96,000 for the payment in addition to current retribution. The probability that this policy is selected is 82% higher than the selection of the baseline level. While the least popular waste management policy provides one day a week for bringing organic wastes to the collection station, less than 5 minutes walking distance to collection station, once a week waste collection frequency of city government from collection station, no separation for non-organic waste, incineration for full implementation of intermediate processing technology, sanitary landfill for final disposal technology and IDR 288,000 for

the payment in addition to current retribution. Table 4.4. reports the results of detail estimates for internal and external choice probabilities.

Table 4.4. Estimated effects on external and internal probabilities

Attribute	Level	External	Internal
Time restriction for bringing organic waste to the collection station	3 days a week	-0.00776	0.00365
		(0.0101)	(0.0113)
	One day a week	-0.0230**	-0.0592***
		(0.0102)	(0.0113)
Walking distance to the collection station	5-15 minutes	0.0210**	0.000879
		(0.00974)	(0.0111)
	< 15-30 minutes	0.00779	-0.0243**
		(0.00962)	(0.0114)
Frequency with which the city government collects waste from the collection station	3 times a week	0.0137	-0.00618
		(0.00975)	(0.0114)
	Once a week	-0.00691	-0.0494***
		(0.0103)	(0.0118)
Separation of non-organic waste for transport to the collection station	Reusable, recyclable, hazardous and others	0.0665***	0.181***
		(0.00929)	(0.0103)
Implementation of intermediate processing technology	Composting	0.0296**	0.156***
		(0.0119)	(0.0138)
	Recycling	0.0403***	0.142***
		(0.0120)	(0.0134)
	Incinerator	0.00617	0.0469***
		(0.0118)	(0.0133)
Final disposal technology	Sanitary landfill	-0.0171**	0.0368***
		(0.00828)	(0.00915)
Payment per month per household, including *retribusi*	IDR 192,000	-0.0980***	-0.154***
		(0.0110)	(0.0118)
	IDR 288,000	-0.199***	-0.300***
		(0.0140)	(0.0131)
	Constant	0.798***	0.501***
		(0.0180)	(0.0187)
	Observations	10,800	10,800
	R-squared	0.043	0.117

Note: Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.4.3. Information Treatment Effect

Figure 4.11 shows the impact of the information treatment. Compared to the non-pecuniary information (which contained descriptions of obligations and technical aspects concerning the five types of waste separation), the pecuniary information (which contained descriptions of the roughly calculated budget and costs of the city government for waste and cleaning issues and simulations of the landfill requirement) had a greater positive impact. This result implies that respondents are more responsive to financial information.

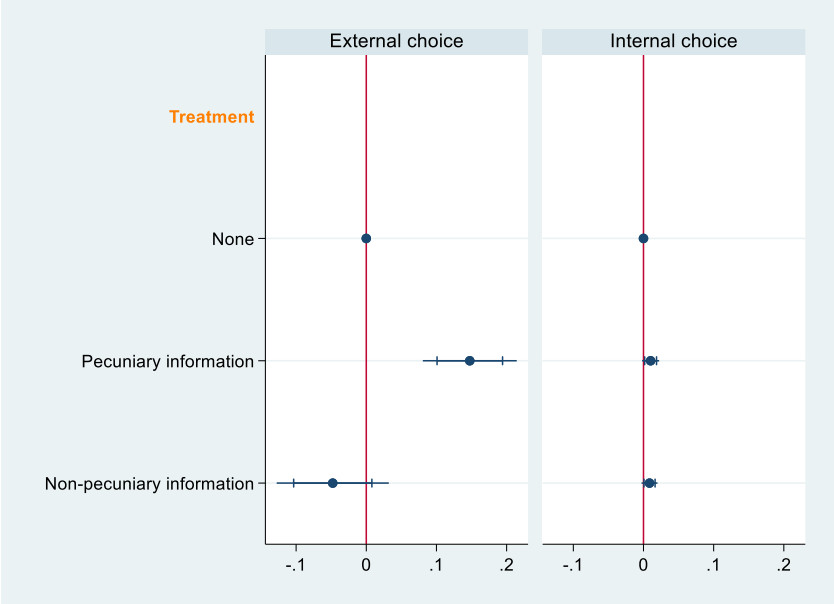


Figure 4.10. Information Treatment Effect

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% and 99.5% confidence intervals.

This result supports the previous research finding that pecuniary information has a stronger impact in comparison to non-pecuniary information that usually contains technical or procedural thing in implementing the proposed program. An example of the previous studies was carried out by Mansur & Olmstead (2012) that argued if wealthier households are less sensitive to price information in comparison to others, meaning that low-income households are more responsive to financial information. This is also consistent with the fact that 50.45% of the respondents have < IDR 3 million monthly income. Given that the minimum wage in Surabaya City in 2017 is IDR 3.2 million, it implies that half of the respondents can be categorized as low-income households.

4.4.4. Impacts of Information on Households' Preferences for Waste Management System

This section reports the results of the AMCE between the treatment groups and the control group on the basis of external and internal choice probabilities. Figure 4.11 shows that providing pecuniary information led to a decrease in the refusal of the additional monthly payment. One possible reason for this result is that households might think that higher payments for an improved waste collection and disposal are a substitute for not performing waste separation at the household level. The results also show that pecuniary information did not have effects on the design components of waste management services except for non-organic separation. Households that received pecuniary information did not prefer non-organic separation. For internal choice, in general, there were almost no effects of pecuniary information on the design components for time restriction and walking distance. The effect of providing pecuniary information on the non-organic separation attribute was similar to that of the no-information group. Mixed results were obtained for the attribute of payment.

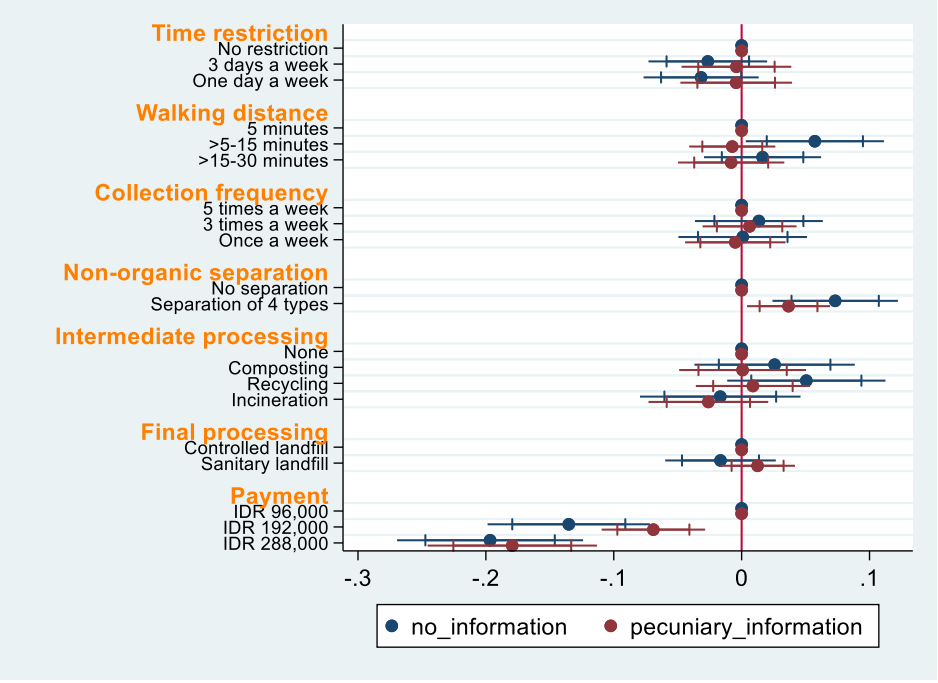


Figure 4.11. External AMCE between No Information and Pecuniary Information Groups

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% and 99.5% confidence intervals.

Providing non-pecuniary information increased the probability of supporting the policy, particularly for the attributes of non-organic separation and intermediate processing (Figure 4.12). The results of the external AMCE show that providing information on how to dispose of household waste according to the correct segregation category, provided as procedural information, increased household preferences for the four types on non-organic separation. The results were significant at both the 95% and 99.5% confidence intervals. Non-pecuniary information also influenced household preferences for composting, recycling, and incineration, under the attribute of intermediate processing. Households that received non-pecuniary information tended to reject the additional monthly payment, particularly for the highest payment level, i.e. USD 20.57 (IDR 288,000), and less for the level of USD 13.71 (IDR 192,000). Therefore, the results were mixed for this attribute.

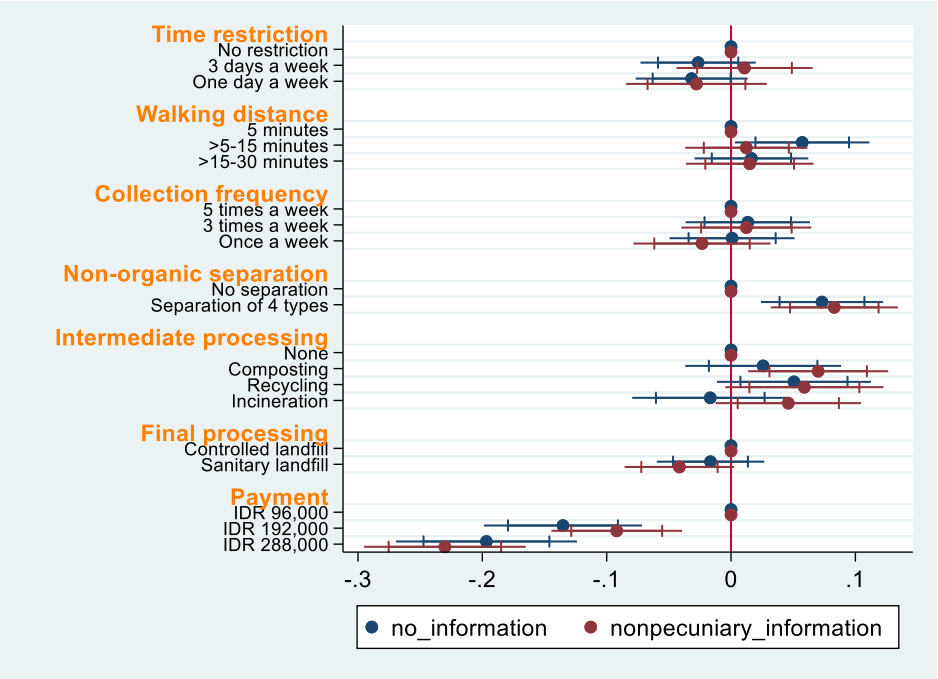


Figure 4.12. External AMCE between No Information and Non-Pecuniary Information Groups

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% and 99.5% confidence intervals.

Regarding internal choice, households preferred no restriction regarding the times at which organic waste can be brought to the collection station and more frequent collection frequency. These conditions represented the current conditions of waste collection in Surabaya city. Similar to external choice, non-pecuniary information led households to

show a stronger preference for the intermediate processing attribute, i.e., composting, recycling and incineration. However, non-pecuniary information led to an increase in the refusal of additional monthly payment.

4.4.5. Impacts of Information on WTP for an Improved Waste Management System

We estimated the distribution of WTP for improved waste management systems. The calculations of WTP for each group are provided in Table 4.5. Our results show that pecuniary information was the most effective information treatment for influencing households to pay more for an improved waste collection and disposal program, whereas non-pecuniary information discouraged households from paying additional amounts. A potential reason for this difference might be that the non-pecuniary information delivered clear and normative information related to the responsibility of an individual to separate household waste. Because households were encouraged to do so, they might believe they should not have to contribute higher payments for improved waste and collection disposal.

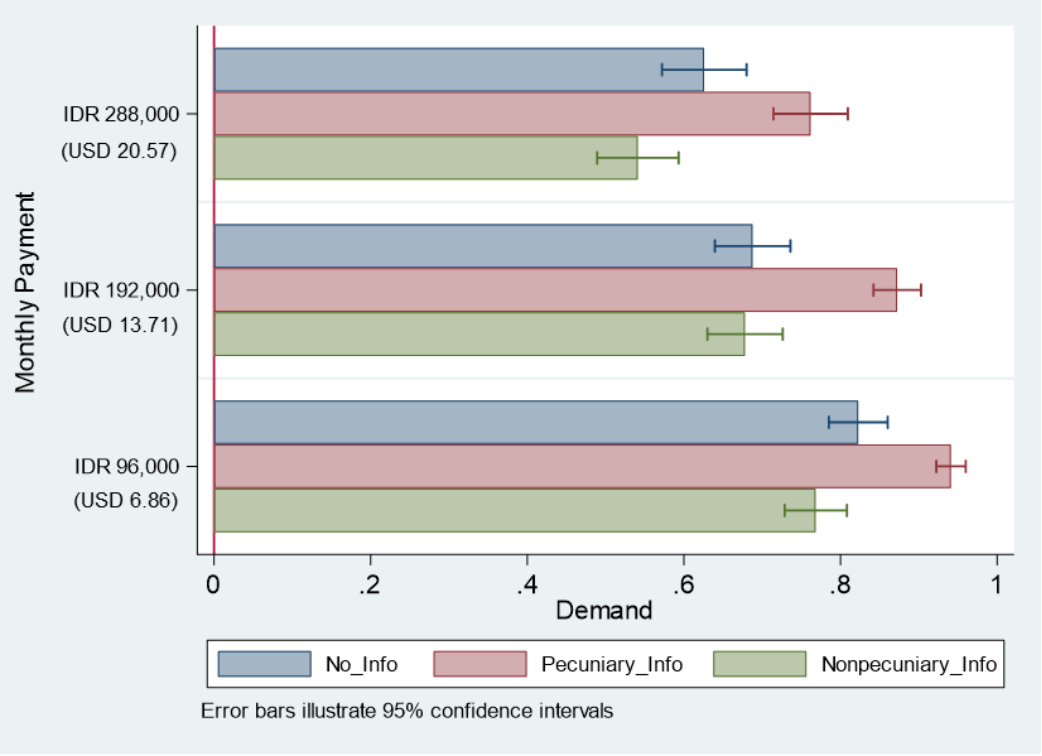


Figure 4.13. Distribution of WTP Across Groups

The average WTPs for the no information group, the non-pecuniary information group, and the pecuniary information group were USD 14.65, USD 17.66, and USD 13.63, respectively. WTP decreased from the no-information group to the non-pecuniary-information group by almost 7%, whereas it increased from the no-information group to the pecuniary-information group by 20.5%.

Table 4.5. Calculation of willingness to pay for each group

Price level	Description	No information	Pecuniary information	Non-pecuniary information
USD 6.86 (IDR 96,000)	β_0	0.823	0.941	0.768
USD 13.71 (IDR 192,000)	$\beta_0+\beta_2$	0.688	0.872	0.678
USD 20.57 (IDR 288,000)	$\beta_0+\beta_3$	0.626	0.762	0.541
	Average WTP	USD 14.65 (IDR 205,088)	USD 17.66 (IDR 247,225)	USD 13.63 (IDR 190,811)
	Percentage change (no information as the baseline)	-	20.5	-6.96

Note: USD 1 is equivalent to IDR 14,000

4.5. Concluding Remarks

This study examines the impacts of information strategy, particularly the impact of pecuniary and non-pecuniary information, on preferences for key elements of waste management services. Furthermore, this study compares shifts in WTP for improvements in waste management services among different types of information strategies.

The results reported in this paper offer quantitative insights into public support for a hypothetical household waste management policy. Overall, they clarify that restrictions regarding how often organic waste can be brought to the collection station, walking distance to the nearest collection station and the frequency with which the city government collects waste from the collection station do not play large roles in shaping public support for an improved waste management system. In Surabaya city, it is common practice in most formal settlements to employ a private garbage collector to transport waste to the temporary collection station as needed. The differences between this practice and the

transport of waste to the collection station by the residents themselves might have significant implications for stated preferences regarding the time restriction, walking distance, and collection frequency attributes, as mentioned previously. The most influential factors with regard to public support seem to be the separation of non-organic waste into reusable, recyclable, hazardous and other categories and monthly payments in addition to the current *retribusi* scheme. One possible explanation for this result is that households realize the importance of source separation as a means of reducing the amount of waste transported to a landfill. As a consequence, waste management costs can be reduced. This result supports previous research by Sidique et al. (2010), who mentioned that recycling activities lead to reduced landfill use.

In general, our results show that providing information such as pecuniary and non-pecuniary information does not greatly affect preferences for the design components of waste management services. Pecuniary information can affect the preference of households only in terms of additional payment for an improved waste collection and disposal program, whereas non-pecuniary information influences preferences regarding non-organic separation and intermediate processing, such as composting, recycling and incineration. A few possible explanations are suggested. First, households are more sensitive to monetary value when they are presented with information on the budget and cost of city government. Thus, our pecuniary information had a significant effect on the payment attribute. Second, households might believe that waste separation at the household level is more effective than collective separation. In addition, they might think that waste separation at the source is not a burden once they understand how to categorize the waste, particularly non-organic waste, as explained in our non-pecuniary information.

The analysis of WTP for each group also supports the view that pecuniary information is the most effective type of information for generating household support for paying more for a superior waste collection and disposal program, whereas non-pecuniary information discourages households from paying higher amounts. The WTP analysis shows that more than half of the respondents were willing to pay more for an improved waste management system. This finding supports the notion that quality waste management is not yet fully perceived by households in Surabaya city. Furthermore, the results of this research imply that governments should seek alternative interventions to induce pro-environmental behavior because the information we provided did not

significantly impact household preferences regarding the design components of waste management services.

The findings of the present study help to extend the existing literature in several aspects. Our study used monetary-related information, which was lacking in previous studies. From the methods side, the present study implemented a combined randomized assignment method for the intervention and randomized conjoint analysis to examine the impacts of the intervention on the stated preferences of households in a developing country. Using randomized conjoint analysis to elicit preferences enabled the interpretation of the results as causal inference. We also extend the scope of waste management systems beyond recycling to comprehensively include all stages, from collection to disposal.

Our study has some limitations that are worth noting. First, we tested the information intervention on the stated preference of households; thus, it cannot represent the real behavior of households. Second, we used a simple information intervention such as a one-shot information provision and did not examine the long-term effect of the intervention. Thus, we advise testing whether the impact of pecuniary information is long-lasting. In addition, future research could observe the real behavior of households through revealed preference methods.

Chapter 5. Impacts of Information Provision on Water Supply Service Improvement in Surabaya

5.1. Introduction and Objective

The use of information is rising in environmental and policy domains. It relies on the assumption that providing information can increase knowledge and leads to more support for public policies. Providing information in public services in developing countries is important as the provision of infrastructure and public services in developing countries is generally insufficient.

Achieving a reliable water supply remains a significant challenge for water companies in developing countries. Reliability in the water supply is required in terms of quantity and quality because those two terms are interconnected. However, many developing countries are not yet ready with the provision of household water supply that can be directly consumed. Water quantity, such as supply continuity, influences the quality of the water that is distributed to consumers (Genius & Tsagarakis, 2006). On the other hand, not only uninterrupted water supply is required, but uncontaminated water quality is also important for the improvement of water supply service. Improvements in water supply service will require higher investment cost from the city, and thus, additional charges have to be paid by consumers.

Information is an intervention frequently used to examine preference changes toward certain public services. In water field, information is intensively used to change behavior, for example, to encourage households to conserve water (Ferraro & Miranda, 2013b) or to increase awareness of health risks (Jalan & Somanathan, 2008; Bennear et al., 2013). Information provision is considered a potential policy tool in developing countries because of its low cost (Jalan & Somanathan, 2008; Bennear et al., 2013).

This study contributes to the literature by studying the impacts of the informational intervention on households' preferences for improved water supply service in the urban area. We compare households' preferences for improved water supply service when presented with the information contained average daily water need per person and additional cost needed to buy gallon water for drinking for a 4-member household. An

additional contribution of this study is that it examines the impacts of the informational intervention on willingness to pay for improved water supply service.

5.2. Literature Review

5.2.1. Preferences for Improved Water Supply Service

Studies on preferences for improved water supply have been conducted mainly in developed countries, such as Canada (Haider & Rasid, 2002), Australia (Hensher, Shore, & Train, 2005), and Italy (Scarpa, Thiene, & Hensher, 2012) using choice experiments. Several attributes were used, such as water quality (Willis, Scarpa, & Acutt, 2005; Echenique & Seshagiri, 2009; Dauda, Yacob, & Radam, 2014), water pressure and water taste (Haider & Rasid, 2002; Echenique & Seshagiri, 2009), frequency, duration and notification of interruption (Hensher et al., 2005), price/additional WTP (Haider & Rasid, 2002; Hensher et al., 2005; Echenique & Seshagiri, 2009; Scarpa et al., 2012), chlorine odor, chlorine taste, and turbidity (Scarpa et al., 2012).

Recent studies focus on information-based intervention of public policies with the assumption that providing information can increase knowledge, enhance support for a new policy, and finally lead to improvement of public quality services. In developing countries, researchers used the information to test the impact on households' behavior to avoid health risk (see Madajewicz et al., 2006; Jalan & Somanathan, 2008). The use of information in developed countries is more varied. For example, Bennear & Olmstead (2008) examined the impact of mandatory information provision on drinking water violations in Massachusetts, USA. The results suggested that disclosing information to households leads to reduced violations by the water suppliers. Dolnicar, Hurlimann, & Nghiem (2010) assessed how information might influence the acceptance of alternative water sources in Australia. Another study in Australia was carried out by Fielding & Roiko (2014) to test the effectiveness of providing brief information about recycled water process on potable recycled water consumption.

Safe drinking water quality remains a serious problem in developing countries. Households mostly use bottled water as a substitute to tap water. However, substituting low-quality tap water with alternatives such as drinking bottled water or filtering at home is neither environmentally friendly nor economically benefit. The plastic container of

bottled water is a potential source of chemical contamination that might cause additional health hazards (Bach, Dauchy, Chagnon, & Etienne, 2012). Thus, it is more important to upgrade the water service to be safe for drinking, and hence, eliciting consumer preferences is required to merit their needs.

Table 5.1. Comparison of Attributes from Previous Research

Attributes	Sources
Tap water quality	Willis et al. (2005); Echenique & Seshagiri (2009); Dauda et al. (2014)
Water pressure	Haider and Rasid (2002); Echenique & Seshagiri (2009); Dauda et al. (2014)
Water taste	Haider and Rasid (2002)
Frequency of interruption	Hensher et al. (2005); Dauda et al. (2014)
Duration of interruption	Hensher et al. (2005); Willis et al. (2005)
Notification of interruption	Hensher et al. (2005)
Price/water rate increase /additional WTP	Haider and Rasid (2002); Hensher et al. (2005); Echenique & Seshagiri (2009); Scarpa, et al. (2012); Dauda et al. (2014)
Chlorine odor	Scarpa et al. (2012)
Chlorine taste	Scarpa et al. (2012)
Turbidity	Scarpa et al. (2012)

5.2.2. Willingness to Pay for Improved Water Supply Service

Willingness to pay for water quality improvement has been most extensively discussed in previous researches. Most of these studies used the Contingent Valuation Method (CVM) and conducted in developing countries in Asia (see Whittington, Pattanayak, Yang, & Kumar, 2002; Raje, Dhobe, & Deshpande, 2002; Pattanayak, Yang, Whittington, & Bal Kumar, 2005; Echenique & Seshagiri, 2009; Akram & Olmstead, 2011; Poulos et al., 2012; Jiang & Rohendi, 2018); Africa (Burt et al., 2017; Dauda et al., 2014); and also Central America and Europe (Casey, Kahn, & Rivas, 2006; Genius & Tsagarakis, 2006; Genius et al., 2008; Vásquez, Mozumder, Hernández-Arce, & Berrens, 2009). Few studies were conducted in developed countries, such as in Australia (Hensher et al., 2005), UK (Willis et al., 2005), Italy (Scarpa et al., 2012) and Florida, US (Chatterjee, Triplett, Johnson, & Ahmed, 2017).

Results of a meta-analysis study conducted by Van Houtven, Pattanayak, Usmani, & Yang (2017) suggest that households are willing to pay between approximately USD 3 and USD 30 per month for improvements in water access. The households' WTP is sensitive to the magnitude of improvement in drinking water services. A recent study on WTP, which was conducted in the disaster-impacted area, Aceh, Indonesia, suggests that the mean household monthly water bill is IDR 80,725 for reliable water supply (Jiang & Rohendi, 2018). In other developing countries, the WTP for improved water service was estimated to be USD 8.33 in Kathmandu, Nepal, for households who already connected to the network (Whittington et al., 2002) and USD 6.12 in Amazonas, Brazil (Casey et al., 2006). The mean WTP in Greece was estimated to be € 10.64 (Genius et al., 2008) and USD 6.22 in Florida, USA, which can be added to the regular water bill (Chatterjee et al., 2017).

5.3. Research Method

5.3.1. Study Area

This study was carried out in Surabaya city, Indonesia. The study area includes four different service coverage types based on the report from local-owned water company (*PDAM* Surabaya). The area varies from less than 24 hours supply with low pressure to 24 hours supply with very good pressure.

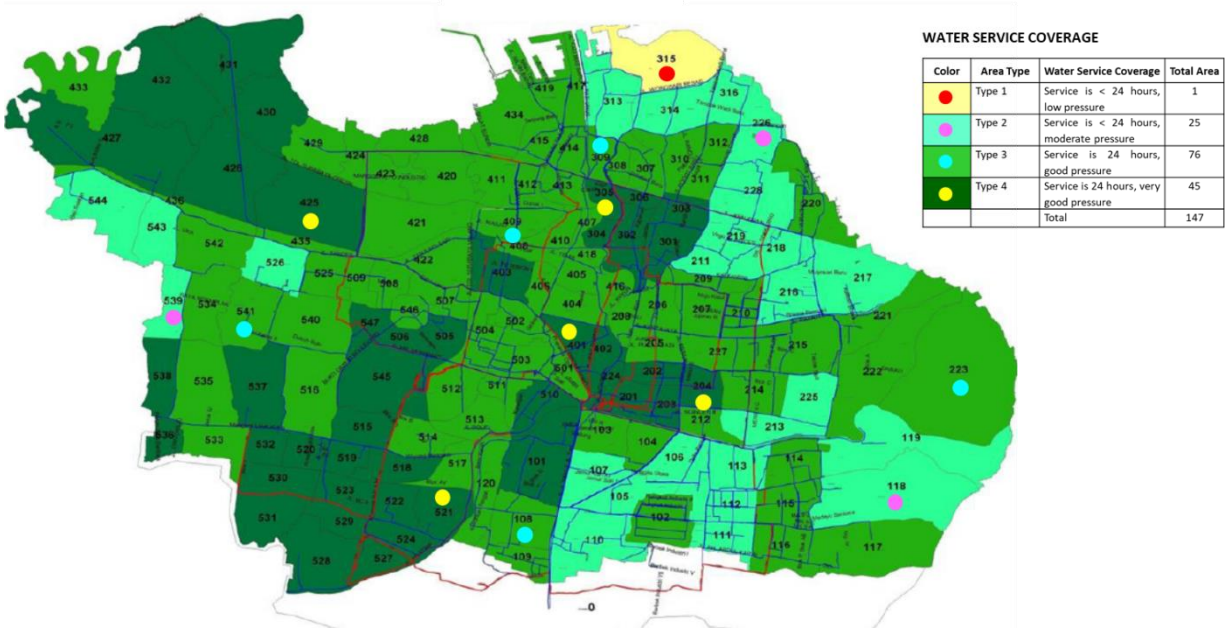


Figure 5.1. Water Service Coverage in Surabaya

Note: The dots indicate the sampling areas.

Table 5.2. Division of Water Service Coverage in Surabaya

Color	Area Type	Description of Water Service Coverage	Number of Area
	Type 1	Water service is < 24 hours, low pressure	1
	Type 2	Water service is < 24 hours, moderate pressure	25
	Type 3	Water service is 24 hours, good pressure	76
	Type 4	Water service is 24 hours, very good pressure	45
		Total	147

Source: Master plan of drinking water supply system for Surabaya, 2014

5.3.2. Sampling and Survey Implementation

To sample respondents in Surabaya City, we used several procedures in consideration of time, budget and administrative constraints. There are 147 area divisions categorized into four different water service coverage types, as shown in Figure 5.1. We then tried to identify the sub district of each code number. There is one area division in type 1; 25 area divisions in type 2; 76 area divisions in type 3; and 45 area divisions in type 4. We randomly selected one area in each type by considering that it must represent north, south, east, west, and central Surabaya. Thus, in total, we obtained one sub-district for type 1; three sub-districts for type 2; 5 sub-districts for type 3; and 5 sub-districts for type 4. We proportionally randomized the sampling within these selected sub districts. The detailed sampling size is presented in Table 5.3. We also assigned households randomly into treatment (received information) and control groups (received no information).

Before conducting the surveys, the researchers trained eight surveyors. The purposes of the training were to provide the surveyors an understanding of how to administer the conjoint questionnaire, obtain cooperation from the respondents, and handle questions that might arise during the survey. The data was collected through face to face interviews.

The questionnaire for this study was divided into two parts. The first part was the stated preference for each choice regarding the proposed policy. The second part was the household survey data. The household data consisted of three parts: (1) respondent data, including name, address, gender, age, marital status, occupation, education, family size, monthly income, storage ownership and electricity water pump; (2) local-owned company (*PDAM*) water usage, satisfaction and monthly bill; and (3) consumption of gallon water and refill water and use of well.

The main survey was conducted from April 19 to May 2, 2019. Prior to our main survey, we conducted the pilot survey from April 12 to April 14, 2019, and obtained 30 respondents for each group (90 respondents total). The pilot survey results indicated that the respondents clearly understood the scenarios, information treatment, and choices.

Table 5.3. Sampling Distribution

No.	Type	Sub district	Population	HHs (*) (± 4 persons/HH)	Sampling
●	Type 1	Bulak Banteng	33,493	8,373	98
●	Type 2	Tambak Wedi	16,062	4,016	47
		Made	8,426	2,107	25
		Medokan Ayu	25,723	6,431	75
●	Type 3	Gundih	30,180	7,545	88
		Sambikerep	18,208	4,552	53
		Gayungan	11,400	2,850	33
		Keputih	16,980	4,245	50
		Ampel	21,824	5,456	64
●	Type 4	Manukan Wetan	9,061	2,265	27
		Kebraon	29,497	7,374	86
		Bongkaran	12,900	3,225	38
		Menur Pumpungan	16,644	4,161	49
		Dr. Soetomo	22,872	5,718	67
		Total	**273,270**	**68,318**	**800**

Note: (*) based on the assumption that each HH consists of four persons

5.3.3. Experimental Design for Information Treatment

The information used in this study is a brief descriptive information. In general, it informs household about the daily water need for a person for all purposes. It also explains the current tap water quality supplied by the local-owned water company (*PDAM* Surabaya). In the last section, it informs the monthly cost of each household for buying gallon water as a drinking water source.

Daily water need for a person is approximately 121 liters for all purposes, i.e. drinking, cooking, washing, bathing, etc.

PDAM Surabaya is continuously improving water supply service to households. However, the tap water quality is not good for cooking and drinking purposes and requires further treatment.

Therefore, households mostly buy water for drinking from gallon. In a month, additional cost needed to buy gallon water for drinking for a 4-member household is ± IDR 144,000 (± 8 gallon). Then, would you pay an equivalent amount of water bill for an improved tap water supply service in your home?

Figure 5.2. Information Treatment

5.3.4. Experimental Design for Conjoint Analysis

Conjoint analysis is used in this study to elicit households' preference for an improved water supply system. The conjoint design consisted of six attributes, with two to three levels for each attribute. The attributes were selected from a comparison of previous studies and considered the local condition.

Table 5.4. Attributes and Levels

No.	Attribute	Levels		
		1	**2**	**3**
1.	Water quality	Good for cooking only	Good for cooking and drinking	---
2.	Water pressure without an additional pump	No change	Enough up to the 2nd floor	Enough up to the 3rd floor
3.	Duration of interruption in citywide level (in a week)	6 hours	3 hours	No interruption
4.	Response to customer complaints	1-3 days	Less than 1 day	---
5.	Chlorine odor/taste	Always	None	---
6.	Payment (additional payment in a month)	IDR 60,000	IDR 120,000	IDR 240,000

Note: USD 1 is equivalent to IDR 14,000

The 1st trial		**Choice Code 109**	**Choice Code 213**	
Alternatives		**Choice A**	**Choice B**	**Choice C**
Attribute 1	Tap water quality	Good for cooking and drinking	Good for cooking and drinking	Do not want
Attribute 2	Duration of interruption in citywide level (in a week)	6 hours	No interruption	
Attribute 3	Response to customer complaints	1-3 days	Less than 1 day	
Attribute 4	Water pressure without an additional pump	No change	Enough up to the 3rd floor	
Attribute 5	Chlorine odor/taste	Always	Always	
Attribute 6	Payment (additional payment in a month)	IDR 60,000	IDR 240,000	
	Your Ranking ==>			

Figure 5.3. Sample of Choice Set

5.4. Results and Discussions

5.4.1. Descriptive Statistics

Table 5.5 summarized the socio-economic characteristics of the survey respondents, including gender, age group, marital status, education, occupation, family member, and monthly income. The respondents were mostly between 36 and 65 years old. 71.50% of respondents were females. Almost 50% of respondents attained senior high school. Respondents' occupation is concentrated mainly in two sectors, the private sector, and self-owned business. Monthly income is mostly distributed in the range IDR 2,000,001 – 3,000,000, IDR 3,000,001 – 4,000,000 and IDR 1,000,001 – 2,000,000.

Table 5.5. Descriptive Statistics

Socio-economic characteristics	N	All Groups		Without Info		With Info	
		Freq.	%	Freq.	%	Freq.	%
Gender							
Male	800	228	28.50	129	32.25	99	24.75
Female		572	71.50	271	67.75	301	75.25
Age group							
0-35 years old	798	183	22.93	83	20.75	100	25.13
36-65 years old		579	72.56	299	74.75	280	70.35
>65 years old		36	4.51	18	4.50	18	4.52
Marital status							
Single		35	4.38	9	2.25	26	6.50
Married	800	697	87.13	362	90.50	335	83.75
Divorced		3	0.38	0	0.00	3	0.75
Widowed		65	8.13	29	7.25	36	9.00
Education							
Elementary school		105	13.27	62	15.66	43	10.89
Junior high school	791	193	24.40	101	25.51	92	23.29
Senior high school		386	48.80	189	47.73	197	49.87
Bachelor/diploma		99	12.52	41	10.35	58	14.68
Master/above		8	1.01	3	0.76	5	1.27
Occupation							
Civil servant		36	4.65	27	6.99	9	2.31
Private	775	354	45.68	176	45.6	178	45.76
Self-owned		225	29.03	101	26.17	124	31.88
Retired		31	4.00	11	2.85	20	5.14
Others		129	16.65	71	18.39	58	14.91

Socio-economic characteristics	N	All Groups		Without Info		With Info	
		Freq.	%	Freq.	%	Freq.	%
Family Member							
1-4 people	799	530	66.33	281	70.25	249	62.41
5-8 people		254	31.79	112	28.00	142	35.59
>8 people		15	1.88	7	1.75	8	2.01
Monthly Income (IDR)							
0-1,000,000	794	57	7.18	36	9.05	21	5.3
1,000,001-2,000,000		163	20.53	89	22.36	74	18.69
2,000,001-3,000,000		260	32.75	138	34.67	122	30.81
3,000,001-4,000,000		176	22.17	77	19.35	99	25
4,000,001-5,000,000		90	11.34	46	11.56	44	11.11
>5,000,000		48	6.05	12	3.02	36	9.09

Note: USD 1 is equivalent to IDR 14,000.
* Differences in the total sample for each characteristic are due to missing responses.

5.4.2. Causal Effects of Policy Attributes on Choice Probabilities

A graphical explanation of the causal effects of policy attributes on external and internal choice probabilities is shown in Figure 5.4. This shows that the movements or shifts of the attribute levels were consistent for both external and internal choice probabilities. The magnitude was larger for internal choice. However, for the external choice, the effects of the attributes of water pressure and response to customer complaints were nonsignificant. For the attribute of supply interruption, among the three levels, only the level of no interruption showed a significant positive effect.

For the internal choice, the attributes of tap water quality, supply interruption, response to customer complaints, and chlorine odor showed significant positive effects. The magnitude of tap water quality, supply interruption, and payment attributes is larger than the external choice. Water pressure that is enough up to the 3rd floor also becomes positive and significant for the internal choice. From both external and internal choice probabilities, it can be concluded that good tap water quality for cooking and drinking, absence of chlorine odor, and no supply interruption are the most preferred attributes.

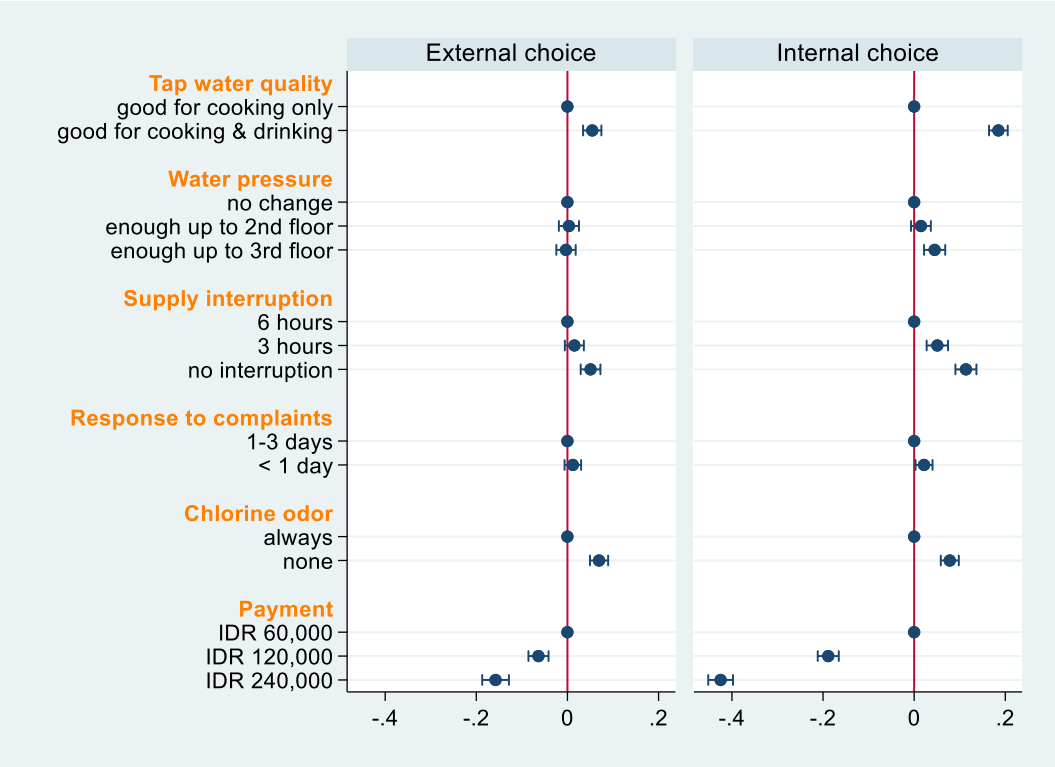


Figure 5.4. AMCE on External and Internal Choice Probabilities

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% confidence intervals.

5.4.3. Information Treatment Effect

Regression of information treatment only is presented in Figure 5.5. The result shows that providing a brief descriptive information did not have a significant impact, although the direction of the graph is positive. Possible arguments for this result are because respondents find it more convenient to buy gallon water for their drinking water and they seem to be a skeptic about the ability of the local-owned water company and doubt if the water company can improve the water service until it meets the standard of safe drinking water supply.

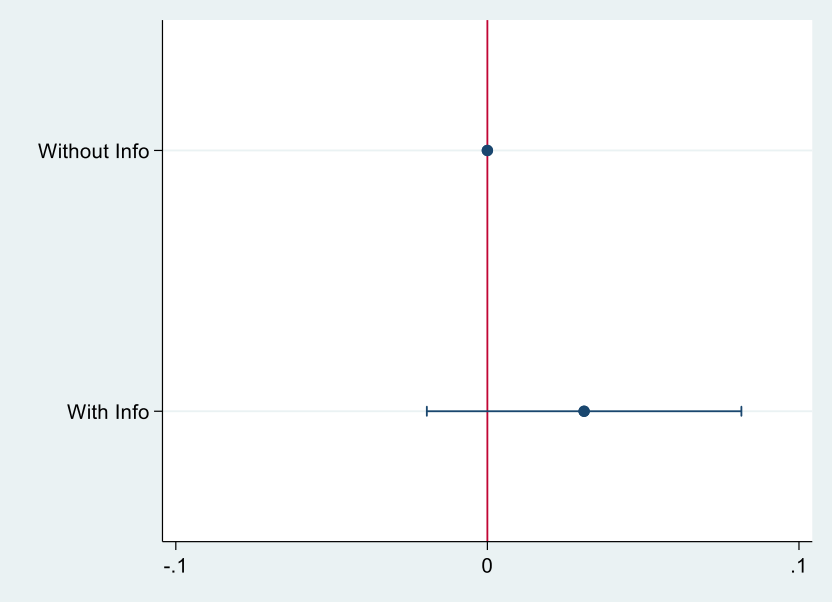


Figure 5.5. Information Treatment Effect

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% confidence intervals.

5.4.4. Impacts of Information on Preferences for Improved Water Supply System

The impact of information on preferences for an improved water supply system for external and internal choices is shown in Figures 5.6 and 5.7. For the external choice, the information does have positive significant impacts on the attributes of tap water quality and response to customer complaints. The impact on the water pressure, particularly for the level of "enough up to the 2nd floor" and supply interruption with the "no interruption" level is also positive and significant. On the other hand, information gives a negative impact on the payment attribute, meaning that respondents are more likely to refuse the additional monthly payment to the current water bill.

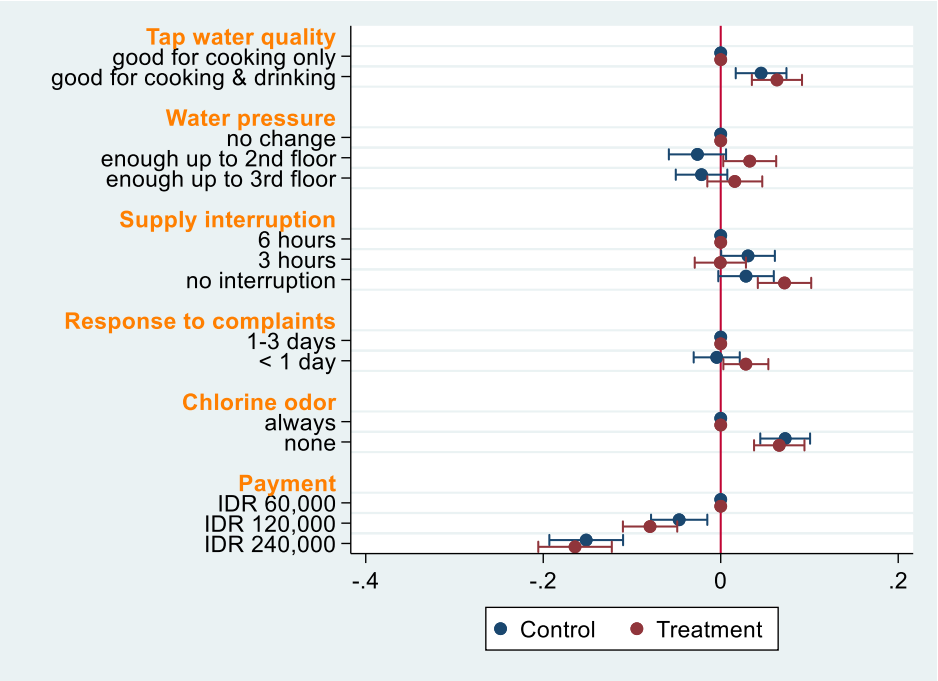


Figure 5.6. External AMCE between Control and Treatment Groups

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% confidence intervals.

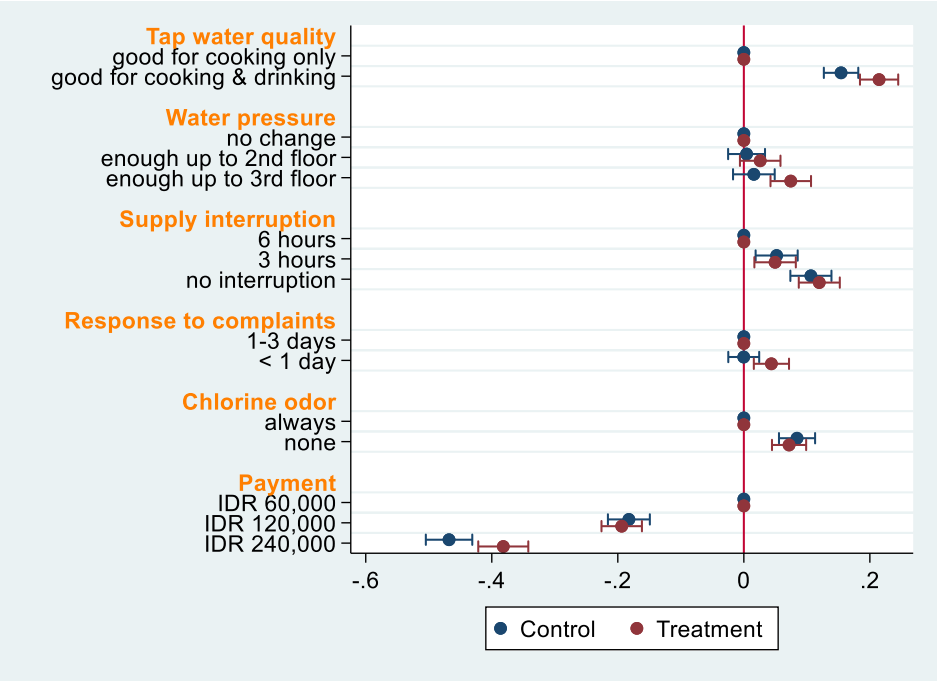


Figure 5.7. Internal AMCE between Control and Treatment Groups

Note: The estimates are based on the OLS regression with clustered standard error; horizontal bars represent the 95% confidence intervals.

The graphical explanation of the information impact on internal choice probability shows a similar direction to the impact of information on external choice probability. The difference is, the magnitude in the internal choice is larger than that in the external choice.

5.4.5. Impacts of Information on WTP for Improved Water Supply System

The distribution of WTP for improved water supply system is estimated in this study. In general, the results showed that the higher the payment, the lower the supporting rate for an improved water supply service. The average WTP for information and no information groups were USD 11.52 (IDR 161,245) and USD 12.97 (IDR 168,936), respectively. As a comparison, the mean water bill of respondents is USD 3.97 (IDR 55,615). The WTP increased from the no-information group to the information group by 4.77%. The detail calculation is provided in Table 5.6.

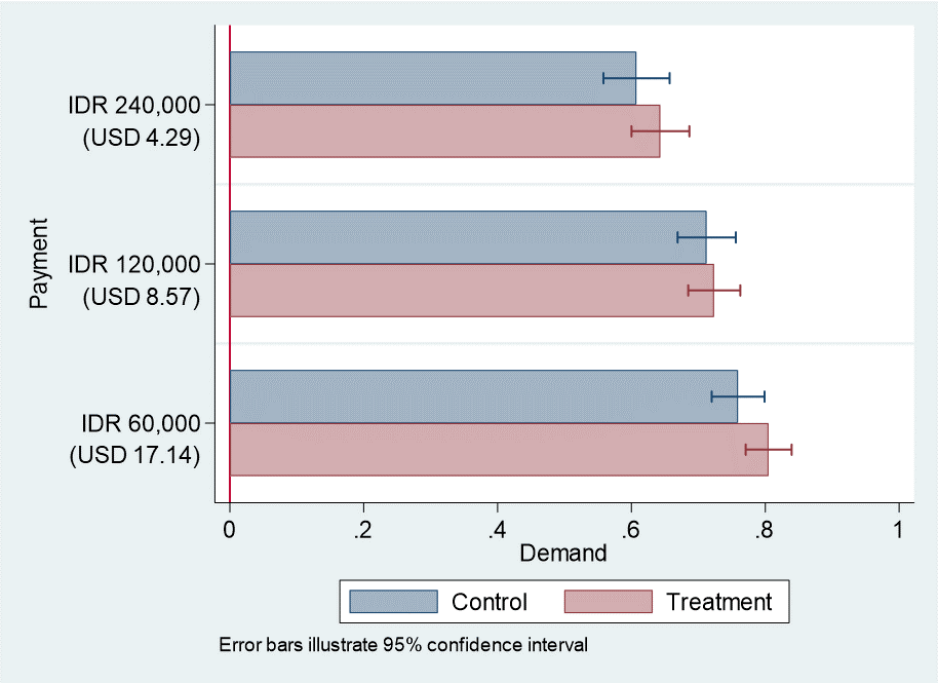


Figure 5.8. Distribution of WTP between Control and Treatment Groups

Table 5.6. Calculation of willingness to pay for each group

Price level	Description	Control	Treatment
IDR 60,000 (USD 4.29)	β_0	0.76	0.81
IDR 120,000 (USD 8.57)	$\beta_0+\beta_2$	0.71	0.72
IDR 240,000 (USD 17.14)	$\beta_0+\beta_3$	0.61	0.64
	Average WTP	IDR 161,245 (USD 11.52)	IDR 168,936 (USD 12.07)
	Percentage change (no information as the baseline)	---	4.77

Note: USD 1 is equivalent to IDR 14,000

A meta-analysis study conducted by Van Houtven et al. (2017) suggested that households are willing to pay between approximately USD 3 and USD 30 per month for improvements in water access.

5.5. Concluding Remarks

This study examines the impacts of information treatment in the form of brief descriptive information on preferences for an improved water supply system. As an extension, this study also tests the impact of information on WTP shift for an improved water supply system.

We found that tap water quality, no chlorine odor, no supply interruption, and response to customer complaints are the preferred attributes. This means that the government should consider these attributes when formulating an improved water supply policy because these attributes might play large roles in shaping public support for an improved water supply system.

When a brief descriptive information was introduced, the preference for good tap water quality for cooking and drinking was increased. The information also influenced the preference for no supply interruption and response to customer complaints. Although the impact of information was positive toward water pressure attribute, the result was nonsignificant. For the payment attribute, showing the information influenced respondents to be more likely to refuse the payment in addition to the current monthly water bill.

Chapter 6. General Conclusion and Policy Implications

6.1. General Conclusion

This research examined the impacts of information provision toward infrastructure and public services in Indonesia. Several types of information have been used to test the effectiveness of information in different infrastructure and public services and different study sites. The analytical chapter is divided into three chapters. Chapter 3 examines the impact of negative information on the preference of households on a remote island toward infrastructure provision. Chapter 4 compares the impacts of pecuniary and non-pecuniary information on stated preferences and willingness to pay (WTP) for an improved waste collection and disposal program. Chapter 5 tests the impact of information on preference for an improved drinking water supply system.

A summary of the findings of each chapter is presented as here. In chapter 3, we prove that providing negative information that mostly related to the failure of water projects lead to diminished household preference toward the water supply attribute, but preferences for other attributes, such as the supply of electricity, health services, and a bridge, are not diminished. The impact of negative information on additional payment remains unclear. A heterogeneous analysis was also conducted based on boat ownership and gender. The pooled sample shows that a bridge is not preferred by the households; the subsample analysis shows that households without boat ownership prefer a bridge to connect to the mainland. In terms of the gender subgroups, the results show that the preferences for the faster provision of electricity supply, health services, and freshwater supply are higher for females than for males.

Chapter 4 presents results that show that providing information, such as pecuniary and non-pecuniary information, does not greatly affect preferences for the design components of waste management services. Pecuniary information can affect the preference of households only in terms of additional payment for an improved waste collection and disposal program, whereas non-pecuniary information influences preferences regarding non-organic separation and intermediate processing, such as composting, recycling and incineration. The analysis of WTP for each group also supports the view that pecuniary information is the most effective type of information for generating

household support for paying more for a superior waste collection and disposal program, whereas non-pecuniary information discourages households from paying higher amounts. The WTP analysis shows that more than half of the respondents were willing to pay more for an improved waste management system.

In chapter 5, we provided a brief descriptive information to respondents to influence the preferences for improved water supply service. The results show that when a brief descriptive information was introduced, the preference for good tap water quality for cooking and drinking was increased. The information also influenced the preference for no supply interruption and response to customer complaints. Although the impact of information was positive toward water the pressure attribute, the result was nonsignificant. For the payment attribute, showing the information influenced respondents to be more likely to refuse the payment in addition to the current monthly water bill. However, the impact of information on WTP is very small.

6.2. Policy Implication

Some policy implications that can be drawn from this study are:

1. Governments can consider using simple and low-cost intervention, such as information provision, to enhance support for public policy, provided that the content is specific and relevant to the purpose.
2. Governments can consider the package that is influential in formulating policy related to improved provision of infrastructure and public services.

6.3. Limitations of the Study

The findings of this study are subject to limitations that are worth noting. First, this study examined the impacts of information interventions on the stated preference of households; thus, it cannot represent the real behavior of households. Second, this study used simple information interventions, such as one-shot information provision strategies, and did not examine the long-term effect of the interventions. Thus, further tests of whether the impact of pecuniary information is long-lasting are advised. In addition, future research could observe the real behavior of households through revealed preference methods.

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Drinking Water Supply System Plan of Surabaya 2015-2035 (*in Bahasa Indonesia: Rencana Induk Sistem Penyediaan Air Minum Surabaya 2015-2035*)

Appendix

Appendix Chapter 3.

Table 3.A. T-Test by Information Group

HHs' Characteristics	Treatment (With Info)			Control (Without Info)			Difference	
	Obs.	Mean	SD	Obs.	Mean	SD	Mean	SE
Gender (female dummy)	218	0.50	0.50	211	0.51	0.50	-0.01	0.05
Age (years)	218	42.64	16.58	211	42.58	16.91	0.06	1.62
Marital status (baseline: single)								
married	218	0.81	0.40	211	0.84	0.36	-0.04	0.04
divorced	218	0.04	0.20	211	0.03	0.18	0.01	0.02
widowed	218	0.14	0.35	211	0.12	0.32	0.02	0.03
Education (baseline: illiterate)								
< elementary school	218	0.15	0.35	211	0.20	0.40	-0.06	0.04
elementary school	218	0.27	0.45	211	0.27	0.45	0.00	0.04
junior high school	218	0.18	0.39	211	0.19	0.39	-0.01	0.04
> senior high school	218	0.12	0.32	211	0.09	0.28	0.03	0.03
Occupation (baseline: fishermen)								
farmers	218	0.02	0.13	211	0.02	0.14	0.00	0.01
government officers	218	0.01	0.12	211	0.01	0.10	0.00	0.01
private	218	0.12	0.33	211	0.12	0.33	0.00	0.03
self-employed	218	0.12	0.33	211	0.11	0.31	0.01	0.03
others	218	0.33	0.47	211	0.39	0.49	-0.06	0.05
Expenditure (baseline: IDR 0-1,000,000)								
IDR 1,000,001 - 2,000,000	218	0.39	0.49	211	0.34	0.47	0.06	0.05
IDR 2,000,001 - 3,000,000	218	0.23	0.42	211	0.26	0.44	-0.03	0.04
IDR 3,000,001 - 4,000,000	218	0.13	0.34	211	0.16	0.37	-0.03	0.03
IDR > 4,000,000	218	0.04	0.19	211	0.08	0.27	-0.04*	0.02

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 3.B. Estimated effects on internal probabilities between groups

Attribute	Level	Control	Treatment
Electricity	Yes, from 2019	0.209***	0.231***
		(0.0285)	(0.0282)
	Yes, from 2018	0.103***	0.104***
		(0.0277)	(0.0257)
Water supply	Yes (Pipe connection from Lombok)	0.100***	0.0791***
		(0.0246)	(0.0255)
Health service	Yes (resident doctor)	0.147***	0.158***
		(0.0238)	(0.0232)
Payment	IDR 150,000	-0.124***	-0.108***
		(0.0367)	(0.0321)
	IDR 250,000	-0.198***	-0.203***
		(0.0348)	(0.0340)
	IDR 350,000	-0.290***	-0.249***
		(0.0355)	(0.0329)
Bridge	Yes	-0.0196	0.0300
		(0.0269)	(0.0233)
	Constant	0.429***	0.391***
		(0.0342)	(0.0308)
	Observations	1,688	1,744
	R-squared	0.103	0.102

Note: Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

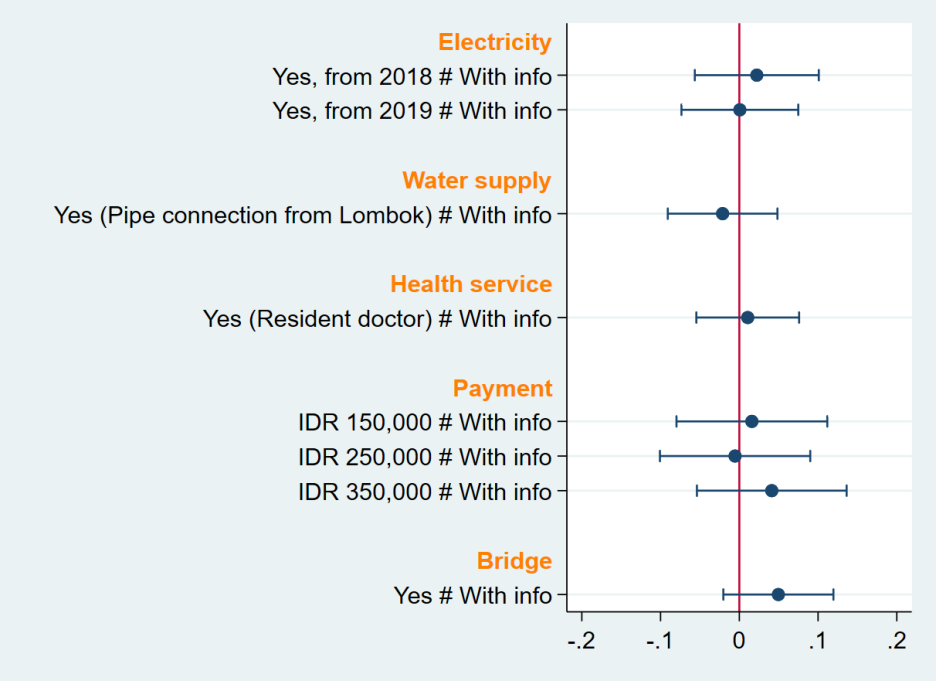

Figure 3.A. Interaction effects with information treatment

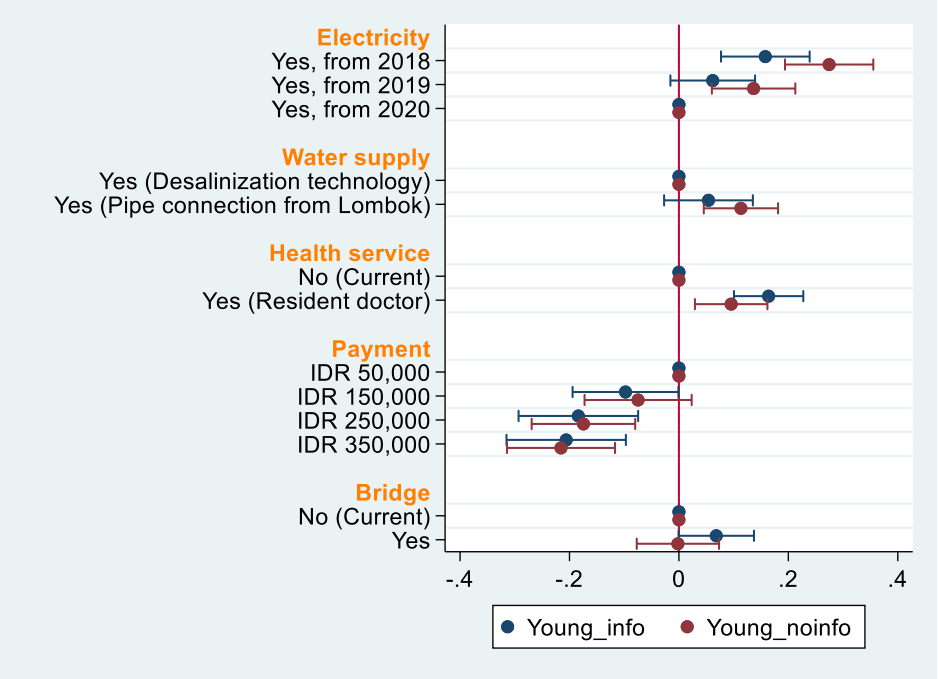

Figure 3.B. Heterogeneity based on Age (Young Age Group)

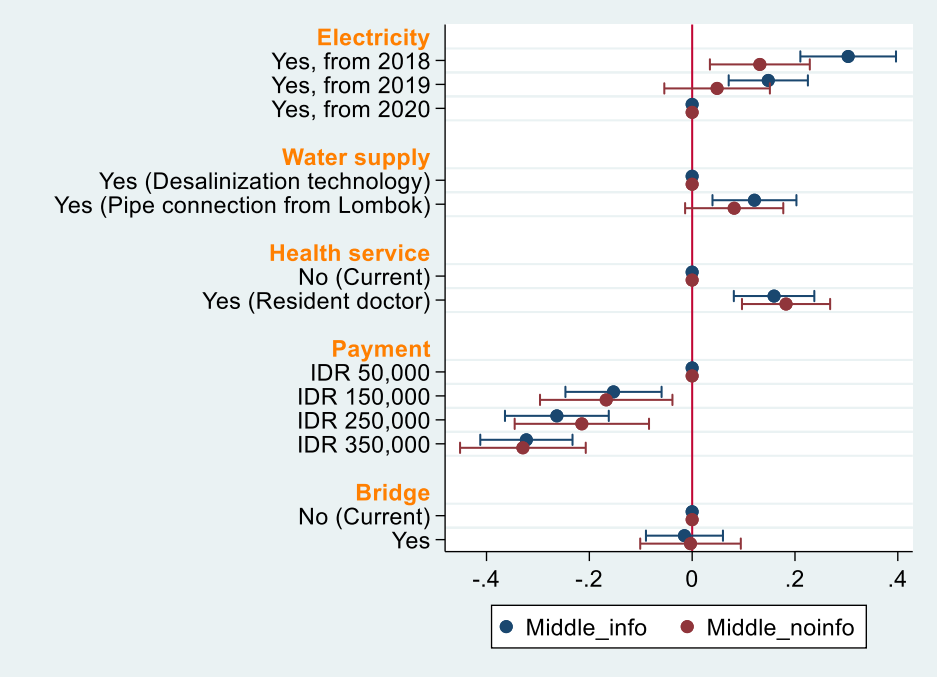

Figure 3.C. Heterogeneity based on Age (Middle Age Group)

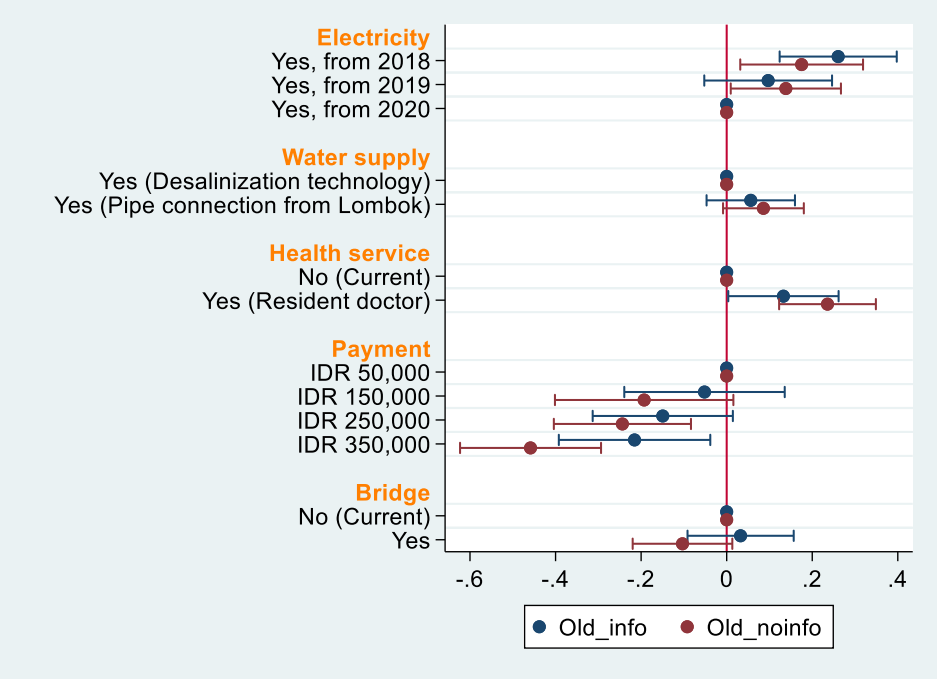

Figure 3.D. Heterogeneity based on Age (Old Age Group)

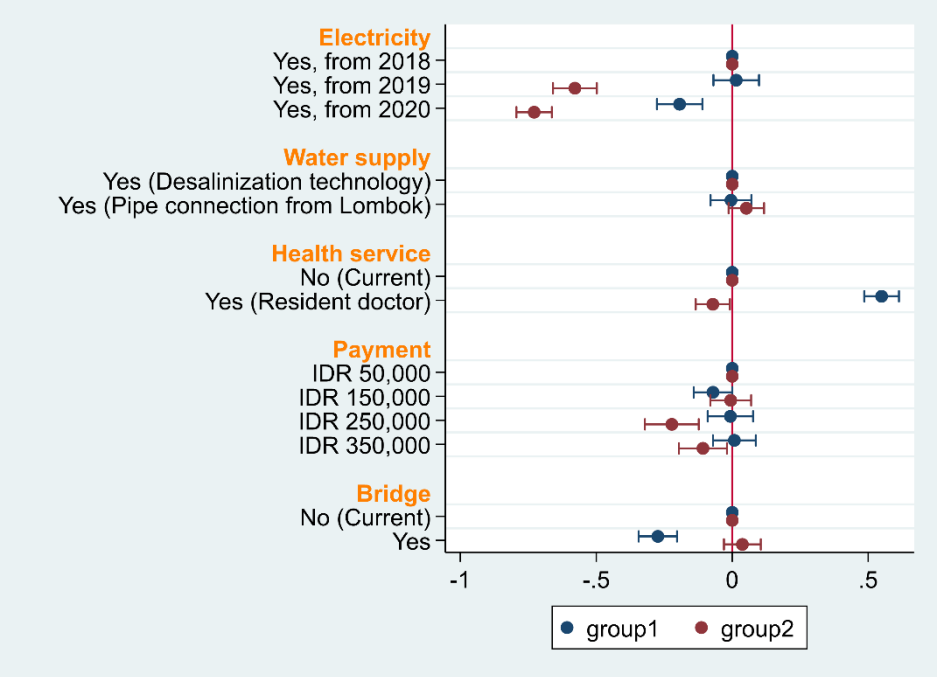

Figure 3.E. Regression clustering

Appendix Chapter 4.

Table 4.A. Estimated effects on external probabilities for each group

Attribute	Level	Group 1 No Information	Group 2 Pecuniary Information	Group 3 Non-Pecuniary Information
Time restriction for bringing organic waste to the collection station	3 days a week	-0.0265	-0.0041	0.0108
		(0.0164)	(0.0152)	(0.0193)
	One day a week	-0.0317**	-0.0043	-0.0278
		(0.0159)	(0.0154)	(0.0200)
Walking distance to the collection station	5-15 minutes	0.0573***	-0.0073	0.0123
		(0.0191)	(0.0119)	(0.0174)
	< 15-30 minutes	0.0164	-0.0082	0.0150
		(0.0162)	(0.0147)	(0.0181)
Frequency with which the city government collects waste from the collection station	3 times a week	0.0135	0.0062	0.0123
		(0.0177)	(0.0130)	(0.0185)
	Once a week	0.0009	-0.0050	-0.0233
		(0.0178)	(0.0139)	(0.0195)
Separation of non-organic waste for transport to the collection station	Reusable, recyclable, hazardous and others	0.0731***	0.0367***	0.0831***
		(0.0173)	(0.0115)	(0.0181)
Implementation of intermediate processing technology	Composting	0.0258	0.0008	0.0701***
		(0.0222)	(0.0175)	(0.0199)
	Recycling	0.0506**	0.0088	0.0590***
		(0.0219)	(0.0158)	(0.0225)
	Incinerator	-0.0167	-0.0260	0.0460**
		(0.0222)	(-0.0260)	(0.0207)
Final disposal technology	Sanitary landfill	-0.0165	0.0125	-0.0415***
		(0.0153)	(0.0103)	(0.0156)
Payment per month per household, including *retribusi*	IDR 192,000	-0.1352***	-0.0690***	-0.0919***
		(0.0225)	(0.0143)	(0.0186)
	IDR 288,000	-0.1967***	-0.1794***	-0.2301***
		(0.0257)	(0.0234)	(0.0230)
	Constant	0.7685***	0.9284***	0.7068***
		(0.0316)	(0.0223)	(0.0340)
	Observations	3,600	3,600	3,600
	R-squared	0.0470	0.0495	0.0544

Note: Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.B. Estimated effects on internal probabilities for each group

Attribute	Level	Group 1 No Information	Group 2 Pecuniary Information	Group 3 Non-Pecuniary Information
Time restriction for bringing organic waste to the collection station	3 days a week	0.0195	0.0183	-0.0207
		(-0.0200)	(-0.0195)	(-0.0195)
	One day a week	-0.0011	-0.0635***	-0.1072***
		(-0.0195)	(-0.0194)	(-0.0201)
Walking distance to the collection station	5-15 minutes	-0.0168	0.0044	0.0134
		(-0.0186)	(-0.0192)	(-0.0198)
	< 15-30 minutes	-0.0546***	-0.0504***	0.0303
		(-0.0190)	(-0.0191)	(-0.0204)
Frequency with which the city government collects waste from the collection station	3 times a week	0.0423**	-0.0557***	-0.0059
		(-0.0187)	(-0.0206)	(-0.0197)
	Once a week	0.0228	-0.0793***	-0.0897***
		(-0.0197)	(-0.0226)	(-0.0188)
Separation of non-organic waste for transport to the collection station	Reusable, recyclable, hazardous and others	0.1840***	0.1837***	0.1726***
		(-0.0179)	(-0.0180)	(-0.0176)
Implementation of intermediate processing technology	Composting	0.1550***	0.1539***	0.1587***
		(-0.0238)	(-0.0245)	(-0.0231)
	Recycling	0.1338***	0.1408***	0.1440***
		(-0.0228)	(-0.0236)	(-0.0238)
	Incinerator	0.0151	0.0570**	0.0549**
		(-0.0240)	(-0.0237)	(-0.0216)
Final disposal technology	Sanitary landfill	0.0541***	0.0393**	0.0141
		(-0.0156)	-(0.0169)	(-0.0147)
Payment per month per household, including *retribusi*	IDR 192,000	-0.1485***	-0.1527***	-0.1555***
		(-0.0209)	(-0.0208)	(-0.0199)
	IDR 288,000	-0.2959***	-0.2841***	-0.318***
		(-0.0237)	-0.0225	(-0.0220)
	Constant	0.4435***	0.5252***	0.538***
		(-0.0325)	(-0.0341)	(-0.0302)
	Observations	3,600	3,600	3,600
	R-squared	0.1172	0.1190	0.1305

Note: Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.C. Estimated effects of treatment on external probabilities

Information treatment	**External**
Pecuniary information	.096***
	(.0159)
Non-pecuniary information	-.03389
	(.0190)
Constant	.476***
	(.0131)

Note: Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 4.A. Pecuniary information

2 WELL-DOCUMENTED COMMON RESPONSIBILITIES FOR ALL IN INDONESIA

(based on Law No.18/2008; Public Works Ministry Regulation No.3/2013 and Local Regulation of Surabaya City No.5/2014)

1 Every person in the management of household waste and household-like waste is obliged to reduce and handle waste based on environmentally sound management (Law No.18/2008, Article 12).

2 Waste sorting has to be done by each person at the source (Public Works Ministry Regulation & Surabaya Local Regulation)

Sorting is your obligation!

Waste has to be sorted into at least 5 types as described below:

NO.	TYPES OF WASTE	EXAMPLES	LABEL	COLOR
1.	**ORGANIC WASTES**			
	Organic/degradable waste		**Organic Waste** Food scraps, bones, thorns, dried leaves, meat 	GREEN
2.	**NON-ORGANIC WASTES**			
a.	Reusable waste		**Reusable Waste** Glass bottles, plastic bottles, cans and other 	YELLOW
b.	Recyclable waste		**Recyclable Waste** Cardboard, food and beverage cartons, news-paper, books 	BLUE
c.	Dangerous & hazardous waste		**Hazardous Waste** Light bulbs, batteries, cas-settes, disks, insecticides 	RED
d.	Others (residue)		**Residue** Sanitary pads, diapers, cigarettes, chewing gum, etc. 	GREY

Figure 4.B. Non-pecuniary information

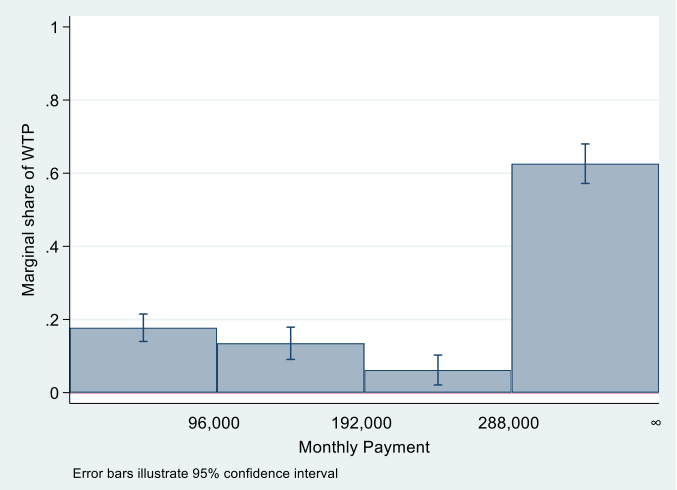

Figure 4.C. Marginal Share of WTP for Control Group

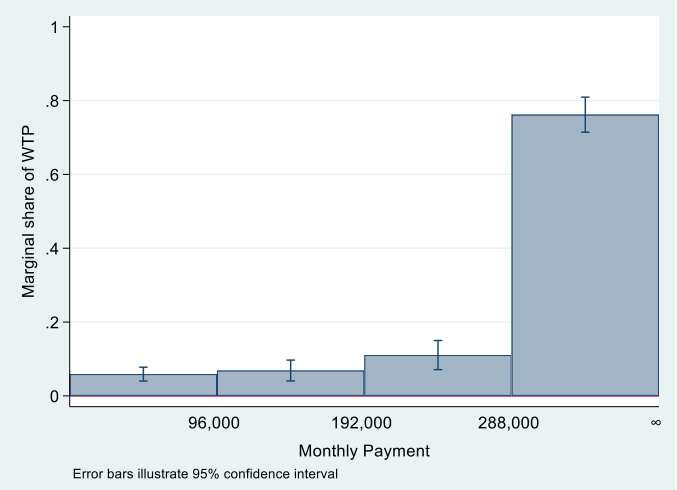

Figure 4.D. Marginal Share of WTP for Pecuniary Information Group

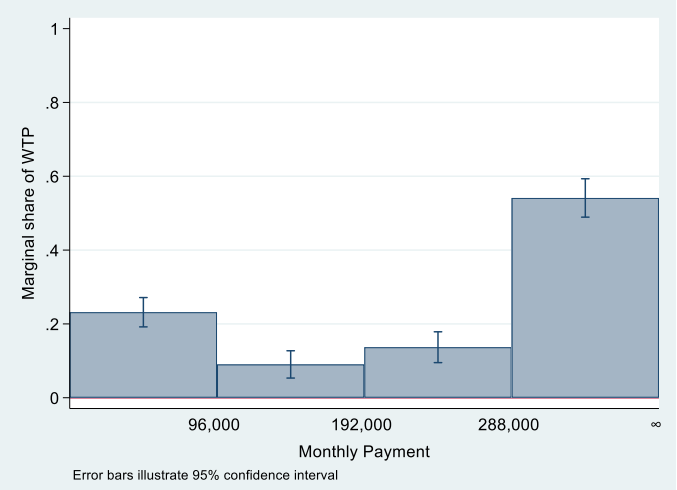

Figure 4.E. Marginal Share of WTP for Pecuniary Information Group

HOUSEHOLD SURVEY
Household ID: _____
Name of Surveyor: _____
Date of Interview: _____
Start Time: _____
End Time: _____

QUESTIONNAIRE

1.	Name of Respondent:
2.	Age:
3.	Gender a. Male b. Female
	I. SOCIO-ECONOMIC CHARACTERISTIC
4.	What is the status of your house? a. Self-owned b. Rent c. Others, please specify ……..
5.	How long have you been staying in the house? a. < 5 years b. 5 to 10 years c. 10 to 15 years d. 15 to 20 years e. > 20 years
6.	What is the highest education level attended? a. Elementary school b. Junior high school c. Senior high school d. University (Bachelor) e. University (Master or above)
7.	What is your occupation? a. Civil servant b. Private company c. Own a small business d. Retired e. Other, please specify ……...……

8.	What is the total household income per month? (both husband and wife) a. < IDR 1,000,000 b. IDR 1,000,000 – IDR 2,500,000 c. IDR 2,500,000 – IDR 5,000,000 d. IDR 5,000,000 – IDR 7,500,000 e. More than IDR 7,500,000
9.	What is the total expenditure per month? a. < IDR 750,000 b. IDR 750,000 - IDR 2,000,000 c. IDR 2,000,000 - IDR 4,000,000 d. IDR 4,000,000 - IDR 7,000,000 e. IDR 7,000,000
10.	How many people live in your household? a. 1 - 4 b. 5 - 6 c. 6 - 10 d. More than 10
II. ATTITUDE AND BEHAVIOR	
11.	How much waste is generated at home per day? a. ≤ 1 kg b. 1,1 – 1,9 kg c. 2 – 2,5 kg d. > 2,5 kg
12.	Who does mainly engage in waste disposal at home? a. Father b. Mother c. Children d. Maid e. Others, please specify ……..……
13.	Do you sort/separate your waste? a. Yes → go to Q16 b. No
14.	If not, which of the following limits your motivation to participate in the waste separation? You may choose more than one category. a. Negative nearest neighbor effect b. Complicated MSW classifications c. Do not have time d. Mixed transport and disposal after separating at source e. Lack of awareness of MSW source separation f. Delay in bag delivery or poor collection service g. Insufficient MSW source separation facilities h. Inadequate public education

	i. Other, please specify ……..……..….
15.	If you do not sort/separate your waste, would you consider starting waste sorting at home? a. Yes b. No If no, please state why ……...…..…
16.	Do you have regular/scheduled waste collection time? a. Yes, please specify …… b. No
17.	Are you satisfied with waste collection system in your community? a. Yes b. No If no, please state why ……
18.	What is the importance of MSW source separation? You may choose more than one category. a. Reduce the amount of waste disposed and reduce waste treatment fees b. Reduce environmental pollution and negative health impacts c. Sell recyclables for money d. Not concerned
19.	How much time is required to walk to the nearest collection station? a. ≤ 5 minutes b. 6-10 minutes c. 11-15 minutes d. 16-20 minutes e. > 20 minutes f. Others, please specify ……..

Appendix Chapter 5.

Table 5.A. Estimated effects on external and internal probabilities of pooled samples

Attribute	Level	External	Internal
Tap water quality	Good for cooking and drinking	0.0545***	0.185***
		(-0.0102)	(0.0105)
Water pressure without an additional pump	Enough up to the 2nd floor	0.0033	0.0148
		(-0.0112)	(0.0111)
	Enough up to the 3rd floor	-0.0031	0.0450***
		(-0.0108)	(0.0118)
Duration of interruption in citywide level (in a week)	3 hours	0.0153	0.0509***
		(-0.0106)	(0.0120)
	No interruption	0.0508***	0.114***
		(-0.0110)	(0.0117)
Response to customer complaints	< 1 day	0.0119	0.0217**
		(-0.0093)	(-0.0095)
Chlorine odor/taste	No	0.0694***	0.0782***
		(-0.0101)	(0.0101)
Payment (in addition to monthly water bill)	IDR 120,000	-0.0635***	-0.189***
		(-0.0112)	(0.0117)
	IDR 24,000	-0.158***	-0.425***
		(-0.0149)	(0.0138)
	Constant	0.692***	0.486***
		(-0.0192)	(0.0153)
	Observations	9,600	9,600
	R-squared	0,032	0.171

Note: Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.B. Estimated effects on external probabilities between groups

Attribute	Level	Control	Treatment
Tap water quality	Good for cooking and drinking	0.0455***	0.0634***
		(0.0145)	(0.0144)
Water pressure without an additional pump	Enough up to the 2nd floor	-0.0262	0.0327**
		(0.0164)	(0.0152)
	Enough up to the 3rd floor	-0.0216	0.0158
		(0.0148)	(0.0158)
Duration of interruption in citywide level (in a week)	3 hours	0.0308**	-0.0005
		(0.0154)	(0.0147)
	No interruption	0.0285*	0.0719***
		(0.0159)	(0.0153)
Response to customer complaints	< 1 day	-0.0045	0.0283**
		(0.0132)	(0.0129)

Attribute	Level	Control	Treatment
Chlorine odor/taste	No	0.0726***	0.0659***
		(0.0143)	(0.0144)
Payment (in addition to monthly water bill)	IDR 120,000	-0.0468***	-0.0796***
		(0.0161)	(0.0156)
	IDR 24,000	-0.152***	-0.164***
		(0.0211)	(0.0211)
	Constant	0.698***	0.686***
		(0.0282)	(0.0261)
	Observations	4,800	4,800
	R-squared	0,029	0,040

Note: Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.C. Estimated effects on internal probabilities between groups

Attribute	Level	Control	Treatment
Tap water quality	Good for cooking and drinking	0.154***	0.215***
		(-0.0139)	(0.0154)
Water pressure without an additional pump	Enough up to the 2nd floor	0.0043	0.0260
		(-0.0149)	(0.0163)
	Enough up to the 3rd floor	0.0159	0.0745***
		(-0.0168)	(0.0164)
Duration of interruption in citywide level (in a week)	3 hours	0.0521***	0.0496***
		(-0.0170)	(0.0167)
	No interruption	0.106***	0.120***
		(-0.0166)	(0.0166)
Response to customer complaints	< 1 day	-0.0002	0.0437***
		(-0.0125)	(0.0142)
Chlorine odor/taste	No	0.0844***	0.0718***
		(-0.0146)	(0.0138)
Payment (in addition to monthly water bill)	IDR 120,000	-0.182***	-0.194***
		(-0.0169)	(0.0163)
	IDR 24,000	-0.468***	-0.382***
		(-0.0187)	(0.0202)
	Constant	0.537***	0.434***
		-0.0211	(0.0219)
	Observations	4,800	4,800
	R-squared	0,188	0.163

Note: Robust standard errors are in parentheses
*** p<0.01, ** p<0.05, * p<0.1

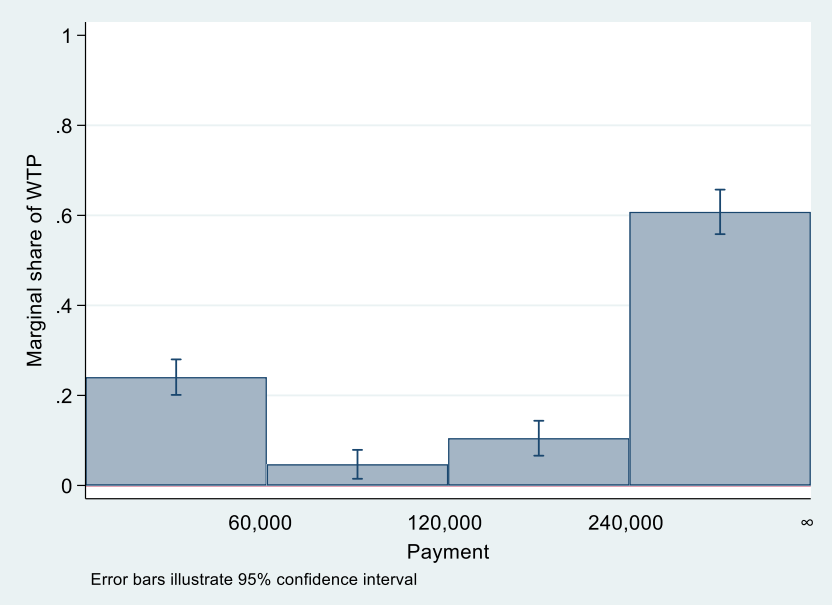

Figure 5.A. Marginal Share of WTP for Control Group

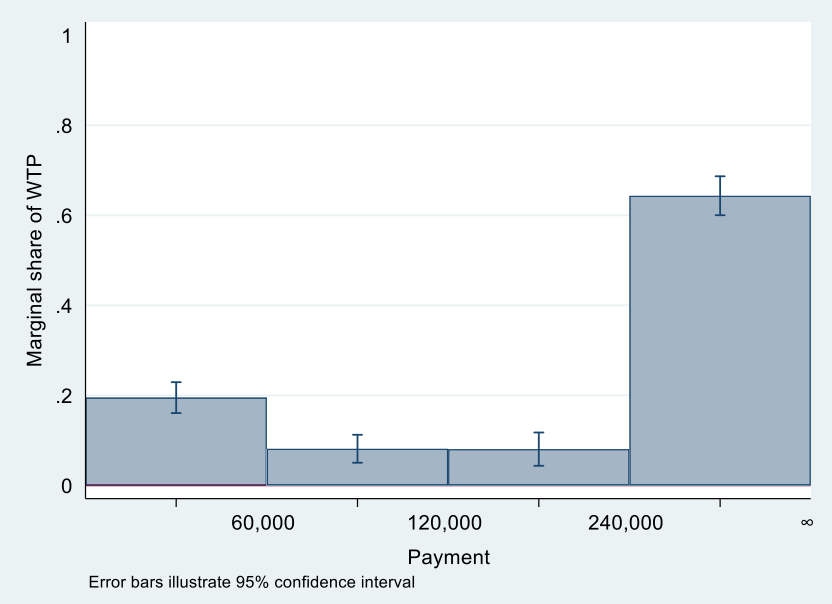

Figure 5.B. Marginal Share of WTP for Treatment Group

QUESTIONNAIRE OF HOUSEHOLD SURVEY
PREFERENCES FOR AN IMPROVED DRINKING WATER SUPPLY

Household ID:	
Name of Surveyor:	Start Time:
Date of Interview:	End Time:

A.	**RESPONDENT IDENTITY**		
1.	Name of respondent:		
2.	Address:		
3.	Gender:		
4.	Age:		
5.	Gender of household head: Male/Female		
6.	Marital status:		
	a. Single	b. Married	c. Divorced
	d. Widowed		
7.	Occupation of household head:		
	a. Civil servant	b. Private company	c. Self-employed
	d. Retired	e. Others:	
8.	Highest education attainment of household head:		
	a. Elementary school	b. Junior high school	c. Senior high school
	d. Diploma/bachelor	e. Master or above	
9.	Family size (including household head):		
10.	Monthly income (total husband and wife):		
	a. ≤ IDR 1 million	b. IDR 1-<2 million	c. IDR 2-<3 million
	d. IDR 3-<4 million	e. IDR 4-<5 million	f. ≥ IDR 5 million
11.	Storage ownership: Yes/No		
	a. Upper storage	b. Bottom storage	c. Upper & bottom storage
12.	Do you use electric water pump?		
	a. Yes	b. No	
B.	***PDAM* WATER USAGE, SATISFCATION, AND WATER BILL**		
1.	What are the water sources used for your daily life?		
	a. PDAM	b. Gallon water (branded)	
	c. Refill water	d. Others:	
2.	What is the usage of water from PDAM?		

	1. Drinking	a. Yes	b. No
		Reason:	
	2. Cooking	a. Yes	b. No
		Reason:	
	3. Washing	a. Yes	b. No
		Reason:	
	4. Bathing	a. Yes	b. No
		Reason:	
3.	Consumer satisfaction toward water service 1: very dissatisfied 2: dissatisfied 3: Neither satisfied nor dissatisfied 4: satisfied 5: very satisfied		
	1. Quality	Water clarity	1 2 3 4 5
		Taste of water	1 2 3 4 5
		Smell	1 2 3 4 5
		Smell of chlorine	a. Yes
			b. No
	2. Quantity	Water supply from PDAM is sufficient for daily life	1 2 3 4 5
	3. Continuity	Water fluency	1 2 3 4 5
	4. Pressure	Do you use water pump?	a. Yes
			b. No
4.	How much is your average monthly water bill?		IDR
C. CONSUMPTION OF GALLON WATER, REFILL WATER, AND WELL			
1.	Purchase and consumption of gallon water	What is the usage of gallon water?	a.
			b.
			c.
		How many gallons are bought in a month?	
		How much does it cost for one gallon?	IDR

2.	Purchase and consumption of refill water in a gallon	What is the usage of refill water?	a.
			b.
			c.
		How many gallons of refill water are bought in a month?	
		How much does it cost for one-gallon refill water?	IDR
3.	Do you use water from well in your home?	a. Yes	b. No

--- Thank you for your participation ---