Preferences mapping of household biodigester in Bandung

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Abstract. Bandung city government implemented household biodigester grants in 2015 and 2016. Unfortunately, there are some household biodigesters that still functioning well but not in use. Therefore, this study is an effort to improve the acceptance and usage rate of household biodigesters in Bandung. The purpose of this study is to know citizen’s preference when it comes to household biodigester. To get the picture, we conducted survey through online questionnaire based on eight dimension of quality defined by Garvin (1987) as basis to construct factors that might be favoured by current and potential users of household biodigesters. Based on result of cluster analysis, three clusters with different preferences were interpreted and profiled through Welch's ANOVA and Games-Howell Test. This study reveals that the cluster with the largest number of members shows reliability and features as the key to determining current and potential user’s preference. This study suggests the developer of household biodigester to choose cluster 1 and prioritize the aspect of reliability and feature within the development of the next household biodigester product to get higher level of public acceptance.

1. Introduction

The service capacity of garbage handling until now by PD Kebersihan (local waste management company) is still not optimal with only about 65% of the waste is served [1]. In jabarprov.go.id [2], Bandung Vice Mayor Oded M. Daniel mentioned that the city of Bandung produces waste up to 1,500 tons per day while the waste transport capacity is only about 1,100 tons.

Biodigester, a waste-to-energy power generation, generates power by turning organic waste into gases and fertilizers. In February 2015, Bandung City Government provided 100 biodigesters, each with the capacity of processing 15 kg of organic waste, for interested Bandung citizens in exchange of only a number of application documents [3].
Based on Figure 1, it is seen that the organic waste makes for the biggest percentage of total waste in Bandung. For this reason, the application of biodigester becomes highly potential even though it requires citizens’ willingness to separate waste. National news channel kompas.com reported that in 2014, Bandung Mayor Ridwan Kamil made a declaration to reduce household waste. One way through which household waste could be reduced is through the use of household biodigester, which would hopefully alleviate garbage transportation cost by reducing the amount of waste that must be transported into landfills.

Prior to providing grants for household-scale biodigesters, Bandung City Government had provided grants for larger-scale biodigesters able to process 250 kg of waste. The grant program resulted in 14 250 kg biodigesters by BPLH in Bandung, but after some time, according to the survey conducted by BPLH [4] the use of 250 kg biodigester is considered to have much greater problems than household biodigesters. Those problems are:

- **Community involvement**
  BPLH [4] mentioned that 5 of 14 communal-scale biodigesters have no clear biodigester management responsibilities. Seven of the nine operating biodigesters are granted to an institution. Thus, the agency may assign parties within the agency to operate the biodigester. Unfortunately, in the seven institutions, the surrounding community has not been involved in donating waste to biodigesters, violating the initial goal of biodigester procurement in Bandung to reduce household waste. Therefore, the initial goal is most likely unattainable from 250 kg biodigesters.

- **Land use**
  A 250 kg biodigester require a minimum land size of 6.8 by 4.6 meters, therefore requiring government-owned land so as not to risk being converted. With some of the fourteen 250
kg biodigesters in Bandung still located in private lands, they face risks of conversion. For example, in Palasari Village, landowners say they want to transfer land functions in the next 5-10 years. There is also a biodigester installed in the burial ground, which makes it susceptible to land use conversion into a grave. 15 kg biodigesters occupy an area of only 1 by 1 meter and can be installed on the residents' land, for example, citizens’ backyards.

- The need for organic waste
  Almost all 250 kg biodigesters have not been used optimally. Some of these biodigester recipients are only able to provide 2-20 percent of the total waste needed. When compared to 15 kg biodigesters, 250 kg biodigesters grant recipients have higher difficulty in finding organic waste to meet daily waste requirements. Some 250 kg biodigesters in Bandung use biomass, mostly purchased from cattle farm waste. This is less suited to the original purpose of biodigester installation, i.e. to reduce household waste. Most people objected to transporting garbage from their homes because of the location of biodigester are quite far enough from their homes. With the neighbourhood-located 15 kg biodigesters, most residents around the biodigester’s location are still willing to collect and deliver their organic waste to the within-reach location of the biodigester.

- The utilization of energy yield is not yet optimal
  One biodigester installed with 250 kg of garbage input per day should be used for 5 households or more, but the energy produced by most of the 250 kg biodigesters in Bandung is only used by one party. In Rancasari Village, the biogas produced is only used for lighting in Rukun Warga (RW) offices. In Sumur Bandung Subdistrict, the energy generated was only utilized by managers of a landfill. Until recently, gas produced from 15 kg biodigester can only be consumed by one house, but this is worthwhile considering the much lower investment fund compared to the 250 kg biodigesters.

- Potential hazard
  Unused gas produced by biodigester can fill up the gas holder. Rancasari Subdistrict suffers from potential leakage of gas holder due to the stove only being used about three times per week. This may lead to leakage as well as explosion of gas holder, releasing methane gas as contaminant into the environment.

Of the various problems that have been mentioned, 250 kg biodigester capacity is considered less feasible to reapply in the city of Bandung. Therefore, household-scale biodigester is considered to have potential that is expected to grow better in the city of Bandung because the problem posed is not as much a problem of biodigester capacity of 250 kg.

While almost all 250 kg biodigesters are not used, household biodigester has better potentials. According to research results by Cahyono, more than half of household biodigesters distributed around Bandung is still used by their respective owners. The research by Cahyono [5], seen in further details in Figure 2 below, reveals that 67 out of 103 household biodigesters are still functioning well. This fact reveals a difference between the term of “functioning biodigester” and “biodigester still in use”. Some biodigesters are still functioning but not used.
Biodigester is a technology-driven product or known as push technology product. Eppinger & Ulrich [6] implies that although push products are at the heart of a technology success, product developers need to pay attention to the preferences of users or potential users. Developing new product carries a lot of risks that are reduced by identifying customers’ needs. In household biodigesters, residents become the operators, which renders researching the suitability user preference crucial. So far, no studies have focused on capturing a clear picture on citizens’ preferences for household biodigesters. Therefore, this research aims to elucidate citizens’ preferences for household biodigester.

According to Gendall and Esslemont [7] market research is unable to produce explanations of consumer behaviour reliably and comprehensively, but market research can increase the probability of making the right decision. McMillan [8] states that one’s interest in using a product is when the product provides the benefits they want. In a city or region, the community is the main generator of waste, rendering its role very important. The success rate of use and management of biodigesters is highly dependent on community participation. Therefore, to achieve a strong community acceptance, it is necessary to know how citizens’ expectations for biodigesters. This study aims to map the preference of Bandung citizens about household biodigesters in order to improve the community acceptance towards household biodigesters.

2. Data methodology

Assumption and Scope
Biodigesters are not yet commonly known by the citizens of Bandung. As such, to increase response rate, these questionnaires are only distributed to people with in environmental preservation: environmental activists, researchers, and students who study biodigesters in their majors. This research assumes that the preference of Bandung citizen can be represented by those people. Another assumption is that preference are the same across various regions of Indonesia, because we assume that in general the people of Indonesia have the same perception about energy. To verify this assumption, available data will be tested using cross-tabulation (chi-square) which will identify any discrepancies between Bandung and non-Bandung citizens.

Design of Data Collection
The important condition for a product to succeed is that it must offer what the customer/user perceives as benefit (6). Therefore, in this research will use the quality concept of Garvin [9] which divides the
quality of a product into 8 dimensions: performance, features, reliability, conformance, durability, serviceability, aesthetics, and perceived quality.

In this study, the dimensions of conformance, aesthetics, and perceived quality are not used because they are less relevant to household biodigester products. Then the operationalization of the concept conducted by describing these dimensions into 31 indicators that are considered capable of measuring these dimensions. Indicators used are obtained from various references, such as journals, articles, theories in product development, final project, and others. In addition to the literature study, the indicators were also obtained through interviews with some biodigester users in Bandung as well as the results of brainstorming (as a form of verification/content validation) with the biodigester household product developers on the technical suitability of indicators identified with household biodigester products.

2.1. Scale selection
This study uses ordinal scale which is considered as the interval scale that would be useful to process the data using parametric statistics, if the basic assumption test statistics was passed first. The type of scale selected in this study is Likert scale. To ensure the objectivity, the questionnaires were made on a balanced scale. Unbalanced scales are commonly used when obtained data has the possibility of abnormalities [10]. In order to make the respondents could choose neutral option within the scale based question answer, the odd-scale was selected because it has a middle value or a neutral value. Respondents can choose neutral because as there is a possibility that they feel neutral with these indicators. On an odd scale too, this questionnaire becomes a questionnaire that does not compel respondents because if they feel neutral about an indicator then they can choose the middle value. The scale used is 7. The scale is chosen to avoid being too narrow with 5 and to avoid respondents’ being overwhelmed with too many options in the case of 9.

2.2. Questionnaire design
A good questionnaire should motivate respondents to be willing to contribute, feel involved, and provide complete, honest and accurate answers [10]. Each statement representing the indicator of this study will be marked as required. This is done to avoid missing value. Although the activated feature required this questionnaire to be impressed, respondents should not feel threatened. First, because all indicators have been identified do not require any personal data that may be too sensitive to divulge. Second, as described in the previous section, there is a neutral choice in this questionnaire. Third, data retrieval will be done using typeform.com which has a user interface that is convenient for the respondent.

The questionnaire consists of two parts. The initial part of the questionnaire contains the respondents’ assessment of the indicators identified. The form of the questionnaire selected is in the form of numbers 1 through 7 with information on the highest, lowest, and middle scale to facilitate the respondents to understand each scale used in the research questionnaire.

In the second part is a request for respondents to fill out the identity. Questions about demographics are deliberately placed at the end to improve the completion rate. According to Lindemann [11], there is a common practice in making questionnaires that we must begin to avoid: do not start a questionnaire with questions about the demographics of respondents. Because it will make people lazy to fill out the questionnaire thereby lowering the response rate. Preferably in a questionnaire that was first asked not in the form of personal data.

The questionnaire for this study also uses a progress bar to show completion percentage. Progress bars are used because basically humans have a desire to achieve goals. If he does not know how far he has stepped he might stop before finishing the questionnaire so because he does not know when the questionnaire ends. According to Zhang [12] with this progress bar, when he has completed most of the questions in the questionnaire when at the end there is a sensitive question, most likely respondent will fill it because he knows he has done a lot by looking at the progress bar. So, with the design of such questionnaires, indirectly respondents are forced to provide personal data. Type of progress bar selected is the percentage because if the progress bar shows the number of questions that have been filled, then
from the beginning to open the questionnaire, respondents already know the number of questions very much in the questionnaire of this study so it is feared respondents become lazy and immediately close the questionnaire without completing it first. It will be different if the progress bar is used as a percentage, then the respondent will not know the number of questions but he will have a picture of how far he has done in the questionnaire that is being filled.

2.3. Validity and Reliability Test
Quality data is obtained through a valid and correct method: the measurement is in accordance with what the researcher would like to measure. In this research, we have collected data for validity and reliability test three times with each test using about 30 respondents. The validity test used is construct validity and the results of all indicators are valid convergent. The reliability test performed is internal consistency reliability with the calculation method of Cronbach's Alpha. According to Malhotra [10], a dimension is reliable if the alpha value more than 0.6. From the calculation result is concluded that all dimensions used are reliable because all dimensions have alpha value more than 0.6.

| Dimensions   | Cronbach's Alpha | Reliable |
|--------------|------------------|----------|
| Performance  | 0.6945           | Yes      |
| Features     | 0.7340           | Yes      |
| Reliability  | 0.9010           | Yes      |
| Durability   | 0.7063           | Yes      |
| Serviceability | 0.8739       | Yes      |

3. Collection and processing data method
After the questionnaire is proven to be valid and reliable, we collect data from 146 respondents. According to Zhao [13], the respondent required in a study should be five times the number of variables used – in this case, at least 100 respondents. After data collection, we conduct outlier test using Grubbs Test, identifying three outiers due to unusual filling that are subsequently removed. After that, we conduct the basic assumption test using the normality test, heteroscedasticity test, and linearity test. The result states that the data used pass the linearity test but cannot be assumed to be normal and heteroscedasticity. In this research, autocorrelation test is not conducted because the data used is not a time series data so it is not necessary to do autocorrelation test [14].

The tools used in this research are cluster analysis and ANOVA along with its post hoc test to know the preference of each cluster. This research also uses cross tabulation to find the demographic relation with the cluster formed. According to Malhotra & Birks [10], cross tabulation is a statistical technique that describes two or more variables simultaneously and generates a table that reflects a combination of two or more variables that have a number of different categories or values. In this research is used chi-square calculation to know the relation of demography variable with cluster formed.

Based on Santiago [15] some testing tools such as the t-test, Analysis of Variance (ANOVA), Regression, and Design of Experiment (DOE) are considered robust against normality assumptions. According to Glen [16], although ANOVA requires normality assumptions, we can still use this test if the sample size is large enough (usually more than 20). If the sample size is very small then it is better to use nonparametric testing. This study uses 143 samples (sans outliers) to justify the use of ANOVA testing.
Considering one of the assumption test results that the data obtained for this study cannot be assumed to have the same variance, this study cannot use classic ANOVA. In processing the heteroscedasticity data, Welch's ANOVA and Kruskal-Wallis (nonparametric) can be an alternative data processing. Liu (17) has conducted a study to compare what is likely to be a lower type I error and which has higher power between Welch's ANOVA and Kruskal-Wallis Test. His research concluded that Welch's ANOVA gives the best performance in the appeal of Kruskal-Wallis, and then in this study will be used Welch's ANOVA.

Welch correction is a widely used solution in testing the difference between the average of two populations when the variance is not the same. The Games-Howell test is based on Welch’s correction of degrees of freedom by t-test and using studentized range statistics. This method is based on the studentized distribution range. This method uses the formula to approximate Welch's degrees of freedom (Welch's d.o.f) to obtain a confidence interval approximation and to see the difference between the two averages based on the student's t-test.

Welch correction is designed to provide valid t-test when there is an unequal population variance. This correction involves the use of a number of degrees of freedom (v) corrected to assess t-statistical significance. v is the number obtained from the following equation (1):

\[ \nu = \frac{\left( \frac{s_i^2}{n_i} + \frac{s_j^2}{n_j} \right)^2}{\frac{s_i^2}{n_i} \left( n_i - 1 \right) + \frac{s_j^2}{n_j} \left( n_j - 1 \right)} \]

With the following information, 
- \( s_i^2 \) and \( s_j^2 \) represent the variance of group samples i and j
- \( n_i \) and \( n_j \) are the number of samples used

And the statistical test is,

\[ t_W = \frac{\bar{x}_i + \bar{x}_j}{\left( \frac{s_i^2}{n_i} + \frac{s_j^2}{n_j} \right)^{1/2}} \]

With the following information,
- \( \bar{x}_i \) and \( \bar{x}_j \) is the average of the sample
- \( s_i^2 \) and \( s_j^2 \) represent the variance of group samples i and j
- \( n_i \) and \( n_j \) are the number of samples used

Then the critical value is as follows,

\[ q_{a,k,v} \]

Where \( \nu \) is as mentioned in equation (1), then \( k \) is the number of treatments. The value of \( q_{a,k,v} \) shows the upper \( \alpha \) point of the studentized distribution range by using the parameters \( k \) and \( \nu \). Reject \( H_0 \) if \( t_W \geq \frac{q_{a,k,v}}{\sqrt{2}} \) and do not reject \( H_0 \) if the opposite happens.

The post-hoc test that will be used is Games-Howell Test. According to Shingala & Rajyaguru (18), the Games-Howell (GH) procedure is the equivalent of the Tukey Kramer Test. The GH method provides the best results for pairwise comparison. Then according to Hilton and Armstrong (19), the Games-Howell test is one of the robust methods among the latest methods. With Games-Howell, pairwise comparison can be performed although there are differences in the number of samples being
compared, with the data being heterogeneously variable, and when the data does not meet the assumption of normality.

4. Processing and analysis of data

4.1. Selection of clustering variables
Cluster analysis is one type of multivariate analysis aimed to categorize objects (such as respondents, products, and others) based on the characteristics they have (20). In this study, cluster analysis is used to determine whether there are different groups in a population. This is important because by understanding the preferences of groups in society, people's preferences can be understood in more detail and in depth. Steps in cluster analysis include choosing cluster variable, determining optimal cluster number, cluster validation, outlier analysis, and profiling the cluster.

An ideal clustering variable is a variable that is not correlated with other variables. However, because in this study there are no variables that really do not correlate with other variables, the selected cluster variable is the variable with the least number of correlations. Based on the calculation of the number of correlations between variables, it is found that the selected cluster variable (to represent every dimension) can be seen in table 2 below.

| Dimensions   | Variables                                                                 |
|--------------|---------------------------------------------------------------------------|
| Performance  | X1  Biodigester is able to convert waste into gas that can be used for cooking |
| Features     | X8  There is a monthly incentive for the person who operates the biodigester |
| Reliability  | X19 The stove can still be used even when the power (electricity) is off    |
| Durability   | X20 The biodigester-generated gas has the same quality in every operation of biodigester |
| Serviceability | X24 There is a regular meeting with biodigester engineers for the users  |

4.2. Agglomeration method
The most optimal number of clusters is the number of clusters that most explain the differences between the clusters that are formed. To determine it, the tools used are hierarchical cluster using SPSS 20. The hierarchical method used is agglomerative method. This method is a grouping method that is bottom up that is done by cluster number as much of number of samples then samples are grouped one by one based on their similarity to finally form one cluster.

| Number of Clusters | Difference of Coefficient | Changes in Coefficient Difference | Difference in Changes |
|--------------------|---------------------------|----------------------------------|----------------------|
| 1                  | Emptied                   | Emptied                          | Emptied              |
| 2                  | 152.68                    | 108.3%                           | Emptied              |
| 3                  | 79.02                     | 56.4%                            | 51.8%                |
| 4                  | 74.78                     | 53.8%                            | 2.6%                 |
| 5                  | 51.75                     | 37.5%                            | 16.3%                |
| 6                  | 28.64                     | 20.9%                            | 16.6%                |
| 7                  | 28.13                     | Emptied                          | Emptied              |

The optimal number of clusters depends on the stopping rule. The cluster formation must stop when there is the biggest change in the value of heterogeneity. Table 5.12 reveals that the spike occurring in cluster 3 makes it the best cluster, as the highest heterogeneous change spike is in the difference of
cluster 2 to cluster 3 (51.8 percent), followed by clustering the respondents into 3 clusters. The methods used are the same as those done when determining the optimal number of clusters using Ward's Method, distance measurement using Squared Euclidean Distance, and standardization of data using Z-score (variable). This grouping is done using Minitab 17. The proportion of members of each cluster formed can be seen in Figure 3 below.

![Comparison of Each Cluster Composition](image)

Figure 3. Comparison of each cluster composition.

4.3. *Validity test*
To test the validation of the clusters formed, cluster analysis with other methods (K-Means) was performed. It is known that 78.38 percent of the cluster members generated by K-Means are the same as cluster members generated through hierarchical methods. With the minimum standard validity of a cluster being 75 percent (20), it can be concluded that this study has passed the validation test.

4.4. *Interpreting and profiling cluster*
This study interprets and profiles cluster using Welch's ANOVA, Games-Howell Test, and cross-tabulation. The cross-tabulation test shows no difference between citizens’ preference in Bandung and outside of Bandung, which means this study’s assumption stands true. However, this result also makes it impossible for this research to describe member of an entire cluster. And then, to know the most important dimension of every cluster, we use the Welch’s ANOVA and Games Howell Test. The result can be seen in Table 4 below.

| Cluster | The most important dimensions               |
|---------|---------------------------------------------|
| 1       | Reliability                                  |
|         |    Features                                  |
| 2       | Durability                                   |
|         |    Reliability                               |
| 3       | Performance                                  |
|         |    Durability                               |
|         |    Reliability                               |

Table 4. The most important dimensions.
After that, we perform Welch's ANOVA and Games Howell Test again on the indicators of each dimension’s clusters. The summary of the results can be seen in Table 5 below.

**Table 5. Summaries of preferences.**

| Cluster | The Most Important Dimensions | The Most Important Indicator | The Most Important Indicator of Clustering Variables |
|---------|--------------------------------|-----------------------------|-----------------------------------------------|
| 1       | Features and Reliability       | X14 Biodigester not easy to leak | X19 The stove can still be used even when the power (electricity) is off |
|         | X16 Gas pipes to the stove are not easily broken | X20 The biodigester-generated gas has the same quality in every operation of biodigester |
|         | X17 Gas distribution pipes are not easily clogged |                                           |
|         | X15 Not easily damaged if hit by a hard object collision |                                           |
| 2       | Durability and Reliability     | X14 Biodigester not easy to leak | X20 The biodigester-generated gas has the same quality in every operation of biodigester |
|         | X20 The biodigester-generated gas has the same quality in every operation of biodigester |                                           |
|         | X19 The stove can still be used even when the power (electricity) is off |                                           |
|         | X17 Gas distribution pipes are not easily clogged |                                           |
|         | X16 Gas pipes to the stove are not easily broken |                                           |
|         | X15 Not easily damaged if hit by a hard object collision |                                           |
| 3       | Performance, Durability, and Reliability | X16 Gas pipes to the stove are not easily broken | X1 Biodigester is able to convert waste into gas that can be used for cooking |
|         | X14 Biodigester not easy to leak |                                           |
|         | X4 The resulting gas does not have a potent smell when used | X20 The biodigester-generated gas has the same quality in every operation of biodigester |
|         | X20 The biodigester-generated gas has the same quality in every operation of biodigester |                                           |
|         | X17 Gas distribution pipes are not easily clogged |                                           |
Cluster 1 has the biggest proportion compared to other clusters, reflecting the most common preference of the general population. Commercialization of household biodigesters should aim cluster 1 as target market due to its sizeable amount. In addition, the dimensions preferred by cluster 1 is quite easy to implement due to their simplicity, allowing household biodigester developers to focus more on delivering those preferred indicators. Cluster 1 prefers a reliable biodigester: one whose gas storage is not easy to leak and whose pipes delivering gas to the stove are not easily broken. Cluster 1 also prefers feature of stoves that can still be used even though the electricity is not on and a monthly incentive for biodigester operators. Biodigester developers should focus on developing a reliable stove with this feature for household biodigester and structure proper financial incentive for biodigester operators to maintain their willingness to operate.

5.2. Recommendation
The main stakeholder in this problem is Bandung City Government. Cross-tabulation analysis shows no demographic variables affecting user preferences. This means that the city government is able to use the result from this study without considering demographic variables.

The next question is how to structure proper management. This study reveals different preferences between different clusters when it comes to household biodigesters. Therefore, to increase community acceptance of biodigesters, Bandung City Government should design policies that match the preferences of citizens and provide household biodigesters designed in accordance with those preferences.

This study recommends cluster 1 to be the target market, emphasizing on reliability and features as the main preference. Cluster 1 mainly wants a biodigester that is not easy to leak and that has a reliable gas distributor not easily broken. By utilizing these findings, biodigesters should have a warranty against leakage and that ensures reliability of connecting pipe.

Development of household biodigester can also be done based on the most important variables among the variables used for cluster analysis. This is done because the clustering variable has a function as a differentiating variable between the clusters formed. Therefore, the use of clustering variables for the development of household biodigester is expected to make biodigesters more appropriate to the preference of the selected segment. In cluster 1, the most important of clustering variable is a stove that can still be used even though the electricity is off and there is an incentive for those who operate the biodigester. Based on this finding, Bandung City Government should provide incentives for people who are willing to operate household biodigester. Then the Bandung City Government should also ask the manufacturer (or find a capable producer) to produce household biodigesters that can be operated when the power goes out.
Then, cluster 1 can be reached by asking prospective recipients of household biodigesters to fill out the same questionnaire as used in this study. After processing the questionnaire results (using testing ANOVA and Post Hoc Test on clustering variable and on the indicators of the important dimension), the results should be compared with the cluster results formed in this study to determine whether the respondent is a member of cluster 1, 2 or 3? If the result states that the potential recipient of this biodigester belongs to cluster 1, they should be highlighted as potential beneficiary of the biodigester grant.

Information about the biodigester program should be disseminated by environmental activists because most of this study’s respondents are those concerned about environmental sustainability. Therefore, it is possible that the preferences generated by this study will be more appropriate to those participating in the forums of environmental activists. However, disseminating information through local officials (heads of sub-districts, heads of neighbourhood units, etc.) should be conducted as well in order to reach the rural areas of Bandung. As some respondents of this research are ordinary citizens, preferences outlined by this study is predicted to still be in accordance with the preferences of citizens in general. For the next biodigester grant program, the recommendation of the biodigester recipient search path can be seen in Figure 4.

When disseminating information about household biodigester grant programs, warranties and additional features existing in biodigester should not be mentioned to prevent shaping the perception of potential biodigester grantees when it comes to them answering the later questionnaire. Without the mention of warranties and additional features, respondents are able to fill out the questionnaire honestly, according to their initial preferences.

Any citizen who wishes to be a biodigester grantee should be required to submit the requirement to the Bandung City Government or a designated office in person and not via courier. Upon submission, the potential grantee interested in accepting and maintaining the household biodigester should be asked to fill out the online questionnaire using a gadget provided by the government under the supervision of government officials.

By using this flow, Bandung City Government can find the right biodigester household recipients to minimize failure risks in the form of not using the provided biodigesters, because unused biodigesters are massive expenses that bleed out from the government’s budget.
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Figure 4. Recommendation of the biodigester recipient search path.
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