CLASSIFICATION OF WASTE BANK POTENTIAL IN APPLYING ONLINE MANAGEMENT SYSTEM USING SINGLE LINKAGE CLUSTERING METHOD (A STUDY ON BANKSAMPAH.ID USERS IN BANDUNG)

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Abstract

Waste has been an issue to the world since years ago, especially the waste that cannot be decomposed. Indonesia, in 2010, was nominated as the second largest contributor of plastic waste to the ocean. Some ways have been conducted and one of the ways Indonesia has been done for this issue is by creating waste bank. BankSampah.id is one of online management systems for waste banks developed by Smash.id team as the company. This is a web-based application that has been established since 2015. This application is made to help waste bank managers to manage their customers and waste data. Unfortunately, 86.66% users have not conducted any transactions, 77.02% users have not input the Customer data, 65.30% users have not input the Waste Category data, and 61.15% users has not input any data at all. Smash.id then developed a program which allow a collaboration and partnership with other parties such as government and company. This program is still being tested in Bandung City and the result shows that after the collaboration, Bandung City has 189 waste banks registered in BankSampah.id and 61 of them is actively transacting within the app. This collaboration program needs to be maintained and developed. Unfortunately, Smash.id team has no reference on giving treatment for users as their marketing strategy. Each user surely has different behavior that requires different treatment but giving each user different treatment only cause unnecessary effort. So, classification of waste bank needs to be conducted.

This research is conducted in order to classify the users of BankSampah.id based on their behavior within the app. The classification is done by combining the Analytical Hierarchy Process and Single Linkage Clustering. Customer Lifetime Value (CLV) is used in measuring the objects by adapting LFRMP model: Length (L), Recency (R), Frequency (F), Amount of Waste (M), and Potential (P). The result shows that there are 7 clusters in total. 5 clusters contain of active users and the other 2 contains of inactive users only. Cluster 1 has, in average, 12.4 months of customer life, 1 month of recency, 0 transactions, 0 kg of waste, and 306 customers. Cluster 2 has, in average, 3.7 months of customer life, 2 months of recency, 83 transactions, 54.22 kg of waste, and 169 customers. Cluster 3 has, in average, 4.6 months of customer life, 2 months of recency, 151 transactions, 273.98 kg of waste, and 67 customers. Cluster 4 has, in average, 4.6 months of customer life, 1 month of recency, 507 transactions, 939.52 kg of waste, and 57 customers. Cluster 5 has, in average, 33.31 months of customer life, 32 months of recency, 1 transaction, 4.57 kg of waste, and 1 customer. Cluster 6 is for the older users, and cluster 7 is for the newer users. The marketing strategy is then developed using SWOT analysis by considering the internal factors of Smash.id team as the strength and weakness, and the cluster profile as the opportunity and threat.

Keywords: Clustering, Waste Bank, Marketing Strategy, SWOT

1. Background

Waste has been an issue to the world since years ago, especially plastic waste as one of the wastes that cannot be decomposed. Indonesia, in 2010, has been contributed a very large number of plastic waste and placed the second largest contributor of waste in the world with 3.8 million tons per year of plastic waste (Jambeck, et al., 2015). In order to suppress the waste, the ministry of environment issued various programs, which one of them is waste bank, as the implementation of 3R (Reduce, Reuse, Recycle) activity. Waste bank itself is a place for sorting and collecting recyclable or reusable trashes that has economic value.

In September 2015, the Ministry of Environment and Forestry held a National Coordination Meeting (Rakornas) of Waste Bank III with topic "Innovation of Waste Bank Online System Development" in Makassar. For such reason, web and mobile-based application developers started to make online systems to fulfill the needs of online management system for waste bank. One of online management system developed for waste banks in Indonesia is SMASH.

SMASH is an online system developed by Smash.id team under PT. Solusi Hijau Indonesia company. SMASH has developed an application to be used by waste bank managers called BankSampah.id. BankSampah.id is a web and mobile based application that helps supporting the operational activities of waste bank all over Indonesia. Usually, waste bank managers record their transaction data in a book. By using books to save every transaction conducted means producing paper waste while paper is one of the wastes that should also be reduced. Saving

transactional data in books is also vulnerable of losing and broken. So, BankSampah.id comes to help by providing an online system that allows waste bank managers to input their transaction data online.

According to *Kementerian Lingkungan Hidup Republik Indonesia* (2018), there are 5,468 waste banks that exist in Indonesia, including main and unit waste banks. Per December 2018, there are 2219 waste banks that have already used BankSampah.id as their online system. Unfortunately, the activity of the users seems to show a low number. According to BankSampah.id data, 86.66% users have not conducted any transactions, 77.02% users have not input the Customer data, 65.30% users have not input the Waste Category data, and 61.15% users has not input any data at all.

Based on field observation in waste banks, most of the waste bank managers and its customers are old people that has difficulties in understanding and learning about technology. Some areas in Indonesia are also not properly covered by internet so the waste bank managers cannot really understand the importance of using online system. Several ways have been done by the company to handle this inactivity of users, but it seems that the inactivity of the users is still not showing a significant improvement. Going more of the big strategy, SMASH developed a professional collaboration with *Dinas Lingkungan Hidup* (DLH) of Bandung.
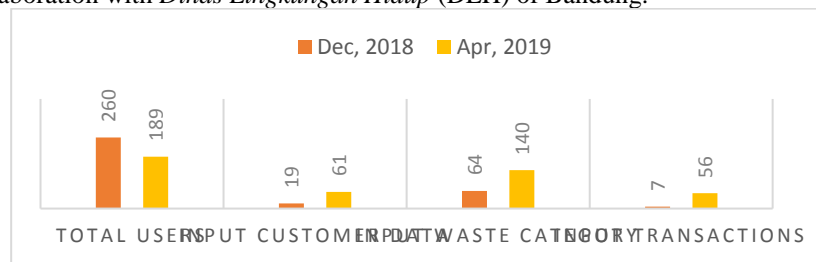

Figure 1. Chart of Activities Change Among BankSampah.id Users in Bandung After Collaboration with DLHK of Bandung

After the collaboration is held, Bandung seems to have a quite significant number of active users. As shown in Figure 1, the number of users that have input customer data increases 221% from 19 users to 61 users, the number of users that have input waste category data increases 118% from 64 users to 140 users, and the number of users that have input transactions also increases from only 7 users to 56 users. The only thing that decreases after the collaboration is the number of users. As stated by BankSampah.id director, it is because before the collaboration held, the users' data is cleaned and the users that show no cooperative feedback is removed from the system.

This improvement on users' activity shows that this collaboration is considered successful. If this collaboration is applied to other cities and provinces, the total amount of active users might be increasing. Before that, the collaboration with DLH of Bandung should be maintained. The problem is, the marketing team does not segment or classify the users as a reference for their marketing strategy. The treatments are given by considering one or two aspects about the user based on personal judgement and sometimes the treatment is given only after being requested by the users.

Since the concept of Segmenting, Targeting, and Positioning (STP) concept is proposed, marketing strategy become so close with the grouping process or classification. This is intended to make the marketing strategy become more targeted and structured. Clustering analysis then become more popular to be used as a tool for a precise classification before generating marketing strategy.

Punj & Stewart (1983) have described some uses of clustering analysis in marketing research, as for market segmentation, understanding buyers' behaviors, classifying products before introducing it to the market, market selection, etc. All those purposes of using clustering analysis is basically about reducing the data to develop aggregates of data which are more general and easily managed than individual observation. So, classification should be conducted before generating the marketing strategy so that the strategy can be easier to held since there is a reference about who to target, what treatment to give, etc.

For waste banks as the users of BankSampah.id, the classification should be held to understand their activity behavior in BankSampah.id as online management system. Users' activity can also show the customer value in the eye of company. To understand more about them in order to develop a better marketing strategy, the research on classification of waste bank based on their Customer Lifetime Value should be held.

2. Theoretical Review/Methodology

2.1 Waste Bank

Waste bank is firstly initiated in 2008 by Bambang Suwerda, a lecturer of *Politeknik Kesehatan Kementerian Kesehatan* in Yogyakarta (Tokoh Indonesia, 2011). Waste bank is a place for sorting and collecting recyclable or reusable trashes that has economic value. The trashes should be ones that have economic value because it will be processed further or sold to other parties so that he trashes deposited can be exchanged to money.

2.2 Marketing for Waste Bank

American Marketing Association (2013) has defines marketing as the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large. In short, Kotler & Keller (2012) describes marketing as identifying and meeting human and

social needs. Since there has been not much study on waste bank, marketing for waste bank is still in grey area that needs to be researched deeper and further. In waste bank system, there should be a manager who is responsible with the whole process inside waste bank. Based on field research, most of waste bank managers are adult to old people. The customers of waste bank are also from the similar demographic state. This type of people is usually new to technology. Some of them even have difficulties to understand about technology and prefer to use conventional methods on things they do, including waste bank management. It is not impossible to introduce online system to waste bank managers, but it will need a different approach considering the condition of people who are responsible to take care of waste banks.

2.3 Data Mining

Data mining—also known as Knowledge Discover from Data (KDD)—is a collection of exploration techniques for efficient automated discovery of previously unknown, valid, novel, useful, and understandable pattern in large database based on advanced analytical methods and tools for handling a large amount of information (Gupta, 2014). To complete this research, the concept of data mining will be used to classify the waste banks.

2.4 Clustering Analysis

Clustering analysis, or simply clustering, is the task of grouping a set of objects in the same group that are more similar, based on some measure, to each other than those in other group (Gupta, 2014). Han, et al. (2012) mentioned that there are 4 different types of clustering methods: Partitioning method, Hierarchical method, Density-Based method, and Grid-Based method.

2.5 Single Linkage Clustering

Single linkage clustering is one of hierarchical clustering methods. This method is based on the minimum distance between two objects and the connection within cluster is determined by the links between single entities. This single linkage clustering will group two objects with smallest distance. So, in each step, the number of clusters will decrease by one. The next shortest distance will be identified, so, it is whether the third object is grouped into the first cluster or the other two objects will form another cluster. The steps will be repeated until there is only one cluster left. The result of single linkage clustering can be presented in Dendogram or tree diagram.

2.6 Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is a multicriteria decision making approach initiated by Thomas L. Saaty (1990) in which factors are arranged in a hierarchic structure. Hierarchy is defined as a representation of a complex problem in a multi-level structure where the first level is the goal, followed by the level factor, criteria, sub-criteria, and so on down to the last level of the alternative (Darmanto, et al., 2014).

AHP uses a comparison judgement which is assessed by the number 1-9 (Table 1). This method also measures the consistency of the judgement. If the consistency rate is below 0.1 then the judgement needs to be revised.

Table 1. The Fundamental Scale of Absolute Numbers

Intensity of Importance	Definition
1	Equal importance
2	Weak or slight
3	Moderate importance
4	Moderate plus
5	Strong importance
6	Strong plus
7	Very strong or demonstrated importance
8	Very, very strong
9	Extremely important

2.7 Customer Lifetime Value

Customer Lifetime Value describes the net present value of the stream of future profits expected over the customer's lifetime purchases (Kotler & Keller, 2012). One of the most common methods for segmenting and identifying the customer values in company is RFM (Daoud, et al., 2015). RFM (Recency, Frequency, Monetary), which is proposed by Stone (1984), is a model that is used to analyze the customers based on their behavior to make predictions (Hughes, 1996). Wei, et al. (2012) developed an additional variable L (Length) to the model which measures the life length of customers and constructed LRFM model. Parvaneh, et al. (2014) did another research in combining AHP with clustering by adopting Liu and Shih's research method and adding the Potential (P) variable to generate LRFMP model recommendation.

2.8 Marketing Strategy

Marketing strategy consists of analysis, strategy development, and implementation of activities in: developing a vision about the market of interest to the organization, selecting market target strategies, setting objectives, implementing, and managing the marketing program positioning strategies designed to meet the value requirements of the customers in each market target (Cravens & Piercy, 2009, p. 13). So basically, marketing strategy is strategies that are developed based on the condition of the market of interest to the company or organization. This focus on organizational performance in customers' view.

2.9 Clustering Analysis in Marketing Strategy

Clustering method has been a common tool used in marketing research. Usually, the researchers use clustering as a classification tool, whether to classify the people, products, occasions, places, or any other things that are related to marketing strategy.

The most common use of clustering has been for segmentation because it is one of the most important part in developing marketing strategy. The next common use of clustering in marketing is in identifying the customer behavior based on the classification of buyers. It can also be used to identify the opportunities in developing new service, product, or strategy; select the test market based on its homogeneity within cluster; reduce the general data to develop data aggregates which are more general and easier to manage than individual observations.

2.10 SWOT Analysis

SWOT stands for Strength, Weakness, Opportunity, and Threat. It is an identification of systematical factors to formulate strategy by maximizing the Strengths and Opportunities and also minimizing the Weaknesses and Threats (Rangkuti, 2016, p. 19).

The tool that is used to develop marketing strategy from SWOT analysis is TOWS Matrix. This matrix shows how to combine between the internal strength, internal weakness, opportunity, and threat. The combination is then developed to create marketing strategy.

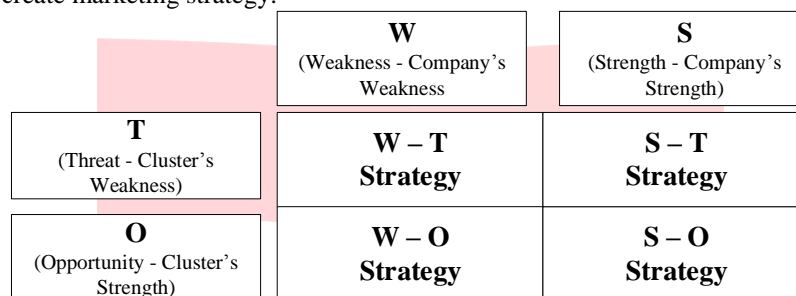|	**W** (Weakness - Company's Weakness	**S** (Strength - Company's Strength)
T (Threat - Cluster's Weakness)	**W – T Strategy**	**S – T Strategy**
O (Opportunity - Cluster's Strength)	**W – O Strategy**	**S – O Strategy**

Figure 2.TOWS Matrix

1. W – T Strategy: supports defensive strategy which minimize the weakness and avoid the threat
2. S – T Strategy: uses the internal strength to overcome the threat
3. W – O Strategy: makes use of the opportunity to minimize the weakness
4. S – O Strategy: makes use of all the company's strength and opportunity to gain as many benefits as possible
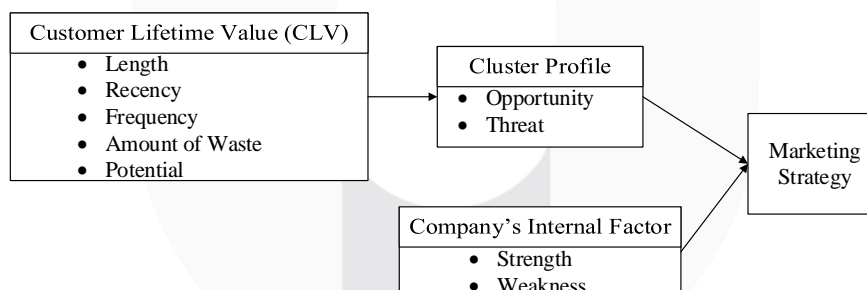
2.11 Conceptual Model

Figure 3. Conceptual Model

Conceptual model is a model that shows logical relationship between factors/variables that has been identified as important to analyze the research problems (Sinulingga, 2013). In this research, the LRFMP model (Parvaneh, et al., 2014) will be used as the parameter of waste bank potential. LRFMP model contains 5 variables that define 5 criteria: Length (L), Recency (R), Frequency (F), Amount of Waste (M), and Potential (P).

These 5 variables of CLV is used to develop cluster profile that contains of waste bank strengths and weaknesses. Variables with high values are considered as cluster's strength and the low values are considered as weakness. Because waste banks are external factors, so they are translated as opportunity and threat for the company. The opportunity and threat from cluster profile is then be combined by company's internal factors (strength and weakness) to develop marketing strategy using SWOT analysis.

3. Results

3.1 Profile of Research Object

The object of this research is BankSampah.id, which its profile is described in Table 2 below.

Table 2. BankSampah.id Profile

Object Name	BankSampah.id
Date of Establishment	September, 2015
Market Coverage	Indonesia
Type of Product	Web and Mobile Application

Market Target	Waste Bank all over Indonesia
Number of Users (per Dec, 2018)	2219 users
Source of Revenue	Investors, phone credits and billing sales using SmashPay
Partners	KLHK RI, Unilever, Summareccon Bandung, Allianz, Gojek

This research is conducted by analyzing the data of BankSampah.id users by taking sample in Bandung, Jawa Barat, Indonesia. BankSampah.id is an application developed by PT. Solusi Hijau Indonesia for waste banks to help them managing the transaction data in their waste banks. So, BankSampah.id users are the waste banks that already registered in BankSampah.id system, whether they continue using the application or not.

3.2 Analytical Hierarchy Process (AHP)

The recapitulation data of expert judgement is converted into the comparison matrix by using geometric mean since there are 4 respondents taken in this research. The comparison matrix can be seen in Table 3.

Table 3. AHP Comparison Matrix

Criterion 1	Criterion 2				
	L	**R**	**F**	**M**	**P**
L	1	0,1962	0,1517	0,1342	0,1678
R	5,0971	1	0,3398	0,2374	0,5081
F	6,5935	2,9428	1	0,8801	1,3161
M	7,4539	4,2129	1,1362	1	1
P	5,9579	1,9680	0,7598	1	1
Total	26,1024	10,3199	3,3875	3,2516	3,9921

The comparison matrix is then being normalized and transformed into normalization matrix as shown in Table 4 below.

Table 4. Normalization Matrix

	L	**R**	**F**	**M**	**P**	**Total**
L	0,0383	0,0190	0,0448	0,0413	0,0420	0,1854
R	0,1953	0,0969	0,1003	0,0730	0,1273	0,5928
F	0,2526	0,2852	0,2952	0,2707	0,3297	1,4333
M	0,2856	0,4082	0,3354	0,3075	0,2505	1,5872
P	0,2283	0,1907	0,2243	0,3075	0,2505	1,2013

After the data is normalized, the priority vector can be found and the result is shown in Table 5.

Table 5. Priority Vector of Variables

Criterion	Priority Vector
Customer Life	0,0371
Last Transaction	0,1186
Frequency	0,2867
Total amount of waste	0,3174
Total customers	0,2403

After finding the priority vector, the consistency of AHP judgement should be tested. The result of consistency test can be seen in Table 6.

Table 6. Consistency Test Result

λ max	5,1220
CI	0,0305
RI	1,12
CR	0,0272

The Consistency Rate of this AHP result is 0.0272 which is less than 0.1. So, the judgement is consistent.

3.3 Data Preprocessing

According to BankSampah.id users' data that has been collected, 128 out of 189 data contains of only Customer Life data. This means that the 128 users have not input any data at all since they registered to BankSampah.id. So, to make sure that the data processed in clustering is clean and consistent, the 128 objects with only Customer Life data will be excluded into a different section. So, there will be two sections in this clustering process: Active User (61 objects) and Inactive User (128 objects).

All the data is checked to be cleaned from the missing value and inconsistency, then transformed into the standardized and normalized value. The last step is detecting the outliers and it leaves 48 objects of Active User and 128 objects of Inactive Users.

3.4 Clustering

The clustering process is conducted by combining the AHP priority vector result with the normalized value of BankSampah.id users. It uses Single Linkage Clustering to execute the clustering process. Based on company's internal judgement, they want the Active User to be clustered into 5 clusters and Inactive Users into 2 clusters. The result of clustering process for Active User and Inactive User is shown in Table 7.

Table 7. Clustering Result

Section	Cluster	Total Member
Active User	1	2
	2	2
	3	29
	4	11
	5	4
Inactive User	6	116
	7	12

3.5 Clusters Profile

Each cluster has different value from each other and that's what makes them counted as different clusters. Some might have a higher value on one variable but lower on the other. Some might have all negative value. To understand that, the average value of each variables in the clusters will be counted and used to profile the clusters. The average value of variable within the clusters in Active User and the profile of each cluster can be seen in Table 8.

Table 8. Cluster's Profile of Active Members

Cluster	Cluster Profile
1	Cluster 1 contains of users that has been registered to BankSampah.id for 12 months in average, but there is no transaction conducted. Besides, it has a high number of customers (306 customers).
2	Cluster 2 contains of new users that is registered to BankSampah.id for around 3-4 months, but the users has already had many customers (169 customers). The frequency and amount of waste shows a moderate number which is 54.22 kg in total 83 transactions. On the other hand, the last transaction conducted is in previous 2 months, which means there is no transaction conducted in 2 months.
3	Cluster 3 contains of new users that has been registered to BankSampah.id for around 4-5 months. The frequency and amount of waste shows a high number which is 151.62 kg in total 273 transactions. The last transaction conducted is in previous 2 months and the total customer shows a moderate number which is 67 customers.
4	Cluster 4 contains of new users that has been registered to BankSampah.id for 4-5 months. It has a really high number of transactions which is 507 transactions with 939.52 kg of waste. In contrary, the customers they have are only 57 customers.
5	Cluster 5 contains of old users that has been registered for 33 months, but also has not conducted any transaction since the last 32 months. The frequency and amount of waste also show a low number which is 1 transaction with 4.57 kg of waste in total. The number of customers they have input is only 1 customer.

Inactive User contain of users that have not input any data at all since the day they registered to BankSampah.id. The only data they have is customer life data. So, the objects are only divided into 2 clusters which are older users and newer users. The profile of each cluster is shown in (table) below.

Table 9. Cluster's Profile of Inactive User

Cluster	Cluster Profile
6	Contains of old users with average customer life = 20 months
7	Contains of newer users with average customer life = 4 months

3.6 Marketing Strategy Using SWOT Analysis

Strength and weakness of the company can be seen in Table 10.

Table 10. Company's Strength and Weakness

Weakness	Strength
1. Lack of human resource 2. Lack of funds	1. Flexibility of the team 2. The system can be accessed anywhere at anytime 3. Dominating the market of online management system for waste banks 4. Partnership with government and companies

The marketing strategies are developed by considering and comparing the strength and weakness of the company and the cluster's profile by using TOWS matrix. The marketing strategies as the result of SWOT analysis can be seen in

Cluster	T-O	Marketing Strategy
1	**T** 1 - No transaction **O**	- Sort out the users (W1,2 – T1,2) - Communicate about transaction (S1 - T1) - Build trust (S3,4 – T1)

Cluster	T-O	Marketing Strategy
	1 - Length (12 months) 2 - Potential (306 customers)	- Introduce to mobile application (S2 - T1) - Private training (W1,2 - O1) - Mass training for waste bank managers (S2,4 – T2)
2	**T** 1 - Length (3 months) 2 - Recency (2 months ago) **O** 1 - Frequency (83 transactions) 2 - Amount of waste (54.22 kg) 3 - Potential (169 customers)	- Create a reminder to input transaction (W1,2 - T2) - Communicate about the transaction (S1 - T2) - Encourage to input the transaction at least once a month (S4 - T2) - Improve the customer and technical support (W1 - O1,2) - Give rewards to the most active user (S4 - O1,2,4)
3	**T** 1 - Length (4 months) 2 - Recency (2 months ago) **O** 1 - Frequency (151 transactions) 2 - Amount of waste (273.98 kg) 3 - Potential (67 customers)	- Create a reminder to input the transaction (W1,2 – T2) - Communicate about the transaction (S1 - T2) - Encourage to input the transaction at least once a month (S4 - T2) - Improve the customer and technical support (W1 – O1,2) - Give rewards to the most active user (S4 - O1,2,4)
4	**T** 1 - Length (4 months) 2 – Potential (57 customers) **O** 1 - Recency (less than 1 month ago) 2 - Frequency (507 transactions) 3 - Amount of waste (939.53 kg)	- Give tips on how to encourage people to deposit waste (W1 – T2) - Make a campaign about waste bank to encourage people to deposit on waste bank (S3,4 - T2) - Improve the customer and technical support (W1 – O1,2) - Give rewards to the most active user (S4 - O1,2,4)
5	**T** 1 – Recency (32 months ago) 2 – Frequency (1 transaction) 3 – Amount of waste (4.57 kg) 4 - Potential (1 customer) **O** 1 – Length (33 months)	- Sort out the users (W1,2 – T1,2) - Build trust (S3,4 – T1,2,3) - Mass training (S2,4 – T2) - Make a campaign about waste bank to encourage people to deposit on waste bank (S3,4 - T4) - Introduce to mobile application (S2 - T1,2,3) - Private training (W1,2 - O1) - Give a "welcome back" reward (S1,4 – O1)
6	**T** 1 - No customer data 2 - No transaction **O** 1 – Length (20 months)	- Sort out the users (W1,2 – T1,2) - Discuss about the zero activity with the government as the responsibility holder (S1,2,4 - T1) - Introduce to mobile application (S2 - T2) - Private training (W1,2 – O1) - Build trust (S3,4 – T1) - Give a "welcome back" reward (S1,4 – O1) - Mass training (S1,4 – O1)
7	**T** 1 - No customer data 2 - No transaction **O** 1 - Length (5 months)	- Private training (W1,2 – T1) - Discuss about the zero activity with the government as the responsibility holder (S1,2 – T1) - Introduce to mobile application (S2 – T2) - Improve the customer and technical support (W1 – O1,2) - Build trust (S3,4 – T1)

4. Conclusion

The conclusion of this research is as follows.

1) BankSampah.id user is divided into two section: Active User (48 objects) and Inactive User (128 objects). Active User is classified into 5 clusters: Cluster 1 with 2 objects, Cluster 2 with 2 objects, Cluster 3 with 29 objects, Cluster 4 with 11 objects, and Cluster 5 with 4 objects. Inactive Users is classified into 2 clusters: Cluster 6 with 116 objects and Cluster 7 with 12 objects.

2) In Active User section, Cluster 1 has 12 months of customer life, conducts 0 transaction, and has 306 customers; Cluster 2 has 3 months of customer life, has 169 customers, conducts 83 transactions with

54.22 kg of waste, and the last transaction is in 2 months; Cluster 3 has 4 months of customer life, has 67 customers, conducts 151 transactions with 273.98 kg of waste, and the last transaction is in 2 months; Cluster 4 has 4 months of customer life, has 33 customers, conducts 507 transactions with 939.52 kg of waste, and the last transaction is in less than a month; Cluster 5 has 33 months of customer life, has 1 customer, conducts 1 transaction with 4.57 kg of waste, and the last transaction is in 32 months. In Inactive User section, Cluster 6 contains of old users with 20 months of customer life and Cluster 7 contains of newer users with 4 months of customer life.

3) Marketing strategies developed for each cluster are:

a. For Cluster 1: sorting out the users, private training, communicating about the transaction, building trust, introducing to mobile application, and mass training.

b. For Cluster 2: creating a reminder, improving customer and technical support, communicating about the transaction, encouraging to input at least once a month, giving rewards to the most active user.

c. For Cluster 3: creating reminder, improving the customer and technical support, communicating about the transaction, encouraging to input the transaction at least once a month, and giving rewards to the most active user.

d. For Cluster 4: giving tips on how to encourage the customer to deposit, improve the customer and technical support, making a campaign about depositing to waste bank, and giving rewards to the most active user.

e. For Cluster 5: sorting out the users, private training, building trust, mass training, and making a campaign for society.

f. For Cluster 6: sorting out the users, private training, discussing about zero activity with the responsibility holder (government), building trust, giving a "welcome back" rewards, and mass training.

g. For Cluster 7: private training, improving the customer and technical support, discussing about the zero activity with the responsibility holder (government), building trust, and introducing to mobile application.

Reference

Booms, B. H. & Bitner, M. J., 1981. Marketing Strategies and Organization Structures for Service Firms. In: *Marketing of Services.* Chicago: American Marketing Association, pp. 47-51.

Cravens, D. W. & Piercy, N. F., 2009. *Strategic Marketing.* 9th ed. New York: McGraw-Hill/Irwin.

Daoud, R. A., Amine, A., Bouikhalene, B. & Lbibb, R., 2015. Customer Segmentation Model in E-commerce Using Clustering Techniques and LRFM Model: The Case of Online Stores in Morocco. *International Journal of Computer and Information Engineering,* IX(8), pp. 2000-2010.

Darmanto, E., Latifah, N. & Susanti, N., 2014. Penerapan Metode AHP (Analytic Hierarchy Process) untuk Menentukan Kualitas Gula Tumbu. *Jurnal SIMETRIS,* April, V(1), pp. 75-82.

Gupta, G. K., 2014. *Introduction to Data Mining with Case Studies.* 3rd ed. Delhi: PHI Learning Private Limited.

Hughes, A. M., 1996. Boosting Response with RFM. *Marketing Tools,* Volume V, pp. 4-10.

Jambeck, J. R. et al., 2015. *Plastic Waste Inputs from Land to The Ocean,* Washington DC: AAAS.

Kementerian Lingkungan Hidup dan Kehutanan Republik Indonesia, 2018. *Bank Sampah.* [Online] Available at: http://sipsn.menlhk.go.id/?q=bank-sampah [Accessed 20 August 2018].

Kementrian Lingkungan Hidup dan Kehutanan Republik Indonesia, 2018. *Bank Sampah.* [Online] Available at: http://sipsn.menlhk.go.id/?q=bank-sampah [Accessed 20 August 2018].

Kotler, P. & Keller, K. L., 2012. *Marketing Management.* 14th ed. New Jersey: Pearson education, Inc..

Parvaneh, A., Tarokh, M. J. & Abassimehr, H., 2014. Combining Data Mining and Group Decision Making in Retailer Segmentation Based on LRFMP Variables. *International Journal of Industrial Engineering & Production Research,* September, Volume XXV, pp. 197-206.

Perreault, W. D., Cannon, J. P. & McCarthy, E. J., 2014. *Basic Marketing: A Marketing Strategy Planning Approach.* 19th ed. New York: McGraw-Hill Irwin.

Punj, G. & Stewart, D. W., 1983. Cluster Analysis in Marketing Research: Review and Suggestions for Application. *Journal of Marketing Research,* May, XX(2), pp. 134-148.

Rangkuti, F., 2016. *Teknik Membedah Kasus Bisnis Analisis SWOT.* 21st ed. Jakarta: PT Gramedia Pustaka Utama.

Saaty, T. L., 1990. How to Make a Decision: The Analytical Hierarchy Process. *European Journal of Operational Research 48,* pp. 9-26.

Sinulingga, S., 2013. *Metode Penelitian.* 3rd ed. Medan: USU Press.

Stone, B., 1984. *Successful Direct Marketing Methods.* 3rd ed. Lincolnwood: NTC Publishing.

Tokoh Indonesia, 2011. *Bank Sampah Gemah Ripah.* [Online] Available at: https://tokoh.id/biografi/5-wiki-tokoh/bank-sampah-gemah-ripah/ [Accessed 22 August 2019].

Wei, J.-T., Lin, S.-Y., Weng, C.-C. & Wu, H.-H., 2012. A Case Sudy of Applying LRFM Model in Market Segmentation of a Children's Dental Clinic. *Expert Systems with Applications,* Volume XXXIX, pp. 5529-5533.