Analysis of the quadrant strategy for household solid waste management (Case study: BUMDes Amarta, Pandowoharjo Village Sleman Yogyakarta)

B T Sumbodo¹, Sardi¹, Sunarya Raharja¹, H Prasetyanta², and C Kusdarjito¹

¹Faculty of Agriculture, Janabadra University Yogyakarta, Jl. TR Tentara Rakyat Mataram 55-57 Yogyakarta, 55231, Indonesia
²AMPTA Yogyakarta, Indonesia

Email: tresno@janabadra.ac.id

Abstract. BUMdes Amarta is a company owned by Pandowoharjo Village, where one of the businesses is household waste management. This study aimed to examine the service quality of the BUMdes to seek customer performance and the importance of household waste management and determine the further management development strategy. This research was conducted for three months in mid of 2020. The data were collected using a questionnaire of 30 household waste customers and analyzed using satisfaction level analysis and development strategy quadrant analysis with the importance-performance analysis method. The main variables analyzed include five aspects: tangible, empathy, responsiveness, reliability, and assurance. Most of the customers assessed that they were satisfied with the feasibility of the garbage transporting vehicle. The polite officers' attitude when picking up the trash, informing the customer about the time to pick up the garbage, the certainty of the service schedule, the certainty of the cost of retribution, and the customer could trust the officer. Based on the level of conformity of expectations and performance, three attributes have poor performance: equipment for transporting garbage, uniform for officers, and safety and health equipment for transporters. The results based on quadrant analysis show that three attributes are the main priority: safety and health equipment for transport officers, officers' willingness to provide information and consultation regarding waste, and officers' readiness and responsiveness to respond to customer complaints.

1. Introduction
The waste problem is part of the environmental problem. The increasing number of populations with high growth rates and changes in consumption patterns results in high volume, type, and variety of waste produced. The Ministry of Environment (2014) states that the average volume of waste in Indonesia reaches 200 thousand tons per day, assuming that the waste produced by individuals every day is 0.8 kilograms. Household waste is the biggest contributor to waste. Household waste comes from kitchen waste, yard waste, or objects that are no longer used. Every activity, both production, and consumption will produce waste that requires serious handling. If not managed and controlled properly, it will cause environmental pollution. The more people who live in an area, the more waste will be produced in that area.

In general, the implementation of household solid waste services is carried out by way of collecting waste by door-to-door officers using garbage carts to people's homes. Garbage that has been collected in a garbage cart is transported to a Garbage Collection Place (TPS). This TPS is generally an open space located at a certain point (location) as a temporary place or container/trash car. After being
collected for a certain period and having met the TPS's volume capacity, the waste is then transported to the TPA (Final Disposal Site). There are still several weaknesses in the household waste management system, including the transportation of waste from people's homes within a certain time, for example, twice a week. As a result, garbage piling up in homes creates an unpleasant smell and sight. The waste transported has not been separated in terms of its types and characteristics, namely organic and inorganic waste. The carts that are used are in relatively poor condition, worn, dirty, and unkempt. It can even be said that the trash carts are not suitable for use.

The waste management method at the TPA is open dumping. The open dumping method is the simplest method, where garbage is simply dumped in an empty land, and left until it finally rots. This method has disadvantages including waste decomposition which takes a long process and time. The continuous application of this method will not be able to solve the waste problem that will continue to grow. This management system also demands a large space to accommodate garbage. Furthermore, according to Samin, in 2017 the open dumping system is considered to be no longer suitable to be a landfill for garbage, as usual, a source of disease, unpleasant odors and others.

According to Elli, (2016), there are two other waste management methods, namely controlled landfills and sanitary landfills [1]. Controlled Landfill, which is a development method of open dumping, where waste that has been dumped on empty land will be leveled and compacted with heavy equipment, then covered with soil. Meanwhile, a sanitary landfill, which is a method where garbage is dumped in a prepared hole, followed by compaction, then covered with soil as a cover layer [2]. The system is also equipped with an exhaust gas treatment plant and leachate (wastewater) [3]. This sanitary landfill method is a standard used internationally and requires the provision of infrastructure and facilities which are quite expensive [2].

Bumdes Amarta was officially established in 2011, with a business activity unit that is engaged in managing household waste to be processed into fertilizer. Unlike in general, household waste management uses the concept of the controlled landfill and sanitary landfills. Bumdes Amarta manages household waste by separating organic and inorganic waste. Inorganic waste is disposed of directly to the TPA in general, while organic waste is further processed into organic fertilizer.

The implementation of solid waste services as a form of public service to the community will influence the quality of solid waste service that is felt by the community as customers. The perceived quality of public services determines the level of customer satisfaction which in the end will determine the sustainability of the household waste management business because customers will determine the attitude whether to continue subscribing or stop based on the level of satisfaction with the services obtained. Based on the background of the problems above, this research was carried out by analyzing waste management strategies by Bumdes Amarta.

A research study has been conducted to examine the impact of technical support on customer satisfaction: the case of automotive paints. The study shows that among the five aspects of service quality, the ones that most attribute the value of technical support (knowledge and customer relationships) are assurance and reliability. Assurance is directly related to people factors, namely the ability of employees to serve customers so that trust and confidence are built, employee competence in carrying out certain work fields, and courtesy. Reliability is the main dimension in shaping consumer impressions and is a description of the company's ability to fulfill promises completely, precisely, and accurately to consumers for the products offered. The company's ability to meet the reliability dimension directly creates customer satisfaction [4]. The results of other studies indicate that reliability has an effect on customer satisfaction [5], and reliability is a variable that influences customer satisfaction [6].

Concerning Public Service, Zamil (2011) explains that the government as a big organization has its customers; those customers are citizens, businesses, and the public. The government through its agencies, departments, and ministries provides information and services for each group of its customers, and as a result, this performance can be judged fairly only by the customers [7].

Regarding the level of customer satisfaction, research conducted at the Kartini Mandiri Waste Bank, Pesanggrahan Village, Batu City shows that 5 variables have a satisfaction level of >1, namely waste separation specifications, customer registration process, membership type, teller desk, and savings interest. Meanwhile, the variables that are considered unsatisfactory or have a satisfaction
level <1 are the diversity of types of waste, weighing tables, customer service desks, availability of inorganic waste processing facilities and infrastructure, selling prices for waste, customer savings, savings, and loans and profit-sharing. [8].

By using the IPA method, a research study on the quality of website services shows that of the 22 attribute items studied four items are in top priority, and 10 items that need to be maintained by the manager of tokopedia.com. The factors found in quadrant II are important and critical to customer satisfaction. Therefore, the organization will continue to monitor them and ensure their importance. The results of other studies, regarding customer satisfaction with service quality and product prices in supermarkets with the IPA method, show 17 attributes that are made improvements and 10 attributes that need attention to be maintained by the company [9].

The purpose of this study is to evaluate service quality indicators. In relation to customer satisfaction at Bumdes Amarta. This institution was established and started to provide household waste services in 2011 with the concept of a door-to-door pick-up. The service has been running for a long time, but the number of customers has stagnated, not increasing. Although most of the customers are still loyal customers, some of them show dissatisfaction but there is no other choice.

2. Methods
This research is a descriptive study with a qualitative approach. According to Creswell, (2014) a qualitative approach is an approach used to explore and understand the meaning of an individual or group of people/society in certain social problems [10]. Neuman, (2014) argues that a qualitative approach can construct social realities and an understanding of culture. Besides, the qualitative approach also focuses on dynamic processes that can be seen from the observed events due to the direct involvement of researchers in qualitative research [11].

The data were collected through literature review, in-depth interviews, and observation. The literature review is used as secondary data to complement primary data. According to Alston and Bowles, 2003, the use of the literature review is to obtain pre-existing knowledge about the problem being studied, to find out how research is different from previous research. Meanwhile, documentation study as secondary data is also needed to support and strengthen the primary data obtained from field research activities. Interviews were conducted to obtain primary data related to the research topic. According to Neuman, 2013, field research interviews take place in several ways: unstructured, in-depth, ethnographic, open-ended, informal, and long. This study uses in-depth interview techniques using interview guidelines as a reference in conducting interviews so as not to deviate from the topic to be discussed.

2.1. Different Test of Expectations and Perceptions
In the context of Importance Performance Analysis, this test is carried out to test whether there is a gap between expectations and perceptions in the variables being analyzed. The test is done by differentiating the mean value between expectations and perceptions and the differences take place in the same sample group (same customers, filling out the same questionnaire). To test for gaps, the Wilcoxon Signed-Rank Test was used. The Wilcoxon Signed-Rank Test is applied to 2 score sets to be compared. The scores come from the same participants. The different scores are the Expectation score and Perception score. The same participants are the same customers. The Wilcoxon Signed-Rank Test was carried out using SPSS [12].

2.2. Importance-Performance Analysis
Importance-Performance Analysis (IPA) is a method of mapping the position of an entity toward enhancing its performance. In the early stages of the IPA research, the metrics that were examined focused on service quality at a car dealer as an object of study to evaluate a marketing strategy [13]. Since it was initiated, the IPA has been widely adopted in various fields such education [14], food and beverages [15], transportation [16], management accounting [17], hospitals [18], and others.

Research on the evaluation of the service performance of the Kartini Mandiri waste bank on customer satisfaction was carried out using the Important Performance Analysis method, which is a research method to measure the relationship between consumer perceptions and priority to improve
product / service quality, also known as quadrant analysis. IPA has been generally accepted and used in various fields of study because of its ease of application and display of analysis results that facilitate proposals for performance improvements [19].

To find out how much consumer expectations are for the quality of tokopedia.com’s services, a study was conducted using the Importance Performance Analysis method. The IPA method has the main function of displaying information related to service factors which according to consumers greatly affect their satisfaction and loyalty to certain e-commerce and service factor which consumers highly expected to be enhanced, because the current condition is not satisfying enough [20]. The IPA method has been applied to determine customer satisfaction at bhineka.com. The results of research by Dirgantara and Sambodo, (2015) show that bhineka.com must prioritize services on websites related to server speed so that load times are faster and add detailed information on goods or services offered to consumers [21].

IPA analysis has been accepted and used in various fields of study because of its ease of application and display of analysis results that make it easier to suggest performance improvements [19]; the same method has been carried out in research on the performance evaluation of waste bank services to measure the relationship between consumer perceptions and service quality improvement priorities as a quadrant analysis [22]. The main role of IPA is to show information on service factors which affect their satisfaction and loyalty according to consumers and service factors which consumers feel need to be improve, as the present situation is not satisfactory. The steps taken in calculating the level of satisfaction and interest level of waste bank customers are as follows:

1. Calculating conformity to the formula

\[
\text{LoC} = \frac{X \times 100 \%}{Y} \times 100 \% \quad (1)
\]

The level of conformity is used to see the level of customer satisfaction.

2. Calculate the location of the variable points on the Cartesian diagram using the formula:

\[
X_i = \text{The average weight of the } i\text{-th performance attribute rating} \\
N = \text{Number of respondents} \\
Y_i = \text{The average weight of the rating of the interest attribute } i\text{-th} \\
N = \text{Number of respondents}
\]

3. Determine the location of the intersection of two perpendicular lines on the Cartesian diagram with the following formula:

\[
X_i = \text{The average weight of the } i\text{-th performance attribute rating} \\
N = \text{Number of attributes} \\
Y_i = \text{The average weight of the rating of the interest attribute } i\text{-th} \\
N = \text{Number of attributes}
\]

4. Determination of the variables that fall into the 4 quadrants available in the Cartesian diagram

In this methodology, respondents were requested to determine the level of importance and performance of the organization, and then the mean values of importance and performance level is evaluated in the Importance Performance Matrix, where the x-axis shows perceptions while the y-axis shows expectations. After the results are gathered, the results will be presented on the form of four quadrants, based on the following chart.
3. Results and discussion

3.1. Level of Conformity between performance and importance

In the first step analysis of this research, the researcher must determine the C-line for the X-axis and C-line for the Y-axis. The way to find this is to make Table 1. The C-line for the X and Y axes is the same. It’s just that the plotting of the data is different. In this study, 5 indicators were used (tangible, empathy, responsiveness, reliability, and assurance) so the mean performance and mean importance were made based on the scores of each indicator.

Table 1. Mean Performance and Mean Importance

| Indicator   | mean Pi | mean Ii | Gap Pi-Ii | Tki (%) |
|-------------|---------|---------|-----------|---------|
| Tangible    | 2,58    | 4,29    | -1,72     | 59,00   |
| Empathy     | 3,33    | 4,27    | -0,93     | 78,13   |
| Responsiveness | 3,06  | 4,50    | -1,44     | 67,80   |
| Reliability | 3,76    | 4,36    | -0,60     | 86,07   |
| Assurance   | 3,78    | 4,21    | -0,43     | 89,61   |
| Total       | 16,50   | 21,63   |           |         |
| C-line      | 3,30    | 4,33    |           | 76,12   |

Source: Own compilation

Of the five indicators used to measure the level of conformity of performance with customer expectations, two of them, namely reliability and assurance, have the highest level of LoC (more than 80%), meaning that these two indicators very well meet customer expectations, two other indicators are empathy and responsiveness (LoC 60-80%) is at the second level, which is good, while another indicator, tangible (LoC <60%), is at the third level, which is good enough, there are no indicators that are not good enough to meet customer expectations.

By the Wilcoxon Signed-Rank Test Differences, it is found that the value of zcount 4.786> ztable 1.96 at a significance level of 0.05 then H0 is rejected and H1 is accepted, which means that there is a significant gap between importance and customer performance on the attributes used in this study.

3.2. Importance-Performance Analysis

In this study, the characteristic of the Importance Performance Analysis method is the use of cartesian quadrants. In this research, there are five indicators of service quality studied, namely Reliability, Responsiveness, Assurance, Empathy, and Tangible. Each indicator is represented by 5 question items. In the study, 5 indicators of service quality were measured by 20 attributes. In this case, the researcher wants to know the data plots for each item and each indicator.
The Cartesian diagram of service quality in Figure 2 illustrates that the attributes of safety & health equipment for transport officers, the willingness of officers to provide information & consultation concerning waste and the readiness & responsiveness of officers to respond to customer complaints, are in Quadrant A (main priority). The attributes of the feasibility of vehicles, certainty of service schedules, certainty and reasonableness of retribution fees, and trust that gives customers a sense of security are in quadrant B (maintain performance). In addition, equipment, uniforms for officers' attitudes to receive complaints, willingness to help with administration, and the ability of officers to handle waste are in Quadrant C (low priority). Meanwhile, polite attitude, security, and justice are in Quadrant D (excessive).

![Figure 2. Cartesian diagram](image)

There are managerial implications according to the results of the quality of service diagram. This institution should highlight the progress of the attributes of safety and health equipment for transport officers, the willingness of officers to provide information & consultation concerning waste, and the readiness and responsiveness of officers to respond to customer complaints who are in quadrant A. Recommended recommendations are to improve the attributes of safety and health equipment for officers to best serve the consumer. After that, the attributes in Quadrant B (feasibility of vehicles, the certainty of service schedules, certainty and reasonableness of retribution fees, as well as trust that provides a sense of security to customers) must be maintained because they are the strength of this institution's services. If not, then there is a risk of going into Quadrant A. Meanwhile, attributes in Quadrant C (equipment, the uniform attitude of officers in receiving complaints, willingness to help with administration, and ability of officers in handling waste) that have less urgency must also be taken care. The reason is, their existence remained needed and cannot be eliminated. Resources in Quadrant D (polite attitude, security, and justice) reflect the politeness attitude of officers who are still very strong in Javanese culture. This is a distinctive marker of the quality of service in the middle of the Javanese social life. The attribute of openness and friendliness of officers at the crossing needs to be maintained unless they enter Quadrant D with low priority.

Compared to the research of Tontini and Picolo (2013) this research supports the likelihood of IPA being explored for indicators of service quality [24]. Research results provide profound insights into management in order to improve service quality. While there are specific service characteristics, the information collected can be used in the selection of which features to enhance management in order to achieve greater customer satisfaction. For example, in a situation when the management of waste service examines, they must pay more attention to various related attributes. This will result in increased customer satisfaction more than ever. The results of the analysis of service quality in this
study confirm the research of Tzeng and Chang (2011) ini kok tdk sesuai format kutipan and Adinegara and Turker (2016). This shows that IPA can analyze service quality and provide information for management in taking strategic actions [25] [15].

The results obtained in this study confirm some of the previous studies even with different research objects. As previously mentioned, the analysis of customer satisfaction for Bumdes services is still rarely discussed. Therefore, this study contributes to developing a customer satisfaction system in Bumdes using service quality attributes. The findings of this analysis can only be applied to the present situation. This structure can, however, be extended to Bumdes or other similar institutions.

Results of the level of conformity the performance and expectations of the safety and healthy equipment attributes for the waste transport officers show unsatisfactory results. This is because officers assume that household waste has been placed in a dust bin and wrapped in a plastic bag so that all they need to do is take it without paying attention on healthy protocols. Meanwhile, during the Covid-19 pandemic, customers saw officers taking from houses to sorting without using personal protective equipment according to health standards. This condition makes the level of risk of being exposed to the coronavirus quite high for field officers who manage waste.

4. Conclusion

Of the 5 indicators of consumer satisfaction, which reflect 20 attributes, there are 2 indicators, namely reliability, and assurance, respectively at a very good level, two indicators, namely empathy and responsiveness at a good level, and one indicator, namely tangible at a good enough level. Of the 20 attributes, the customer assesses the level of conformity as very good for the attributes of the feasibility of transporting garbage vehicles, the attitude of polite officers when picking up trash, informing customers about the time to pick up garbage, the officer transporting garbage as promised customer administration records well, and customers can trust the officer. Meanwhile, the three other attributes, namely equipment for transporting garbage, uniform for officers, and safety and health equipment for waste transporters showed poor results.

The strategy for developing the waste management of BUMdes Amarta must be prioritized on three attributes, namely the safety and health equipment for waste transport officers, the willingness of officers to provide information and consultation regarding waste, and the readiness and responsiveness of officers to respond to customer complaints.

Attributes that must be maintained in service in order to remain superior in the eyes of customers are: the feasibility of transporting waste vehicles, informing customers about the time to pick up waste, the manager determines a reasonable retribution fee, the officer transports waste as promised (certainty of service schedule), the officer has administrative records customers well (certainty of retribution costs), customers feel safe when garbage officers enter the home area; customers can trust officers.

Other attributes that also need attention in the development strategy but with a low priority are equipment for transporting garbage, the uniform of officers and open attitude when receiving complaints, the willingness of officers to help customers in administrative matters, the ability of officers to be reliable in handling customer waste.

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