THE EXPLORATION OF CUSTOMER SATISFACTION MODEL FOR MUNICIPAL SOLID WASTE COLLECTION PERFORMANCE – A CASE STUDY IN SARAVANE CITY, SARAVANE PROVINCE, LAOS

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Abstract - This study was conducted to assess the customers' satisfaction level with solid waste collection service in Salavane city, Salavane province, Laos. The interviewed data from 132 households have been tested and analyzed for the correlations between influencing factors and customers' satisfaction. Through testing Cronbach's alpha coefficient and KMO and Bartlett test, as well as exploratory factor analysis, from 36 observed variables, the authors reduced to 18 significant observed variables. Multivariate regression analysis was applied to build a model to assess the level of satisfaction with solid waste collection services. The results show that "Responsiveness of workers", "Responsiveness of facility", and "Reliability" have a great influence on customer's satisfaction**.**

Key words - Waste Collection and Transport (WCT); Service Performance; Customer Satisfaction; Exploratory Factor Analysis; Multiple Linear Regression

1. Introduction

One of the basic missions assigned by the government to the administration is to provide public services. According to the current common understanding, public services are activities that serve the essential needs of society and people; for the common interests of the community and society, directly undertaken by the government or authorized to private organizations and individuals to ensure order, common interests, and social justice. In terms of service provision, public services include three types: public services in the non-business field; public services in the field of public utilities and public services in the field of state administration [1]. Accordingly, urban solid waste collection and transport (WCP) is a type of public service. The administrative system is increasingly developed, so public services are expanded in many different fields with increasing requirements for quality, and at the same time it is necessary to coordinate and harmonize individual aspirations with the interests of the community and the country. Many public service activities are gradually transferred to private sectors by the years [2].

Environmental protection socialization, including urban solid waste collection, is one of the basic solutions for environmental protection and sustainable development for the locality and the country. Currently, activities in solid waste management (SWM) are mainly undertaken by state-owned companies, except for a few urban areas with community participation but mainly collection and transportation. Thus, SWM is currently using a huge capital from the state budget, especially for waste treatment and destruction [3]. According to the trend, under the encouragement of central and local governments, private sectors will participate in SWM. To ensure efficient operation as well as increase competitiveness, besides economic efficiency, WCP service providers also need to start paying more attention to people's satisfaction with service quality.

One of the important factors reflecting service quality that is often concerned about is working efficiency, which is often expressed through economic efficiency (profit) under the competitive mechanism in the market. In addition, service quality is reflected in the satisfaction of customers (citizens), who are service beneficiaries. However, in recent times, according to the general trend, public service providers mainly focus on profits, so service quality tends to decrease, not meeting customer expectations [2].

Customer satisfaction is the level of emotional state derived from the comparison between the perception of the product/service with the customer's expectations when using the service [4]. Customer satisfaction is the response to the perceived difference between the customer's experience and the customer's expectations of the service. Satisfaction is a fundamental goal of business organizations because there is a positive relationship between service quality/performance and customer satisfaction [5].

Service quality is formed based on three main components including: Functional quality, technical quality, and service provider image. Service quality is the gap between the customer's perception and expectation when using the service. Service quality is the perceived level of customers when using the service [6]. On the other hand, customer-perceived value is the perceived quality that is proportional to the price of the product. Customer perceived value is the emotional relationship that is established between a customer and a supplier after the customer has used a product or service of the supplier and realizes that the product or service creates added value. Client's perception of value describes the balance between the quality of a product or the benefits they perceive from the product and the sacrifices they make when they pay for the product's price [7].

Therefore, customer satisfaction is a topic of interest to many researchers in many different fields. Studies often use SERVQUAL or SERVPERF scales to measure customer satisfaction in different fields [8]. Adil Mohd et al mentioned that the perceived factor was a better predictor of service quality by analyzing the relationship between customer satisfaction and purchase intention [9]. The development of the model of service quality involved a systematic research undertaking which began in 1983, and after various

refinements, resulted in the publication of the SERVQUAL instrument in 1985. Parasuraman et al argued that the initial ten dimensions that were believed to represent service quality were: (1) **Competence** is the possession of the required skills and knowledge to perform the service. (2) **Courtesy** is the consideration for the customer's property and a clean and neat appearance of contact personnel, manifesting as politeness, respect, and friendliness. (3) **Credibility** includes factors such as trustworthiness, belief, and honesty. It involves having the customer's best interests at prime position. It may be influenced by company name, company reputation and the personal characteristics of the contact personnel. (4) **Security** enables the customer to feel free from danger, risk or doubt including physical safety, financial security and confidentiality. (5) **Access** is approachability and ease of contact. (6) **Communication** means both informing customers in a language they are able to understand and also listening to the customers. (7) **Knowing the customer** means making an effort to understand the customer's individual needs, providing individualized attention, recognizing the customer when they arrive and so on. This in turn helps to delight the customers by rising above their expectations. (8) **Tangibles** are the physical evidence of the service, for instance, the appearance of the physical facilities, tools and equipment used to provide the service; The appearance of personnel and communication materials and the presence of other customers in the service facility. (9) **Reliability** is the ability to perform the promised service in a dependable and accurate manner. The service is performed correctly on the first occasion, the accounting is correct, records are up to date and schedules are kept. (10) **Responsiveness** is the readiness and willingness of employees to help customers by providing prompt timely services, for example, mailing a transaction slip immediately or setting up appointments quickly [10]. By the early 1990s, the authors had refined the model to five factors which in testing, appear to be relatively stable and robust: (1) **Reliability**: the ability to perform the promised service dependably and accurately. (2) **Assurance**: the knowledge and courtesy of employees and their ability to convey trust and confidence. (3) **Tangibles**: the appearance of physical facilities, equipment, personnel and communication materials. (4) **Empathy**: the provision of caring, individualized attention to customers. (5) **Responsiveness**: the willingness to help customers and to provide prompt service [11].

Cronin and Taylor modified the gap-based SERVQUAL scale into SERVPERF, a performance-only index. Their study was later replicated by Brady, Cronin and Brand [12], [13]. According to the SERVPERF scale, measuring service is considered a convenient and obvious method of assessing service quality based on measurement through the results of service quality. However, according to the SERVQUAL scale, the analytical framework easily causes confusion between customer satisfaction and customer service attitude [8]. Biljana Angelova et al assumed that service quality can be defined as “similar to an attitude”, and instead of “expected performance”, “actual performance” will define better service quality. Accordingly, service quality is evaluated only through customers' perception without evaluation of service quality in customer expectations, without weighting for each service quality component [14]. In addition, Hollis Landrum el at defined service quality by measuring only perceived service quality, instead of measuring both perceived quality and expectations [15]. Dyah R. Rasyida et al argued that the conceptual basis of the SERVQUAL scale is confusing with the service satisfaction and suggested leaving the perception alone, hence the SERVPERF model plays its role. The components and measurement variables of the SERVPERF scale are derived from the SERVQUAL scale: **Reliability, Responsiveness, Assurance, Empathy** and **Tangible** [16]. In 2020, M. Irfanullah Arfeen et al assessed the citizen perception on municipal solid waste management system in Guimaraes, Portugal. Quality of services were assessed in terms of tangibility, reliability, responsiveness, assurance, and empathy using SERVPERF scale to assess it in relation to the performance of services [17].

The comprehensive relation between the **perceived value** and overall satisfaction have been studied. Arcording to Zeithaml el at, perceived value is defined as the result of the comparison between perceived benefits and perceived sacrifices by the customer [18]. In addtion, by using the notion of trade-off, Buzzell and Gale argue that perceived service value is a ratio between perceived total benefits received to perceived total sacrifices taking into consideration the available offerings and perceived cost [19]. Research on many service industries also suggests that perceived value plays a more important role than perceived quality in influencing customer satisfaction and loyalty. A service offered to customers which they perceive as high in quality but not high in value is unable to attain a high level of customer satisfaction and loyalty [20].

Reputation is usually considered as the assessment in which a thing or any person is commonly held, as a name or favorable standing or as the way in which a particular person or thing is known for. The relationship between customer’s loyalty and image of company is drawn by the European Customer Satisfaction. A good reputed product/service will diminish the perceived risk connected with performance vagueness and information symmetry that lead to positive purchase and repurchase intent [21].

To improve customer's satisfaction with the quality of WCT services, increase revenue and ensure sustainable development, the authors conducted a study on the factors affecting customer satisfaction with the quality of WCT services in Saravane, Laos. In this study, customer satisfaction with service performance includes seven dimensions such as: **Reliability, Assurance, Service capacity, Empathy, Tangible, Reputation,** and **Perceived Value**. The observed variables were clarified by the Exploratory Factor Analysis (EFA) method, thereby establishing an evaluation model based on the Partial Least Squares Structural Equation Modeling (PLS - SEM) and Multiple Linear Regression (MLR).

2. Methodology

2.1. Hypotheses

H1: Citizens/customers of Salavane are satisfied with solid waste collection services.

H2: Perceived service quality mediates between the waste collection performance and customers satisfaction.

2.2. Research model

SERVPERF model consists of seven service dimensions: Reliability, Responsiveness, Service Capacity, Empathy, Tangible, Reputation, and Perceived Value was used to assess customer satisfaction (Figure 1).

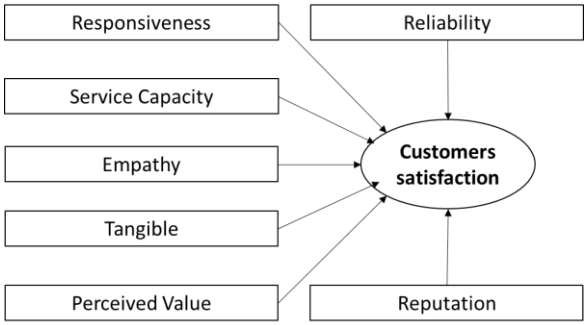

Figure 1. *Model of factors affecting customer satisfaction with waste collection service performance*

The "**Reliability**"component (**REL**) is reflected in the company's satisfactory dealing with people's complaints (REL1), waste collection time as announced (REL2), and no occurred mistakes (REL3). The "**Responsiveness**" component (**RES**) is expressed through several observed variables such as: the company collects all the garbage everyday (RES1), the workers support citizens to discharge garbage (RES2), the workers collect the bulky waste (RES3), the workers do not scatter garbage along the road (RES4), the leachate, odors are prevented from vehicles (RES5), the number and volume of dustbins are adequate (RES6), the dustbins' location is proper (RES7), workers are always ready to help when asked (RES8), workers are willing to work overtime when the amount of waste suddenly increases (RES9). The "**Service Capability**" component (**SER**) is explained through employees who create an absolute trust (SER1), are always polite and courteous (SER2), have working skills (SER3), the company designs proper collection point locations (SER4) and convenient collection schedule (SER5). The "**Empathy**" component (**EMP**) is reflected in the attitude of workers in guiding residents to dispose of garbage in accordance with regulations (EMP1), trying to keep the residential area clean (EMP2), listening to residents' opinions (EMP3), and respond to special requests from residents, such as having to go to the kitchen to collect garbage instead of in front of the house (EMP4). The "**Tangible"** component (**TAN**) is represented by the company having modern equipment (TAN1), clean and hygienic collection vehicles (TAN2), neat and professional work clothes (TAN3), and clear and detailed service invoices (TAN4). The "**Reputation**" component (**REP**) relates to company scale (REP1), well-known (REP2), reputation (REP3), and recognizable main offices (REP4). For the "**Perceived Value**" component (**PER**), the customer will consider the reasonable service fee (PER1) and waste collection efficiency (PER2).

2.3. Questionnaire design

A self-administered questionnaire was used for this study. All questions are standardized so that all respondents receive the same questions with identical wording. The questionnaire was designed to collect interviee's demographic information, such as gender, occupation, household's member, etc. In addition, the waste separation behavior of household was asked.

For waste collection service performance and satisfaction of households, the questionnaire sheets include 36 observed variables, expressed on a Likert scale from 1 to 5 with the following levels: 1 is "totally disagree"; 2 is "disagree"; 3 is "neutral"; 4 is "agree"; and 5 is "totally agree".

2.4. Research area

The research area was Salavane city (ສາລະວັນ), Salavane provine, Laos, with three community: Watkang, Nakokpho and Phonkeo, composed 803 households. The waste management in Salavane does not have sufficient consideration from the local government. Domestic waste is collected manually by tricycle to the meeting points, then delivered to the open dumping site 7 km nearby, where the waste is buried or open burning.

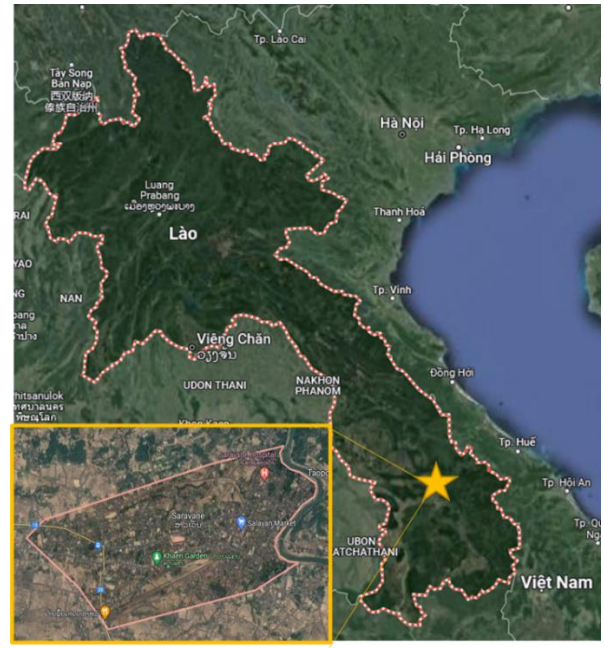

Figure 2. *Research area: Salavane city*

2.5. Data collection method

The sample size was based on the formular (1), and sumarized in Table 1.

$$n = \frac{N}{1+N\times e^2} \quad (1)$$

Where, n: Sample size, 132 households; N: Population, 803 households; e: Standard error, 5%.

Table 1. *General information of sample size*

No.	Community	Population	Sample
1	Watkang	160 (19.7%)	26
2	Nakokpho	350 (43.9%)	58
3	Phonkeo	293 (36.4%)	48
	Salavan	803 (100%)	132

Convenience sampling method was applied for this study to ensure that the data is rich in terms of age, education, income and residence or locality. The number of interviewed

households by each community was shown in Table 1. The authors directly interviewed representatives of households. To ensure that the questionnaires were properly completed, the authors double-checked the answers sheets. The first step was carried out immediately after the interviewees finished answering the questionnaire to detect omitted questions or misunderstood answers, and interview again if needed. The second step, the authors conducted when re-aggregating the data, removed invalid questionnaires.

2.6. Data analysis method

Analytical methods used including descriptive statistics analysis to assess the level of customer satisfaction. Cronbach's alpha test method to test the reliability of the scales. Exploratory Factor Analysis (EFA) is performed to group observed variables into factors on the principle of ensuring monism and convergence. Finally, the evaluation model is based on Partial Least Squares Structural Equation Modeling (PLS - SEM) and Multiple Linear Regression to test the hypothesis theories and models. Data were processed and analyzed using MS Excel and SPSS software.

3. Results and discussions

3.1. Descriptive statistics analysis

The descriptive statistics analysis results were shown in Table 2.

Table 2. *Descriptive statistics analysis results*

Characteristics	Frequency	Percent
Gender		
Male	44	33.3%
Female	88	66.7%
Occupation		
Civil servants	79	59.8%
Freelancer	11	8.3%
Business	31	23.5%
Farmer	11	8.3%
Living time in Salavane (years): Min: 7; Max: 39; Mean±SD: 23.1±7.6		
Family members: Min: 2; Max: 9; Mean±SD: 4.8±1.5		
Income (million Kip) Min: 1.5; Max: 3.5; Mean±SD: 1.9±0.3		
Tipping fee (thousand Kip) Min: 20; Max: 30; Mean±SD: 24±2		
Waste generation rate (g/cap.day) Min: 129; Max: 250; Mean±SD: 195±25		
Waste separation at source		
Yes	109	82.6%
No	23	17.4%
Discharge waste at the right place		
Yes	119	90.2%
No	13	9.8%

Survey results show that the majority of respondents are female (66.7%), and the most common occupation is a civil servant (59.8%). Each household has an average of 4.8±1.5 members, with an average time of living in the locality of 23.1±7.6 years, which is relatively long to be able to objectively assess the waste collection service performance in Salavane. Most households have a habit of sorting waste (recycled waste, leftovers) at the source at the rate of 82.6%, and most of them discharge their waste at the prescribed place (90.2%).

3.2. Reliability test results

The equivalence reliability of each scale should be assessed by using Cronbach's alpha test. Cronbach's alpha is the average of all possible split-half reliabilities projected onto the number of measures in the scale. Arcoding to Richard A. Zeller, Cronbach's alphas mirror instructional grades as follows: 0.9 or higher are considered excellent; 0.8 to 0.9 are adequate; 0.7 to 0.8 are marginal; 0.6 to 0.07 are suspect; and less than 0.6 are totally unacceptable [22].

The reliability test results in Table 3 shows that the reliability scale of 7 components (36 observed variables) with Cronbach's alpha coefficient from 0.61 to 0.86 are all greater than 0.6, except for the "**Reputation**" component which has the coefficient of the degree of precision Cronbach's Alpha scale reliability is 0.55 < 0.6, and Cronbach's Alpha coefficient if the removal of all components observed variables is less than 0.6. The results of reliability test of "**Reputation**" component did not achieve minimal reliability and were excluded from subsequent analyses. This result was not consitency with the statement from a study conducted by R. Gul in 2014. The author argued that corporate reputation is highly important to build a profitable enterprise. He believed that there is consensus on the advantages of sustained positive publicity for the corporate brand. He commented that reputation has a positive impact on the customer's satisfaction and loyalty, thus, creates value for the firms [21].

Table 3. *Reliability test results*

Components	Variables	Cronbach's alpha
Reliability	3	0.67
Responsiveness	9	0.73
Service Capability	5	0.69
Empathy	4	0.63
Tangible	4	0.61
Reputation	4	0.55
Perceived Value	2	0.67
Satisfaction	5	0.86

On the other hand, the analysis results also pointed out that the correlation coefficient of the total variable is from 0.328 to 0.819, except for the observed variables RES1 and RES4 have a "variable-total" correlation coefficient of -0.110 and 0.295, respectively, less than 0.3, so they were eliminated in the later analysis. Finally, the remaining 30 observed variables have analytical results with high reliability. In addition, the "**Satisfaction**" component (SAT) scale has Cronbach's alpha coefficient of 0.86, and the lowest "variable-total" correlation coefficient is 0.56. This component has high reliability. Therefore, all 7 components take 30 observed variables that are satisfactory for the exploratory factor analysis to reduce the observed variables belonging to the composition of common factor groups.

3.3. Exploratory factor analysis results

The KMO and Bartlett's tests were conducted to determine the possibility of guaranteeing the factor analysis. Table 4 shows that the KMO test result was 0.835, which was greater than 0.5 and the significance level in the Bartlett test is less than 0.05, so the observed variables are linearly correlated with the representative factor. The data,

thus, fulfilled the condition for exploratory factor analysis.

Table 4. *KMO and Bartlett's test results*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.835
Bartlett's Test of Sphericity	Approx. Chi-Square	1.525
	df	300
	Sig.	0.000

The Rotation Sums of Squared Loadings results in Table 5 shows that the analyzed variables are arranged into 6 groups corresponding to 6 factors, respectively. The results also show that the cumulative variance of 6 factors is 68.015%, meaning 68.015% of the change of the factors is explained by the observed variables. This value is greater than 50% and according to Gerbing and Anderson is consistent with the overall data [23].

Table 5. *Rotation Sums of Squared Loadings*

Component	Total	% Of Variance	Cumulative %
1	2.793	11.172	22.388
2	2.621	10.485	32.873
3	2.440	9.761	42.634
4	2.257	9.029	51.663
5	2.095	8.379	60.042
6	1.993	7.973	68.015

During the analysis of the factor rotation matrix, 7 observed variables with factor loading coefficients less than 0.5, which are not guaranteed, were removed in the factor rotation analysis, including: REL2 (0.48), RES7 (0.47), SER4 (0.43), EMP2 (0.48), EMP3 (0.43), TAN1 (0.49), TAN3 (0.44). Finally, 18 observed variables belonging to factors with factor loading coefficients greater than 0.5 and evenly distributed on factors, the results are shown in Table 6.

Table 6. *Rotated Component Matrix*

	Factor					
Variables	**1**	**2**	**3**	**4**	**5**	**6**
EMP1	0.76					
RES2	0.71					
RES9	0.68					
RES8	0.59					
RES3	0.58					
SER1		0.77				
SER2		0.75				
SER3		0.57				
RES5			0.80			
RES6			0.80			
SER5			0.72			
PER2				0.84		
PER1				0.81		
REL1					0.78	
REL3					0.64	
EMP4					0.56	
TAN4						0.86
TAN2						0.71

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

The rotated component matrix results show that the observed variables were rearranged into different groups, and therefore the factor components were organized as shown in Table 7.

Table 7. *The EFA's results*

Factor	Variables	Explanation
F1	EMP1, RES2, RES9, RES8, RES3	Responsiveness of workers
F2	SER1, SER2, SER3	Service Capability
F3	RES5, RES6, SER5	Responsiveness of facility
F4	PER2, PER1	Perceived Value
F5	REL1, REL3, EMP4	Reliability
F6	TAN4, TAN2	Tangible

3.4. Multiple Linear Regression analysis results

To assess customer satisfaction with solid waste collection service performance in Salavane city, a multivariate regression analysis model was applied with observed variables selected from the results of the exploratory factor analysis above. The multivariable regression model has the equation as followed.

$$SAT = \beta_0 + \beta_1 \times F1 + \beta_2 \times F2 + \beta_3 \times F3 + \beta_4 \times F4 + \beta_5 \times F5 + \beta_6 \times F6$$

The analysis results in Table 8 show that the importance of the variables affecting the customers' satisfaction is the highest "**Responsiveness of workers**" (33.2%), expressed through workers' willingness to help and support residents to collect waste. Workers directly interact with citizens (customers) during the working process, so it will greatly affect the satisfaction level of people. Therefore, improving the working skills, the gentle and professional attitude of workers is an important factor that the company needs to pay attention to. Similar as other service sectors, having a responsive culture at work will surely be worth it. The workers are required to improve their interpersonal communication and teamwork abilities. For further improvement, environmental awareness campaign should be held for local commune and workers, then they might grasp the resident's expectation and worker's difficults.

Table 8. *Model Summary*

Model	β	t	VIF	Contribution	Important
β_0	0.463	1.9^{ns}			
F1	0.321	4.7^{***}	1.6	33.2%	1
F2	0.053	0.9^{*}	1.6	5.5%	5
F3	0.237	4.4^{***}	1.2	24.5%	2
F4	0.031	0.7^{*}	1.3	3.2%	6
F5	0.204	3.8^{***}	1.8	21.1%	3
F6	0.120	2.3^{**}	1.2	12.4%	4
$R^2 = 0.78$					
Durbin-Watson = 1.76					

Note: ^{ns}: p>0.05; *: p<0.05; **: p<0.01; ***: p<0.001.

Next is the "**Responsiveness of facility**" (24.5%), explained by the regular maintenance, prevention of leachate and odors, investment for the appropriate number and volume of a dustbin, as well as establishment a proper collection time. Beside upgrading facilities and equipment to collect all the waste, the prevention of secondary pollution (odor, leachate) arising is also an important factor to satisfy the citizens.

The "**Reliability**" component (21.1%) was reflected in answering customer's questions, not making mistakes when providing services, as well as meeting special needs

of customers such as transporting bulky waste or picking up trash inside the kitchen instead of picking it up at the front gate. The "**Tangible**" component also significantly affects the satisfaction level (12.4%), reflected in detailed transaction receipts, as well as clean and hygienic collection facilities. "**Service Capability**" and "**Perceived Value**" components have relatively limited contributions to custumer's satisfaction.

4. Conclusions

The study on factors affecting the satisfaction level of Salavane residents with solid waste collection services performance is necessary and essential for environmental companies to improve quality serving.

The study established a model representing the relationship between influencing factors and custumer's satisfaction. From 7 components with 36 observed variables, the exploratory factor analysis results have been reduced to 6 components with 18 observed variables that affect residents' satisfaction with waste collection services performance, respectively by importance level: (1) Responsiveness of workers; (2) Responsiveness of facility; (3) Reliability; (4) Tangible; (5) Service capacity and (6) Perceived value. The reliability test results showed that "**Reputation**" component did not achieve minimal reliability and were excluded from the model. It is constrash with common relationship between reputation and customer satisfaction. According to the multivariable regression model analyses, the importance of the variables affecting the customers' satisfaction is the highest "Responsiveness of workers" (33.2%), followed by "Responsiveness of facility" (24.5%), Reliability" (21.1%), and "Tangible" (12.4%). "Service Capability" and "Perceived Value" components have relatively limited contributions to custumer's satisfaction.

The analysis results show that environmental companies need to pay more attention to the responsiveness of workers, working skills, attitudes to help residents, as well as upgrade their facilities and equipment to prevent the pollution such as bad odors and leachate from the collection vehicles to improve the waste collection service performance in Salavane.

The limitation of this study is evaluating the waste collection service performance in Salavane through the household's opinions. The future task of this study is to reveal the satisfaction on waste collection service performance at other relevant sectors such as business, public sector, and others.

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