Conjoint Analysis for New Service Development on Electricity Distribution in Indonesia

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Abstract. Many cases of illegal use of electricity in Indonesia is still rampant, especially for activities where the power source is not available, such as in the location of street vendors. It is not only detrimental to the state, but also harm the perpetrators of theft of electricity and the surrounding communities. The purpose of this study is to create New Service Development (NSD) to provide a new electricity source for street vendors’ activity based on their preferences. The methods applied in NSD is Conjoint Analysis, Cluster Analysis, Quality Function Deployment (QFD), Service Blueprint, Process Flow Diagrams and Quality Control Plan. The results of this study are the attributes and their importance in the new electricity’s service based on street vendors’ preferences as customers, customer segmentation, service design for new service, designing technical response, designing operational procedures, the quality control plan of any existing operational procedures.

1. Introduction
Illegal use of electricity in Indonesia is still rampant, especially for activities where the power source is not available, such as in the location of street vendors. It is not only detrimental to the state, but also harm the perpetrators of theft of electricity and the surrounding communities. These conditions trigger state electricity company of Indonesia to deliver new services to support many activities which location are uncertain, called SPLU, an electric charging stations. This product is expected to be the solution to reduce electricity theft and illegal electricity usage. This product will be launched first in DKI Jakarta, as one of coastal area in Indonesia, with the main target are the street vendors. This service is expected to help the street vendors to gain legal electricity and avoid electricity theft, since it may harm the state and endanger the street vendors as a user.

The first generation of SPLU is designed and made without customers’ involvement. The product has been designed without knowledge of preferences and expectations from customers. Lacks of knowledge about customer preferences were causing a perception gap between institution and customers. For example, 5500 VA power which was previously planned were over supply for street vendors, some of them when the preliminary project ask electricity power in range 450-1300 VA.

Learning from experience of production the first generation of SPLU, the company requires the development of a new service or new service development that systematically and accordingly to customers preferences service SPLU second generation which will be launched. It was common that new services were solely based on the experience of a team of developers. The subjective process will be difficult to implement the new service development competitive and sustainable [1]. Meanwhile, ideas for new service development preferably gained from customer suggestion, customer concern, and customer demographics [3]. With the design of the development of a new service or new service
development to suit the preferences of these customers, expected service SPLU second generation can meet the wishes of our customers and maximize the benefits of the SPLU.

New service development has been widely recognize, especially in academic community. Not always for profit business, NSD also effective to design a non-profit service, such as the emergency management services, to prevent another disaster for obtaining unhealthy foods [4] highlight the importance of all organization members’ involvement for a successfully NSD, such as front line employees [5] and also tied with the nature of dynamics team, including conflict intensity and frequency, and conflict management styles [6].

[7] Conducted a study to revealed important parameters in NSD process, that was grouped as locality, timing, and human resources internal factor. In NSD process, one important technique in determining the service attributes is conjoint analysis. Conjoint analysis is a powerful method to design both product attributes such as food product, packaging, or automotive [8],[9],[10],[11],[12], and service attributes, such as hotel services, tourism package, ecosystem services, and online business [13],[14],[15],[16].

The problems discussed in this research are: The customer’s considerate attributes to use SPLU; The design of the SPLU service according to customer's preferences if analyzed using conjoint analysis; Customer segmentation based on similarity of services customers preferences SPLU if analyzed using cluster analysis; The technical response that must be carried out by PT PLN Disjaya to meet the expectations and needs of the customer; How to design the right operations to do PT PLN Disjaya to realize the technical response that has been designed before; Quality control plan that was formed to be able to control the operational activities that have been designed.

According [17], New Service Development that is systematically done with 5 stages, consists of opportunity identification, customer understanding, concept development, process design, and refinement and implementation.

2. Methods
This study, the process of New Service Development (NSD) is done in five steps as shown in Figure 1.

Distributing questionnaires at this step to determine the most favoured stimuli by respondents based on the respondent’s preferences. The object of this research is the street vendors who trade on the official site based on the local government of DKI Jakarta (West Jakarta, Central Jakarta, South Jakarta, East Jakarta and North Jakarta).
3. Result and Discussion

3.1. Opportunity Identification
To create the new service development for second generation of SPLU service. The following diagram in Figure 2 is the interrelationship diagram that used as the basis to create the new service development for next generation of SPLU service. Figure 2 shows the existence of a discrepancy between the SPLU machine (1st generation) that will be placed in 16 locations in East Jakarta to the needs of the target customers. Before the next generation of SPLU machine place in the whole area in Jakarta, special research needs to find the customer’s preferences regarding the SPLU service. By creating the new service development for SPLU service next generation, the company can determine the customer’s preferences, customer segmentation, technical response to fulfill the customer’s needs, and control any operational activities.

3.2. Customer Understanding
To create the new service development for second generation of SPLU service. The following diagram in Figure 2 is the interrelationship diagram that used as the basis to create the new service development for next generation of SPLU service. Figure 2 shows the existence of a discrepancy between the SPLU machine (1st generation) that will be placed in 16 locations in East Jakarta to the needs of the target customers. Before the next generation of SPLU machine place in the whole area in Jakarta, special research needs to find the customer’s preferences regarding the SPLU service. By creating the new service development for SPLU service next generation, the company can determine the customer’s preferences, customer segmentation, technical response to fulfill the customer’s needs, and control any operational activities.

Conjoint Analysis
In conjoint study, the determination of attributes is done by reviewing the service design of SPLU next generation that has been designed by the development teams from PT PLN (Persero) Disjaya and examine the results of the survey that has been done by the company against target of customers, i.e. street vendors. Table 1 presented the attributes and levels of service on the SPLU machine.

![Figure 2. Interrelationship Diagram](image-url)
Table 1. Comparison Between Supply and Demand of Clean Water in Ambon Bay

| Attributes                  | Levels                        |
|-----------------------------|-------------------------------|
| Payment method              | Co-Branding with Bank         |
|                             | Electronic Money              |
|                             | Prepaid Token                 |
| Instruction to use          | Written Instruction           |
|                             | Audio Instruction             |
| And an entry                | 450 VA                        |
|                             | 900 VA                        |
|                             | 1300 VA                       |
|                             | 2200 VA                       |
|                             | 3500 VA                       |
|                             | 4400 VA                       |
|                             | 5500 VA                       |
| Paid Wifi as additional feature | Need                  |
|                             | Do Not Need                   |

Before analysis was conducted on the importance value and utility of each attributes and levels, an evaluation of the goodness of fit model of the correlation value that is has the Pearson’s coefficient < 0.05, then the model has accurately so that the calculation results worthy to be analyzed more.

From 180 data that has been collected, 180 respondents have seen that the Pearson’s coefficient < 0.05. This means all the answers given to respondent when filling the questionnaire has been accurate and consistent so it can analyze more. The following Table 2 is presented the conjoint analysis result that consist importance value and utility of each attribute and level from the preference analysis from 180 respondents on the year 2037, more sub-districts are having the land availability status of deficit. Thus, it is concluded that the land carrying capacity in Ambon Bay, is decreasing time to time, which is shown by the increasing land deficit in the sub-district units.

Table 2. Attributes and Levels of SPLU Service

| Attributes                  | Levels                        | Utility Estimate | Std. Error | Importance Value |
|-----------------------------|-------------------------------|------------------|------------|------------------|
| Payment Method              | Electronic Money              | -0.296           | 0.079      |                   |
|                             | Co-branding with Bank         | -0.283           | 0.079      | 33,951           |
|                             | Prepaid Token                 | 0.580            | 0.079      |                   |
| Instruction of Use          | Written Instruction           | -0.067           | 0.059      | 10,678           |
|                             | Audio Instruction             | 0.067            | 0.059      |                   |
| Power Capacity              | 450 VA                        | 0.076            | 0.116      |                   |
|                             | 900 VA                        | 0.717            | 0.116      |                   |
|                             | 1300 VA                       | 0.621            | 0.153      |                   |
|                             | 2200 VA                       | -0.162           | 0.153      | 47,386           |
|                             | 3500 VA                       | -0.343           | 0.153      |                   |
|                             | 4400 VA                       | -0.408           | 0.153      |                   |
|                             | 5500 VA                       | -0.501           | 0.153      |                   |
| Paid Wifi as Additional     | Need                          | 0.088            | 0.059      | 7,986            |
|                             | Do Not Need                   |                  |            |                   |
From the four existing attributes, the respondents considered the most important attributes of power capacity of SPLU service with a percentage of 47.38%. After that, followed by the attribute that has the priority to 2, 3, and 4 in the SPLU service are the payment methods (33.95%), the instructions for use (10.678%), and the attributes of paid wifi as additional facilities (7.986%).

The payment method attribute, respondents prefer prepaid token with the utility value of 0.58 as a medium through which consumers in the payment transaction before using electricity from the SPLU machine. The majority of respondents has last education in junior and senior high schools was minimal to determine the payment with electronic method. In addition, the determination of the prepaid token due to the comfort level of street vendors who have been using prepaid tokens in daily life.

The instructions for use attribute, respondents prefer the audio instructions from machine with a utility value of 0.67 as a way of delivering to consumers about steps when using electricity from the SPLU machine. The power capacity attribute, respondents were more likely to use the power of 450 VA, 900 VA, and 1300 VA with utility value respectively 0.076; 0.717; 0.621. This is because the street vendors have different type of merchandise and uses several electronic tools such as lights, fans, rice cooker, TV, music player, and blender so that the power of 450 VA, 900 VA, and 1300 VA can be used to power the electronic tools.

The attribute of additional facilities paid wifi, respondents consider additional facilities should be installed such as paid wifi. This is because the majority of street vendors aged between 21-30 years and 31-45 years. The age range was relatively young and understand the use of the internet.

Cluster Analysis
To classify the 180 prospective customers based on the similitarity of customer’s perception then do some steps. The steps is called two stage clustering that using Ward’s method and K-means [3]. The first step, Ward’s method is used to determine the optimal number of clustering [3]. The output of the Ward’s method was shown to the coefficient agglomeration schedule. Coefficient algorithm of 180 respondents causes elbow on the graph. Thus the number of the clustering can be found by the total number of respondents was reduced by the number of respondents who experienced elbow [3], namely (180-176) = 4 clusters

The second steps is used the K-means method, this method will show the number of members in each cluster and have been classify each respondent based on group respectively and show average values of SPLU service combination to all customers and each segment. To validate the clustering of potential customers, it can use the Analysis of Variance (ANOVA). Results of the F-test one way ANOVA shows p-value for all combinations which was obtained p-value < 0.05. This means that there are significant differences between each cluster on the service combinations on a machine SPLU.

The majority of respondents in cluster 1, aged between 25-30 years with the last education is high school. This cluster has the highest average value on a combination of services SPLU with details as follows: payment method - prepaid token, instructions for use – audio instruction from machine, the power capacity - 1300 VA, and the need to paid wifi as additional facilities. Respondents in cluster 2 consists of respondents aged between 31-45 years and graduated from high school. This cluster has the highest average value on a combination of services SPLU with details as follows: payment method - prepaid token, instructions for use – audio instruction from machine, the power capacity - 1300 VA, and the need to paid wifi as additional facilities.

Respondents in cluster 3 between the ages of 31-45 years old and have a high school education and the last is already trading more than 5 years. This cluster has the highest average value on a combination of services SPLU with details as follows: payment method - electronic money, instructions for use – written instruction, the power capacity - 1300 VA, and need to paid wifi as additional facilities. In cluster 4, majority of respondents were in the age range 31-45 years with the last education middle and high school and has been trading for 3-5 years. This cluster has the highest
average value in combination with the following services: payment method - prepaid token, instructions for use – written instruction, the power capacity - 450 VA, need to paid wifi as additional facilities.

3.3 Concept Development
At this stage, the method using Quality Function Deployment for translating customer needs regarding services SPLU (2nd generation) to be able to design the technical response to be made by the company to meet customer needs.

Identification Of Customer Needs
After observing directly to the target customers and reviewing the results of a survey that has been done by PT PLN Disjaya, there are some attributes that need to be considered in the design of SPLU services are payment method, usage instructions, power capacity and additional facility paid wifi. The priority attribute of the desire desire level based on customers obtained through the process of conjoint analysis in aggregate and individual.

Determine The Technical Response
Technical response is the things that should be done by PT PLN (Persero) distribution of Jakarta Raya to be able to develop and improve the service quality of the SPLU will be given to the customer. Some technical responses that must be done by the company include:

1. The sale of prepaid tokens with a smaller nominal
2. Designing the energy return system
3. Forming a special division to take care the entire operations of SPLU machine
4. Doing quality checking of SPLU machine before released
5. Designing instruction of using SPLU machine
6. In 1 SPLU machine will be provided some meters with different power capacity
7. Cooperating with the PT Icon+ to provide wifi service
8. Maintenance on a regular basis against SPLU
9. Cooperation with vendors that manufacture SPLU machine
10. Surveying on the target location
11. Introducing SPLU directly to target consumers

Determine The Technical Response
House of Quality (HoQ) is a matrix that represents the Quality Function Deployment (QFD). HoQ represents relationship between technical responses that has been designed by the Corporation with the needs of customers within the service SPLU (2nd generation) as can be seen in Figure 3.

Process Design
At this stage will be explained about the service of process that will be given to customers who presented in the draft blueprint and the operational service of the technical response that has been designed in the form of process flow diagrams. The process visualize by service blue print to show the design of the SPLU service system that will be given to customers ranging from entering the number token to use electricity from SPLU machine, and the design of the SPLU service starts from the customer's finished using electricity from SPLU machine to design the remaining energy return system.

Operational design for doing quality checking of SPLU machine before released are consist of operational design for maintenance on a regular basis against SPLU, operational design for partnership with vendors that produce SPLU machines, and operational design for location survey.

Refinement and Implementation
At this stage will be designed Quality Control Plan for each operational design which have been prepared so that all operations can run according to standard. Quality Control Plan consist:
a. **Quality Control Plan for Doing Quality Checking of SPLU Machine Before Released.** Quality checker teams must have a high degree of accuracy in order to avoid errors as there are components of the SPLU machine are not checked and errors in filling checklist.

b. **Quality Control Plan for Maintenance on a Regular Basis Against SPLU.** In regular maintenance of SPLU machine there are five processes, namely the checking condition of SPLU machine, report the results of checking, assessing the extent of damage and the cost involved, approving repair damage to components, repair damaged components, create reports on the repair components, review the components has been improved, making SPLU machine maintenance reports to the Distribution Office.

c. **Quality Control Plan for Cooperation with Vendor.** In cooperation with vendors, there are four processes that establish the criteria for selection of vendors, determine the appropriate vendor criteria, producing SPLU machine by vendor, evaluate the vendor performance.

d. **Quality Control Plan for Location Survey.** There are four processes of location surveys, namely in cooperation with the local government to find the official location for laid SPLU, conducted a survey directly to the proposed location, making the survey report of appropriate location to be paired SPLU to the Distribution Office, and issued the approval letter.

| Level | Customer Needs | Technical Response | The Relative Importance |
|-------|----------------|--------------------|------------------------|
|       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| L1    | 9 | 9 | 1 |   |   |   |   |   |   |   |   |
| L2    | 9 | 9 | 9 |   |   |   |   |   |   |   |   |
| L3    | 9 | 9 | 9 |   |   |   |   |   |   |   |   |

![Figure 3. House of Quality](image)

4. **Conclusion**

Based on the direct observation and survey by PT PLN Disjaya, here are several customer’s considerate attributes to use SPLU machine are payment method (with levels: co-branding with bank, electronic money, and prepaid token), instruction of use (with levels: written instruction and audio instruction), power capacity (with levels: 450 VA, 900 VA, 1300 VA, 3500 VA, 2200 VA, 4400 VA, and 5500 VA), and paid Wifi as additional facility. Based on data processing and analysis that has been done using conjoint analysis, design of the SPLU to meet the preferences of the customer is using the prepaid token as a method of payment, audio instructions from the engine, the capacity of power of 450 VA, 900 VA, and 1300 VA, and customers require paid wifi as additional facility.

The segmentation is done based on similarity on customer’s preference of SPLU service. Customer segmentation is done by using cluster analysis. Results from cluster analysis this is customers are divided into four clusters. After knowing the customer's needs to the services of the company, then the SPLU designing technical response to meet the needs of the customers. The technical response among other prepaid tokens with nominal sales are smaller, making locations and the introduction of the SPLU products directly to the target consumer.
From the technical response then would be designed to run the operations of the technical responses is structured. Some of the operational design that has been designed, among others, the design of the operational quality of the SPLU machine checked before the draft was circulated, the routine maintenance operations against SPLU, draft operational cooperation with vendors and operational design of the survey locations. From some operational design, the quality control plan will be designed for each process in the design of such operations in order to ensure that all operational activities already underway in accordance with standards and provide the results in the appropriate standard.

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