**Prediction Model of Customer Relationship Management to Generate Customer Segmentation of Electric Service Users Using Machine Learning**

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**Abstract.**

The increasing number of electricity users in Indonesia does not necessarily mean positive growth for the only electricity provider in Indonesia. Therefore, understanding customer segmentation and customer preferences is very important to increase customer satisfaction (ie PT. PLN Persero customers per customer). In response, we present new insights into power user customer segmentation and preferences using customer relationship management (CRM) with the help of Key Account Marketing (KAM). We use PT. PLN Persero's consumer data, from 2019 to 2020, operate three machine learning for classification (Decision Tree, Random Forest Tree, Xgboost) and compare it with Logistic regression to determine the segmentation model and customer preferences We propose four dominant customer segments and characterizing customer preferences for a single electricity provider in Indonesia. Finally, we offer a new framework using Customer relationship management (CRM) with the help of Key Account Marketing (KAM) to predict customer segmentation.

**Keyword**: Customer Relationship Management, Machine Learning, Key Account Marketing,

Prediction

# Introduction

Customer Satisfaction refers to the company's process of providing services to customers. Based on data taken from katadata.co.id, the increase in the number of electricity users in Indonesia from 2010 to 2020 was 33.25 percent. With such a large number of users, of course it requires a very large electricity supply, but PLN is one of the sole providers in Indonesia. experiencing difficulties because the supply of electricity to remote areas is still limited. Based on this information, in the next 10 years the Indonesian government plans to open the door for the private sector to enter the electricity transmission business. This step aims to ease the financial burden of the stun company, namely PLN. This makes PLN threatened because its customers can switch to using private electricity. In this case, PLN needs to understand customer segmentation in CRM which is useful for predicting or predicting customer characteristics in using PLN services, recognizing customer characteristics as PLN's future innovations so that customers are satisfied with PLN services. Customer Relationship Management (CRM) is a method of understanding customer behavior through intense communication with customers to improve performance, attract customers, retain customers, and increase loyalty and profitability [1]. Most of the previous CRM studies predict in terms of customer loyalty and customer satisfaction rarely. Beginning in 2020, Key Account Marketing is a systematic approach to managing and developing customers to achieve maximum value and mutually beneficial results and increase revenue. The Key Account Marketing function accelerates the delivery of information and accelerates service to Customers/Prospective Customers [2]. Key Account Marketing (KAM) is the ultimate goal to increase sales (sales) and more broadly, build relationships and partnerships with customers to establish strong business partnerships. Key Account Marketing can also be said to increase the effectiveness of Customer Relationship Management with the existence of Key Account Marketing which can create a new framework that can predict the extent to which customer satisfaction with the services or products offered by the company can increase company revenues. [3]. The two methods previously described are expected to create a new model that predicts customer satisfaction more quickly and accurately [4]. Machine learning is a tool used to predict customer satisfaction. We wanted to develop a predictive model by combining CRM and KAM to make it more effective. Using this new prediction model is expected to make machine learning predict faster than the model.

## Research Question

The following will be the research question to guide the research process:

1. How is the impact of using a combination of Customer Relationship Management and Key Account Marketing methods in measuring customer segmentation?
2. How effective is the implementation of Key Account Marketing in Customer Relationship Management?

## Research Objective

The research study aims to understand how effective Customer Relationship Management is against Key Account Marketing and PT. PLN Persero advantage of applying the combination methods. The following will act as the objectives of the study:

1. To create a new framework by adding Key Account Marketing in predicting customer segmentation.
2. To increase the effectiveness or speed in predicting Customer Relationship Management by adding Key Account Marketing.

# Literature Review

## 2.1 Machine Learning in Customer Relationship Management Framework

According to (Payne 2012), it is stated that Customer Relationship Management is a business strategy that implements the management of relationships between companies and customers to maintain those aimed at the prosperity of the company or organization by optimizing the company's ability to find connections between companies or organizations and customers to obtain special meaning. Relational marketing improvises by presenting innovative strategies for marketing concepts, encouraging a move from marketing orientation to customer acquisition (transactional) to focus on customer retention or loyalty (VAVRA, 1993). There are important factors, namely quality, customer service, and aftermarket customer loyalty. The following is previous research on machine learning in the CRM. Based on the research framework taken from Payne,2012 . The aim of this research is to categorize customers in terms of their buying habits and, more specifically, in terms of the product/service mix they tend to buy. This marketing objective is translated into data mining objectives of behavioral segmentation by using clustering algorithms to automatically detect natural clustering in the customer base. The end result of this project is the identification of different customer typologies and the assignment of each customer to the appropriate behavioral segment. Data selected for segmentation purposes include relative spend per trader. This information is available at the organization's data mining mart where credit card purchase transactions are differentiated by merchant category, enabling identification of each customer's purchasing preferences. According to Yeh et al. (2019), customer segmentation is obtained from customer satisfaction from services from the company, according to Fan, Chen, & Miao. (2018) Customers who are satisfied with the services provided by the company will repurchase the product. According to J.K.C. Chen, Batchulun, & Limits (2015) in their research explain determining customer segmentation using the Cluster Community Service method to determine the grouping of foods and beverages that are most often ordered by customers, this method is used so that companies can optimize sales and increase products that are liked by customers. In this case, it will develop the intention to buy again in the future, be willing to share experiences with others, not pay attention to competing brands, and even refuse service offers from other brands (Yeh et al., 2019). According to Taghizadeh et al. (2016), service providers must continue to innovate in their service offerings to increase customer satisfaction. Based on previous research, this study describes consumer satisfaction as consumer behavior after experiencing a certain product or service, whether the offer meets their expectations or not, and ultimately affects brand behavior in the future.

## 2.2 Key Account Marketing

Based on previous research conducted by (Hult 2019) Key Account Marketing is used for marketing companies or groups that have reached the limit and an idiosyncratic management approach in managing certain customers to their customers, namely loyal customers. These customers are critical to a company's future development, for example, because they represent a tremendous growth opportunity (Davies & Ryals, 2019; Homburg, Workman, & Jensen, 2002) or because working with customers allows the supplying company to produce more. products (Hakanen, 2019). According to (Ahmmed & Noor, 2019), Key Account Marketing is an approach taken by supplier companies that targets customer loyalty for various needs. Complex with special treatment aimed at the interests of both parties. There are four keys contained in the marketing key account are Earn, Save, Grow, Win Back. The four keys that have been mentioned are closely related to the concept of customer relationship management.The approach of Customer Relationship Management from top to bottom, while Key Account Marketing is the opposite.The literature on Key Account Marketing is still limited. The researchers developed Key Account Marketing by applying a conceptual framework to conceptualize and develop and test hypotheses. (Hunt, 1983, p., 10). Based on previous research, no one has combined the concept of Customer Relationship Management with Key Account Marketing and in previous studies no one has used data analytic methods or machine learning in Key Account Marketing. The following is table 1 of the literature review that has been collected from previous research.

Table

Reviewed Studies on CRM and KAM using Machine Learning

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Article | Model | Forecasted Value | Methods | Business Context |
| Chiang,2018 | CRM | Customer Loyal | Data Mining | Airplane |
| Health, 2011 | KAM | Company Revenue | Simple Regression | Hotel |
| Lee et al. l, 2011 | CRM | Customer Loyal | Simple Regression | Company |
| Rodriguez & Boyer, 2020 | CRM | Sales Peformance | Simple Regression | Company |
| Tworek, K., & Sałamacha, A. (2019 | CRM | Customer Peformance | Simple Regression | Company |
| Kim & Lee, 2015 | CRM | Consumer Segmentation | Hybrid Methodologi | Company |
| Coda & de Castro, 2019 | CRM | B2B | Simple Regression | Company |
| Madsen & Johanson, 2016 | CRM | Customer Loyal | Cluster Analisis | Company |
| Harbin et al., 2016) | CRM | Customer Loyal | Customer Segmentation | Company |
| Demo et al., 2018 | CRM | Customer Loyal | Data Mining | Airlines |
| Yuen & Chan, 2018 | CRM | Customer Loyal | E- CRM | Company |
| Wang & Brennan, 2014 | KAM | Employee Peformance | Interview | Company |
| Ivens et al., 2018 | KAM | Employee Peformance | Simple Regression | Company |
| Ahmmed & Noor, 2018 | KAM | B2B | Simple Regression | Company |
| This Study | CRM & KAM | Customer Segmentation | Logistic Regression,KKN, random forest Tree | Company |

# Methodology



Figure 1 Combining CRM Framework with KAM

Before going to the framework of methods, figure 1 shows the framework in this study. It was adapted from the CRM and KAM methods. Several steps must be done, namely preparing the data to be predicted, determining segmentation with KAM, determining the service with the highest prediction, determining which prediction model to use. Below are the methods are taken by the CRM and KAM framework.

## 3.1. Method

Figure 2 shows the framework in this study. It is adapted from the standard method for constructing predictions, analytic models. There are five stages: collecting data; selecting relevant predictor variables; determine potential prediction methods; evaluate, validate, and select the best prediction model; and finally reported research results.



Figure Prediction model framework

1. **PLN Data Collection**

In this study, we use PLN West Sumatra zone data. Our research used customer transaction data from January 2019 to December 2020, which consisted of 16,811,662 and 90 variables in 2 years. Table 2 shows the descriptive statistics for the dataset.

Table 2

Descriptive Statistics of The Datasets

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Data** | **Attribute** | **Statistics** | **Raw Data** | **Filtered Data** |
| Customer transactions 2019 | Number of Records  Period | Count  Min  Max | 8,005,831  1/1/2019  31/12/2019 | -  1/3/2019  20/12/2019 |
| customer transactions 2020 | Number of Records  Period | Count  Min  Max | 8,705,831  1/1/2020  31/12/2020 | -  5/7/2020  28/12/2020 |

1. **Choice of Variable**

The variable predictor is based on data obtained from the PLN West Sumatra Zone. There are about 80 variables, but not all of them are used then the variables are used only partly because it is not possible to do all the computations. Therefore, the selected variable has the highest potential. Table 3 shows detailed information about the variable predictors.

Table 3

Choice of Predictor Variable

|  |  |
| --- | --- |
| **Variable Prediction Of CRM** | **Variable Prediction Of KAM** |
| Rate | Peak Load Electricity Consumption |
| Month | Beginning of peak load time |
| Payment Code | End of Peak Load Time |
| Early Reading Rate | Peak Load Lighting Payment |
| End Reading Rate | Off peak Time Payment |
|  | Payments Of Street Lamp Lighting Expenses |
|  | Transformer Rental Fee |
|  | Electricity Payment Tax |

1. **Choisce of Potensial Method**

This research aims to develop a combined prediction model between CRM and KAM with coefficients and standard errors that can accurately predict whether customer satisfaction affects the company. Table 4 shows the prediction model that will be used in this study. Looking at multiple models in one machine learning model, researchers investigated both the ensemble model and the single model. In general, ensemble models are more accurate in predicting than single models. However, the single model still outperforms the ensemble model. Researchers used Linear Regression, Naïve Bayes. In the ensemble group, researchers used a cluster approach using the K-Means algorithm.

**C.1. Linear Regression**

Generally, Linear Regression is used to describe and test hypotheses. Therefore, choosing the correct variable and avoiding highly correlated variables must be considered when using Linear Regression. Furthermore, the variable predictors in linear regression can be categorical or numeric, and the target variable for linear regression is binary or dichotomous. Therefore, Linear Regression cannot predict the target variable for more than two classes. Although Linear Regression may have some disadvantages, it can often compete with other machine learning techniques, such as neural networks, machine support vectors, random forest, and gradient enhancement. Linear regression formulation is stated as follows:

Graphical user interface, text, application, email

Description automatically generated

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