Background

Listrik adalah energi vital bagi keberlangsungan aktivitas manusia baik bagi individu, kelompok masyarakat ataupun dunia industry (a). Seiring perkembangan energi listrik lebih banyak digunakan untuk melakukan aktivitas dengan manfaat yang sangat besar di mana berbagai peralatan untuk memenuhi kebutuhan hidup dioperasikan dengan menggunakan energi listrik (b). Kegiatan masyarakat cenderung meningkat seiring berjalannya waktu. Peningkatan kegiatan mendorong peningkatan pengoperasian peralatan dengan tenaga listrik. (sdasdasd). Selama periode konsumsi listrik tahun 2015 hingga 2020, Indonesia mengalami peningkatan konsumsi listrik sekitar 98,99% dengan pelanggan bisnis mendominasi konsumsi listrik terbesar (1). PT. PLN Persero merupakan satu-satunya penyedia listrik di Indonesia yang menyediakan daya listrik lebih tinggi untuk seluruh wilayah, termasuk wilayah Sumatera Barat. Sementara permintaan listrik pelanggan bisnis semakin meningkat, pemadaman listrik sering terjadi hingga frekuensi tinggi yaitu empat kali dalam sebulan. Berdasarkan hasil analisis data yang telah dilakukan, pemadaman listrik menyebabkan rata-rata waktu pemakaian listrik pelanggan bisnis berada di bawah 50 jam per bulan. Hal tersebut disebabkan pelanggan yang menggunakan daya diatas 200 ribu saat beban puncak daripada listrik di luar jam puncak. Pada jam-jam beban non puncak, pemakaiannya rendah.

Berdasarkan hal tersebut, perusahaan listrik harus memahami karakteristik penggunaan listrik pelanggan untuk memaksimalkan distribusi listrik. Sebagai contoh, rendahnya konsumsi pelanggan bisnis akibat pemadaman listrik (di bawah 50 jam per bulan) dapat ditingkatkan. Segmentasi pelanggan merupakan salah satu cara untuk memahami dan memetakan preferensi pelanggan. Menurut penelitian sebelumnya, segmentasi pelanggan mengacu pada pengelompokan pelanggan berdasarkan kesamaan karakteristiknya [3]. Dengan demikian, segmentasi pelanggan dapat dimanfaatkan untuk memprediksi tindakan prospektif dalam mengkonsumsi jasa. Bahwa pelanggan menggunakan dan membangun hubungan serta meningkatkan komitmen pelanggan untuk membangun bisnis yang solid [3][4].

Beberapa penelitian terdahulu membahas segmentasi pelanggan pada konsumsi listrik pelanggan [4], [7], [8], [10], [12]. dan permintaan listrik [7], [9]- [11]. Konteks penelitian lebih kepada menemukan pola perilaku pelanggan baru dalam mengkonsumsi listrik dan lebih banyak metode yang menggunakan kombinasi K-Means dan Self Organizing Maps (SOM) dan metode clustering lainnya [4], [7], [8], [10],[12].

Penelitian lain menggunakan metode regresi untuk segmentasi pelanggan [7], [9]- [11], mereka ingin memprediksi konsumsi listrik di masa depan untuk memenuhi permintaan listrik dari pelanggan. Hasil dari beberapa penelitian terdahulu memberikan rekomendasi untuk optimasi penggunaan listrik terhadap listrik yang telah disediakan [4], [7], [8], [10],[12]. Ada juga penelitian lain tentang menganalisis karakteristik pelanggan dengan menerapkan model K-Means Clustering dengan menganalisis tarif, daya, jumlah tagihan yang dibayarkan dan kemudian dari hasil model tersebut. Konsep tersebut digunakan dalam Customer Relationship Management (CRM) untuk mendapatkan wawasan atau membuat keputusan bisnis perusahaan [11].Penelitian sebelumnya tentang segmentasi pelanggan umumnya didasarkan pada total konsumsi listrik per hari [4], [7], [8], [10], [12]. Penelitian lain hanya menganalisis tarif, listrik, dan total tagihan dengan menggabungkan K-Means dan CRM [11].

Sejalan dengan itu, studi penelitian ini bertujuan mengisi kesenjangan tersebut dengan mengembangkan model segmentasi yang dapat mencerminkan perilaku konsumsi listrik. Temuan ini dapat membantu perusahaan listrik meningkatkan strategi mereka dalam menargetkan pelanggan sesuai dengan karakteristik mereka. Kami memasukkan tiga variabel dalam pengembangan model segmentasi segmentasi: kapasitas daya, konsumsi beban puncak, dan konsumsi beban non-puncak. Kami menggunakan K-means, pendekatan Analytic Hierarchy Process (AHP), dan aspek customer lifetime value. Dataset yang digunakan adalah data transaksi pelanggan PT. PLN Persero Wilayah Sumatera Barat dari tahun 2019 hingga 2020.

English

Electricity is a vital energy for the sustainability of human activities both for individuals, community groups and the industrial world (a). As the development of electrical energy is more widely used to carry out activities with enormous benefits where various equipment to meet the needs of life are operated using electrical energy (b). Community activities tend to increase over time. The increase in activities encourages an increase in the operation of equipment with electric power. (sdasdasd). During the electricity consumption period from 2015 to 2020, Indonesia experienced an increase in electricity consumption of around 98.99% with business customers dominating the largest electricity consumption (1). PT PLN Persero is the only electricity provider in Indonesia that provides higher power for all regions, including West Sumatra. While the electricity demand of business customers is increasing, power outages often occur up to a high frequency of four times a month. Based on the results of the data analysis that has been carried out, power outages cause the average electricity usage time of business customers to be below 50 hours per month. This is due to customers who use power above 200 thousand during peak load rather than electricity outside peak hours. During non-peak load hours, the usage is low.

Based on this, power companies should understand the characteristics of customers' electricity usage to maximize electricity distribution. For example, the low consumption of business customers due to power outages (under 50 hours per month) can be improved. Customer segmentation is one way to understand and map customer preferences. According to previous research, customer segmentation refers to the grouping of customers based on similar characteristics [3]. Thus, customer segmentation can be utilized to predict prospective actions in consuming services. That customers use and build relationships and increase customer commitment to build a solid business [3][4].

Some previous research discussed customer segmentation on customer electricity consumption [4], [7], [8], [10], [12]. and electricity demand [7], [9]-[11]. The research context is more about finding new customer behavior patterns in consuming electricity and more methods that use a combination of K-Means and Self Organizing Maps (SOM) and other clustering methods [4], [7], [8], [10], [12].

Other studies use regression methods for customer segmentation [7], [9]-[11], they want to predict future electricity consumption to meet electricity demand from customers. The results of some previous studies provide recommendations for optimizing the use of electricity against the electricity that has been provided [4], [7], [8], [10], [12]. There are also other studies on analyzing customer characteristics by applying the K-Means Clustering model by analyzing tariffs, power, the number of bills paid and then from the results of the model. The concept is used in Customer Relationship Management (CRM) to gain insight or make company business decisions [11].Previous research on customer segmentation is generally based on total electricity consumption per day [4], [7], [8], [10], [12]. Other studies only analyzed tariffs, electricity, and total bills by combining K-Means and CRM [11].

Correspondingly, this research study aims to fill the gap by developing a segmentation model that can reflect electricity consumption behavior. The findings can help electricity companies improve their strategies in targeting customers according to their characteristics. We include three variables in the development of the segmentation model: power capacity, peak load consumption, and non-peak load consumption. We used K-means, Analytic Hierarchy Process (AHP) approach, and customer lifetime value aspects. The dataset used is the customer transaction data of PT PLN Persero West Sumatra Region from 2019 to 2020.

RQ

Bagian sebelumnya menyoroti perlunya model prediksi segmentasi pelanggan konsumsi listrik yang akurat yang dapat membagi pelanggan berdasarkan segmentasi yang tepat. Hal ini juga membahas tentang strategi marketing yang tepat sesuai dengan karakteristik pelanggan mereka. Oleh karena itu thesis ini focus kepada pengembangan model hybrid segmentasi pelanggan konsumsi listrik di West Sumatera Zone dengan menggunakan data transaksi pelanggan listrik dari January,2019 hingga Desember,2020. Model prediksi dikembangkan berdasarkan model hybrid yaitu gabungan pembelajaran mesin yakni K-Means Clustering,Analytic Hierarchy Process (AHP) approach and Customer Liferime Value Aspect.

Berikut pertanyaannya

1. Bagaimana cara mengembangkan model segmentasi pelanggan yang akurat sesuai dengan karakteristik pelanggan listrik dengan menggunakan data transaksi West Sumatera Zone?
2. Bagaimana cara menerapkan strategi pemasaran sesuai dengan kriteria pelanggan berdarkan hasil model segmentasi pelanggan ?

English

The previous section highlighted the need for an accurate electricity consumption customer segmentation prediction model that can divide customers based on the right segmentation. It also discusses the appropriate marketing strategy according to the characteristics of their customers. Therefore, this thesis focuses on developing a hybrid model of electricity consumption customer segmentation in West Sumatra Zone using electricity customer transaction data from January 2019 to December 2020. The prediction model is developed based on a hybrid model that is a combination of machine learning, namely K-Means Clustering, Analytic Hierarchy Process (AHP) approach ,Customer Lifetime Value (CLV) Aspect and Customer Relationship Management (CRM).

For this purpose, the research questions are formulated as follows:

1. How to develop an accurate customer segmentation model according to the characteristics of electricity customers using West Sumatra Zone business customer transaction data?
2. How to implement marketing strategies according to customer criteria based on the results of the customer segmentation model?

RO

Considering the research question formulated above, the objectives of this study are defined as follows:

1. To develop a hybrid model of customer segmentation to find the right grouping of electricity customers according to their consumption patterns.
2. To apply the concept of Customer Relationship Management (CRM) Strategy according to the characteristics of its customers in order to meet the demand for electricity effectively.

RA and method

This thesis is a design science study that focuses on developing a hybrid model of customer segmentation models. This research uses data on business customer transactions of PT PLN Persero in West Sumatra region from January 2019 to December 2020. This research adopts the predictive analytics framework by Shmueli & Koppius (2011) to develop a hybrid segmentation model, which consists of data collection, data preparation, model development, model evaluation, model usage and reporting.

RS and Limitation

To emphasize the focus of this study, the research scope and limitations are defined as follows:

1. This study focuses on the electricity consumption of business customers specific to the Padang region. The selection of variables used power capacity, peak load consumption, and non-peak load consumption. Further research could investigate a wider selection of regions and a deeper selection of variables.
2. This study used one month of business customer transaction data. Future studies can use one year or more to be further examined as input for segmentation models.
3. This study examines proposals using a combination of machine learning models namely K-Means Clustering, Customer Lifetime Value and Customer Relationship Management (CRM) strategies. Other advance methods can be investigated in further research.

Writing Structure

This thesis is organized as follows: Chapter I presents the overview of the research background, research questions and correspondence objectives, research approach and method, research scope and limitations, and the writing structure of this thesis. Chapter II reviews related literature, identify the knowledge gap and presents the position of this study. Chapter III discusses the research philosophy, paradigm and methodology used in this study, which consist of data collection, data preparation, choice of variables, clustering model, and marketing strategy. Chapter IV presents the empirical results and analysis of the proposed hybrid segmentation model. Finally, Chapter V concludes the findings of this study, contributions, and present limitations alongside suggestions for future research.