

Analysis of Customer Loyalty and Satisfaction Using Structural Equation Modeling (SEM) Approach

Adinda Permata Sari^{1*}, Christian Harito²

¹ Master of Industrial Engineering, BINUS Graduate Program, Jakarta Indonesia.

² Industrial Engineering Department, BINUS Graduate Program - Master of Industrial Engineering, Jakarta Indonesia.

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Corresponding Author:

Adinda Permata Sari

adndaprmt@gmail.com

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Abstract: This study aims to analyze the factors influencing customer satisfaction and loyalty at PT. PLN (Persero) ULP Tanjung Morawa using the Structural Equation Modeling (SEM) approach. A quantitative method was applied by distributing structured questionnaires to 150 customers selected through purposive sampling. The analysis was conducted using SmartPLS version 3.0. The results indicate that customer satisfaction has a significant positive effect on customer loyalty. Furthermore, perceived service quality and perceived value significantly influence customer satisfaction, while trust has a strong and significant effect on customer commitment. However, trust does not directly affect customer loyalty. These findings suggest that improving service quality and building trust are essential strategies to enhance customer satisfaction and commitment, which in turn foster customer loyalty. The study provides practical insights for PT. PLN to refine its customer relationship strategies in response to competitive service demands.

Keywords: Commitment; Customer loyalty; Customer satisfaction; Perceived service quality; PT. PLN (Persero); Structural equation modeling (SEM); Tanjung Morawa; Trust

Introduction

Customer loyalty is a critical factor for the sustainability and profitability of businesses, both in the product and service sectors (Bowen et al., 2015; Khudhair et al., 2019). Loyal customers are more likely to make repeat purchases, recommend the company to others, and be less sensitive to price changes, which in turn contributes to a company's long-term success (Hair et al., 2010; Ilyas et al., 2020). One of the primary drivers of customer loyalty is customer satisfaction. When customers feel satisfied with the products or services they receive, they are more likely to develop an emotional attachment and trust toward the company, leading to loyalty (Mulady et al., 2023). Therefore, ensuring customer satisfaction is not only a means of retaining customers but also a strategy to enhance

profitability and market competitiveness (Rahim, 2016; Zhang et al., 2021).

PT. PLN (Persero) ULP Tanjung Morawa, as a public electricity service provider, faces various service-related challenges that can impact customer satisfaction and loyalty. These include frequent unplanned power outages, slow response times to complaints, lack of transparent billing information, and limited access to user-friendly payment systems (Al Kurdi et al., 2020; Zhang et al., 2021). Moreover, inefficient customer service handling and a lack of effective communication regarding tariffs or maintenance schedules may result in customer distrust and dissatisfaction. These issues highlight the urgent need for strategic improvements in service quality and customer engagement.

In the context of public utility services, such as electricity, customer loyalty is not only a reflection of service excellence but also an indicator of public trust in

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government-regulated entities. Improving customer satisfaction and loyalty is essential for PT. PLN in achieving its mandate of delivering reliable and accessible energy services to the public. Furthermore, in an era where digital services and customer expectations are rapidly evolving, companies must continuously evaluate the effectiveness of their service strategies to remain competitive and relevant (Dam et al., 2021; Otistovo, 2017).

Given this background, this study becomes highly relevant. It not only addresses practical problems faced by PT. PLN (Persero) ULP Tanjung Morawa but also contributes academically by examining the interrelationships among customer satisfaction, loyalty, and related variables using Structural Equation Modeling (SEM). SEM allows for comprehensive analysis by combining regression and factor analysis to explore complex causal relationships among latent constructs. The findings of this research are expected to offer actionable insights for PT. PLN's management in enhancing service quality, fostering customer trust and commitment, and ultimately strengthening customer loyalty. This research also serves as a reference for other public service organizations striving to improve customer-centric strategies in increasingly competitive service environments.

Method

Types of research is quantitative (Sugiyono, 2020). Data collection by distributing questionnaires to respondents. The process of compiling and processing the results of the questionnaire is carried out in several stages as follows: The data collection method in this study is: Questionnaire The questionnaire consists of a series of written questions submitted to respondents. In this study, the researcher used two variables, namely independent variables and dependent variables in data analysis. Independent variables are variables that are influenced, and dependent variables are variables that influence. The sampling method in this research is nonprobability sampling, that is, elements in the population do not have the same chance of being selected as a sample using a purposive sampling technique. In this technique, researchers choose purposive samples or subjectively aimed samples. This "purposive sample" was chosen because the researcher may have understood that the information needed could be obtained from a particular target group who were able to provide the desired information because they indeed had such information. Since the data analysis technique to be used is Structural Equation Modeling (SEM), the required sample size is a minimum of 100-150. Slovin's formula, this formula helps calculate the minimum number of samples needed so that the

research results can adequately represent the population (Sugiyono et al., 2021). Slovin's formula is:

$$n = \frac{N}{1 + \frac{N \cdot e^2}{240}}$$

$$n = \frac{240}{1 + (240) \cdot (0,05)^2}$$

$$n = \frac{240}{1 + (240) \cdot (0,0025)}$$

$$n = \frac{240}{1,6}$$

$$n = 150 \text{ Respondent}$$

Thus, the number of samples needed for a population of 240 with a margin of error of 5% is 150 respondents. This number is sufficient to ensure that the data obtained can accurately represent the population and produce valid findings. Researchers determined loyal customer respondents from PT. PLN (Persero) ULP Tanjung Morawa. The preparation of the questionnaire begins with compiling a Structural Equation Modeling (SEM) loyalty model design. Data is obtained from documents or respondent responses, either in the form of statistics or other forms for research purposes. In this study, the use of a questionnaire form is the first choice in data collection.

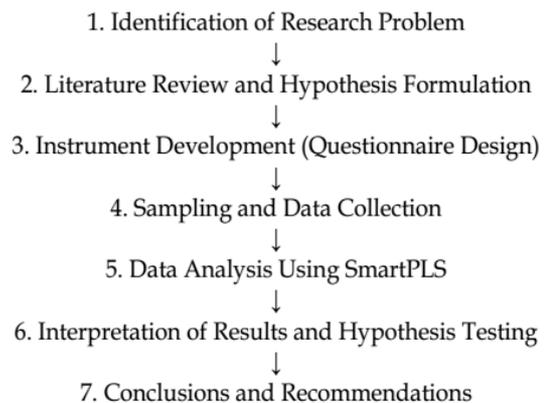


Figure 1. Flowcharts

The measurement of variables in this study uses a Likert scale. The Likert scale starts from strongly agree (SS), agree (S), neutral (N), disagree (TS), strongly disagree (STS) (Sugiyono, 2019). The following are the Likert scale measurement values in the questionnaire used, among others. Data analysis was carried out by the Partial Least Square (PLS) method uses SmartPLS software version 3.

Hypothesis testing using analysis full model structural equation modeling (SEM) with smartPLS. In full model structural equation modeling besides confirming the theory, Hypothesis testing is carried out by examining the probability value. For the probability value, the p-value with an alpha of 5% is <0.05. If the p-value is <0.05, the hypothesis is accepted, while if the p-value is >0.05, the hypothesis is rejected.

Result and Discussion

The algorithm results can be seen in the form of research model data that displays loading scores (outer

loading) (Sugawara et al., 2014). Using Smart PLS, the model is then executed. using the PLS Algorithm, the following is the PLS Algorithm display. The value of testing the research hypothesis can be described as shown below:

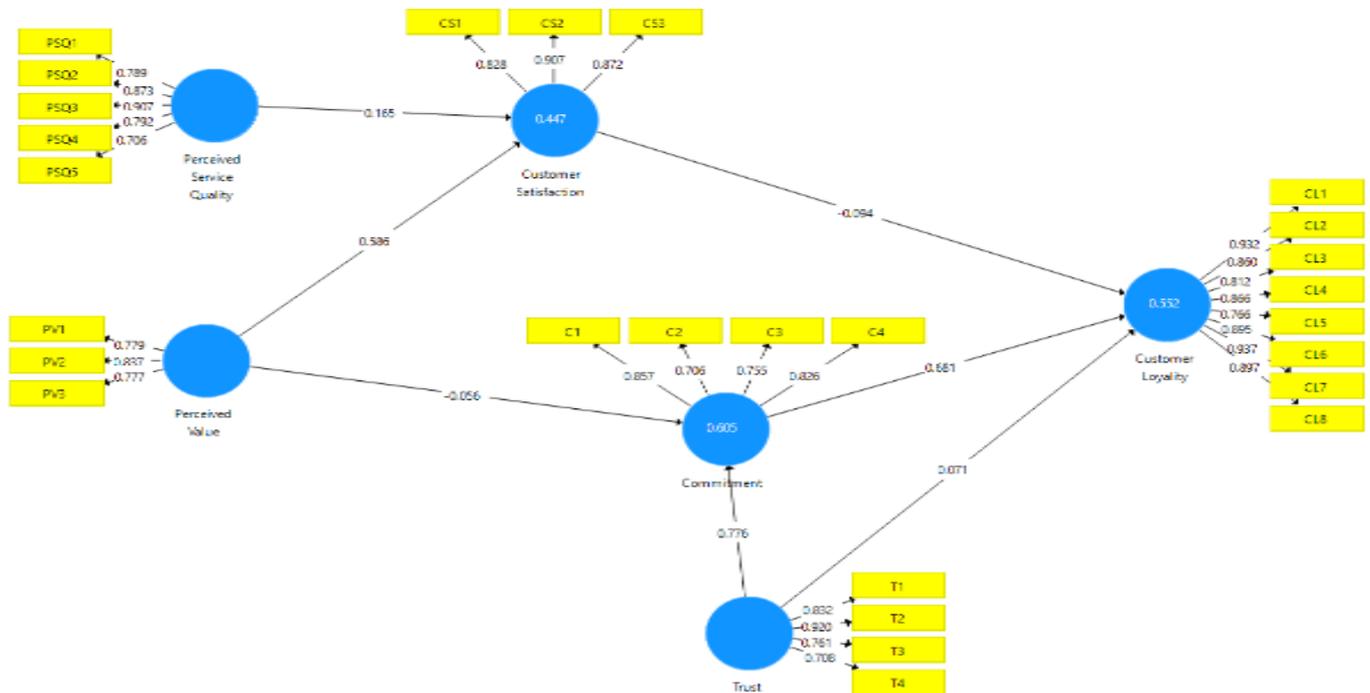


Figure 2. Researchs Model Results

In customer satisfaction theory, Trust and Commitment are often referred to as factors that influence the relationship between customer satisfaction and customer loyalty. For example, the Perceived Value Theory suggests that perceived value can moderate the relationship between Perceived Service Quality and customer satisfaction (Kumar et al., 2019). In this model, Trust and Commitment can be identified as moderating variables based on these theories. In addition to theoretical literature, previous research is also an important source for identifying moderating variables. Relevant empirical studies can provide evidence on variables that have been shown to moderate a particular relationship. For example, previous research shows that Trust moderates the relationship between customer satisfaction and customer loyalty, while Commitment moderates the relationship between perceived value and customer loyalty

Researchers can use these findings to support hypotheses in their research. The research context can also be a source of moderating variables. Factors such as industry, culture, or demographics can influence the relevance of certain moderating variables. In the service industry, for example, Trust may be more relevant as a moderating variable than in the manufacturing industry. Likewise, in certain cultural contexts,

Commitment may be more significant as a moderating variable than in other cultures. In this model, the research context can help explain why Trust and Commitment were chosen as moderating variables. Judging from the results of the PLS Algorithm in the figure, there are variables of organizational culture discipline, and lean management accounting that have correlation values above 0.70. However, in the research development stage, the loading scale of 0.50 to 0.60 is still acceptable. The output results of the SmartPLS graph are shown in Figure 1 which has met convergent validity because all factor loadings are above 0.50.

The validity test uses Pearson's product-moment correlation with a significance level of 5% ($\alpha = 0.05$). To assess good discriminant validity, the Average Variance Extracted (AVE) values for each construct should be greater than 0.50. Table 3 will present the AVE values for all variables.

Based on Table 2, it can be concluded that all the construct variables meet the validity criteria. This is indicated by the Average Variance Extracted (AVE) values for all construct variables being above 0.50, as recommended criteria, so the data used in this study is valid.

Table 1. Validity Test Construct Reliability and Validity

Variabel	Indicator Code	Outer Loadings Value	AVE	CR
Commitment	C1	0.857	0.795	0.621
	C2	0.706		
	C3	0.755		
	C4	0.826		
Customer Loyalty	CL1	0.932	0.955	0.761
	CL2	0.860		
	CL3	0.812		
	CL4	0.866		
	CL5	0.766		
	CL6	0.895		
	CL7	0.937		
	CL8	0.897		
Customer Satisfaction	CS1	0.828	0.838	0.756
	CS2	0.907		
	CS3	0.872		
Perceived Service Quality	PSQ1	0.789	0.880	0.667
	PSQ2	0.873		
	PSQ3	0.907		
	PSQ4	0.792		
	PSQ5	0.706		
Perceived Value	PV1	0.779	0.718	0.637
	PV2	0.837		
	PV3	0.777		
Trust	T1	0.832	0.823	0.654
	T2	0.920		
	T3	0.761		
	T4	0.708		

Table 2. Path Coefficients T-Values, P-Values

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Commitment -> Customer Loyalty	0.681	0.679	0.060	11,450	0.000
Customer Satisfaction -> Customer Loyalty	-0.094	-0.091	0.046	2,031	0.043
Perceived Service Quality -> Customer Satisfaction	0.165	0.172	0.070	2,338	0.020
Perceived Value -> Commitment	-0.056	-0.056	0.044	1,262	0.207
Perceived Value -> Customer Satisfaction	0.586	0.582	0.078	7,556	0.000
Trust -> Commitment	0.776	0.771	0.044	17,696	0.000
Trust -> Customer Loyalty	0.071	0.070	0.085	0.838	0.402

This table provides insight into the relationships between the various constructs in the model, including the original sample estimate, the sample mean estimate, the standard deviation, the T statistic, and the P value. The analysis reveals several significant relationships among the constructs. The relationship between Commitment and Customer Loyalty is strong and positive, with the original sample estimate being 0.681 and the T statistic being 11.450, which is highly significant (P value = 0.000). This indicates that the higher the level of commitment, the higher the customer loyalty.

The relationship between Customer Satisfaction and Customer Loyalty is negative, with an original sample estimate of -0.094. Although the effect is relatively small, it is statistically significant with a T

statistic of 2.031 and a P value of 0.043. This suggests that increased customer satisfaction may slightly reduce customer loyalty, although this finding is counterintuitive and requires further investigation. Perceived Service Quality has a positive effect on Customer Satisfaction, with an original sample estimate of 0.165 and a T statistic of 2.338 which is significant (P value = 0.020). This suggests that higher perceived service quality increases customer satisfaction.

The effect of Perceived Value on Commitment is negative and statistically insignificant, with an original sample estimate of -0.056, a T statistic of 1.262, and a P value of 0.207. This indicates that perceived value does not have a significant impact on commitment in this model. Perceived Value has a strong positive effect on Customer Satisfaction, with an original sample estimate

of 0.586, a T statistic of 7.556, and a highly significant P value (0.000). This shows that higher perceived value significantly increases customer satisfaction. Trust has a large positive effect on Commitment, with an original sample estimate of 0.776 and a T statistic of 17.696, which is highly significant (P value = 0.000). This shows that higher levels of trust result in greater commitment. Finally, the relationship between Trust and Customer Loyalty is positive but not statistically significant, with an original sample estimate of 0.071, a T statistic of 0.838, and a P value of 0.402. This shows that trust does not have a significant direct impact on customer loyalty in this model.

The results of this study provide important insights into the factors that influence customer loyalty. In the first hypothesis, commitment is found to have a positive and significant effect on customer loyalty (p-value = 0.000). This finding is consistent with the research by Rahim (2016) and Saleky et al. (2018), who revealed that customer commitment is a key determinant of long-term loyalty, especially in service-oriented industries. Commitment can be strengthened through loyalty programs, transparent communication, and consistently positive customer experiences.

Customer satisfaction also shows a positive effect on loyalty, with a p-value of 0.043. Although the effect size is relatively small, it aligns with the findings of Ilyas et al. (2020) and Priyo et al. (2019), who emphasized that satisfied customers are more likely to remain loyal and less likely to switch to competitors. Therefore, companies must continually improve customer satisfaction by enhancing product and service quality, responsiveness, and complaint resolution systems.

Service quality has a significant effect on customer satisfaction (p-value = 0.020). This supports previous studies by Khudhair et al. (2019) and Özkan et al. (2019), which concluded that high service quality—characterized by reliability, responsiveness, assurance, and empathy—leads to higher levels of customer satisfaction. PT. PLN should prioritize service excellence to meet and exceed customer expectations.

In contrast, perceived value does not have a significant influence on commitment (p-value = 0.207). This result is supported by Ali et al. (2021), who suggested that perceived value alone may not be sufficient to create commitment without being reinforced by trust and consistent satisfaction. Therefore, PLN must enhance the components of value—such as fair pricing, service benefits, and convenience—to make them more relevant and impactful.

However, perceived value significantly influences customer satisfaction (p-value = 0.000). Customers who perceive high value from a product or service tend to be more satisfied. This is in line with findings by Mulady et

al. (2023) and Zhang et al. (2021), which affirm that when customers feel they receive benefits relative to the cost and effort involved, their satisfaction increases. Offering competitive pricing, tangible benefits, and customer-centric services can strengthen perceived value.

Trust is found to have a strong positive impact on commitment (p-value = 0.000), consistent with Dam et al. (2021) and Fam et al. (2023), who highlighted that trust plays a central role in forming long-term customer relationships and fostering emotional attachment to the service provider. Building trust requires transparency, consistent service delivery, and ethical business practices.

Nonetheless, trust does not have a significant direct effect on customer loyalty (p-value = 0.402). This suggests that while trust is necessary, it alone is insufficient to drive loyalty unless accompanied by satisfaction, value, and commitment. This result echoes findings by Otsetova (2017), who noted that trust more effectively influences loyalty through mediating variables like satisfaction or commitment.

In summary, the findings highlight the importance of commitment, customer satisfaction, service quality, and perceived value in influencing customer loyalty. While trust remains an essential foundation, it must be integrated with other relational factors to be effective. A holistic customer relationship strategy that incorporates all these variables is crucial for PT. PLN (Persero) to strengthen customer loyalty in an increasingly competitive service environment.

Conclusion

The results of this study show that commitment has a strong and significant positive influence on customer loyalty, indicating that higher customer commitment leads to greater loyalty. Although customer satisfaction also significantly affects loyalty, the effect is negative and relatively weak, suggesting the need for further investigation into this anomaly. Perceived service quality significantly enhances customer satisfaction, while perceived value positively influences satisfaction but does not significantly affect commitment. Trust plays a crucial role by significantly influencing commitment, though it does not directly impact loyalty—its influence appears to be indirect through commitment. The most dominant factor in increasing customer loyalty is trust through commitment, followed by commitment itself, while other variables such as perceived value and service quality contribute indirectly through satisfaction. These findings highlight the importance of integrating trust, commitment, and service strategies to build long-term customer loyalty.

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Author Contributions

Conceptualization: A.P.S and C.H; data curation: A.P.S and C.H. funding acquisition: A.P.S and C.H methodology: A.P.S and C.H, visualization: A.P.S and C.H writing – original draft: A.P.S and C.H writing: A.P.S and C.H – review & editing: A.P.S and C.H.

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Conflicts of Interest

No Conflicts of interest.

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