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The Mediating Role of E-Customer Satisfaction on PLN Mobile Application Users: An Analysis of the Influence of E-Service Quality and E-Trust on E-Customer Loyalty

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Keywords

e-service quality,
e-trust,
e-customer satisfaction,
e-customer loyalty

Abstract

This study aimed to analyze the influence of E-Service Quality and E-Trust on E-Customer Loyalty, with E-Customer Satisfaction as a mediating variable. This research was motivated by a phenomenon gap at PLN UP3 Yogyakarta, where massive digital promotions coexisted with persistent customer complaints, and a research gap concerning the inconsistent findings on the direct influence of E-Service Quality and E-Trust on E-Customer Loyalty. This study used a quantitative approach with a sample of 132 PLN Mobile users in the PLN UP3 Yogyakarta area, selected via purposive sampling. Primary data were collected via online questionnaires and analyzed using Partial Least Squares-Structural Equation Modeling (PLS-SEM) with SmartPLS 4. The research findings showed that E-Service Quality and E-Trust had a non-significant effect on E-Customer Loyalty. Meanwhile, E-Service Quality and E-Trust had a significant impact on E-Customer Satisfaction, and (H5) E-Customer Satisfaction had a significant impact on E-Customer Loyalty. This finding proved that E-Customer Satisfaction acted as a full mediator (full mediation). The implication was that the loyalty of PLN Mobile users in Yogyakarta could not be built directly by service quality or trust, but must instead be achieved through customer satisfaction as the primary bridge.

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INTRODUCTION

In the digital era, advances in information technology have changed the way companies operate, forcing them to shift from conventional services to more efficient digital platforms. Digital transformation is a process in which an organization adapts to environmental dynamics by leveraging digital technology to create and enhance value. (Skolastika & Hidayat, 2025). Companies, including state-owned enterprises, must now adopt mobile applications as their primary tool for customer interaction. This step also improves the overall customer experience. Therefore, digital transformation has become crucial for maintaining competitiveness in an increasingly connected market (Saputra et al., 2023; Yusuf et al., 2025).

PT PLN (Persero) has taken strategic steps to respond to the need for digital transformation by launching the PLN Mobile application, designed as an integrated solution to meet various customer needs (Ramadanty & Christin, 2023). This application promises fast, accurate, and accountable services, as reported by Metro Jateng (2024). In Yogyakarta, the application plays an important role, evidenced by the 'HPN Jateng Award 2024' for the innovation it has introduced (Arus Utama, 2024). Additionally, programs such as 'PLN Mobile Gelegar Musik Prambanan 2024' demonstrate PLN's efforts to increase active user engagement (PLN, 2024). Thus, this application not only enhances service efficiency but also strengthens customer relationships.

Nevertheless, this study was conducted to address the gap in the phenomena identified in the field. The application that has been heavily promoted has not fully improved customer satisfaction at PLN UP3 Yogyakarta. Data shows that management needs to be more responsive to customer complaints (Prayogi, 2025), indicating that customer satisfaction remains an important issue. This gap is evident from customers at ULP Yogyakarta City, who still have to visit the office for administrative services (Deni, 2024), that should be resolvable with digital features. This suggests a potential problem with the application's Electronic Service Quality and Electronic Trust.

The novelty of this research lies in introducing the E-Customer Satisfaction variable as a mediating variable to address gaps in the previous literature regarding the mechanism of E-Customer Loyalty formation. This gap focuses on whether there is a direct influence of E-Service Quality (ESQ) and E-Trust (ET) on E-Customer Loyalty (ECL). One line of research found a significant direct influence. Guterres et al. (2024), in their study on PLN Mobile in Malang, found that ESQ has a direct and significant effect on loyalty, while also being mediated by satisfaction (partial mediation). This finding is supported by Pasaribu (2023), who studied the Grab application in Medan, and also concluded that both ESQ and ET have significant direct effects on ECL. Similarly, Saputra et al. (2023), who also studied PLN Mobile in Malang, found that Customer Trust is a significant direct driver of Customer Loyalty

On the other side, conflicting findings emerged from the second research group. Fitriani et al. (2022), in their study on the e-commerce platform Zalora, specifically found that the path from E-Service Quality to E-Customer Loyalty was not significant. The study concluded that satisfaction acts as a full mediator, where service quality alone is not sufficient to create loyalty. This gap is reinforced by the research of Ramadhan & Sugiyanto (2023) on the e-commerce platform Sociolla, which found that Customer Trust does not have a significant effect on E-Customer Loyalty, either directly or through mediation. These findings are also supported by

Sadeghi et al. (2021), who concluded that E-Trust does not have a significant effect on E-Customer Loyalty.

THEORETICAL STUDY AND HYPOTHESIS DEVELOPMENT

E-Service Quality encompasses the reliability and efficiency of the platform (Parasuraman et al., 2005), and theoretically, it can directly build loyalty because a good user experience creates switching barriers for customers. A review of empirical literature shows a significant conflicting evidence gap in this pathway. One group of studies finds that ESQ is a direct driver of loyalty. Guterres et al. (2024), in their study on PLN Mobile in Malang, found that service quality has a direct and significant effect on loyalty. This finding is supported by Pasaribu (2023) in the context of the Grab app and Triatmojo et al. (2025) on PLN Mobile in Bukit Tinggi. Conversely, conflicting findings emerge from the second research group. The study by Fitriani et al. (2022) on the e-commerce platform Zalora specifically found that the path from E-Service Quality to E-Customer Loyalty is insignificant. Based on the inconsistency of findings, the first hypothesis is formulated:

H1: E-Service Quality has a positive and significant effect on E-Customer Loyalty.

Trust functions as a way to reduce uncertainty for consumers who are unsure about whom to rely on. It is built on the expectation that a company will act in line with customer needs and desires (Pasha & Rimadias, 2025). E-Trust is considered the foundation of long-term relationships in a risk-prone digital environment. Theoretically, E-Trust reduces uncertainty and builds commitment, which directly leads to loyalty (Saputra et al., 2023). E-Trust is often associated with three main components: Ability, which is the perception that the platform has the functionality and competence to perform tasks; Benevolence, which is the perception that the platform cares about its customers; and Integrity, which is the perception that the platform is honest and keeps its promises (Saputra et al., 2023). In many digital service studies, E-Trust is also closely related to the dimensions of Security and Privacy, as identified by Parasuraman et al. (2005) and Akpan & Etuk (2024) which encompass the belief that customers' personal data and financial transactions are protected from misuse.However, empirical findings on this pathway are also contradictory. One research camp (Liani & Yusuf, 2021; Saputra et al., 2023) found a significant direct effect. In contrast, a second camp (Ramadhan & Sugiyanto, 2023; Sadeghi et al., 2021) found that this pathway was not significant. Based on these inconsistent findings, the second hypothesis is formulated:

H2: E-Trust has a positive and significant effect on E-Customer Loyalty.

This relationship is based on the Expectancy Disconfirmation Theory, where if the perceived performance of the application (ESQ) meets or exceeds customer expectations, satisfaction (E-Customer Satisfaction) will be achieved (Putri & Marlena, 2021). E-Customer Satisfaction is the affective evaluation or feelings of customers (pleased or disappointed) that arise after comparing the performance or experience perceived from digital services (PLN Mobile) with their previous expectations (Putri & Marlena, 2021). It is a post-consumption assessment that is holistic in nature, reflecting customers' feelings toward their overall interactions with the application (Guterres et al., 2024). Unlike the previous two hypotheses, the literature review shows very consistent findings on this pathway. These findings are strongly supported by various studies in the context of PLN Mobile in different regions (Dewi & Sari,

2024; Luthfiani et al., 2024; Sarwindah et al., 2025) as well as in the context of other digital applications (Fitriani et al., 2022; Ramadhan & Sugiyanto, 2023). Based on these consistent findings, the third hypothesis is formulated:

H3: E-Service Quality has a positive and significant effect on E-Customer Satisfaction.

E-Trust functions to reduce perceived risk and uncertainty in digital transactions. When customers feel secure and trust the integrity of the platform, their transaction experience becomes more positive, which directly increases satisfaction (Luthfiani et al., 2024). This theoretical foundation is supported by strong empirical evidence. Studies by (Luthfiani et al., 2024), all in the context of PLN Mobile, found that E-Trust has a positive and significant effect on satisfaction. Based on this strong empirical support, the fourth hypothesis is formulated:

H4: E-Trust has a positive and significant effect on E-Customer Satisfaction.

E-Customer Loyalty refers to the level of loyalty and commitment of consumers to a brand, product, or service obtained through digital interactions, such as via websites, mobile applications, or social media platforms. This concept describes the tendency of customers to give positive responses to online service providers, which is reflected in repeat purchase behaviour and is influenced by the level of customer satisfaction with the quality of service received (Nurdiana & Komara, 2024).E-Customer Loyalty is defined as a customer's deep commitment to continue using an application service (repeat transactions) and to recommend it to others (positive word-of-mouth), despite situational factors or competitors' marketing efforts that could prompt switching (Guterres et al., 2024; Saputra et al., 2023). Customer loyalty will also be the ultimate goal of any company, because having loyal customers will ensure the long-term sustainability of a company (Nugroho, 2025). E-Customer Satisfaction is the affective evaluation (feeling) of customers after consuming a service. Classical marketing theory positions satisfaction as a direct antecedent of future behavioral intentions, including loyalty (Guterres et al., 2024). This relationship has been shown to be very strong in a digital context. The majority of the literature agrees that E-Customer Satisfaction is the strongest and most direct predictor of E-Customer Loyalty (Fitriani et al., 2022; Pasaribu, 2023; Saputra et al., 2023). Based on this literature consensus, the fifth hypothesis is formulated:

H5: E-Customer Satisfaction has a positive and significant effect on E-Customer Loyalty.

Theoretically, customers' cognitive evaluation of quality does not automatically result in loyalty , but must first be processed through affective evaluation (E-Customer Satisfaction) (Fitriani et al., 2022). This hypothesis directly aims to bridge the research gap identified in H1. If H1 (the direct path) is found to be insignificant, as observed by (Fitriani et al., 2022), then E-Customer Satisfaction has the potential to be a full mediator. Therefore, the mediation hypothesis is formulated:

H6: E-Customer Satisfaction mediates the effect of E-Service Quality on E-Customer Loyalty.

E-Trust is a cognitive condition, E-Customer Loyalty is a behavioral outcome. Mediation theory suggests that cognitive trust must first generate positive feelings (E-Customer Satisfaction) before it can drive loyal behavior (Ramadhan & Sugiyanto, 2023). This hypothesis is proposed to address the research gap identified in H2. If H2 (the direct path) proves to be

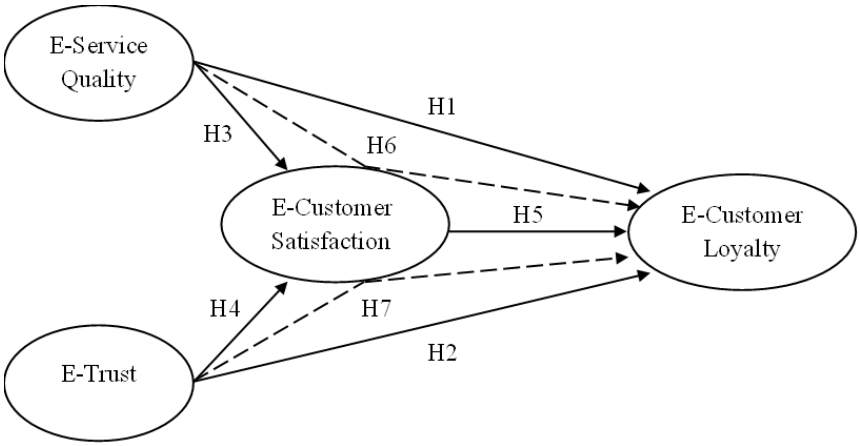


Figure 1. Research Model

Source: Modified from Triatmojo et al. (2025)

insignificant, as found by Ramadhan & Sugiyanto (2023), then E-Customer Satisfaction has the potential to serve as a full mediator. Therefore, the final mediation hypothesis is formulated:

H7: E-Customer Satisfaction mediates the effect of E-Trust on E-Customer Loyalty.

From the study above, Figure 1 explains the research model and hypothesis.

RESEARCH METHOD

This study uses a quantitative approach with a causal explanatory research design. This design is used to test and analyze causal relationships between variables and to test seven (7) previously developed hypotheses, namely the effect of E-Service Quality (ESQ) and E-Trust (ET) on E-Customer Loyalty (ECL) mediated by E-Customer Satisfaction (ECS).

The population in this study consists of all PLN customers in the PLN UP3 Yogyakarta area who have downloaded and used the PLN Mobile application. The sample size in this study is 132 respondents. The sampling technique used is non-probability sampling with purposive sampling method. The criteria set for respondents are: (1) Residing in the working area of PLN UP3 Yogyakarta; (2) At least 17 years old; and (3) Have used the PLN Mobile application in the last 3 months.

The type of data used is primary data obtained directly from respondents. The data collection technique uses a questionnaire survey distributed online via Google Form. The questionnaire instrument uses a 1-5 Likert Scale (Strongly Disagree to Strongly Agree) to measure respondents' perceptions. The operationalization of the research variables is outlined as follows E-Service Quality (ESQ) is measured using 12 items, E-Trust (ET) is measured using 3 items, E-Customer Satisfaction (ECS) is measured using 3 items, and E-Customer Loyalty (ECL) is measured using 4 items. The operationalization can be see in Table 1

The data analysis technique uses Partial Least Squares-Structural Equation Modeling (PLS-SEM). This method is chosen due to its ability to test complex models and predict relationships between variables, as well as not requiring strict data normality assumptions (Hair Jr et al., 2021). Data analysis is assisted using SmartPLS 4.

According to the PLS-SEM analysis guidelines (Hair Jr et al., 2021), model testing is conducted in two stages: (1) Outer Model Evaluation to test the validity (convergent and discriminant) and reliability of the instruments; and (2) Inner Model Evaluation (structural model) to assess the strength of the model through R-Square and F-Square, test the predictive relevance of the model (model fit) through Q-Square, and test the significance of hypotheses using the bootstrapping procedure.

Table 1. Variables Operationalization

Construct	Indicator
E-Service quality (Triatmojo et al., 2025)	**ESQ1:** I feel comfortable using the PLN Mobile application **ESQ2:** The PLN Mobile application makes it easy for me to find the services I need. **ESQ3:** I complete transactions more quickly using the PLN Mobile application **ESQ4:** My privacy is protected when using the PLN Mobile application. **ESQ5:** I feel secure when completing transactions through the PLN Mobile application. **ESQ6:** The information available on the PLN Mobile application is organized in a modern way. **ESQ7**: The PLN Mobile application provides reliable information. **ESQ8:** The PLN Mobile application provides information about its products and services. **ESQ9:** The PLN Mobile application is available anytime and anywhere for PLN services. **ESQ10:** The PLN Mobile application provides information that is accurate and relevant to my needs. **ESQ11:** The PLN Mobile application always responds to my needs. **ESQ12:** The PLN Mobile application can provide solutions when I encounter a problem.
E-Trust (Luthfiani et al., 2024)	**ET1:** The PLN Mobile application is transparent in providing payment information. **ET2:** The PLN Mobile application fulfills its responsibilities to customers. **ET3:** The cost simulation feature on the PLN Mobile application makes it easy for me to check electricity installation costs, electricity bills, and others.
E-Customer Satisfaction (Triatmojo et al., 2025)	**ECS1:** I am satisfied with my decision to use the PLN Mobile application. **ECS2:** I am generally satisfied with the features available on the PLN Mobile application. **ECS3:** My overall experience using the PLN Mobile application is very satisfying.
E-Customer loyalty (Triatmojo et al., 2025)	**ECL1:** I recommend that other customers use the PLN Mobile application. **ECL2:** I convey positive feedback about the PLN Mobile application to others. **ECL3:** I repeatedly use the PLN Mobile application for activities involving PLN services. **ECL4:** I am committed to continuing to use the PLN Mobile application in the long term.

RESULT AND DISCUSSION

This study involved 132 respondents, consisting of 70 females (53.0%) and 62 males (47.0%). The sample profile was predominantly young individuals, evident from 104 respondents (78.8%) being in the 17-27 age range, which aligns with the finding that the majority of them (59.8%) were students. The respondents' educational backgrounds were primarily divided between high school graduates (47.7%) and bachelor's degree holders (42.4%). Geographically, the respondents were concentrated in the Sleman area (42.4%) and Yogyakarta City (37.1%).

Outer Model

The outer model aims to ensure that the indicators used to measure each construct (latent variable) are reliable and valid before proceeding to the structural model testing (Hair Jr et al., 2021).

Table 2. Respondent Characteristics

Characteristics	Category	N	Percentage (%)
Gender	Male	62	47.0%
	Female	70	53.0%
Age	17 - 27 Years Old	104	78.8%
	28 - 37 Years Old	3	2.3%
	38 - 47 Years Old	5	3.8%
	48 - 57 Years Old	8	6.1%
	> 57 Years Old	12	9.1%
Education	High school	63	47.7%
	Diploma	6	4.6%
	Bachelor Degree	56	42.4%
	Master Degree	6	4.5%
	Doctor Degree	1	0.8%
Occupation	Student	79	59.8%
	Private Employee	13	9.8%
	SOE Employee	13	9.8%
	Entrepreneur	8	6.1%
	Housewife	6	4.5%
	Civil Servant	5	3.8%
	Retirement	4	3.0%
	TNI / Polri	2	1.5%
	Lecturer	1	0.8%
	Driver	1	0.8%
Domicile	Sleman	56	42.4%
	Yogyakarta City	49	37.1%
	Kulonprogo	13	9.8%
	Bantul	7	5.3%
	Gunungkidul	7	5.3%
Application Use	< 6 Months	70	53.0%
	7 - 12 Months	28	21.2%
	13 - 24 Months	12	9.1%
	25 -36 Months	7	5.3%
	37 - 48 Months	3	2.3%
	> 48 Months	12	9.1%

Source: Processed by Researcher using Smart PLS 4 (2025)

Table 3. Convergent Validity

Variabel	Indikator	Outer Loading	AVE	Description
E-Service Quality	ESQ1	0.884	0.756	Valid
	ESQ2	0.883		Valid
	ESQ3	0.859		Valid
	ESQ4	0.870		Valid
	ESQ5	0.862		Valid
	ESQ6	0.872		Valid
	ESQ7	0.899		Valid
	ESQ8	0.856		Valid
	ESQ9	0.863		Valid
	ESQ10	0.899		Valid
	ESQ11	0.853		Valid
	ESQ12	0.828		Valid
E-Trust	ET1	0.939	0.831	Valid
	ET2	0.902		Valid
	ET3	0.893		Valid
E-Customer Satisfaction	ECS1	0.957	0.907	Valid
	ECS2	0.947		Valid
	ECS3	0.953		Valid
E-Customer Loyalty	ECL1	0.920	0.830	Valid
	ECL2	0.903		Valid
	ECL3	0.908		Valid
	ECL4	0.913		Valid

Source: Processed by Researcher using Smart PLS 4 (2025)

Evaluation of the measurement model (outer model) is an essential step to assess reliability and validity (Hair Jr et al., 2021). Table 3 presented focuses on Convergent Validity, which evaluates the extent to which indicators of a construct indeed converge to measure the same concept (Hair Jr et al., 2021). This measurement requirement necessitates that two criteria are met. First, indicator reliability is assessed through Outer Loading, which ideally should be ≥ 0.708 (Garson, 2016; Hair Jr et al., 2021). Second, construct convergent validity is assessed using Average Variance Extracted (AVE), which must be ≥ 0.50 (Garson, 2016; Hair Jr et al., 2021; Piaw, 2023).

In Table 3, the E-Service Quality construct is measured by 12 indicators (ESQ1-ESQ12). All indicators show very strong outer loading values, with the lowest value being 0.828 (ESQ12) and the highest values being 0.899 (ESQ7 and ESQ10). The E-Trust construct is measured by three indicators (ET1-ET3). All three show very high loadings, ranging from 0.893 (ET3) to 0.939 (ET1). The E-Customer Satisfaction construct is measured by three indicators (ECS1-ECS3). This construct shows exceptionally high loadings, ranging from 0.947 (ECS2) to 0.957 (ECS1). The E-Customer Loyalty construct is measured by four indicators (ECL1-ECL4). All its indicators are also very strong, with loadings ranging from 0.903 (ECL2) to 0.920 (ECL1). Furthermore, the Average Variance Extracted (AVE) values for the four constructs E-Service Quality (0.756), E-Trust (0.831), E-Customer Satisfaction (0.907), and E-Customer Loyalty (0.830) are all well above the threshold of 0.50. Since all criteria are good The outer loading indicator exceeding 0.708 and the construct AVE value exceeding 0.50 have been met, indicating that the reflective measurement model in this study is declared to be convergently valid.

The outer model test is continued with a discriminant validity test. Discriminant validity aims to ensure that each construct (variable) in this study is empirically truly distinct from other constructs (Hair Jr et al., 2021). This test is important to demonstrate that, for example, indicators for E-Service Quality do not overlap in measuring the same thing as indicators for E-Customer Satisfaction.MThe method used to test this is the evaluation of cross-loadings. The criterion for testing cross-loadings is that the loading value (correlation) of each indicator on its intended construct (its parent construct) must be greater than the loading value of that indicator on all other constructs (Hair Jr et al., 2021). The results of the cross-loadings test for the 22 research indicators are presented in Table 4.

The E-Service Quality construct, with its 12 indicators (ESQ1 to ESQ12), consistently shows the highest loading values in the ESQ column. The ESQ1 indicator has a loading of 0.884 on the ESQ construct, which is higher than its cross-loadings on the ET (0.767), ECS (0.756), and ECL (0.696) constructs. The same pattern is observed for all other ESQ indicators. The same applies to the E-Trust construct, where the ET1, ET2, and ET3 indicators have the highest loadings in the ET column (for example, ET1: 0.939 > 0.789, 0.784, 0.696). Similarly, the E-Customer Satisfaction indicators (ECS1-ECS3) have the highest loadings on their own construct (for example, ECS1: 0.957 > 0.805, 0.813, 0.793). Finally, the E-Customer Loyalty indicators (ECL1-ECL4) also show the highest loadings in the ECL column (for example, ECL1: 0.920 > 0.690, 0.672, 0.769).

Table 4. Discriminant Validity Using Cross Loading

Variable	ESQ	ET	ECS	ECL	Description
ESQ1	**0.884**	0.767	0.756	0.696	Valid
ESQ2	**0.883**	0.736	0.736	0.617	Valid
ESQ3	**0.859**	0.752	0.700	0.679	Valid
ESQ4	**0.870**	0.762	0.732	0.675	Valid
ESQ5	**0.883**	0.736	0.736	0.617	Valid
ESQ6	**0.859**	0.752	0.700	0.679	Valid
ESQ7	**0.870**	0.762	0.732	0.675	Valid
ESQ8	**0.862**	0.776	0.756	0.632	Valid
ESQ9	**0.872**	0.782	0.740	0.629	Valid
ESQ10	**0.899**	0.797	0.756	0.668	Valid
ESQ11	**0.853**	0.810	0.780	0.690	Valid
ESQ12	**0.828**	0.669	0.709	0.651	Valid
ET1	0.789	**0.939**	0.784	0.696	Valid
ET2	0.770	**0.902**	0.788	0.658	Valid
ET3	0.824	**0.893**	0.775	0.630	Valid
ECS1	0.805	0.813	**0.957**	0.793	Valid
ECS2	0.802	0.841	**0.947**	0.773	Valid
ECS3	0.790	0.797	**0.953**	0.762	Valid
ECL1	0.690	0.672	0.769	**0.920**	Valid
ECL2	0.682	0.698	0.737	**0.903**	Valid
ECL3	0.672	0.620	0.693	**0.908**	Valid
ECL4	0.668	0.654	0.767	**0.913**	Valid

Source: Processed by Researcher using Smart PLS 4 (2025)

Table 5. Reliability

Variabel	Cronbach Alpha	Composite Reliability	Description
E-Service Quality	0.971	0.974	Reliable
E-Trust	0.898	0.937	Reliable
E-Customer Satisfaction	0.949	0.967	Reliable
E-Customer Loyalty	0.932	0.951	Reliable

Source: Processed by Researcher using Smart PLS 4 (2025)

Reliability test

Reliability test serves to assess the extent to which a set of indicators measuring the same construct truly correlate and are consistent (Hair Jr et al., 2021; Piaw, 2023). Cronbach's Alpha is the most traditional measure of reliability, but it is considered a lower bound (conservative estimate) because it assumes all indicator loadings are equal (Garson, 2016; Hair Jr et al., 2021). Composite Reliability is often preferred because it does not assume equal loadings, thus providing a more precise estimate of reliability (Garson, 2016; Hair Jr et al., 2021). For both measures, values ≥ 0.70 are generally considered to meet adequate reliability standards (Garson, 2016; Hair Jr et al., 2021; Piaw, 2023).

Table 5, the E-Service Quality construct shows a Cronbach's Alpha value of 0.971 and a Composite Reliability of 0.974. The E-Trust construct obtains a value of 0.898 for Cronbach's Alpha and 0.937 for Composite Reliability. Furthermore, E-Customer Satisfaction has a Cronbach's Alpha of 0.949 and a Composite Reliability of 0.967. Finally, the E-Customer Loyalty construct has a Cronbach's Alpha of 0.932 and a Composite Reliability of 0.951. Therefore, it can be concluded that all constructs have very high internal consistency reliability, as all Cronbach's Alpha and Composite Reliability values far exceed the minimum threshold of 0.70.s

Inner Model

The R-Square value measures the proportion of variance in each endogenous (dependent) construct that can be explained by its predictor constructs (Garson, 2016; Hair Jr et al., 2021). As a general guideline, an R-Square value of 0.75 is considered strong, 0.50 moderate, and 0.25 weak (Garson, 2016; Hair Jr et al., 2021). Based on Table 6, the E-Customer Loyalty construct has an R-Square value of 0.676 (moderate). This indicates that the independent constructs together can explain 67.6% of the variance in E-Customer Loyalty. The E-Customer Satisfaction construct has an R-Square value of 0.771 (strong), meaning that 77.1% of its variance can be explained by the independent constructs. Therefore, this model has good explanatory power for both dependent variables.

Table 6. R Square

Variabel	R Square	R Square Adjusted	Description
E - Customer Loyalty	0.676	0.669	Moderate
E - Customer Satisfaction	0.771	0.767	Strong

Source: Processed by Researcher using Smart PLS 4 (2025)

Table 7. f-Square

Variable	E - Customer Loyalty	E - Customer Satisfaction
E-Customer Loyalty		
E-Customer Satisfaction	0.302	
E-Service Quality	0.030	0.151
E-Trust	0.000	0.294

Source Processed by Researcher using Smart PLS 4 (2025)

Table 7 presents the details of the f-square data of each independent construct on the dependent construct. An f-Square value ≥ 0.02 indicates a small effect, > 0.15 a medium effect, and 0.35 a large effect (Garson, 2016; Hair Jr et al., 2021; Piaw, 2023). In the E-Customer Satisfaction construct, E-Trust shows the largest effect size with an f-Square of 0.294. This is followed by E-Service Quality with an f-Square of 0.151. In the E-Customer Loyalty construct (left column), E-Customer Satisfaction shows an effect size of 0.302. Meanwhile, E-Service Quality has an f-Square of 0.030, and E-Trust has an f-Square of 0.000. E-Trust has a large effect (0.294) on E-Customer Satisfaction, while E-Service Quality has a moderate effect (0.151). For E-Customer Loyalty, E-Customer Satisfaction contributes a large effect (0.302). E-Service Quality only has a small effect (0.030), and E-Trust was found to have no effect (f-Square = 0.000) on E-Customer Loyalty.

Model Fit Evaluation

Table 8 presents the Q-Square predict data for the two endogenous constructs in the model. Q-Square assesses how well a model can predict unobserved (holdout) data. The measurement criterion is that the Q-Square value must be greater than 0 (Garson, 2016; Hair Jr et al., 2021; Piaw, 2023). A positive value indicates that the model has predictive relevance, meaning the model has better predictive capability than simply using the mean value (Hair Jr et al., 2021). The description of these results is as follows: The E-Customer Loyalty construct obtained a Q-Square predict value of 0.560. The E-Customer Satisfaction construct obtained a Q-Square predict value of 0.763. Based on the description of these findings, a conclusion can be drawn. Since both Q-Square predict values (0.560 and 0.763) are greater than 0, this indicates that the model has a good ability to predict unobserved data.

In Table 9, the SRMR value is 0.041, the d_ULS value is 0.434, the d_G value is 0.839, the Chi-Square value is 564.491, and the NFI value is 0.847. The SRMR value of 0.041 is well below 0.08. This indicates that the difference between the observed correlations and those predicted by the model is very small, suggesting that this model has an excellent fit with the data. Although the NFI value (0.847) is slightly below the recommended threshold of 0.90, SRMR is considered a more fundamental and reliable measure for PLS-SEM (Garson, 2016; Hair et al., 2021).

Table 8. Q-Square

Variable	Q^2
E - Customer Loyalty	0.560
E - Customer Satisfaction	0.763

Source: Processed by Researcher using Smart PLS 4 (2025)

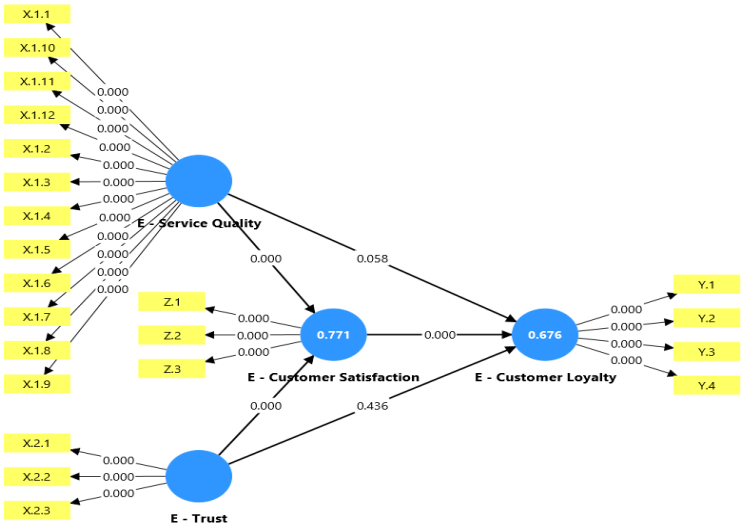
Table 9. Model Fit

	Saturated model	Estimated model
SRMR	0.041	0.041
d_ULS	0.434	0.434
d_G	0.839	0.839
Chi-square	564.491	564.491
NFI	0.847	0.847

Source: Processed by Researcher using Smart PLS 4 (2025)

Hypothesis Test

After the measurement model is confirmed to be valid and reliable, the evaluation proceeds to testing the proposed hypotheses (Hair Jr et al., 2021). The measurement criteria to determine whether a hypothesis is supported (at the 5% significance level) are that the P-Values must be < 0.05 (Piaw, 2023). The T-Statistics value must be > 1.96 (Hair Jr et al., 2021). The following Table 10 presents the results of the bootstrapping procedure for testing the direct effect hypotheses (H1-H5).



Source: Processed by Researcher using Smart PLS 4 (2025)

Figure 2. Conceptual Framework

Table 10. Dirrect Effect

Variable	Original Sample (O)	T Statistics	P Values	Description
E-Service Quality -> E-Customer Loyalty	0.217	1.570	0.058	Rejected
E-Trust -> E-Customer Loyalty	-0.023	0.160	0.436	Rejected
E-Service Quality -> E-Customer Satisfaction	0.378	3.496	0.000	Accepted
E-Trust -> E-Customer Satisfaction	0.529	4.846	0.000	Accepted
E-Customer Satisfaction -> E- Customer Loyalty	0.653	6.120	0.000	Accepted

Source: Processed by Researcher using Smart PLS 4 (2025)

Table 11. Indirect Effect

Variable	Original (O)	Sample	T Statistics	P Values	*Description*
E - Service Quality -> E - Customer Satisfaction -> E - Customer Loyalty	0.247		3.289	0.001	Accepted
E - Trust -> E - Customer Satisfaction -> E - Customer Loyalty	0.345		3.590	0.000	Accepted

Source: Processed by Researcher using Smart PLS 4 (2025)

Table 10 presents the results of the hypothesis testing for direct effects. The main findings indicate that the antecedents of E-Customer Satisfaction are proven to be significant. E-Trust (H4) shows a positive and significant effect on E-Customer Satisfaction (Original Sample = 0.529, T-Statistics = 4.846, P-Values = 0.000). Similarly, E-Service Quality (H3) also has a positive and significant effect on E-Customer Satisfaction, as indicated by a coefficient value of 0.378, T-Statistics of 3.496, and P-Values of 0.000. Next, this model tests the antecedents of E-Customer Loyalty. The strongest influence in the overall model comes from E-Customer Satisfaction (H5) on E-Customer Loyalty (Original Sample = 0.653, T-Statistics = 6.120, P-Values = 0.000), which indicates the central role of satisfaction as a key driver of loyalty.

Based on the results of the mediation hypothesis testing presented in Table 11, strong findings were shown. For hypothesis H6, the path from E-Service Quality (ESQ) to E-Customer Loyalty (ECL) through E-Customer Satisfaction (ECS) shows an indirect path coefficient (Original Sample) of 0.247. This path is statistically significant, with a T-Statistics of 3.289 and a P-Value of 0.001. Similarly, for hypothesis H7, the path from E-Trust (ET) to E-Customer Loyalty (ECL) through E-Customer Satisfaction (ECS) shows a path coefficient of 0.345, which is also supported by a T-Statistics of 3.590 and a P-Value of 0.000.

The Effect of E-Service Quality on E-Customer Loyalty

This study examined the direct relationship between E-Service Quality and E-Customer Loyalty. Based on the statistical testing, Hypothesis 1 (H1) is rejected (P-Value = 0.058 > 0.05). This result indicates that there is no significant direct influence of E-Service Quality on E-Customer Loyalty. In other words, simply improving the technical quality of the PLN Mobile application (system reliability and responsiveness) does not directly increase customer loyalty. This finding suggests that for public utility apps, service quality is perceived as a baseline expectation rather than a driver of loyalty. Users require a deeper emotional connection, specifically satisfaction, before they commit to being loyal. This result contradicts(Guterres et al., 2024; Pasaribu, 2023; Triatmojo et al., 2025), who argued for a direct link. However, it aligns with (Fitriani et al., 2022), who also found that quality requires a mediating mechanism to successfully impact loyalty.

The Effect of E-Trust on E-Customer Loyalty

This study examined the direct influence of E-Trust on E-Customer Loyalty. The statistical results indicate that H2 is not supported (P-value = 0.436 > 0.05), indicating that E-

Trust does not have a significant direct impact on E-Customer Loyalty. This finding contrasts with the study by (Pasaribu, 2023; Saputra et al., 2023), who argued that higher trust leads directly to higher loyalty. However, this result is consistent with the findings of (Ramadhan & Sugiyanto, 2023; Sadeghi et al., 2021), who also found that trust does not guarantee loyalty without other factors. The nature of PLN Mobile can be explained as a public utility service. In this context, trust is considered a "baseline" or hygiene factor; users assume the app must be trustworthy to be used, but this trust alone does not motivate them to be loyal or recommend the app. Loyalty is only formed when that trust is converted into satisfaction, as proven by the mediation path in this study.

The Effect of E-Service Quality on E-Customer Satisfaction

The third hypothesis is accepted (Original Sample = 0.378, P-Value = 0.000), confirming that E-Service Quality has a positive and significant effect on E-Customer Satisfaction. This demonstrates that technical aspects such as app stability, ease of use, and speed directly enhance user satisfaction. When PLN Mobile functions without errors and provides clear information, users feel satisfied with the service. This result supports the research of (Dewi & Sari, 2024; Fitriani et al., 2022; Luthfiani et al., 2024; Ramadhan & Sugiyanto, 2023; Sarwindah et al., 2025), who emphasized that in digital platforms, the quality of the interface and system is the primary predictor of user satisfaction.

The Effect of E-Trust on E-Customer Satisfaction

The fourth hypothesis is accepted with a significant positive influence (Original Sample = 0.529, P-Value = 0.000). This result confirms that E-Trust plays a critical role in shaping E-Customer Satisfaction. This implies that the higher the level of trust perceived by customers, the greater their satisfaction with the PLN Mobile service. Based on these findings, customer trust in PLN Mobile encompasses several key dimensions: confidence in the service's reliability, belief that the application effectively assists customers in electricity-related activities, and assurance that the service provides the necessary features. Furthermore, the sense of security felt by customers while using the service is paramount. Trust plays a pivotal role for the service provider to ensure the continuity of transactions, maintain the confidentiality of information, and protect the privacy of customer accounts to prevent potential criminal acts. This finding aligns with the research of (Luthfiani et al., 2024), which states that trust reduces perceived risk and is a fundamental driver of user satisfaction in digital services.

The Effect of E-Customer Satisfaction on E-Customer Loyalty

The fifth hypothesis is accepted and shows the strongest influence in the entire model (Original Sample = 0.653, P-Value = 0.000). This confirms that E-Customer Satisfaction is the most critical driver of E-Customer Loyalty. Satisfied users are more likely to continue using the app and recommend it to others. This finding is consistent with the vast majority of marketing literature, including (Fitriani et al., 2022; Pasaribu, 2023; Saputra et al., 2023), confirming the "Success Model" where satisfaction is the immediate and necessary precursor to loyalty.

The Mediating Role of E-Customer Satisfaction between E-Service Quality and Loyalty

The sixth hypothesis examines whether E-Customer Satisfaction mediates the relationship between E-Service Quality and E-Customer Loyalty. The result is accepted (Original Sample = 0.247, P-Value = 0.001). Since the direct effect (H1) was insignificant while this indirect effect is significant, this study concludes that E-Customer Satisfaction acts as a Full Mediator. This explains why H1 was rejected. Service quality can only build loyalty if it successfully creates satisfaction first. This finding supports the work of (Fitriani et al., 2022), reinforcing the idea that satisfaction is the necessary bridge between system performance and user loyalty.

The Mediating Role of E-Customer Satisfaction between E-Trust and Loyalty

The seventh hypothesis tests the mediation of E-Customer Satisfaction between E-Trust and E-Customer Loyalty. The result is accepted (Original Sample = 0.345, P-Value = 0.000). Similar to the previous path, since the direct effect of Trust on Loyalty (H2) was insignificant, E-Customer Satisfaction also functions as a Full Mediator in this relationship. This implies that trust alone is "silent" regarding loyalty until it is converted into a positive emotional state (satisfaction). This finding clarifies the mechanism of loyalty formation in PLN Mobile users and supports the theoretical framework proposed by (Ramadhan & Sugiyanto, 2023).

These findings tell an interesting story when combined with the results of previous direct effect tests (Table 10). Previous analyses showed that the direct paths from E-Service Quality (H1) and E-Trust (H2) to E-Customer Loyalty were not significant. According to the literature (Hair Jr et al., 2021; Piaw, 2023), when indirect effects (such as H6 and H7) arefound to be significant while the direct effects (H1 and H2) are not significant, this indicates Full Mediation. Thus, these results confirm that E-Customer Satisfaction plays a crucial role as a mediator, where the influence of E-Service Quality and E-Trust on E-Customer Loyalty is fully channeled through customer satisfaction.

CONCLUSION AND SUGGESTIONS

Based on the results of data analysis and discussion, this study addresses the research problems that were posed. The first conclusion is that (H3) E-Service Quality and (H4) E-Trust have been proven to have a positive and significant effect on E-Customer Satisfaction. These findings confirm that the quality of application services and customer trust are important foundations for building satisfaction among PLN Mobile users at PLN UP3 Yogyakarta.

The second conclusion, (H5) E-Customer Satisfaction has been proven to have a positive and significant effect on E-Customer Loyalty. The most important finding of this study is the rejection of the direct effect of (H1) E-Service Quality (P=0.058) and (H2) E-Trust (P=0.436) on E-Customer Loyalty. This finding directly addresses the research gap identified in the introduction, where there were conflicting findings in previous literature.

Based on the acceptance of the mediation hypotheses (H6) and (H7) and the rejection of the direct paths (H1 and H2), E-Customer Satisfaction acts as a full mediator. This indicates that in the context of PLN Mobile users at UP3 Yogyakarta, loyalty cannot be formed automatically just because the application is sophisticated (ESQ) or secure (E-Trust). Service quality and trust must first successfully create satisfaction, and it is this satisfaction that becomes the sole direct driver of loyalty formation.

Managerial Implications

These fully mediated findings have important managerial implications for the management of PLN UP3 Yogyakarta. Resource allocation is insufficient for the development of technical features (E-Service Quality) or for security assurance (E-Trust). To build customer loyalty, the primary focus must shift to ensuring that every digital interaction results in a satisfying customer experience. Therefore, management is strongly advised to adopt Customer Satisfaction (e.g., Net Promoter Score) as the key performance indicator, rather than focusing solely on the number of downloads. PLN is also advised to actively address the gaps in existing phenomena with concrete improvements. First, regarding the reasons why customers still visit the office for certain services (Deni, 2024), management must identify and migrate these specific administrative services (such as power changes or disputes) fully into the mobile app to reduce physical dependency. Second, to handle "customer complaints" (Prayogi, 2025), PLN needs to implement a real-time tracking feature that allows users to monitor their complaint status, accompanied by strict resolution time limits. By resolving these issues, satisfaction is guaranteed to increase, which this study proves is the only path to loyalty.

Limitations

This study also has several limitations that inform suggestions for future research. First, this study was conducted at only one location (PLN UP3 Yogyakarta) with 132 respondents, so the results may not be generalizable to other areas. Second, the sampling technique used purposive sampling, which has limitations in generalization. Future research is recommended to expand the model by adding other antecedent variables that theoretically could affect satisfaction, such as Customer Experience or E-Promotion, to gain a more comprehensive understanding.

Suggestions

Future research is encouraged to develop further and enrich the conceptual framework established in this study. Considering the finding that E-Service Quality and E-Trust influence loyalty solely through satisfaction, subsequent studies could provide deeper insights by integrating additional constructs such as Perceived Value, Brand Image, or Switching Costs to better capture the drivers of customer loyalty. Additionally, expanding the investigation to diverse demographic segments or broader geographical areas would be beneficial to validate the model's applicability and robustness across different user groups within the digital public service sector.

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