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The Role Of The Network Operational Automation System Model In Supporting Sustainable Operations In The Telecommunications Industry Of PT. XYZ

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ABSTRACT

Purpose – This paper examines the influence of network operational digitalization and network operational automation on sustainable operations, with operational efficiency as a mediating variable. The study was conducted at PT XYZ, a telecommunications company in Indonesia, employing a quantitative approach through a survey of 161 respondents working in network operational units.
Methodology/approach – The research instrument was developed based on indicators of digitalization, automation, operational efficiency, and sustainable operations. Data collected were analyzed using Structural Equation Modeling with Partial Least Square (SEM-PLS) through SmartPLS software.
Findings – The results reveal that both digitalization and automation of network operations significantly influence operational efficiency. Furthermore, operational efficiency plays a mediating role in linking digitalization and automation to sustainable operations. The study also identifies a significant direct effect of network operational digitalization on sustainable operations. However, network operational automation does not yet demonstrate a direct influence on sustainability outcomes. These findings suggest that while automation contributes to efficiency, its role in sustainability is still evolving, reflecting the staged maturity of technological adoption within the telecommunications industry.
Originality/Value – Theoretically, this study contributes to the development of an integrative model connecting digital transformation and sustainable operations in the telecommunications sector. Empirically, it highlights the unique asymmetry between digitalization and automation in driving sustainability, which has been underexplored in prior research. Practically, the results provide valuable insights for company management in formulating effective strategies to enhance digitalization and automation-based network operation systems as a foundation for long-term sustainable operations.

INTRODUCTION

The telecommunications industry has experienced rapid growth over the past two decades. Digital transformation, an increase in the number of mobile device users, and exponential data growth have prompted telecommunications companies to continuously improve the capacity, speed, and reliability of their networks. On the other hand, increasingly complex operational challenges, high operating costs, and demands for environmental sustainability require innovation in network operations management.

The ongoing digital transformation in this sector is not only about improving network technology (such as 4G, 5G, and the upcoming 6G), but also requires fundamental changes in operational management. The sharp increase in data traffic volume, coupled with the complexity of network devices spread across various geographical areas, means that network operational management can no longer rely entirely on manual and conventional approaches. Reactive, non-standardized operational systems that rely on field technicians' decisions are prone to errors, delayed handling, and inefficient resource allocation.

In network operations, telecommunications companies face the real challenge of service disruptions (incidents) that can significantly impact service quality and customer satisfaction. Based on internal data from PT XYZ for the year 2022, there were over 2,500 network outage incidents across various categories, including:

Transmission system outages: 720 cases (28.8%)
Radio equipment outages: 580 cases (23.2%)
Power system outages: 410 cases (16.4%)
Software & configuration disruptions: 360 cases (14.4%)
Fiber optic disruptions: 430 cases (17.2%)

Most of these disruptions were caused by human error during manual configuration processes, delayed detection of disruptions, and inaccuracies in decision-making for repairs. This situation not only caused network downtime that resulted in financial losses, but also increased energy consumption due to suboptimal systems and excessive use of technician resources. For example, in the second quarter of 2022, a major incident occurred in PT XYZ's metro Ethernet transport system, causing a 3-hour downtime in several major metropolitan areas. The impact of this incident not only resulted in potential service revenue losses of Rp1.2 billion but also reduced the customer satisfaction index from 92% to 86% during that period.

According to Business Indonesia published on April 20, 2025, the number of resources owned by the three Indonesian mobile operators is as follows:

Table 1 - Telecommunication Operator Resources

Operator	Number of BTS	Frequency Spectrum	Number of Subscribers	Notes
Telkomsel	271,04	165 MHz	159 million	975 BTS 5G
IOH	250,3	135 MHz	94.7 million	Still expanding 2G BTS
XLSMART	XL 165,000 SF 46,000	90 MHz from XL 62 MHz from SF	94.5 million	By Jan 2027 will return 2×7.5 MHz to the government

Based on the Table 1, effective automation is necessary to manage all telecommunications devices properly, ensuring operational continuity and delivering the best service to all mobile customers.

One strategic solution widely adopted by global telecommunications companies is the implementation of an operational network automation system model. Through automation, companies can reduce reliance on manual processes, minimize human error, improve efficiency, and accelerate data-driven decision-making based on real-time data. Technologies such as Artificial Intelligence (AI), Machine Learning (ML), Big Data Analytics, and the Internet of Things (IoT) have become the cornerstone of developing these automation systems.

The implementation of automation also has a significant impact in supporting the principles of sustainability or Sustainable Development Goals (SDGs), including Energy Efficiency, with automation, the system can adaptively regulate device power according to traffic load, reducing energy consumption. This falls under SDG 7 and 13, Carbon Emission Reduction, by reducing the use of backup generators due to optimized power management, CO_2 emissions are lowered. This aligns with SDGs 7 and 13. Human Resource Efficiency, by reducing the need for manual intervention at the Network Operation Center (NOC). This aligns with SDGs 8 and 9.

PT XYZ, one of Indonesia's leading telecommunications companies, has initiated the implementation of an operational network automation system model in recent years, including Implementation of AI-based Fault Management to detect and mitigate potential disruptions early on, The use of ML-based predictive maintenance to predict potential damage to active devices, Deployment of self-optimizing networks (SON) on radio networks for automatic coverage and capacity optimization.

Some research gaps that can be identified for this study include Limitations of empirical studies in the context of Indonesian telecommunications, namely Most studies on automation and sustainability still focus on the manufacturing and logistics sectors, while the operational context of networks in the telecommunications industry has not been widely researched. The lack of an integrative model between digitalization, automation, and operational sustainability, as previous studies tend to discuss these variables separately without explaining the holistic relationship in the form of a systematic model.

This research will thoroughly examine how the role of the operational network automation system model supports sustainable operations at PT XYZ, from the perspectives of operational efficiency, cost efficiency, environmental sustainability, and customer satisfaction improvement.

LITERATURE REVIEW

Network Operations Digitization

Digitization in the context of telecommunications network operations is the process of converting operational activities that were previously performed manually or analogically into digital-based technology. Digitization includes the application of software, data analytics, real-time monitoring systems, and the use of cloud computing in network management. According to Kane et al. (2015), digitalization plays a crucial role in enhancing decision-making speed, reducing human error, and improving operational agility. According to Bharadwaj et al. (2013), organizational digitalization creates new capabilities in integrating data and business processes to support strategic decision-making. Meanwhile, Verhoef et al. (2021) emphasize that digitalization is the main foundation in accelerating corporate transformation towards operational efficiency and sustainability.

Network Process Automation

Network automation is an extension of digitalization that focuses on automated decision-making and execution of actions by systems. Automation involves the use of artificial intelligence (AI) algorithms, machine learning (ML), and robotic process automation (RPA) to detect, analyze, and resolve network issues without human intervention. According to ITU (2021), automation is the key to creating self-healing networks that can significantly reduce network downtime. According to Marr (2018), AI-based automation helps companies manage operational complexity adaptively through real-time prediction and optimization. In addition, Prasad et al. (2019) emphasize that automation in telecommunications networks directly reduces operational costs while improving service stability.

Operational Efficiency

Operational efficiency is a company's ability to optimally utilize existing resources to achieve the desired output at the lowest possible cost. According to Slack et al. (2010), operational efficiency is achieved when an organization is able to reduce resource waste, speed up response times, and lower operational costs while maintaining service quality. According to Parmenter (2015), operational efficiency can be achieved through cycle time reduction, elimination of non-value-added activities, and optimization of production capacity. Additionally, according to Bourne et al. (2003), operational efficiency plays a crucial role as a link between productivity improvement and the achievement of an organization's financial targets.

Sustainable Operations

Sustainable operations involve managing operational activities that are not only focused on achieving economic targets but also consider social and environmental aspects to ensure long-term business sustainability. Referring to the Triple Bottom Line concept (Elkington, 1997), sustainability is measured across economic, environmental, and social dimensions. According to Lozano (2015), sustainable operations include energy management, emission reduction, waste management, and employee welfare improvement as part of corporate social responsibility (CSR). Hart & Milstein (1999) also emphasize that operational sustainability will create long-term competitive advantages for organizations.

HYPOTHESIS DEVELOPMENT

A. The Impact of Network Operational Digitization on Operational Efficiency (H1)
   Digitization provides support in the form of real-time data collection, rapid decision-making, and reduction of human error, which directly improves operational efficiency (Bharadwaj et al., 2013; Kane et al., 2015; Verhoef et al., 2021).
B. The Impact of Network Operational Automation on Operational Efficiency (H2)
   Automation supports operational efficiency by enabling early detection, self-healing networks, and reducing manual intervention, thereby minimizing downtime and lowering operational costs (Marr, 2018; ITU, 2021; Prasad et al., 2019).
C. The Impact of Operational Efficiency on Sustainable Operations (H3)
   Improved operational efficiency enables companies to reduce energy consumption, costs, and carbon emissions, thereby supporting sustainable operational practices (Slack et al., 2010; Parmenter, 2015; Hart & Milstein, 1999).
D. The Impact of Network Operational Digitalization on Sustainable Operations (H4).
   Digitalization creates efficiency, which ultimately enhances operational sustainability (Nakamura et al., 2019; Ahmed & Khan, 2020).
E. The Impact of Network Operational Automation on sustainable operations (H5).
   Automation supports efficiency, which in turn impacts sustainability (Wilson et al., 2020; Oliveira et al., 2022).

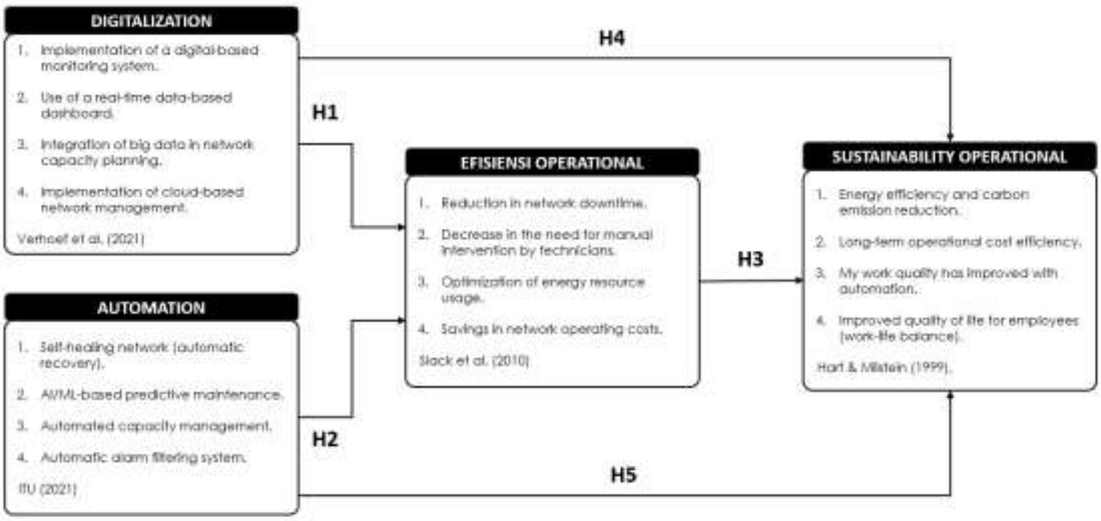

Figure 1 - Thinking Framework

METHOD

This research is quantitative research with a causal approach, which aims to determine the cause-and-effect relationship between the research variables. Causal research is used to test and analyze the influence of Network Operational Digitization (X1) and Network Operational Automation (X2) on Operational Efficiency (Z), as well as their influence on Sustainable Operations (Y), both directly and through the mediating role of Operational Efficiency. Quantitative research was chosen because it allows researchers to perform objective measurements, test hypotheses statistically, and obtain generalizations from the research results. Additionally, the quantitative approach is highly suitable for measuring the extent to which digitalization and automation variables contribute to operational efficiency and sustainability in the context of the telecommunications industry. Data collection techniques use a survey method by distributing structured questionnaires designed based on the indicators of each research variable. The collected data is then analyzed using path analysis with a Partial Least Square-based Structural Equation Modeling (SEM-PLS) approach to test the direct and indirect effects between variables.

This research was conducted at PT XYZ, a telecommunications company engaged in the management and operation of telecommunications networks in Indonesia. The research location covered several strategic work units directly related to network operations, such as the Team Operation, Team Planning, Team Tool, and Team Optimization divisions. This location was chosen because all activities related to the digitization and automation of network operations are concentrated in these units. The research is scheduled to take place over a period of 4 months, from April to July 2025. The details of the activities include the preparation of research instruments, data collection through the distribution of questionnaires, data processing, data analysis, and the preparation of the research report. With clear location and timing, it is hoped that this research will obtain representative data that accurately reflects the actual conditions of network digitalization and automation implementation in the field.

The population in this study is all employees of PT XYZ who work in units directly related to the management, operation, and development of telecommunications networks. These units include the Operation Team, Planning Team, Tool Team, and Optimization Team. Hair et al. (2019) state that a good sample for research using Partial Least Square-based Structural Equation Modeling (SEM-PLS) analysis is 5 to 10 times the number of indicators for all research variables. The research sample was determined using purposive sampling, which is the selection of samples based on specific criteria relevant to the research objectives. The criteria for respondents selected as samples in this study are directly involved in activities related to network digitization and automation and understand the processes of managing, maintaining, and developing telecommunications networks at PT XYZ.

The sample size taken in this study is adjusted to the requirements of Structural Equation Modeling (SEM) analysis based on Partial Least Square (PLS), which is a minimum of 5 to 10 times the number of indicators used in the research model. Since the number of research indicators in this study is 16, the possible sample size is 85-140. Based on this reference, the sample size for this study was set at 161 people, calculated as follows, Sample = 10 x Indicators (n), Given that n = 16, Sample = 10 x 16 = 160 (Number of respondents = 161)

1. Data analysis technique

The data analysis method used in this study is Structure Equation Modeling (SEM), which makes use of the digital data processing program SmartPLS (Partial Least Square). One alternative approach to covariance-based structural equation modeling is partial least squares (PLS), often known as variance-based structural equation modeling.

The following are the testing procedures that will be used:

a. Assessment of the Outer Measurement Model

Outer models, which specify the relationship between each indicator block and its latent variable, are also commonly referred to as outer relations or measurement models. Convergent validity, discriminant validity, and composite reliability are among the procedures that are used.

b. Hypothesis testing or structural models (inner models)

The process of developing a model based on theoretical ideas to examine the relationship between exogenous and endogenous variables as outlined in the research conceptual framework is known as inner model testing. By examining the R-squared value, the structural model was tested (Ghozali & Latan, 2015). The Rsquare, Q-Square, and F-Square values are the steps used in the structural model testing phases (also known as hypothesis testing).

d. The hypothesis test

The two components of the hypothesis testing used in this study are direct influence and indirect influence.

d. Criteria for mediation testing

If a variable affects the link between the independent and dependent variables, it is referred to be a mediating variable (Sekaran & Bougie, 2017). Path coefficients a and b can be multiplied to test the mediation hypothesis using the bootstrapping method by assessing the Standard Error (SE) (Hayes, 2013).

RESULT AND DISCUSSION

The respondents in this research were 161 Staff and MS PT XYZ from Team Operation, Team Planning, Team Tool and Team Optimization. The level of respondent participation in this research is full, this means that all questionnaires distributed have been filled in and returned by all respondents. Based on the research data obtained, the largest gender is male, 147 or 91.3%. At the age level, the most respondents were aged > 36 years with a total of 91 respondents or 56.5% of the total percentage. The highest level of education among respondents was S1 level with a total of 112 respondents or a percentage of 69.6%. The largest title is Engineer, 147 respondens or 91.3% and The largest division is Team Operation, 116 respondens or 72%.

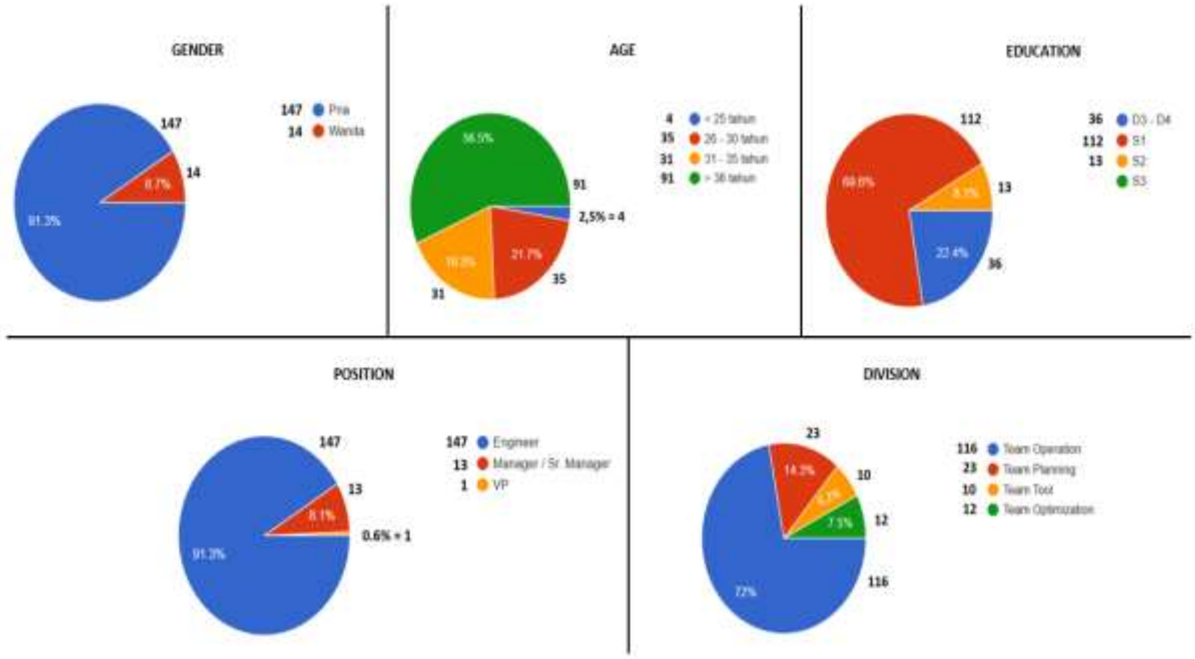

Figure 2 - Responden description

1. Measurement Model Test Results (Outer Model)

Table 2 - Cross Loading

Variable	Indicator	Loading Factor	CutOff	Kesimpulan
Automation	X1.1	**0.772**	**0.700**	Valid
	X1.2	**0.781**		Valid
	X1.3	**0.702**		Valid
	X1.4	**0.729**		Valid
Digitalization	X2.1	**0.834**		Valid
	X2.2	**0.730**		Valid
	X2.3	**0.811**		Valid
	X2.4	**0.714**		Valid
Efficiency Operational	Y1.1	**0.741**		Valid
	Y1.2	**0.809**		Valid
	Y1.3	**0.748**		Valid
	Y1.4	**0.787**		Valid
Sustainability Operational	Z1.1	**0.732**		Valid
	Z1.2	**0.849**		Valid
	Z1.3	**0.804**		Valid
	Z1.4	**0.828**		Valid

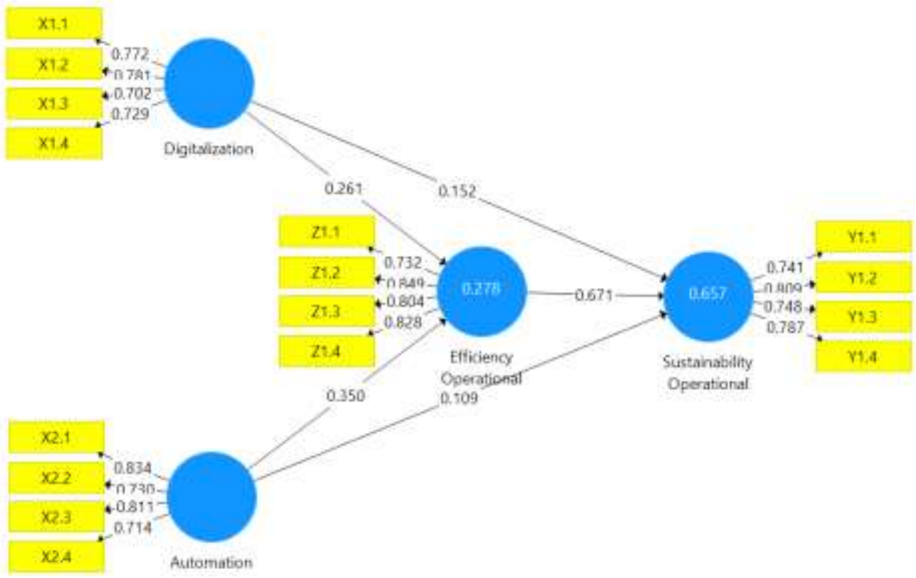

Figure 3 - Outer Model Result

Based on Table 2 and Figure 4, it appears that the overall loading factor of the indicators for the variables of Digitalization, Automation, Operational Efficiency, and Operational Sustainability shows that the model meets the requirements for convergent validity, with loading factor values indicating values greater than 0.7.

Table 3 - Average Variancce Extracted (AVE)

No	Variable	AVE	CutOff	Keterangan
1	Automation (X1)	**0.599**	0,500	Valid
2	Digitalization (X2)	**0.558**		Valid
3	Efficiency Operational (Z1)	**0.647**		Valid
4	Sustainability Operational (Y1)	**0.595**		Valid

Based on Table 3, it can be seen that all AVE values are > 0.5. This indicates that all latent variables in the estimated model meet the criteria for convergent validity (valid). According to Ghozali and Latan (2015), the convergent validity test can also be carried out by examining the AVE (Average Variance Extracted) value provided the AVE value is ≥ 0.5.

2. Dispatch Validity Test

The Discriminant Validity testing process is carried out to determine whether an indicator used is reflective appropriately and well for measuring the research construct based on the principle that each indicator for itself has a greater value than the value of one indicator for other indicators (Ghozali & Latan, 2021). There are two ways to test discriminant validity using SmartPLS, the first way is to look at the cross loading value of each indicator, and the second way is to look at the Fornell-Lecker value.

Table 4 - Cross Loadings Result

Indikator	Automation	Digitalization	Efficiency Operational	Sustainability Operational
X1.1	0.295	0.772	0.423	0.488

X1.2	0.368	0.781	0.270	0.267
X1.3	0.356	0.702	0.208	0.329
X1.4	0.433	0.729	0.312	0.312
X2.1	0.834	0.336	0.333	0.412
X2.2	0.730	0.405	0.266	0.385
X2.3	0.811	0.391	0.452	0.407
X2.4	0.714	0.341	0.397	0.341
Y1.1	0.410	0.413	0.559	0.741
Y1.2	0.431	0.396	0.712	0.809
Y1.3	0.272	0.391	0.569	0.748
Y1.4	0.420	0.314	0.572	0.787
Z1.1	0.397	0.325	0.732	0.591
Z1.2	0.361	0.338	0.849	0.687
Z1.3	0.372	0.394	0.804	0.635
Z1.4	0.399	0.317	0.828	0.617

The cross loadings in Table 4. indicate good discriminant validity, as the correlation values of the indicators with their constructs are higher than the correlation values of the indicators with other constructs. As an illustration, the factor loading of X1.1 for the Digitalization variable (X1) is 0.772, which is higher than the factor loadings for other constructs, namely X2 (0.295), Z1 (0.423), and Y1 (0.488). This condition indicates that the variables under study are valid.

Table 5 - Fornell-Lacker for Discriminan Validity

	Automation	Digitalization	Efficiency Operational	Sustainability Operational
Automation	0.774			
Digitalization	0.475	0.747		
Efficiency Operational	0.475	0.428	0.804	
Sustainability Operational	0.500	0.491	0.788	0.772

Based on the Fornell Lacker Criterion, the AVE roots are Digitalization = 0.774, Automation = 0.747, Operational Efficiency = 0.804, and Operational Sustainability = 0.772. Each AVE root is higher than the correlations of the other variables, so from table 5. the evaluation of discriminant validity based on the Fornell-Lacker criterion is acceptable.

RELIABILITY TEST

Reliability tests in research are carried out to prove the accuracy, consistency and precision of instruments in measuring constructs (Ghozali, 2014). In this research, reliability tests were carried out using Cronbach's Alpha and Composite Reliability which can be said to be reliable if they have values ≥ 0.6 and ≥ 0.7 (Siswoyo, 2017).

Table 6 - Reliability Result dan Cronbach's Alpha

	Cronbach's Alpha	rho_A	Composite Reliability	CutOff	Keterangan

Automation	**0.775**	**0.783**	**0.856**	0.700	Reliable
Digitalization	**0.744**	**0.770**	**0.834**		Reliable
Efficiency Operational	**0.817**	**0.819**	**0.880**		Reliable
Sustainability Operational	**0.774**	**0.781**	**0.855**		Reliable

The results of construct reliability testing as presented in Table 6 show Composite Reliability and Cronbach's Alpha values for all latent variables > 0.70. Thus, all manifest variables in measuring latent variables in the estimated model are declared reliable.

STRUCTURAL MODEL TEST (INNER MODEL)

R-Square (R2)

Based on the results of calculations using SmartPLS software version 3.2.9, the R2 value is obtained which shows the level of determination of the independent variable on the dependent variable as follows:

Table 7 - R Square Model Struktural

	R Square	R Square Adjusted	Criteria	Catagory
Efficiency Operational (Z1)	0.278	0.269	0.33-0,67	Low
Sustainability Operational (Y1)	0.657	0.651	> 0.67	Moderat

As shown in Table 7, the R2 value for Operational Efficiency (Z1) is 0.278. This result is below the range of 0.33-0.67, so it can be categorized as Low. This finding indicates that 27% of Operational Efficiency (Z1) is influenced or determined by Digitalization and Automation, while the remaining 73% is influenced/determined by other variables/factors not observed/studied in this research. The R2 value for Sustainable Operational (Y1) is 0.657. This result is below 0.67, so it is classified as Moderate. This finding explains that 65% of Operational Sustainability is influenced/determined by Digitalization and Automation, and Operational Efficiency, while the remaining 35% is influenced/determined by other factors/variables not observed/studied in this research.

FIT Model

The model fit evaluation in this study was conducted using three testing models, namely: Chi-square, standardized root mean square residual (SRMR), and normal fit index (NFI). The NFI value criteria range from 0 to 1; if it is close to 1, it means that it is a good fit. Additionally, the Chi-square value is greater than 0.9 (Chi2 > 0.9) and SRMR ≤ 0.1 (Hair et al., 2021). The results of Chi-square, SRMR, and NFI are presented in Table 7 below:

Table 8 - FIT Model

	Saturated Model	Estimated Model	CutOff	Keterangan
SRMR	0.091	0.091	≤0,1	Fit
Chi-Square	380.405	380.405	>0,9	Fit
NFI	0.684	0.684	0-1	Fit

Based on model fit testing, the results show that the model in this study has a good fit because the SRMR value is < 0.1, Chi-square >0.9, and NFI is close to 1.

HYPOTHESIS TESTING

The results of the hypothesis test, which include the path coefficient values and T-statistics, are visualized in Figure 5 and summarized in Table 8 below:

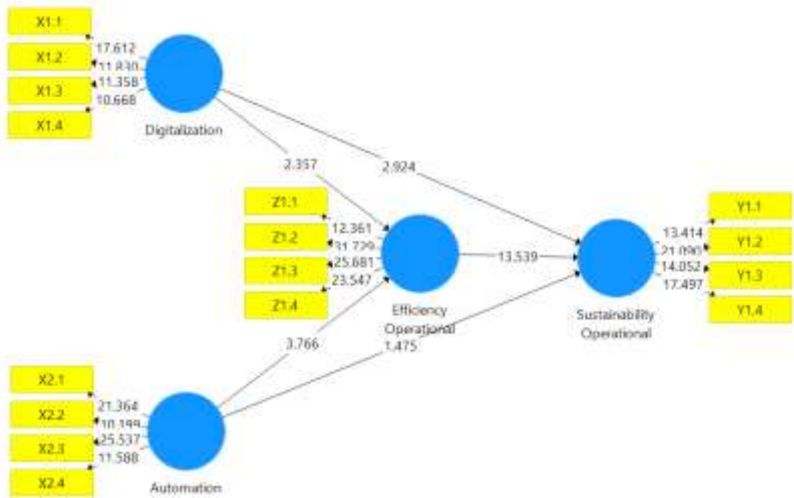

Figure 4 - Coeffisien Result and T-Statistik (Bootstrapping)

Table 9 - Hipotesis Result

Hipotesis	Variable	Path Coefficient	T-statistics	p- values	Kesimpulan
H1	Digitalization (X1) -> Efficiency Operational (Z1)	0.261	2.339	**0.020**	Significant and Positive
H2	Automation (X2) -> Efficiency Operational (Z1)	0.350	3.851	**0.000**	Signifikan and Positive
H3	Efficiency Operational (Z1) -> Sustainability Operational (Y1)	0.671	14.297	**0.000**	Signifikan and Positive
H4	Digitalization (X1) -> Sustainability Operational (Y1)	0.152	2.916	**0.004**	Signifikan and Positive
H5	Automation (X2) -> Sustainability Operational (Y1)	0.109	1.502	**0.134**	Not Effect

Based on the results of the hypothesis test above, all direct and indirect causal relationships are significant at α = 0.05. The explanation for each hypothesis is described as follows:

a. The direct effect of digitalization on operational efficiency

First Hypothesis (H1): "Digitalization has a direct effect on Operational Efficiency in the telecommunications industry of PT XYZ." The results of the H1 test show a path coefficient value of 0.261 and a t-statistic value of 2.339 > t-table value (n = 161, α = 0.05) = 1.96. This indicates that digitalization has a direct effect on operational efficiency in the telecommunications industry at PT XYZ, so improvements in digitalization can have positive consequences for operational efficiency in the telecommunications industry at PT XYZ.

b. The Direct Effect of Automation on Operational Efficiency

Second Hypothesis (H2): "Automation has a direct effect on Operational Efficiency in the telecommunications industry of PT XYZ." The results of the H2 test show a path coefficient value of 0.350 and a t-statistic value of 3.851 > t-table value (n = 161, α = 0.05) = 1.96. This indicates that automation has a direct effect on operational efficiency in the telecommunications industry at PT XYZ, so improvements in automation can have a positive impact on increasing operational efficiency in the telecommunications industry at PT XYZ.

c. Direct effect of operational efficiency on operational sustainability

Third Hypothesis (H3): "Operational Efficiency has a direct effect on Operational Sustainability in the telecommunications industry of PT XYZ." The results of the H3 test show a path coefficient value of 0.671 and a t-statistic value of 14.297 > t-table value (n = 161, α = 0.05) = 1.96. This indicates that Operational Efficiency has a direct effect on Operational Sustainability in the telecommunications industry of PT XYZ, so that improvements in the implementation of Operational Efficiency can have a positive impact on increasing Operational Sustainability in the telecommunications industry of PT XYZ.

d. Direct effect of Digitalization on Operational Sustainability

Fourth hypothesis (H4): "Digitalization has a direct effect on Operational Sustainability in the telecommunications industry of PT XYZ." The results of the H4 test show a path coefficient value of 0.152 and a t-statistic value of 2.916 > t-table value (n = 161, α = 0.05) = 1.96. This indicates that digitalization has a direct effect on operational sustainability in the telecommunications industry of PT XYZ, so improvements in digitalization can have a positive impact on enhancing operational sustainability in the telecommunications industry of PT XYZ.

e. Direct Effect of Automation on Operational Sustainability

Fifth Hypothesis (H5): "Automation does not have a direct effect on Operational Sustainability in the telecommunications industry of PT XYZ." The results of the H5 test show a path coefficient value of 0.109 and a t-statistic value of 1.502 > t-table value (n = 161, α = 0.05) = 1.96. This indicates that Automation does not have a direct effect on Operational Sustainability in the telecommunications industry at PT XYZ, so it must continue to be improved by PT XYZ management.

Based on Table 8, Digitalization has the strongest impact on Operational Sustainability, while Automation has no impact on Operational Sustainability..

CONCLUSION

Based on the results of research and discussion Digitalization has a direct, positive, and ignificant effect on operational efficiency in telecommunications companies at PT XYZ. This indicates that solid digitalization can make a positive contribution to operational efficiency in telecommunications companies at PT XYZ. As a consequence, improvements in digitalization can stimulate an increase in operational efficiency in telecommunications companies at PT XYZ. Automation has a direct, positive, and significant impact on operational efficiency in telecommunications companies at PT XYZ. This shows that well-implemented automation can have a positive impact on operational efficiency in telecommunications companies at PT XYZ. Operational efficiency has a direct positive and significant impact on operational sustainability in telecommunications companies at PT XYZ. This shows that high operational efficiency can have a positive effect on operational sustainability in telecommunications companies at PT XYZ. Digitalization has a direct positive and significant impact on operational sustainability at PT XYZ. This shows that solid digitalization can have a positive effect on operational sustainability at PT XYZ. Automation does not have a direct positive and significant effect on operational sustainability in telecommunications companies at PT XYZ. This indicates that automation needs to be continuously improved to enhance operational sustainability in telecommunications companies at PT XYZ.

Suggestion for companies should develop sustainable Digitalization enhancement programs involving all employees. Top management needs to review and utilize the results of this study with a focus on improving aspects related to Operational Efficiency and Operational Sustainability. The management of automation systems at PT XYZ telecommunications companies needs to be continuously improved to enhance operational efficiency and sustainability. To this end, the board of directors needs to establish policies that support innovation in the process of moving toward automation, create faster and more practical platforms, and build responsive and integrated automation centers to improve operational efficiency and sustainability. The next focus is to maintain and improve the quality of operational efficiency and operational sustainability consistently. This requires collaboration between employees and management in identifying and realizing operational sustainability. Regular improvements in digitalization and automation optimization need to be carried out to enhance the quality aspects of operational efficiency and operational sustainability. This empirical research model can serve as a reference for further studies in the field of telecommunications industry management. Researchers are encouraged to apply this model in different contexts to generate new, relevant, and more comprehensive insights, and conduct more in-depth analysis using advanced and detailed analytical tools, such as LiSrel, to obtain more comprehensive and in-depth results.

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