



Implementation of Software Define-Wide Area Network (SD-WAN) to Improve Efficiency on KGX Logistic Company

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Abstract. The purpose of this study is to develop digital transformation roadmap and measure the cost-benefit of transformation in increasing efficiency at KGX Logistic Company using Software Define-Wide Area Network (SD-WAN). This study uses a digital maturity model that combines the dimensions of customer, strategy, technology, operations, and culture using the digital maturity model method from the TM forum. Based on the data and analysis in this study, the resulting Net Present Value (NPV) was positive 439,916,416; Internal Rate of Return (IRR) 47% and payback period in the second year. The practical implication in this research is to facilitate justification to the management that the digital transformation projects using SD-WAN are feasible and able to increase time and business operational cost efficiency.

Keywords: SD-WAN · Management · Logistic · Efficiency · Digital Transformation

1 Introduction

The development of technology makes it easier for humans to improve the business performance of an industry. According to research [1] this is due to the need for acceleration and productivity growth of each industry. The digital disruption that occurred had an impact on various elements with the marking of the industrial era 4.0. Technology can provide production automation that will increase business opportunities, business effectiveness, efficiency, and renew the environment through better asset management [2].

One industry that plays an important role in a country to help increase the economic value of a country is the transportation and warehousing industry or often called logistics. The concept of digitizing logistics is by emphasizing transparency over time from suppliers to customers. Logistics must also get a bigger vision to meet industry 4.0 requirements in a sustainable manner in terms of using the right technology and

increasing integration among supply chain partners [3]. Indonesia still has problems in terms of national logistics, so improvements are still needed [4].

The wide geographical scope is a challenge as well as an opportunity for companies that will do business in this industry. Judging from the ranking of Indonesia's logistics performance in the world, it was in the 46th position in 2018. The Logistic Performance Index (LPI) is issued by the world bank every 2 years to assess the performance of each country in the logistics sector.

Based on the Table 1, Indonesia's position has increased at the world level from position 63 in 2016 to position 46 in 2018. However, seen from ASEAN countries, Indonesia experienced a slowdown, followed by Vietnam which rose to 39th in the world. One of the causes is logistical inefficiency from time to time and high operational costs, to improve efficiency and performance, fundamental improvements need to be made [5]. This is influential because the logistics sector in Indonesia faces several challenges such as providing support for economic growth, strengthening industrial structures and increasing product competitiveness.

According to [6] the Indonesian state is classified as a nascent country which shows a weak production structure and economic structure. Seen in Fig. 1 below in relation to the logistics industry, in 2020 the contraction that occurred in the second quarter where there was a contraction in the transportation & warehousing sector of 30.84% which was quite influential on the rate of GDP in Indonesia. This is also influenced by the COVID-19 outbreak, where Large-Scale Social Restrictions (PSBB) were implemented in several major cities in Indonesia [7].

KGXpress (KGX) companies providing services in the logistics industry are required to develop their business in order to improve services. This has an impact on the IT service infrastructure that is currently running conventionally. Digital Transformation changes are needed to provide new experiences and can adapt to company needs flexibly.

SWOT analysis is used in to obtain the right strategy formulation, this analysis in its application in a company can detect any weaknesses and strengths and minimize the

Table 1. Ranking of logistics performance of ASEAN countries in the World (2016 & 2018)

	2016		2018	
	LPI Rank	LPI Score	LPI Rank	LPI Score
Singapore	5	4.14	7	4.00
Thailand	45	3.26	32	3.41
Vietnam	64	2.98	39	3.27
Malaysia	32	3.43	41	3.22
Indonesia	63	2.98	46	3.15
Philippines	71	2.86	60	2.90
Brunei	70	2.87	80	2.71
Myanmar	113	2.46	137	2.30

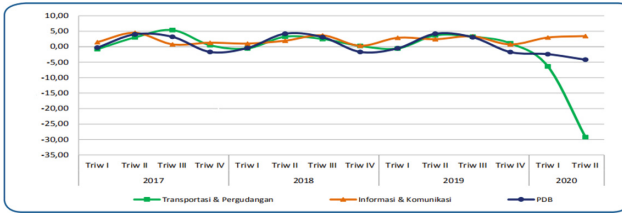


Fig. 1. GDP growth in several business fields (q to q).

impact or consequences in the future [8]. In addition, this analysis is able to determine realistic business goals seen from the condition of a company, therefore it is expected to be easier to achieve [9]. The SWOT analysis consists of the acronyms Strength, Weakness, Opportunity and Thread which are used to see the state of the company (Table 2).

After analyzing the SWOT, a TOWS matrix is then made according to the Table 3 to systematically improve the strategy and consider the factors of strengths, weaknesses, opportunities and threads.

The first problem in Table 3 is regarding the company’s SWOT analysis, in terms of weaknesses and threads, the problems faced by the company include the level of reliability or unreliability of the system which is lacking where the services provided are not always normal, the low speed of access from the hub or sorting in areas to access the company’s internal information resources located in the Head Office and in the Cloud is often an obstacle. This of course affects the continuity of operations such as data transmission and packet delays.

The second problem in terms of logistics costs is inefficiency, including system management and operational costs. The management here is the configuration manual which is still being implemented. For companies on a national or global scale, things like this need to be automated to support operational activities and minimize costs.

With the related industry exposure above, the author wants to implement digital transformation related to the application of SD-WAN technology that will help improve

Table 2. Strength, Weakness, Opportunity, Thread (SWOT)

Strengths	Weakness
<ul style="list-style-type: none"> - some apps are in the cloud - offer flexible logistics solutions as one stop solution services - distributed network throughout Indonesia 	<ul style="list-style-type: none"> - conventional network infrastructure is slow to accommodate business needs - device configuration manually - frequent misunderstanding of IT problems - IT governance is not managed
Opportunities	Thread
<ul style="list-style-type: none"> - Kompas Gramedia Business Unit collaboration - the need for additional branches is high - improving QoS by performing system enhancements 	<ul style="list-style-type: none"> - high IT costs - lack of knowledge - reduced business unit trust

Table 3. TOWS Matrix

	<i>Strengths</i>	<i>Weakness</i>
<i>Opportunities</i>	SO: - Expand marketing - Maintain the quality of service - Always make IT improvements	WO: - IT system automation - Make clear network monitoring as needed - ISP consolidation with other business units
<i>Thread</i>	ST: - Monitoring cloud and onpremise resources and costs - Special price for sister company - Conduct sprint meeting every 2 weeks	WT: - Provide internal training for IT - Improved Network Security - Looking for the latest IT system solutions at affordable prices

network performance from the KGX business process. It is hoped that in the future the company will be able to focus and compete with competitors and achieve a competitive advantage that will help the company in developing the right Business Model.

2 Literature Review

A. Deloitte & TM Forum: Digital Maturity Model

Digital maturity model analysis is used to see the current condition of the company and compare it with the company’s expected condition in the future. Thus, analysis can be carried out and a roadmap can be drawn to determine the way to reach that goal. Based on research journals from [10] there are now more and more maturity assessment framework models that are generally available, and use checklists that are often prepared based on experience and subjective observations. The selected model takes a custom and personalized form, and is prepared to assess the analytical maturity of entities with specific business profiles (Fig. 2).

In this paper, the digital maturity model (DMM) used in this digital transformation project was developed by TM Forum in collaboration with Deloitte. As shown in

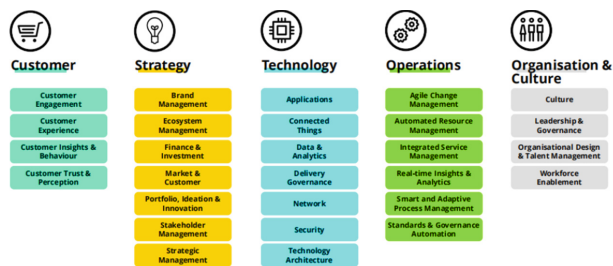


Fig. 2. Deloitte Digital maturity model [11].

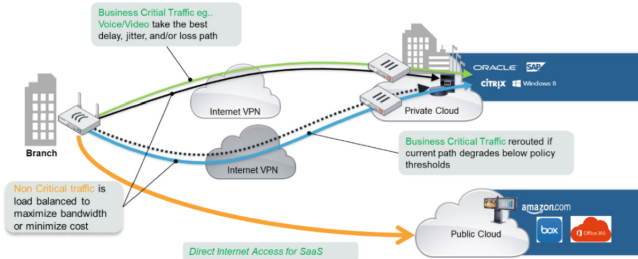


Fig. 3. SD-WAN illustration.

Fig. 3 above, according to [11] in this DMM there are 5 main dimensions, namely customer, strategy, technology, operations, culture. This DMM will evaluate the 5 defined dimensions to create a holistic view of digital maturity in an organization.

B. Software Define Wide Area Network (SD-WAN)

SD-WAN is a technology that carries a software define system where this system will separate the control plane and data plane so as to create a Virtual WAN architecture that allows companies to take advantage of any combination of transport services – including Dedicated Internet, Broadband Internet, MPLS/Private leased line, and also LTE/4G Wireless.

Explicitly SD-WAN will simplify the management of Wide Area Network (WAN) operations and virtualize its transport services. In its implementation, SD-WAN will help a more reliable communication process from branch offices to head office as well as KGX’s Cloud Providers. It can be seen in the picture above that there are two physical SD-WAN devices located in the Branch and Private Cloud (Head Office Data Center). This device will be the gateway for every transport line, both internet and private connections. For communication to the HO, this SD-WAN will form a VPN tunnel automatically including all the policies in it just by registering other appliances that will be included in its membership. As for communication to the public cloud, several cloud providers also have integration into several SD-WAN devices.

According to research [12] and research [13] described several capabilities of SD-WAN compared to using only conventional WAN. This is of course also a new feature in the network system including:

- 1) Quality of Service (QoS) Guarantee
- 2) Service Automation
- 3) Solution to the problem of cost efficiency (High bandwidth cost with low utilization)
- 4) Pengalaman baru (new user experience)

3 Methodology and Data Analysis

A. Proof of Concept (PoC)

Seeing the company’s considerable capabilities, supporting initiatives are also carried out in parallel, such as carrying out a Proof of concept (PoC) related to SD-WAN

technology which aims to find out the details of the features and how to implement them. For Sampling, PoC will be tried at one of the KGX branches in Cakung for 2 weeks. Sampling in Cakung is because Cakung has three different connections including Dedicated, Leased line, and Broadband. Several test scenarios were developed such as disconnection of some providers. In terms of devices used using Velocloud VMware devices. This selection is based on Gartner in 2019 where VMware holds the top leaderboard for WAN Edge Infrastructure. The hope is that this PoC can be seen thoroughly for the features that can be provided to support this digital transformation project.

B. Digital Maturity Model

Measurement of DMM can see the difference in the situation from the current condition and the expected future conditions after this digital transformation is carried out. This difference occurs because there are still many services that can be improved compared to Corporate IT for KGX. Thus, the reason why this digital transformation needs to be carried out is that there is a gap between ideal conditions and existing conditions (Fig. 4).

The picture above show the current vs future state DMM measurement results from 5 different sub-dimensions. In the measurement above, there are 5 levels: 1-Initiating, 2-Emerging, 3-Performing, 4-Advancing, 5-Leading.

C. Validity Test

The test criteria for the validity test use a significance value (P-value) where if the significance value is < 0.05 then the conclusion is valid. Meanwhile, if the significance value is > 0.05 then the conclusion is invalid. For the interpretation of the validity test output can be seen in the Table 4.

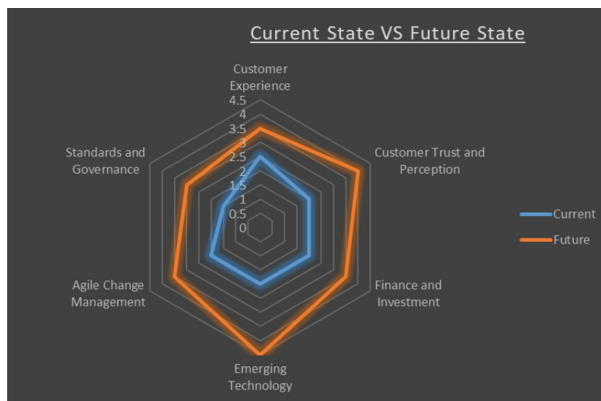


Fig. 4. Current state vs Future state DMM.

Table 4. Validity Test

No Soal	Sub-dimension	Sig = 0.05	Kriteria
1	CE01	0.006	Valid
2	CE02	0.011	Valid
3	CT01	0.000	Valid
4	CT02	0.001	Valid
5	FI01	0.009	Valid
6	FI02	0.000	Valid
7	ET01	0.003	Valid
8	ET02	0.025	Valid
9	CM01	0.000	Valid
10	CM02	0.000	Valid
11	SG01	0.005	Valid
12	SG02	0.002	Valid

CE: Customer Experience, CT: Customer Trust and Perception, FI: Finance and Investment, ET: Emerging Technology & Applications, CM: Agile change Management, SG: Standards and Governance.

D. *Reliability Test*

Testing criteria for the reliability test according to (Ghozali., 2011) the variable is said to be reliable if the value of Cronbach's alpha > 0.700 . And in this test, Cronbach's alpha value is 0.823, which means reliable (Fig. 5).

Reliability test criteria:

- If alpha > 0.90 then it is said to be very reliable;
- If the alpha is between $0.70 - 0.90$, it is highly reliable;
- If the alpha is between $0.50 - 0.70$ then it is moderately reliable;
- If alpha < 0.50 then it can be said to be low reliable.

4 Research Result and Discussion

A. *Respondent Characteristics*

Regarding the implementation plan for the analysis of DMM measurement companies, a questionnaire was made this time to be distributed to 30 respondent from the operational, IT, finance and Strategic Management teams from KGX. It is intended to see the point of view of IT network services from different perspectives. Referring to the data obtained, there are different results from the questionnaires distributed, there are those who rate the current IT services as good with a fairly good score and there are also those who think that IT services need to be improved again with a low score. In

Reliability

[DataSet0]

Scale: ALL

Case Processing Summary

		N	%
Cases	Valid	30	100.0
	Excluded ^a	0	.0
	Total	30	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.823	12

Fig. 5. Reliability Tests.

addition, the future state will be given to the Manager of Infrastructure Corporate IT & IS Kompas Gramedia as a service provider for KGX through an interview system.

B. *Statistic Analysis*

The Table 5 and Fig. 6 below shows the comparison between Current and Future Levels of DMM in KGX. Also mapped from each of these sub-dimensions, 2 focuses were taken to conduct Maturity Model research. There is a gap between each of these sub-dimensions.

In ways of working, repetitive tasks, return on investment, business reqs, and organization design, there is a gap between current conditions and conditions expected in the future. This shows the need for improvement in several parts. Furthermore, in low customer satisfaction, fulfillment treatment, dedicated investment, technology evolution, process monitoring, and governance, there are 2 gaps. Where improvements need to be made to continue to support this business running and to fulfill the company's vision and mission. Finally, the technology roadmap has the highest gap, namely 3 gaps. Careful planning, the latest technological breakthroughs, and transformations need to be carried out immediately to maximize the performance of all IT services at KGX companies.

C. *Roadmap Planning*

In accordance with the plans discussed regarding the formation of digital transformation case studies and the company's capabilities, several initiatives were made.

Table 5. Current vs Future state measurement of DMM

		Current	Future
Customer Experience	Ways of working	3	4
	Repetitive tasks	2	3
Customer Trust and Perception	Low customer satisfaction	2	4
	Fulfilment trust	2	4
Finance and Investment	Dedicated investment	2	4
	Return on investment	2	3
Emerging Technology & Applications	Technology roadmaps	2	5
	Technology evolution	2	4
Agile change Management	Business reqs	2	3
	Process Monitoring	2	4
Standards and Governance	Organization design	2	3
	Governance	1	3

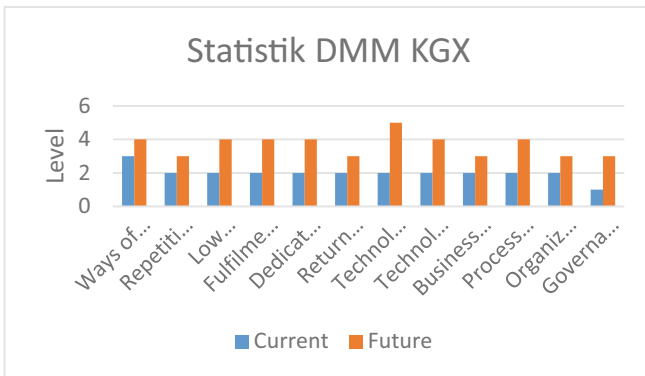


Fig. 6. Current state vs Future state DMM statistics.

This initiative was taken to determine the roadmap rather than planning this digital transformation.

The following is an overview of the project that will run for 3 years, and is divided into 6 stages. Each stage lasts approximately 6 months. For the first year, stage 1 and stage 2 focused on increasing internet speed in each branch. Then in the second year, stage 3 and stage 4 focused on the implementation of SD-WAN. And in the last year, in the third year of stage 5 and stage 6, the entire project will be reviewed and reassessment will begin for the next plan (Fig. 7).

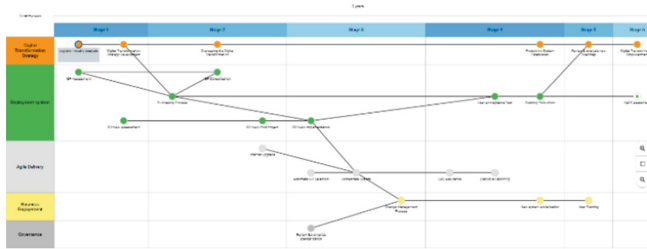


Fig. 7. Big Picture Roadmap Transformasi Digital.

D. Solution Discussion

A centralized monitoring system can be used to monitor all KGX branches from one dashboard. by turning off several links either directly or with the original condition of the network being disconnected, it can be seen that the results from SD-WAN Enhancement still show network quality at 9.99 for voice, 9.99 video, and 10 for business transactions (Fig. 8).

Furthermore, the historical data in real time can be seen in the image below. During the 2 weeks of testing there was a comparison of which links were often problematic. Thus justification can be done in detail, especially for executive reports to management (Fig. 9).

E. Project Feasibility Analysis

Tangible Benefit: The calculation below shows the financial calculation scenario to assess the benefits of the SD-WAN Project. Calculations are performed to determine the value of Net present value (NPV), Internal rate of return (IRR), and Payback period. For the calculation of the total per year, both benefits and costs.

For benefits consist of avoid cost of legacy network and maintenance at existing edge branches, Reduced cost to connect and operate new branches, Increased efficiency from centralized network management, and Additional productivity from reduced network downtime. While the cost consists of cost of Velocloud SD-WAN Solution Premium

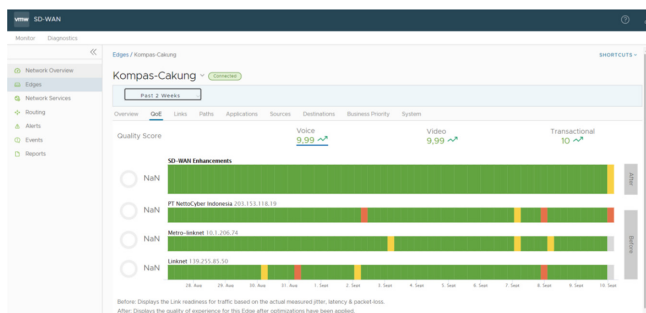


Fig. 8. SD-WAN network quality.

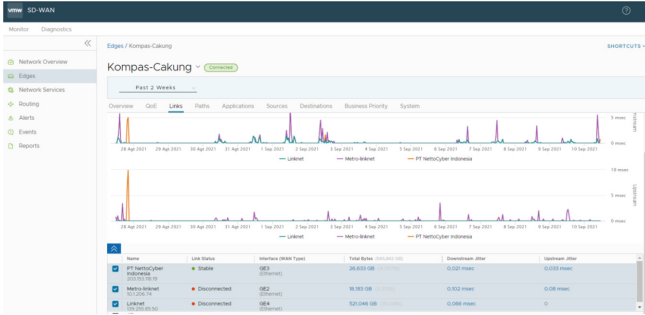


Fig. 9. SD-WAN Details History Links.

subscription, Cost of deployment and implementation, and Cost of ongoing network management - with SD-WAN (Fig. 10).

The first calculation regarding the Net present value (NPV) can be calculated by changing the Cash Flow to the present value value, after changing it is calculated. Another way can also be to apply the following formula in Excel, calculated using the formula = -364,677,768 + NPV(15%, 225,260,344 371,519,863 498,532,600) so as to produce a value of 439,916,461.

The second is the calculation of the Internal rate of return (IRR) using the formula = IRR(Net Cashflow year 1 to year 3), which means = IRR -364,677,768 195,878,560 280,922,392 327,793,277). The results of this calculation produce an IRR value of 47%. The company itself asks for an increase in return of at least 20%. So if the IRR calculation is greater than 20%, the project is declared feasible (Table 6).

Interest Rate					15%	
	Year 0	Year 1	Year 2	Year 3	Total	
Benefit		475,327,397	544,211,231	498,532,600	1,518,071,228	
Cost	-364,677,768	-250,067,053	-172,691,368		-787,436,189	
Accumulated Cash Flow	-364,677,768	-139,417,423	232,102,439	730,635,039		

	Year 0	Year 1	Year 2	Year 3
Benefit		475,327,397	544,211,231	498,532,600
Cost	-364,677,768	-250,067,053	-172,691,368	
Cash Flow	-364,677,768	225,260,344	371,519,863	498,532,600

Present Value (PV)	-364,677,768	195,878,560	280,922,392	327,793,277		
NPV calculation of PV					439,916,461	
Using Excel formula					439,916,461	
IRR					47%	
Payback Periode					2	

Fig. 10. Cost Analysis.

Table 6. NPV and IRR Project Feasibility Indicators

Indicator	Value	Limit	Results
Internal rate of return (IRR)	47%	IRR > 20%	Worth running
Net present value (NPV)	439,916,461	NPV = - Not worth running NPV = + Worth running	Worth running

Third, the Payback period calculation is calculated using the formula = MATCH(0,Accumulated Cashflow year 0 to year 3,1), which means = MATCH(0, -364,677,768 -139,417,423 232,102,439 730,635,039) and the payback period is obtained in year 2.

Intangible Benefit: One of the potential benefits of SD-WAN that currently cannot be calculated is the cost of internet. It is known that one of the capabilities of SD-WAN is by maximizing broadband services, so that the cost of long connections using MPLS. However, this benefit is not included in the benefit calculation because not all branches have the same connection at this time.

Uncalculated Potential Benefit: Some of the potential benefits that cannot be calculated with the SD-WAN include (Fig. 11).

- For leaders and managers of the Corporate IT&IS Department, decision making will be easier with the existence of an executive report that can be automatically scheduled for delivery
- For employees of the Corporate IT&IS Department, make it easy for employees to manage remote network systems to be centralized and easier. Some repetitive tasks are no longer exist because of the automation features of SD-WAN. In its application digital transformation allows changes to the business model [14]. It can be seen that the business model canvas has also changed as shown in Figure below
- For the KGX company, Improved service effectiveness can flexibly follow business needs. Such as adding branches, both permanent and temporary, can be completed more quickly. In addition, each PIC from the Branch also has its own monitoring access to monitor activities that occur on the network at the branch

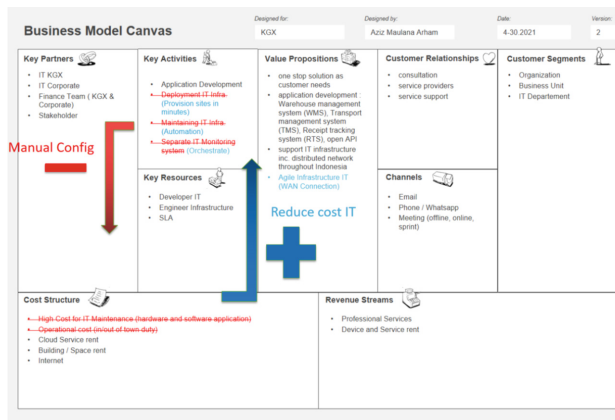


Fig. 11. KGX company's Business Model Canvas after the Digital Transformation Project.

5 Summary

Based on the results of the analysis design of SD-WAN implementation at the KGX Company, several conclusions can be drawn as follows:

- F. There is a gap in the assessment of the maturity model that is currently running with the company's future targets. Means for some business capabilities need and must be improved.
- G. Seeing the benefits, ongoing operations are agile and able to respond to business challenges. Quality of Services guarantee is an added value to provide the best service for the company.
- H. From a financial perspective, the simulation of NPV calculation resulted in a positive value of 439,916,461 and an IRR of 47%. As long as this value is above 20%, it indicates that this project is feasible.

Thus, it can be concluded that the implementation of SD-WAN will be able to assist companies in developing their business both in terms of operational business, business growth, and risk business.

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