

# Proposed Improvement of New Electrical Connection Business Process

(Case Study of New Electricity Connection of PT PLN (Persero) Medium Voltage Customers)

Muhammad Ridha<sup>1</sup>, Rosalendro Eddy Nugroho<sup>2</sup>  
Master of Management, Economic and Business Faculty  
Mercubuana University, Indonesia

**Abstract:-** Based on the provisions of the Regional PLN for Java Madura Bali in 2021, the speed of new connection service days for medium voltage (20KV) customers is carried out a maximum of 100 working days. From the data on connecting new electricity customers at PLN UP3 North Banten from 2017 to 2020 there are 52 customers that exceed 100 days. This delay requires PLN to pay a fine to the customer, resulting in a loss. In this research, business processes are improved for new electricity connections so that problems do not occur again. This research was conducted with qualitative methods and data collection was carried out by direct interviews. By using value stream mapping, an analysis of the ongoing business processes is carried out so that nonvalue added activities can be eliminated and lead times can be reduced. The results of the future stream mapping show that the biggest delay in business processes comes from the licensing process and material preparation, so business processes are improved by changing the flow and simplifying activities. From the results of business process improvements, the lead time decreased by 40% so that from the previous 100 working days to 60 working days. In addition, there was an increase in the value-added ratio to 95% from the previous 76%.

**Keywords:-** New Connection, Service Quality Level, Lead Time, Value Stream Mapping, Increased Sales.

## I. INTRODUCTION

PT PLN (Persero) UP3 Banten Utara is a PLN work unit located in Serang City, Banten which is within the scope of UID Banten. PLN is a state-owned company that is tasked with

providing electricity in Indonesia and is obliged to provide the best service for the community. Based on law number 30 of 2009, PLN must provide the best service for the people of Indonesia, including in providing new installation services for electricity [6]. According to Danang (2019), "With the new fast electricity connection, customers will be satisfied and PLN's image will be getting better" [3].

The new electricity connection is regulated in the regulation of the Minister of Energy and Mineral Resources (ESDM) number 18 of 2019 (Ministry of Energy and Mineral Resources, 2019) provided that the standard level of service quality provided must be carried out within the following time [4]: (1) 5 working days if a new low-voltage connection is made without network expansion, (2) 15 working days if the new low voltage connection with the addition / expansion of the low voltage network (JTR), (3) 25 working days if the new connection is low voltage with the addition of a transformer.

According to the provisions of the TMP PLN Regional Java Madura Bali in 2021 For medium voltage customers (20 kV), the speed of service days is carried out a maximum of 100 (one hundred) working days [5].

Lead time is the time required by the production department to produce goods with a predetermined capacity or the time required for the service department to provide services from the time the customer arrives until the customer's needs are achieved. [8].

On average in a month, North Banten UP3 sales are 310.9 billion/month for medium voltage, 270.5 billion/month for high voltage and 144.1 billion/month for low voltage [11].

TABLE I. COMPOSITION BY TYPE OF TARIFF FOR PLN UP3 BANTEN UTARA

Tariff Class	Number of Customers	Usage (kWh)	IDR Income	Percentage
Low Voltage	859.726	151.095.380	144.080.344.837	19,9%
Medium Voltage	559	266.490.601	310.980.303.679	42,9%
High Voltage	20	265.662.353	270.552.715.781	37,3%

Source: Data Perusahaan PT PLN (Persero) UP3 Banten Utara, 2021.

In the 2017 – 2020 period, there were 52 customers who exceeded the service quality level, this can be seen in Figure 1. With this delay, PLN must pay a late fee for late connections. The value of the fine paid by PLN in accordance with the MEMR regulation number 18 of 2019 article 6B is: (1) 35% of the minimum account (40 hours on) / subscription fee for consumers in the tariff category subject to tariff adjustment or; (2) 20% of the minimum account (40 hours of operation) /

subscription fees for consumers in the tariff category that are not subject to electricity tariff adjustments (non-tariff adjustment)

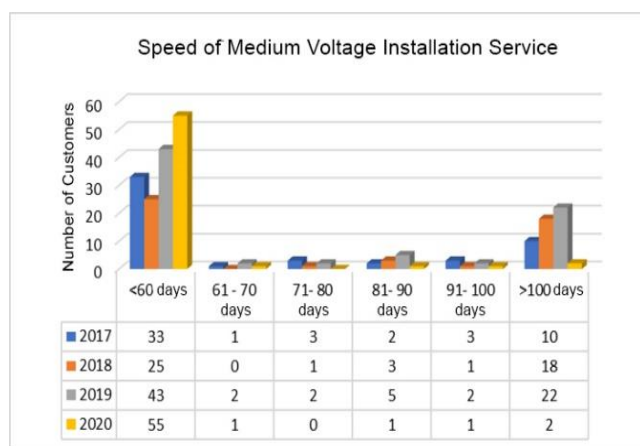


Fig. 1. Speed of the Day New Medium Voltage installation service

From the existing problems, the authors try to conduct research related to simplifying the business process of connecting electricity for medium voltage to reduce lead time.

The objectives of the research include the following: (1) Knowing the activities that are omitted to reduce lead time, (2) Designing new simpler business processes

## II. METHODOLOGY

### A. Research methodology

The method used in this study is to use a qualitative method, which is carried out by interviewing parties directly related to the work and using historical data on the duration of company connection obtained from 2017 to 2020.

In this study, the researcher used a case study approach. Case study research is an approach that examines events that occur, cases and various kinds of cases by collecting detailed data and involving various sources of information to be described in a qualitative approach (Creswell, 2015) [1].

### B. Operational Variables

The operational variables used in this study are as follows:

TABLE II. OPERATIONAL VARIABLES

Research variable	Dimension	Indicator	Data Type
Lead Time Decrease	Activity	<ul style="list-style-type: none"> <li>Non-Value Added (NVA)</li> <li>Necessary Non-Value Added (NNVA)</li> <li>Value Added (NA)</li> </ul>	Primary & Secondary
	Flow	<ul style="list-style-type: none"> <li>Flow Process (as is)</li> </ul>	Primary & Secondary
	Process	<ul style="list-style-type: none"> <li>Flow Process (to be)</li> <li>Number of activities and time</li> </ul>	Primary & Secondary
	Human	<ul style="list-style-type: none"> <li>Number of personnel</li> <li>Knowledge and skills</li> </ul>	Primary
	Material	<ul style="list-style-type: none"> <li>Availability of materials</li> </ul>	Primary
	Methods	<ul style="list-style-type: none"> <li>Legal &amp; Permits</li> <li>Issuance of registers</li> <li>Issuance of work orders (SPK)</li> </ul>	Primary
	Environment	<ul style="list-style-type: none"> <li>Field conditions</li> </ul>	Primary

Source: Data processed by the author, 2022

### C. Population, Sample and Key Informants

The population in this study is a new medium voltage connection customer in UP3 North Banten. While the sample used is Medium Voltage customers at UP3 North Banten who have a connection TMP above the provisions (Sugiyono, 2008) [12].

In this study, the key informants used were the manager of the construction division, the manager of the planning division, and the engineering division of the service unit. This informant was chosen because the person most understands and is directly related to work.

### D. Data Collection and Analysis Method

The methods used in data collection are as follows: (1) Direct observation, in the business process of connecting new medium voltage customers, (2) Interview with the party who feels most understand about the new electrical connection work (3) Study literature to obtain supporting data in the form of research sources such as journals, scientific books, and related

materials online that are directly related to the problem of the new electrical connection process.

The stages of the research data analysis methodology used are as follows: (1) Identify existing business processes. This identification aims to obtain information in running business processes. This stage is carried out by interviewing with informants, then analysis and mapping using current stream mapping is carried out, (2) Analysis of existing business processes. This stage is carried out to classify ongoing activities (VA, NVA and NNVA) (3) Identification of waste activities. It is carried out by simplifying the process for further comparison with the proposed new business process. (4) New business process planning. The business process is described by a future stream mapping that has been designed based on the planned improvements.

### III. RESULTS AND DISCUSSION

connecting Medium Voltage electricity. The general business process requirements are as follows:

#### A. Identification of Existing Business Process

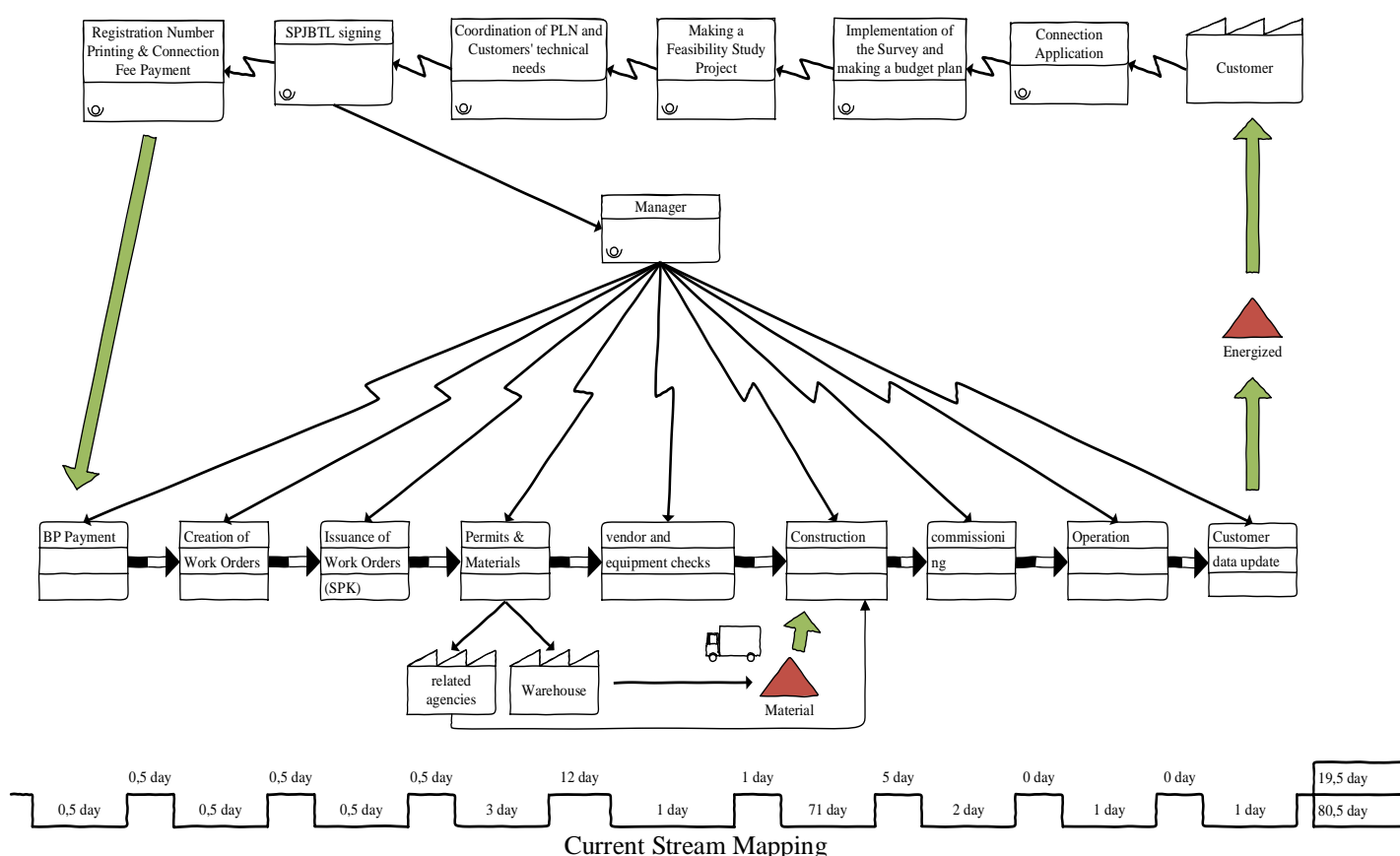
Based on the results of interviews, in general there are 3 main problems and complaints that occur in the process of

TABLE III. GENERAL BUSINESS PROCESS NEEDS

No	Business Process Details	Problem	Solution
1	Development permit process	The permit approval process is often delayed from the Ministry of Public Works	Business process improvement
2	The process of providing Distribution Materials (MDU)	The permit approval process is often late from the Public Works department (PU)	Business process improvement in supply chain management
3	Slow project implementation process	There is 1 vendor appointed to carry out the work	Appointment of more than 2 vendors for 1 project

Source: Data processed by the author, 2022

Next, a Current Stream Mapping is made to describe the ongoing business processes. The first step in the process of identifying waste/waste is to classify activities that are value-added or not-value-added in a business process. Current Stream Mapping is very necessary [2].



Source: Data processed by the author, 2022

From the description of the current stream mapping, it can be seen that when the customer pays the connection fee, it is counted as the first day of the TMP. The total time required for the implementation of the new connection is 80.5 days out of 100 days in total.

#### B. Business Process Analysis (model and analyze process)

Furthermore, business process analysis is carried out using value added analysis. The value-added analysis activity process includes determining the activities of each process that

is in the initial business process that provides benefits (value added), not added benefits but is still needed (necessary non-value added) and not useful (non-value added) [10].

Identification of value-added analysis is carried out to eliminate activities that do not add value to customers or companies so that more effective and efficient business processes are achieved. The identification of non-value added in each activity is as follows:

TABLE IV. PROCESS ANALYSIS OF NEW INTERCONNECTION OF MEDIUM VOLTAGE CUSTOMERS

No	Activity	Type of activity	Waste Category	Improvements
1	SPJBTL signing	VA	-	-
2	Survey and budget planning	VA	The process is carried out after the signing of the SPJBTL	Done immediately after there is information on the request from the customer
3	BP Payment	VA	-	-
4	Permit process & material preparation	NVA	A long process that affects TMP	Done directly after the survey and making a budget plan
5	Making a work order	NNVA	Appointment of 1 vendor for 1 project	Change of work order into unit price contract (KHS) so that 1 job can be done by more than 1 vendor
6	Project implementation	VA	Reporting is done weekly	Daily coordination and daily documentation reporting via group chat
7	Final Check & Energize	VA	-	-

Source: Data processed by the author, 2022

The category of waste (time wasted) that was identified the most occurred was the activity of obtaining permits and material preparation. The proposed improvement plan is to change the order of the existing NVA process activities, so that before the customer makes a BP payment (days calculated from TMP), the time-wasting process can be eliminated. In addition, the process of making SPK can be improved in the form of changing the usual contract into a unit price contract so that the time and number of vendors becomes more efficient.

### C. Process Activity Mapping

Process activity mapping is carried out to classify activities into 5 types of groups, including; operation, transportation, inspection, delay, and storage. From this grouping, the proportion and percentage for each activity group will be obtained.

TABLE V. PROCESS ACTIVITY MAPPING CURRENT STATE

No	Activity	Time (day)	Activity type					Type	Description
			O	T	I	S	D		
1	Customers make BP payments								When customer pays BP, TMP starts to be calculated
	Customers make BP payments	0,5	V					VA	
	The process of confirming data and information to the connection section	0,5					V	NVA	
2	Making PK from the customer service section to the engineering section and informed to the construction section								
	PK making process	0,5	V					VA	
	Delivery of PK and information by engineering section to construction section	0,5		V				NNVA	
3	Issuance of Working permit (WO) / SPK by the Construction Section to the vendor								
	Issuance of contracts and appointment of field supervisors	0,5	V					VA	
	Delivery of SPK and information to vendors	0,5		V				NNVA	
4	Permit Process and Material readiness								
	S curve creation and vendor working methods	1	V					VA	
	Management of work permits to the relevant agencies	1	V					NNVA	Permit management can be done before the customer pays BP
	Material collection from PLN warehouse to vendor warehouse	1		V				NNVA	Material collection can be hampered if the material is not available
	Permit process issued from the relevant agency	12					V	NVA	Waiting time for permit processing takes time

No	Activity	Time (day)	Activity type					Type	Description
			O	T	I	S	D		
5	Checking workers and equipment in preparation for implementation								
	The process of preparing workers and equipment	0,5					V	NVA	
	Project Implementation and Monitoring	0,5			V			VA	
	Material transportation from warehouse to field	1	V					VA	
6	Project Implementation								
	Job evaluation	5		V				NNVA	
	Preparation of Commissioning Schedule and Operation	69	V					VA	
	Making final check / commissioning results	2			V			VA	
7	Customer Operation								
	Proposal of new network SLO to main unit	2			V			VA	
8	Return of leftover material to PLN warehouse								
	Submission of PK BA, Substation data input on APKT and customer data update on AP2T	0,5	V					VA	
	Billing file preparation	0,5				V		NNVA	
9	Substation data entry								
	Customer data update	1	V					VA	
	Customers make BP payments		V					VA	
	Customers make BP payments		V					VA	
	<b>TOTAL</b>	<b>100</b>							

Source: Data processed by the author, 2022

From Process Activity Mapping Current State, 5 types of groups were obtained, which then obtained the percentage for each group. From the table, it is found that in running business processes there is a delay of 13 days or 13% of the total time.

TABLE VI. AMOUNT AND PROPORTION OF TIME EACH ACTIVITY

Activity	Count	Time	Percentage	VA	NNVA	NVA
Operation	11	75	75,00%	74,5	0,5	
Transportation	4	7	7,00%		7	
Inspection	3	4,5	4,50%	4,5		
Storage	1	0,5	0,50%		0,50	
Delay	3	13	13,00%			13
Total	22	100	100,00%	79	8	13

Source: Data processed by the author, 2022

Furthermore, from the results of grouping the types of activities, the value-added ratio can be calculated based on the following formula;

$$\text{Value added ratio} = \frac{\text{Value added time (process time)}}{\text{Total process cycle time}} \times 100\%$$

$$\text{Value added ratio} = \frac{79 \text{ days}}{100 \text{ days}} \times 100\%$$

$$\text{Value added ratio} = 79 \%$$

From the calculation results, the value-added ratio value is 79%. This value still has the potential to be increased so that all business processes become more effective and efficient.

#### D. New Business Process Review (New Process Review)

The review of the proposed new business process is carried out by means of corrective actions. The review of the proposed new process is carried out in the form of a Process Improvement Matrix (PIM). PIM serves as an illustration of the plan for improving the existing business process so that new business process improvement proposals are obtained [7].

TABLE VII. PROCESS IMPROVEMENT MATRIX

No	Activity	Business process as is	Time as is (day)	Total time (day)	Business process to be	Time to be (day)	Total time (day)	Information
1	Customers make BP payments							
	Customers make BP payments	ü	0,5	1	ü	0,25	1	<i>time reduction</i>
	The process of confirming data and information to the connection section	ü	0,5		ü	0,25		<i>time reduction</i>
2	Making PK from the customer service section to the engineering section and informed to the construction section							
	PK making process	ü	0,5	1	ü	0,25		<i>time reduction</i>
	Delivery of PK and information by engineering section to construction section	ü	0,5		ü	0,25		<i>time reduction</i>
3	Issuance of Working permit (WO) / SPK by the Construction Section to the vendor							
	Issuance of contracts and appointment of field supervisors	ü	0,5	1	ü	0,5	1	
	Delivery of SPK and information to vendors	ü	0,5		ü	0,5		
4	Permit Process and Material readiness							
	S curve creation and vendor working methods	ü	1	1	ü	0,5	1	<i>time reduction</i>
	Management of work permits to the relevant agencies	ü	1	1	û	-		<i>moved out of process flow</i>
	Material collection from PLN warehouse to vendor warehouse	ü	1	1	ü	0,5		<i>time reduction</i>
	Permit process issued from the relevant agency	ü	12	12	û	-		<i>move out of process flow</i>
5	Checking workers and equipment in preparation for implementation							
	The process of preparing workers and equipment	ü	0,5	1	ü	0,25	1	<i>time reduction</i>
	Workers and Equipment Checks	ü	0,5		ü	0,25		<i>time reduction</i>
	Proposed job safety analysis and work plan from vendor	ü	1	1	ü	0,50		<i>time reduction</i>
6	Project Implementation and Monitoring							
	Material transportation from warehouse to field	ü	5	5	ü	1	1	<i>time reduction by ensuring the material is available in advance</i>



No	Activity	Business process as is	Time as is (day)	Total time (day)	Business process to be	Time to be (day)	Total time (day)	Information
	Project Implementation	ü	69	69	ü	50	50	time reduction by implementing $\geq 2$ vendors
	Job evaluation	ü	2	2	ü	2	2	
7	Preparation of Commissioning Schedule and Operation							
	Making final check / commissioning results	ü	2	2	ü	1	1	time reduction
8	Customer Operation							
	Proposal of new network SLO to main unit	ü	0,5	1	ü	0,5	1	
	Return of leftover material to PLN warehouse	ü	0,5		ü	0,5		
9	Submission of PK BA, Substation data input on APKT and customer data update on AP2T							
	Billing file preparation	ü	1	1	ü	1	1	
	Substation data entry	ü			ü			
	Customer data update	ü			ü			
	TOTAL			100			60	

Source: Data processed by the author, 2022

Based on the results of the process improvement matrix, there is a decrease in time for each activity. Activities that were previously categorized as NVA can be cut in time by removing activities from previously in the process to being outside the process. In addition, activities that were previously categorized as NNVA can be done with time reduction.

#### E. Business Process Improvement

By eliminating activities that have no value in the current state map, then the future stream mapping is made. The process of making future stream mapping is carried out the same as the process of making current stream mapping. From the results of the analysis that has been carried out, it is obtained a future stream mapping design that can reduce lead time from one operation to another [9]. The following is the desired future stream mapping:

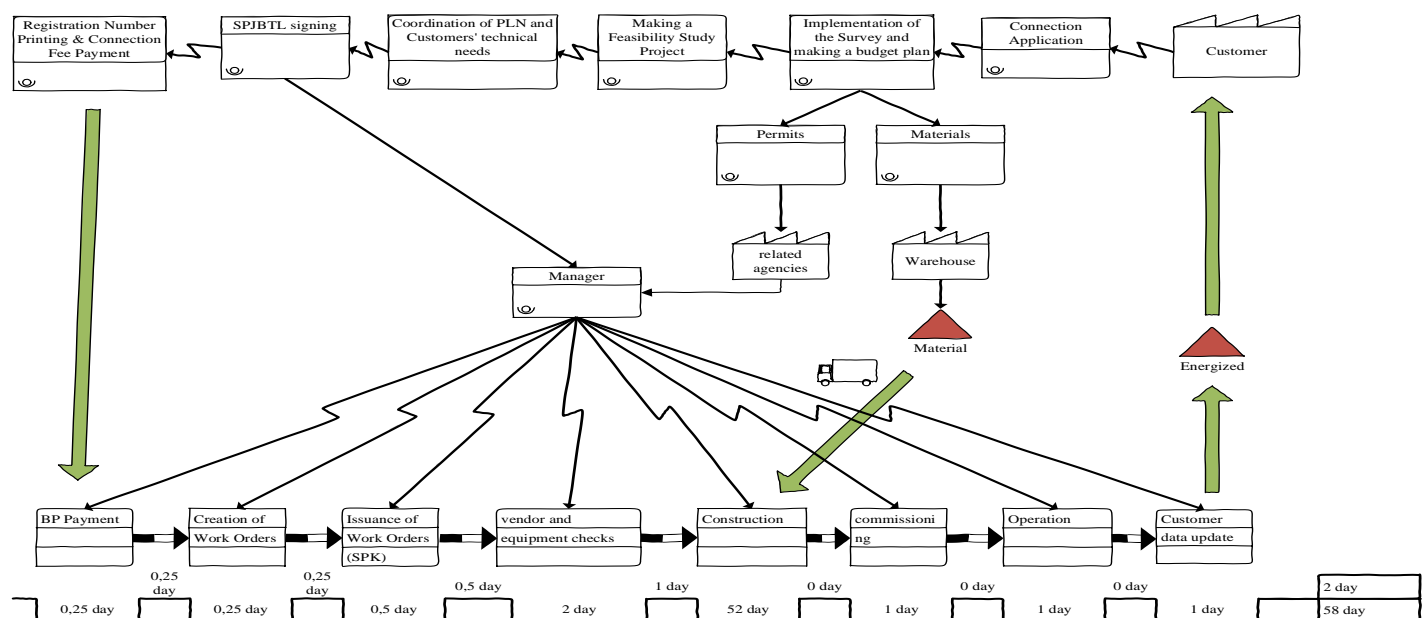


Fig. 2. Future Stream Mapping  
Source: Data processed by the author, 2022

From the results of the future stream mapping, it was found that the time required for the implementation of the new electricity connection was 58 days from 60 days in total from the previous 100 days in total. Licensing and material preparation activities that account for the largest delay time are excluded from the process but still exist. Licensing arrangements and material preparation are carried out after the site survey is carried out, so that potential delays can be avoided.

TABLE VIII. PROCESS ACTIVITY MAPPING FUTURE STREAM

No	Activity	Time (day)	Activity type					VA/NNVA /NVA	Description
			O	T	I	S	D		
1	Customers make BP payments								When customer pays BP, TMP starts to be calculated
	Customers make BP payments	0,25	V					VA	
	The process of confirming data and information to the connection section	0,25					V	NVA	
2	Making PK from the customer service section to the engineering section and informed to the construction section								
	PK making process	0,25	V					VA	
	Delivery of PK and information by engineering section to construction section	0,25		V				NNVA	
3	Issuance of Working permit (WO) / SPK by the Construction Section to the vendor								
	Issuance of contracts and appointment of field supervisors	0,5	V					VA	
	Delivery of SPK and information to vendors	0,5		V				NNVA	
4	Permit Process and Material readiness								
	S curve creation and vendor working methods	0,5	V					VA	
	Management of work permits to the relevant agencies	0,5		V				NNVA	Material collection can be hampered if the material is not available
5	Material collection from PLN warehouse to vendor warehouse								
	Permit process issued from the relevant agency	0,25					V	NVA	
	Checking workers and equipment in preparation for implementation	0,25			V			VA	
	The process of preparing workers and equipment	0,50	V					VA	
6	Project Implementation and Monitoring								
	Material transportation from warehouse to field	1		V				NNVA	
	Project Implementation	50	V					VA	
	Job evaluation	2			V			VA	
7	Preparation of Commissioning Schedule and Operation								
	Making final check / commissioning results	1			V			VA	
8	Customer Operation								
	Proposal of new network SLO to main unit	0,5	V					VA	
	Return of leftover material to PLN warehouse	0,5				V		NNVA	
9	Submission of PK BA, Substation data input on APKT and customer data update on AP2T								
	Billing file preparation	1	V					VA	
	Substation data entry		V					VA	
	Customer data update		V					VA	
	<b>TOTAL</b>	<b>60</b>							

Source: Data processed by the author, 2022



From the results of the Process Activity Mapping Future Stream, there are different categories for each activity that is in the process of connecting new electricity to experience improvements. Nonvalue added activities that previously numbered 4 can be reduced to 2 activities.

TABLE IX. AMOUNT AND PROPORTION OF TIME EACH ACTIVITY

Activity	Count	Time	Percentage	VA	NNVA	NVA
Operation	11	54	90,00%	54		
Transportation	4	2	3,33%		2	
Inspection	3	3	5,00%	3		
Storage	1	0,5	0,83%		0,5	
Delay	3	0,5	0,83%			0,5
Total	22	60	100,00%	57	2,5	0,5

Source: Data processed by the author, 2022

From table IX it can be seen that the percentage of operating time has increased from the previous 75% to 90% and the delay decreased from the previous 13% to 0.83%.

$$\text{Value added ratio} = \frac{\text{Value added time (process time)}}{\text{Total process cycle time}} \times 100\%$$

$$\text{Value added ratio} = \frac{57 \text{ days}}{60 \text{ days}} \times 100\%$$

$$\text{Value added ratio} = 95 \%$$

Based on the analysis and description of the future stream mapping, it was found that the lead time decreased from 100 days to 60 days. In addition, there was an increase in the value-added ratio of 95% from the previous 79%

#### IV. RESULTS, IMPLICATIONS AND CONCLUSION

##### A. Results

The results of the research related to the improvement of business processes for connecting new connections for Medium Voltage customers, including:

(1) Activities that can be eliminated in the process of connecting new electricity to medium voltage customers include:

- Management of permits and preparation of materials by changing the flow that was previously in the process to be outside the process.

- Addition of implementing vendors to 2 implementing vendors for 1 project work so that the project execution time becomes faster.

- Lead time for new electricity connections for medium voltage customers decreased by 40% and the value-added ratio increased to 95% with business process improvements.

(2) The proposal for a new, simpler business process is carried out by issuing licensing management activities and material preparation. In addition, several activities were carried out to simplify time so that new business processes became more effective and efficient

##### B. Implication

The implications obtained with the proposed new business process are: (1) Increasing the effectiveness of new business processes so as to speed up the connection of new electricity, (2) Reduction of lead time for new electricity connections to 60 working days from the previous 100 working days.

##### C. Conclusion

The current business processes still have potential for improvement so that the acceleration of new electricity connections can be carried out. Proposed new business processes can be proposed by changing the flow of some activities and simplifying activities so that the lead time which previously amounted to 100 working days can be reduced to 60 working days with the implementation of new business processes. In addition, the value-added ratio also increased from the previous 79% to 95% which indicates that the proposed new business process is more effective and efficient than the existing business process.

#### REFERENCES

- [1]. Creswell, John W. 2015. Penelitian Kualitatif & Desain Riset. Yogyakarta: Pustaka Pelajar.
- [2]. D. Locher, 2008. Value Stream Mapping for Lean Development. New York: Taylor & Francis Group
- [3]. D. Setiawan, and M. S. Perdhana, "Business Model Canvas Jasa Penyambungan Baru Listrik Pada Perusahaan Kelistrikan di Indonesia," *JURNAL BISNIS STRATEGI*, vol. 28, no. 2, pp. 91-98, Dec. 2019. <https://doi.org/10.14710/jbs.28.2.91-98>
- [4]. Indonesia. Kementerian Energi dan Sumber Daya Mineral. Peraturan Menteri Energi dan Sumber Daya Mineral. Peraturan Menteri Energi dan Sumber Daya Mineral tentang Perubahan Atas Peraturan Menteri Energi Dan Sumber Daya Mineral Nomor 27 Tahun 2017 Tentang Tingkat Mutu Pelayanan Dan Biaya Yang Terkait Dengan Penyaluran Tenaga Listrik Oleh PT Perusahaan Listrik Negara (Persero). Jakarta; 2019. [Online]. Available: <https://peraturan.bpk.go.id/Home/Details/142330/permen-esdm-no-18-tahun-2019>. [Accessed: Sept. 29, 2021].
- [5]. Indonesia. Kementerian Energi dan Sumber Daya Mineral. Tingkat Mutu Pelayanan PT PLN (Persero) Regional Jawa Madura Bali. Jakarta; 2021. [Online]. Available:

- [https://gatrik.esdm.go.id/assets/uploads/download\\_index/files/727eb-tmp-2021-pln-reg-jawa-madura-bali.pdf](https://gatrik.esdm.go.id/assets/uploads/download_index/files/727eb-tmp-2021-pln-reg-jawa-madura-bali.pdf). [Accessed: Jan. 3, 2022].
- [6]. Indonesia. Pemerintah Pusat. Undang-undang (UU). Undang-undang (UU) No 30 Tahun 2009 tentang Ketenagalistrikan. Jakarta; 2009. [Online]. Available: <https://peraturan.bpk.go.id/Home/Details/38767>. [Accessed: Sept. 29, 2021].
- [7]. I. Angraini et. al, Perbaikan Proses Bisnis Layanan Perkreditan Menggunakan Metode Business Process Improvement (BPI) Dengan Failure Mode and Effect Analysis (FMEA) Pada PT. BPR Bina Reksa Karyaartha Pare. Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer. Vol. 4, No. 9, September 2020, hlm. 3135-3142
- [8]. J. Heizer et.al, 2017. Operations management sustainability and supply chain management, 12th ed. Harlow: Pearson Education Limited.
- [9]. Marendra I G, Penerapan Lean Manufacturing dengan Value Stream Mapping (VSM) untuk Meminimasi Waste di PT Indah Kiat Pulp & Paper Tbk, Mercu Buana University Jakarta, 2019. [Online]. Available: <https://repository.mercubuana.ac.id/>
- [10]. M. Fajrian, Implementasi Value Stream Mapping Dan Kaizen Relayout Untuk Menurunkan Lead Time dan Meningkatkan Performa Delivery Pada Industri Sepeda Motor Line Mainstand, Mercu Buana University Jakarta, 2019. [Online]. Available: <https://repository.mercubuana.ac.id/>
- [11]. PT PLN (Persero) UP3 Banten Utara, “Buku Pengusahaan PT PLN (Persero) UP3 Banten Utara Tahun 2021”, Bagian Perencanaan, Serang; 2021
- [12]. Sugiyono. 2008. Metode Penelitian Kuantitatif Kualitatif dan R&D. Bandung: ALFABETA