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Application of value stream mapping for improving the efficiency of the supply chain: A case study of Mueang Kao Post Office, Thailand

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Abstract

The development of Thailand's basic land logistics system is needed to increase the capacity of deliveries and support the growth of competition in the digital world. There are more domestic and international business owners entering the delivery market resulting in high competition. Therefore, the delivery business in the country must be adapted by focusing on customers' needs regarding products and services. This study applied the Value Stream Mapping (VSM) method to analyze the supply chain of Muang Kao Post Office in Sukhothai province from upstream, midstream, to downstream. Moreover, the Why-Why Analysis method was used to find the causes of problems. The eliminate, combine, rearrange, and simplify (ECRS) technique was used to discover how to improve efficiency. According to the surveys, collected data, observations, and interviews as well as the analysis of data before and after the improvement, it was found that there were 66 activities in the supply chain using a total of 673.85 min. For the improvement, three necessary non-value-added activities along with eleven other non-value-added activities were removed. Thus, there were fifty-two activities left in the supply chain, which used 657.09 min. The total time difference in the supply chain was 16.76 min. Finally, the researcher proposed ways to improve sustainable efficiency through the use of the VSM concept and by focusing on the environment, sustainability, and a circular economy.

Keywords: Value stream mapping, Supply chain management, ECRS technique, Why-Why analysis, Sustainability

1. Introduction

The development of a land transportation system focusing on sustainable development from 2015 to 2020 aimed to develop the structure of land transportation in Thailand in order to increase the capacity of transportation, handle the competition among transporting companies in the digital era, and use technology for online marketing, which expanded due to the rise in e-commerce. The data from 2019 – 2020 found that the revenue from e-commerce was approximately THB 3,150.2 billion, with the growth rate of 14.04%. This caused Thailand to have the highest revenue from e-commerce in Asia, which had about USD 24.70 billion [1]. In addition, the number of transporting companies is growing fast, which causes many entrepreneurs in the transporting business to face high competition. Thus, transporting businesses must adapt themselves in order to develop products and services, satisfy customers' needs, improve and increase their operational systems to be standardized as well as create creditability for delivery to consumers.

According to [2], which is a state enterprise under the Ministry of Digital Economy and Society, the company is determined to be the leader in the mailing business and to provide efficient service to satisfy the needs of all businesses and Thai people in every region. Having 1,200 branches and 13 centers in Bangkok and each region, the market share of Thailand Post Co., Ltd. in the transporting business is over 41%. However, from the data statistics during 2018-2020, it was found that the tendency for providing service decreased. For example, the parcel delivery service decreased from 13.47 million parcels in 2018 to 10.35 million parcels in 2019, and 7.26 million parcels in 2020 [3]. Based on the surveys and interviews, it was found that Mueang Kao Post Office (the case study), which is located in Sukhothai province and is responsible for nine villages, provides less service and

encounters management problems. These internal problems include the limited number and work-overload of staff, as well as the lack of equipment and facilities. This leads to a slow delivery service and causes the customers to change to private delivery companies, which are new alternatives for them.

Therefore, it is important to improve the efficiency of the organization's management and logistics' capacity ranging from upstream, midstream, to downstream. Also, it is significant to see the overall image of delivery management and the process as well as create customers satisfaction. Thus, problems within the organization were studied to find the solutions. Value Stream Mapping (VSM) was used to analyze the working process ranging from upstream, midstream, to downstream. The tool was also used to analyze the current problems occurring within the organization. Moreover, Why-Why Analysis was used to investigate the root of the problems. In addition, the eliminate, combine, rearrange, and simplify (ECRS) technique was applied to find ways to reduce waste from the working process, and lead to ways of improving and increasing the efficiency of Mueang Kao Post Office of Thailand Post Co., Ltd. Finally, this research aimed to study SCM and solve problems effectively to increase the working efficiency of Thailand Post Co., Ltd.

2. Materials and methods

In this study, a case study was used to analyze the supply chain's efficiency of the Mueang Kao Post Office of Thailand Post Co., Ltd. The case study was selected using the purposive sampling. Furthermore, the concepts of SCM, VSM, and ECRS were applied to investigate the causes of problems and find effective solutions. In addition, surveys, participant observations, and unstructured interviews were used to collect data. The data from both the observations and the interviews were recorded for content analysis. The flow chart representing the activity of the supply chain and its relationship is shown in Figure 1.

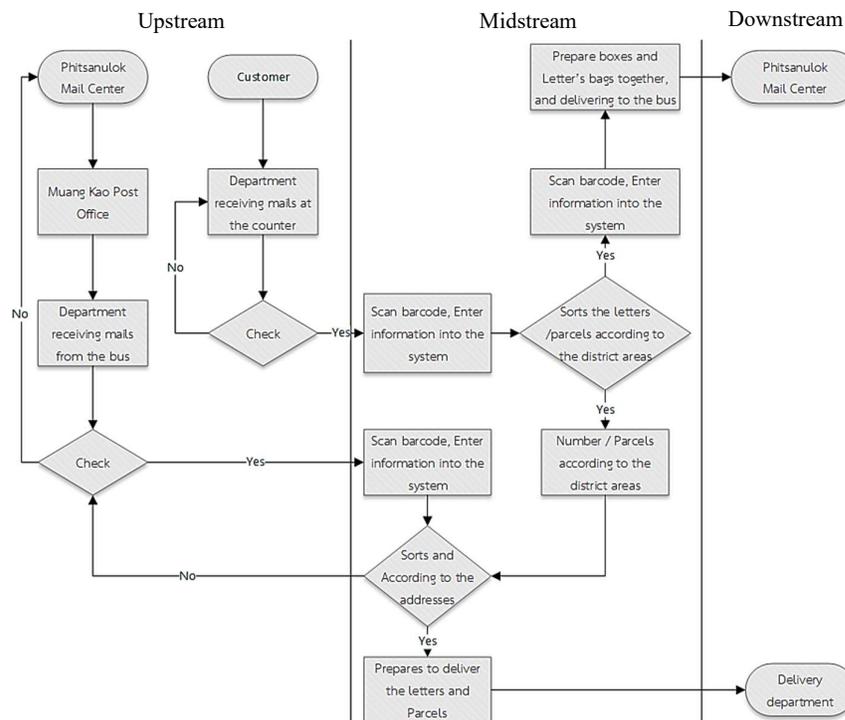


Figure 1 Flow chart of Mueang Kao Post Office of Thailand Post Co., Ltd.

Theories to improve the efficiency of the supply chain in the case study of Mueang Kao Post Office of Thailand Post Co., Ltd were used to identify and solve the problems as follows:

2.1 Supply chain management (SCM)

Boon-itt and Jittimane [4,5] explain that the supply chain's management is significant to the process and activities that represent the flow of the products ranging from upstream, midstream, to downstream as well as the purchasing process, information, and production until the product is delivered to the customer efficiently [6] as

expected. The successful supply chain's management consists of three elements as follows: [7] 1) supply chain 2) the business process of the supply chain and 3) the elements of the supply chain's management.

Moreover, [7] describes how the supply chain integrates the main activities of the working process such as purchasing, production, and delivery. Furthermore, the supply chain involves the planning to control the flow of raw materials and all services ranging from seeking raw materials to delivering them to the consumers. [8] It is also the tool for analyzing the overall image of the work flow and for improving the ways of flowing to create efficiency.

2.2 Value stream mapping (VSM)

Jitthananan, et al [9] explains that VSM analysis provides an overall image of the system by focusing on improving the working process of the supply chain. Moreover, [10] uses the VSM method to analyze the process and understand the overall process. The main activities are classified into three categories: 1) non-value-added activities, the activities that should be eliminated such as waiting; 2) necessary non-value-added activities, which are the activities that create waste, but are needed to have in the production process such as the walking long distance to pick up raw materials; and 3) value-added activities, which are the activities that create value and can be adjusted to increase efficiency. Furthermore, [11] describes that VSM is a concept for studying the order of the work flow since it shows all the stages of activities and helps to improve the flow of resources and information, which helps to explain the current status and set ways for the future.

2.3 ECRS technique

Nantajinda [12] explains that the ECRS technique is the method that is relevant for the improvement of the working process, the reduction of unnecessary work that causes waste, the combination of certain working processes, and working arrangements to create the most appropriate working processes in order to increase efficiency, improve production, reduce time, as well as reduce costs and labor. The method is; 1) Eliminate (E), which is to get rid of unnecessary working processes or waste; 2) Combine (C), which is the combination of some work processes to save time or labor; 3) Rearrange (R), which is the appropriate rearrangement of working processes, locations, staff and to reduce unnecessary movement; and 4) Simplify (S), which is the improvement of work to be more comfortable and have easier processes for the staff. The concept is similar to the study of [13], which applies the ECRS technique to reduce waste in the working processes of the hotel industry. According to the study, it is found that the ECRS technique can reduce waste and unnecessary activity along with not adding more value, which leads to cost reductions.

2.4 Why-why analysis

Phanprasat, et al [14] uses the Why-Why analysis technique to solve the problems systematically by seeking the root of the problems, considering the possibilities, and finding reasonable solutions. Furthermore, [15] explains that the analysis and finding the main causes helps reveal the true problems. The method of Why-Why analysis consists of four steps, which are 1) identifying the problems; 2) doing surveys and gathering information regarding the problems; 3) setting goals for easing the problems; and 4) planning to solve the problems. Also, [16] analyzes the problems using the Why-Why analysis method systematically and is able to prevent the problems from occurring again. This is similar to [17], who applies the Why-Why analysis method to seek for the causes and roots of the problems to improve efficiency.

3. Results

From the analysis of the supply chain's efficiency in the case study of Mueang Kao Post Office of Thailand Post Co., Ltd using Value Stream Mapping, Why-Why Analysis, and the ECRS technique, the results were as follows:

3.1 Supply chain

Mueang Kao Post Office of Thailand Post Co., Ltd consists of two supply chains' management within the organization. These are 1) supplying the chain's management of inbound trucks from distribution centers; and 2) supplying the chain's management of the customers. Both kinds of managements have different ways of administration, but use the same group of staff and resources as the following:

3.1.1 Supply chain's management of inbound trucks

- a) The inbound or distributing task of Mueang Kao Post Office of Thailand Post Co., Ltd consists of five categories,

which are EMS, registered mail, parcels, certified mail, and standard mail. During the process, the staff and relevant units start working at 6:20 am by receiving the mail and parcels from inbound trucks at the distribution center and distributing them to Mueang Kao Post Office of Thailand Post Co., Ltd every day, except for Sunday and national holidays.

b) The staff scan the barcodes to open the inbound parcels, sort the parcels, and package them into white plastic boxes. The parcels consist of five categories, which are EMS, registered mail, parcels, certified mail, and standard mail. The parcels are distributed by five staff to each responsible area, and this includes the designated area of Wang Thong Daeng sub-district, which is the responsibility of the Mueang Kao Post Office of Thailand Post Co., Ltd.

c) The staff sort the parcels and the mail. The areas of responsibility consist of five areas including Wang Thong Daeng sub-district, which is a designated area. Concerning the plan to deliver the parcels, the staff arrange the mail from the nearest address to the farthest address. The parcels are delivered in the community area, close to each other, or far from the main road, using a zigzag pattern. The parcels with addresses close to a main road that has many road lanes, are delivered only on the left side or the side where cars drive.

3.1.2 Supply chain's management of the customers

The sending or outgoing task of Mueang Kao Post Office of Thailand Post Co., Ltd consists of five categories, which are EMS, registered mail, parcels, C, and standard mail. During the process, the staff receives the parcels and mail from the front of the counter at Mueang Kao Post Office. The customers have to package the products or mail. The staff then check the condition of the parcels along with the addresses of both the senders and receivers using the identification cards of the senders before accepting the parcels into the system. A fee is charged according to the categories of the parcels. After that, the parcels are placed in a container before being sorted, their barcodes scanned, and packaged in a box for pick-up for delivery to the distribution center in Phitsanulok at 16:30-17:00 pm.

3.2 Value stream mapping (VSM)

The researcher analyzes the activities of the supply chain in the case study of Mueang Kao Post Office of Thailand Post Co., Ltd using VSM to see the overall image of the supply chain process as shown in Figure 2. Microsoft Visio Professional 2019 is used to provide details of the processes, which consist of 1) upstream processes such as picking up the parcels from the distribution center and from the customers at the post office; 2) midstream processes such as dealing with the parcels from both the distribution center and customers within the organization; and 3) downstream processes such as distributing the parcels to the distribution center and to the customers. The activities consist of three categories, which are 1) value-added 2) necessary non-valued-added and 3) non-valued-added as shown in Table 1- Table 3.

Table 1 Activities in the supply chain: A case study (Upstream).

Activity	Sub-Activities			Activity	Sub-Activities							
	Activity of Logistics	Time (Min)	Type of Activity		Value of Activity	Activity of Logistics	Time (Min)	Type of Activity	Value of Activity			
I1: Upstream Inbound Logistics				I2: Upstream Working Process								
A1: Department receiving mails from the bus	a1: TS	1. The bus arrives at Mueang Kao Post Office.	0.33	TS	A1: Customer Service	a1: CS	1. The staff asks the customer questions.	0.40	OT	NNVA		
		2. The driver gets off the bus to open a door.	0.60	OT			a2: OP	2. The customer fills in the information.	2.50	DL	NNVA	
		3. The driver gets on the bus.	0.70	OT				NNVA	3. The customer chooses a box or container for sending a parcel.	0.48	OT	VA
		4. The driver drives to the back of the sorting room.	0.35	TS				NNVA	4. The customer attaches the mailing information to the box.	1.20	OT	NNVA
	a2: OP	5. The driver hands in the paper order to the staff for checking.	0.60	IT			NVA	5. The customer hands the box to the staff at the counter.	0.70	OT	NNVA	
		6. The driver takes the parcels out of the bus.	2.00	OT			NNVA	a3: CS	6. Staff ask about the type of delivery the customer wants (EMS, registered et al.).	0.30	OT	VA
		7. Staff check whether the number of parcels is according to the paper order.	0.54	DL			NNVA		7. The staff weigh the parcel.	0.30	OT	NNVA
		8. The staff returns the order paper to the driver.	0.35	IT			NVA	8. The staff enter the information into the system.	1.03	OT	NNVA	
		9. The driver signs to confirm the delivery.	0.60	IT			NVA	9. The staff scan the front of the parcel.	0.02	OT	NNVA	
	a3: TS	10. The driver closes the bus door.	0.63	OT			NNVA	a4: OP	10. The staff informs the customer of the fee for delivery.	0.10	OT	NNVA
		11. The bus leaves Mueang Kao Post Office	2.30	TS			NNVA		11. The staff sort the parcels according to the type of delivery (EMS, registered, regular).	0.10	OT	VA
				A2: Department receiving mails at the counter								

Table 2 Activities in the supply chain: A case study (Midstream).

Activity	Sub-Activities	Time (Min.)	Type of Activity	Value of Activity	Activity	Sub-Activities	Time (Min.)	Type of Activity	Value of Activity				
Activity of logistics					Activity of logistics								
M1: Midstream (Inbound Logistics)					M2: Midstream (Working Process)								
B1: Departing sorting mails from the bus	b1: OP	1. The staff walk to pick up the scanner from the table.	0.80	TS	NNVA	B1: Departing sorting mails from the counter	b1: MH	1. The staff walk to pick up a cart to put the parcels in.	0.35	TS	NNVA		
		2. The staff scan the barcode attached to the table.	1.50	OT	NVA			2. The staff put the box of parcels in the cart.	0.30	OT	NNVA		
		3. The staff scan the barcode on the parcel.	5.00	OT	NNVA			3. The staff take the cart to the sorting room.	3.00	TS	NNVA		
	b2: MH	4. The staff put the scanner back on the table.	1.30	TS	NVA		b2: OP	4. The staff use the boxes in the sorting room to sort the different types of delivery	2.00	OT	NNVA		
		5. The staff pick up the cream from the table. The staff use the cream to open the box and letter bags.	4.50	OT	NNVA			5. The staff sort each type of letter and parcel according to post numbers.	7.00	OT	VA		
		6. The staff put the cream back on the table.	0.80	TS	NVA			b3: MH	6. The staff walk to pick up the scanner from the table.	0.90	TS	NVA	
		7. The staff pick up the scanner from the table.	0.50	OT	NVA				b4: OP	7. The staff scan the barcode attached to the table.	0.64	OT	NVA
	b3: OP	8. The staff scan the letters and parcels in the boxes.	8.00	OT	NNVA		b5: OP	8. The staff scan the barcode on the parcel.	4.00	OT	NNVA		
		b4:MH	9. The staff put the scanner back on the table.	1.00	ST			NVA	b6:MH	9. The staff put the scanner back on the table.	0.90	TS	NVA
			b5: OP	10. The staff sort the letters/parcels according to the district areas.	16.00			OT		NNVA	b7:MH	10. The staff walk to pick up the boxes and letter bags.	0.93
	B2: Sort according to the amount of staffs	b6:MH	11. The messenger walks to pick up his own scanner.	1.60	OT		NVA	b8: OP	11. The staff put the letters and parcels into the boxes and letter bags	3.00		OT	NNVA
			12. The messenger scans the letters and parcels for the district that he is responsible for.	15.0	OT		NNVA		12. The staff seal the boxes and letter bags.	4.00	OT	NNVA	
		b7: OP	13. The messenger sorts the letters and parcels according to the addresses.	14.0	OT		NNVA	b9: MH	13. The staff walk to pick up the scanner from the table.	0.90	TS	NVA	
			14. The messenger gathers the letters and parcels.	3.00	OT		NNVA		b10: OP	14. The staff scan the barcode attached to the table.	1.00	OT	NVA
	b8: MH	15. The messenger puts all the letters for which he is responsible into district bags on the motorcycle.	4.30	ST	NNVA		15. The staff scan the barcodes on the boxes and letter bags.	6.00		OT	NNVA		
		B3: Check before distributing	b9: OP	16. The messenger prepares to deliver the letters and parcels.	1.30		OT	NNVA	b11: MH	16. The staff put the scanner back on the table.	0.83	TS	NNVA
B3: Prepare For delivery	b12: OP			17. The staff arrange the boxes and letter bags together and prepare them for delivery to the bus.	2.00	OT	NNVA						

Table 3 Activities in the supply chain: A case study (Downstream).

Activity	Activity of logistics	Sub-Activities	Time (Min.)	Type of Activity	Value of Activity	Activity	Activity of logistics	Sub-Activities	Time (Min.)	Type of Activity	Value of Activity
O1: Downstream (Working Process)						O2: Downstream (Outbound Logistic)					
A1: Delivery Department by the postman	a1: TS	1. The postman rides a motorcycle to deliver the letters and parcels in the districts for which he is responsible.	480	TS	VA	A2: Delivery Department at Muang Kao Post Office	a1: TS	1. Transfer the parcels into the bus.	0.46	TS	NNVA
		2. The postman rides the motorcycle back to Muang Kao Post Office.	20	TS	VA			2. The driver gets off the bus to open a door.	0.68	OT	NNVA
					3. The driver gets on the bus.		1.60	OT	NNVA		
					4. The driver drives to the back of the sorting room.		1.10	OT	NNVA		
					5. Staff hand the order paper to the driver.		1.00	OT	NNVA		
					6. The driver checks whether the number of boxes and bags are according to the paper.		5.60	OT	NNVA		
					7. The staff and the driver put the boxes and bags into the bus.		6.92	OT	NNVA		
					8. The driver closes the bus door.		1.20	OT	NNVA		
					9. The bus leaves Muang Kao Post Office.		1.75	OT	NNVA		

Note: Activity of logistics; TS = Transportation, OP = Order Processing, CS = Customer Service, MH = Material Handling
 Type of Activity; TS = Transportation, OT = Operation, IT = Inspection, DL = Delay
 Value of Activity; VA = Value-added, NVA = Non-value-added, NNVA = Necessary non-value-added

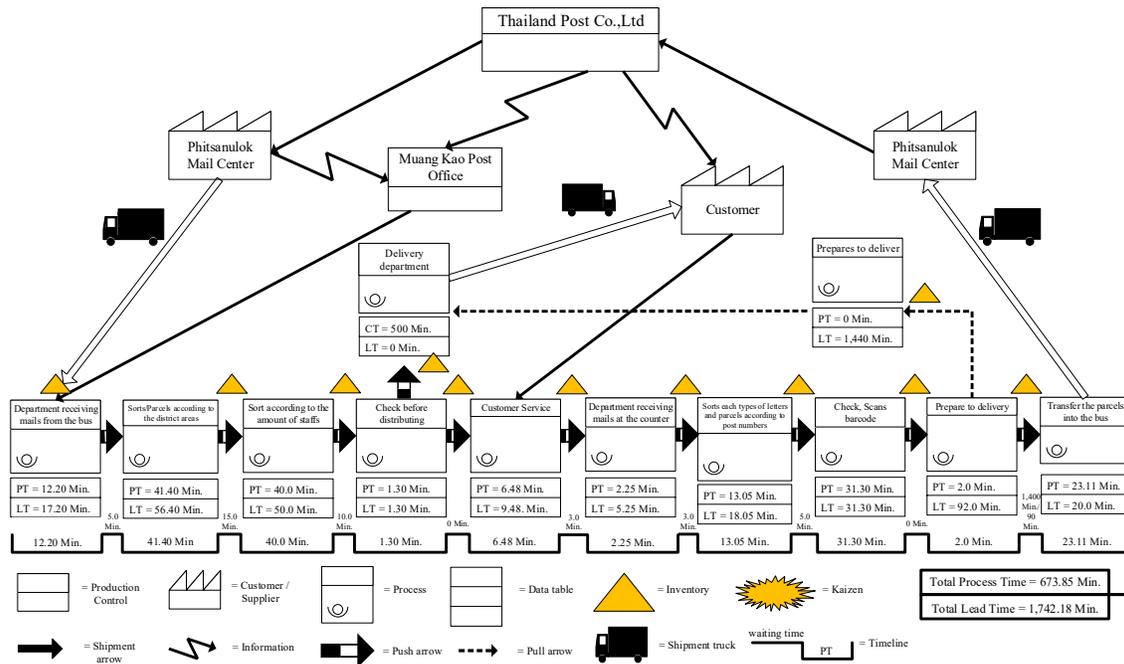


Figure 2 Value Stream Mapping: A Case study of Muang Kao Post Office of Thailand Post Co., Ltd. (Current).

Figure 2 represents the overall image of activities currently occurring in the supply chain using VSM to analyze. The total time spent is 673.85 min consisting of 6 value-added activities (9.10%), 14 non-value-added activities (21.20%), and 46 necessary non-value-added (46.0%).

3.3 The improvement of efficiency

The application of the ECRS technique to reduce seven wastes that occurs during the analysis of the supply chain's efficiency at Muang Kao Post Office in Sukhothai province found eleven non-value-added activities and three necessary non-value-added activities, which are the activities that do not create value and should first be improved to find the ways to reduce such activities. Therefore, the researcher applies the Why-Why analysis method to find the cause and root of the problems as shown in Table 4. Then, the ECRS technique is used to improve the efficiency as shown in Table 5.

Table 4 Cause and root of the problems.

Non-added activities and should be improved	The results of using the Why-Why analysis method
I1: Upstream Inbound Logistics	
The staff check the amount according to the order paper.	To carefully check whether the numbers and the products are according to the paper order
The staff return the paper back to the delivering staff (inbound truck)	To carefully check whether the numbers and the products are according to the paper order
The truck driver signs the confirmation of the delivery.	To carefully check whether the numbers and the products are according to the paper order as well as completing the delivery
M1: Midstream (Inbound Logistics)	
The staff walk to pick up the scanner from the table.	There is no equipment to help carrying. The barcode needs to be scanned on the table.
The staff scan the barcode attached to the table.	This is where all the barcodes are placed and cannot be moved.
The staff put the scanner back on the table.	There is no equipment to help carrying.
M2: Midstream (Working Process)	
The staff put the cream back on the table.	There is no equipment to help carrying. The barcode needs to be scanned on the table since the table is where all the barcodes are placed and cannot be moved.
The staff pick up the scanner from the table.	
The staff put the scanner back on the table.	
The staff walk to pick up the scanner from the table.	
The staff scan the barcode attached to the table.	
The staff put the scanner back on the table.	
The staff walk to pick up the scanner from the table.	
The staff put the scanner back on the table.	

Table 5 Apply the ECRS technique.

Method	Amount	Activity
I1: Upstream Inbound Logistics		
E = Eliminate	3 activities	NNVA NVA NVA
		The staff check the amount according to the order paper. The staff return the paper to the delivering staff. The truck driver signs the confirmation of the delivery.
M1: Midstream (Inbound Logistics)		
S = Simplify	3 activities	NNVA NVA NVA
		The staff walk to pick up the scanner from the table. The staff scan the barcode attached to the table. The staff put the scanner back on the table.
M2: M2: Midstream (Working Process)		
		NVA NVA NVA NVA NVA NVA NVA
S = Simplify	8 activities	
		The staff put the cream back on the table. The staff pick up the scanner from the table. The staff put the scanner back on the table. The staff walk to pick up the scanner from the table. The staff scan the barcode attached to the table. The staff put the scanner back on the table. The staff walk to pick up the scanner from the table. The staff put the scanner back on the table.

From Table 5, the application of the ECRS technique uses Eliminate (E) three activities in I1 processes during upstream inbound logistics and finds that three activities create waste and do not add any value to the process. The main causes of the problems in this process are paper examination, counting packages, and signing signature. These activities are redundant and do not add value. Eliminating these three activities by improving and replacing them with new technology and platforms helps to increase the efficiency and create a continuous process.

The application of the ECRS technique uses Simplify (S) three activities in the M1 process during midstream inbound logistics and eight activities in the M2 process during the working finds that the main causes of problems in both processes are the lack of equipment to help carrying the scanner easily and the barcodes, which cannot be moved. The above problems cause low work efficiency since they create time waste from waiting, walking, and redundant working. Therefore, the researcher decides to improve the above process by introducing the equipment that can be carried and create more barcodes that can be used easily. The improvement increases the working efficiency of the staff as shown in Figure 3.

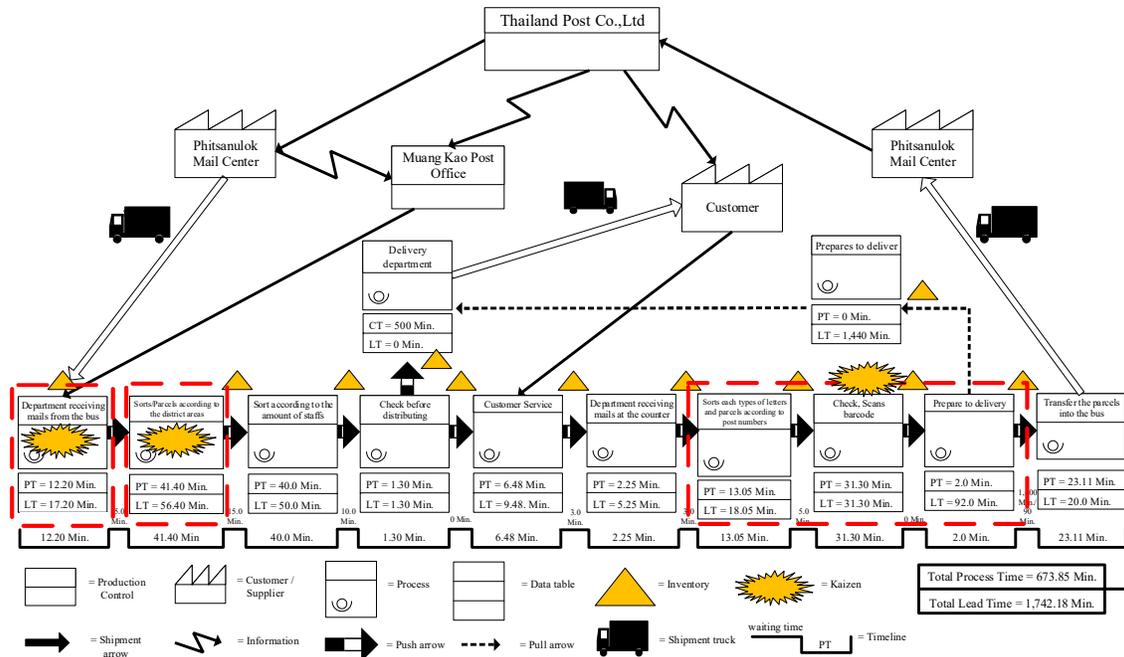


Figure 3 Value Stream Mapping: The Case study of Mueang Kao Post Office of Thailand Post Co., Ltd. (Improved).

From Figure 3 showing the comparison of activities before and after the improvement, VSM represents the improvement of efficiency. Why-Why analysis is used to find the cause and root of the problems. Also, the ECRS technique is used to improve efficiency. This reduces the activities in VSM from fourteen non-value-added activities to three activities, and from forty-six necessary non-value-added activities to forty-three activities as shown in Table 6.

Table 6 Value stream analysis of the current case and proposed case scenario.

Value of Activity	Current Case				Proposed Case			
	Activities		Time (h)		Activities		Time (h)	
	No. of activity	%	%	%	No. of activity	%	%	
Value-Added Activities (VA)	6.0	9.10	509.08	75.50	6.0	11.54	509.08	77.47
Non-Value-Added Activities (NVA)	14.0	21.20	17.39	2.60	3.0	5.77	4.00	0.61
Necessary-Non-Value-Added Activities (NNVA)	46.0	69.70	147.38	21.90	43.0	82.69	144.01	21.92
Total	66.0	100.0	673.85	100.00	52.0	100.00	657.09	100.00

The VSM concept is used to classify the activities in the supply chain before applying the Why-Why analysis method to find the causes of problems and the ECRS technique to improve efficiency. The activities in the supply chain can be classified into 66 activities consisting of 6 value-added activities (9.10%), 14 non-valued-added activities (21.20%), and 46 necessary non-value-added activities (69.70%). The total time spent in the supply chain is 673.85 min. After seeing the result, the researcher considers the causes of the delay and the ineffectiveness. Factors which are important to the management of the supply chain are such as (i) repetitive activities, (ii) poor-quality technology, (iii) lack of budget, (iv) human errors, and (iv) ineffectiveness of internal management. Thus, the researcher proposes ways of improving the efficiency as follows.

The application of the Eliminate (E) method cuts three activities in I1 processes during upstream inbound logistics since paper examination, counting packages, and signing a signature are redundant processes and do not add any value. Cutting these three activities is to improve by replacing them with new technology and platforms in order to increase the efficiency, reduce costs and create a continuous process. Therefore, 46 necessary non-value-added activities using 147.38 min are reduced to forty-three activities using 144.10 min. The total time difference is 3.37 min.

The application of the Simplify (S) method to improve the working process cuts three activities in the M1 process during midstream inbound logistics and eight activities in the M2 process during working. The main causes of problems in both processes are the lack of equipment to help carrying the scanner easily and the barcodes, which cannot be moved. The above problems cause low work efficiency since they create time waste from waiting, walking, and redundant working. Therefore, the researcher decides to improve the above process by introducing the equipment

that can be carried and by creating more barcodes that can be used easily. The improvement of both M1 and M2 reduces fourteen non-value-added activities into three activities using 4.0 min. The total time difference is 13.39 min.

In the management of the working process of Mueang Kao Post Office in Sukhothai province, three necessary non-value-added activities are cut using the Eliminate method, and eleven activities are cut to reduce waste. This causes the efficiency of Mueang Kao Post Office in Sukhothai province, or a new VSM, to have six value-added activities, three non-value-added activities, and forty-three necessary non-value-added activities, which are fifty-two activities in total using 657.09 min. The total time difference is 16.76 min. This is similar to the study of [18], which explains the factors influencing the supply chain to reduce waste. Kumar, et al [18] uses VSM to identify the waste activities. Moreover, [19] studies and analyzes the processes using the ECRS technique to reduce waste in the working processes of the service industry. Wattanuchariya, et al [20] also analyzes the efficiency of the supply chain before using the ECRS technique to improve the efficiency of the operations. The result finds that the time reduction leads to an increase in efficiency. Furthermore, [21] applies the ECRS technique to improve the efficiency of a paper packaging factory with the aim to identify and improve the bottleneck and reduce the time spent during the working process. The result found that the time is reduced by 28.06% of the total time spent.

4. Conclusion

To conclude, due to the decrease of the delivery rate during 2018-2020, there was a reduction of profit and market share for [3]. Therefore, the researcher saw the problems and conducted a case study in the area. The result found that the parcel delivery rate in the area was decreasing. Furthermore, the researcher encountered other problems such as the poor-quality of internal management, the limited staff, and the lack of equipment and facilities. These problems led to a slower delivery and customers using the services of other private companies. Thus, the researcher used the VSM technique to analyse the working processes, seek solutions, and reduce waste. From the VSM analysis, the researcher found a limitation in the study. Since the management's system of the case study could not be improved and adjusted immediately, the researcher proposed the overall solutions that were beneficial to the organization. The solutions to create sustainable efficiency were to separate both necessary and non-necessary activities, and emphasize the environment, sustainability, and a circular economy. The result of the study was similar to many studies as follows. Bogdanski, et al [22] used the VSM technique with a lean manufacturing system to manage the traditional working process in order to improve quality, cost, time, flexibility, as well as preserve the environment and reduce CO₂. Moreover, [23] applied the Sus-VSM technique developed by [24] to reduce the use of energy and raw materials, pay attention to both the environment and society, and improve the working environment to create sustainability. Baysan, et al [25] also analyzed the impact of the lean system energy. The result found that the application of the lean system showed the adaptation to effective manufacturing. Similarly, [26] explained many forms of sustainability in VSM, which helped reduce the use of resources and costs, including creating less impact on ecology and industry to the international level. In addition, [24] stated that the creation of sustainability should not emphasize only cost reduction and effective improvement, but it should also focus on the environment and society. Moreover, [27] proved that the lean system helped reduce time. However, the VSM technique used in the field of transportation and industry has not focused on energy effectiveness. Sultan, et al [28] stated that the logistics' processes are still slow, and this could impact on the product quality and increase pollution. Therefore, the objective of this study was to promote sustainability in the supply chain through the use of VSM.

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6. References

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