Improvement of Used Shoes Supply Chain by Lean Concept

การปรับปรุงห่วงโซ่อุปทานรองเท้ามือสองโดยใช้แนวคิดแบบลีน

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Abstract

This research focused on reviewing used shoes supply chain. Preliminary reviews of used shoes supply chain were identified from secondary databases and documents. A survey of the chain and interviews with stakeholders in the chain were then performed. In addition, value chain of this business was analyzed to identify value added. As a result, many activities were found to increase value to the chain, especially operation activities before remarketing. Those activities could create tremendous value to used shoes depending on the value chain activity.

Furthermore, value changes in each stage of the used shoes supply chain were clarified. Supply chain stakeholders achieved different margins. The highest margin appeared among middlemen producing 520.17%, and the lowest margin was in merchants group 1 at 25.71%.

Subsequently, Value Stream Mapping (VSM) was used to define and analyze processes. This step enabled researcher to find wastes in these processes. Finally, some suggestions and recommendations were provided to each stakeholder to improve the process. Value Stream Mapping (VSM) showed the highest activities in used shoes supply chain occupied 52.38% of Value Added Activities (VA). Recommendations from researcher included attempting to eliminate, combine, simplify, and re-arrange processes. As a result, NVA, NNVA and shortening process times of VA diminished 21.75 hours of total operating time.

Keywords: Used Shoes Supply Chain, Remarketing, Value Change, Value Stream Mapping

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บทคัดย่อ

งานวิจัยนี้เป็นการศึกษาเกี่ยวกับภาพรวมของห่วงโซ่อุปทานรองเท้ามือสอง โดยการทำงานวิจัยนี้จะเริ่มต้นจากการศึกษาข้อมูลทั่วไปและการเข้าไปสำรวจในพื้นที่จริง รวมทั้งสัมภาษณ์ผู้ที่เกี่ยวข้องในห่วงโซ่อุปทาน นอกจากนี้แล้ว ยังได้ทำการวิเคราะห์ห่วงโซ่คุณค่าของธุรกิจรองเท้ามือสองเพื่อที่จะได้รู้ว่าในปัจจุบันนี้ผู้ที่เกี่ยวข้องในห่วงโซ่อุปทานได้มีการดำเนินการหรือทำกิจกรรมใดบ้างเพื่อเป็นการสร้างคุณค่าให้แก่ห่วงโซ่อุปทาน ซึ่งจากการวิเคราะห์ห่วงโซ่คุณค่านี้ก็พบว่ามีหลายๆกิจกรรมที่ช่วยเพิ่มคุณค่าให้แก่ห่วงโซ่อุปทาน อีกทั้งยังช่วยเพิ่มมูลค่าให้แก่รองเท้ามือสอง โดยเฉพาะอย่างยิ่งกิจกรรมในส่วนของการดำเนินงานก่อนที่จะนำรองเท้าออกวางจำหน่าย

ในขั้นตอนของวิเคราะห์การสร้างมูลค่าเพิ่มจากรองเท้ามือสองพบว่า มูลค่าเพิ่มของรองเท้ามือสองที่เกิดขึ้นกับผู้ที่เกี่ยวข้องในห่วงโซ่อุปทานแต่ละรายนั้นไม่เท่ากัน โดยผู้ที่สามารถสร้างมูลค่าเพิ่มให้แก่รองเท้ามือสองมากที่สุดคือ พ่อค้าคนกลาง สามารถสร้างมูลค่าเพิ่มได้ 520.17% และผู้ที่สร้างมูลค่าเพิ่มได้น้อยที่สุดคือพ่อค้ากลุ่มหัวซึ่งสร้างมูลค่าเพิ่มได้เพียง 25.71%

ในส่วนของการวิเคราะห์กิจกรรมในห่วงโซ่อุปทานจะใช้หลักการของแผนผังสายธารคุณค่า เพื่อที่จะได้ทราบว่ากิจกรรมใดที่ไม่ก่อให้เกิดมูลค่าเพิ่ม และในลำดับสุดท้ายเป็นการนำเสนอแนวทางในการปรับปรุงห่วงโซ่อุปทานเพื่อให้ผู้ที่เกี่ยวข้องสามารถนำไปประยุกต์ใช้ให้เกิดประโยชน์ต่อไป ผลจากการจำแนกกิจกรรมตามหลักการของแผนผังสายธารคุณค่าทำให้ทราบว่ากิจกรรมที่พบมากที่สุดในห่วงโซ่อุปทานรองเท้ามือสองคือกิจกรรมที่สร้างคุณค่าเพิ่ม (VA) โดยคิดเป็น52.38% ของกิจกรรมทั้งหมด สำหรับแนวทางในการปรับปรุงการดำเนินงาน ผู้วิจัยได้มีแนวคิดที่จะพยายามตัดขั้นตอนการดำเนินงานที่ไม่สร้างมูลค่าเพิ่ม รวมงานที่สามารถทำร่วมกันหรือทำพร้อมกันได้ และมีการจัดเรียงลำดับการทำงานใหม่เพื่อให้การดำเนินงานง่ายขึ้น ซึ่งหากผู้ที่เกี่ยวข้องดำเนินงานตามที่ได้นำเสนอไปนั้นจะทำให้สามารถลดเวลาในการดำเนินงานไปได้ถึง 21.75 ชั่วโมง

คำสำคัญ : ห่วงโซ่อุปทานของรองเท้ามือสอง การนำสินค้ากลับเข้าสู่ตลาดใหม่ การสร้างมูลค่าเพิ่ม แผนผังสายธารคุณค่า

Introduction

Most companies launch new products to the consumer to increase their business chance, which can increase their profit margins. Moreover, customer satisfaction grows when new products are launched. Additionally, this situation is an advantage to customers because they have many choices. On the other hand, a disadvantage occurs when the product lifecycle is shortened due to dynamic customer needs and dumping of production. Customers do not want to use old items, obsolete items or worn-out items. Therefore, customers dispose of old items when the new items are released. Thus, many products are not used to their full potential.

Second hand markets are places that take advantage of the remaining market value of used items. These places collect a variety used items from many origins. Nowadays, second hand markets are popular in many countries. For example, The United Kingdom, United States of America, France and Germany have many second hand markets for fashion items (Fitzgerald., 2017) and Sweden shopping centres for recycled goods (Mckenna., 2017). In addition, e-commerce websites such as eBay and Amazon are part of a global marketplace for people who are looking for second hand products from other countries. Moreover, people can sell their used products on these sites (Chahal., 2013). In fact, business growth of second hand markets is continuing to expand (Stevens., 2017; M.Rucker, 1995).

The biggest second hand market in Thailand is Rong Kluea market, which is located in Sakaeo near the Thai-Cambodia border approximately 360 km from Bangkok. This market is popular for Thai people, tourists and sellers. Rong Kluea market can be considered a retailer and wholesaler. Used fashion items such as clothes, bags, accessories and shoes account for the majority of goods at this market. Used shoes is a large and important sector.

Many used shoes imported from others countries flow through Laemchabang port, which is located in Southern Bangkok, and they are then forwarded to Rong Kluea Market for reselling. The process flow of the selling chain is of great interest. The middlemen who import the used shoes sell them to merchants in Dech Thai market (a sub-market of Rong Kluea market). The merchants are classified into four groups based on the grade and price of products they select. Used shoes are put through the following processes: separating, selecting, washing, repairing and coloring. Subsequently, the shoes are resold at both retail and wholesale prices. Generally, all products in this chain are used brand-name shoes and consumers are interested in buying them because of the low price.

This study focused on reviewing used shoes supply chain for analysis of the value chain and processes. Value added of used shoes was investigated with the purpose of encouraging people to consider the remaining value of used items and capture that value by recovery processes (Rathore, et al., 2011; Pigosso, et al., 2010). Moreover, the processes were analyzed and defined using Value Stream Mapping (VSM) to reduce unnecessary activities. Finally, improvement based on lean concept is suggested and can be used as a guideline for entrepreneurs to adjust their procedures in order to reduce cost and time as well as to increase customer satisfaction. Moreover, the techniques adopted in this work should be applicable to other recycled products. Improvement of used shoes supply chain may increase profit margins as well. Thus, these ideas can inspire entrepreneurs to realize the remaining

value of other used products and bring them into recovery processes before re-marketing. In addition, re-marketing of used products can reduce waste and adverse effects on the environment.

Literature Review

There have been very few studies on used shoes supply chains—hence the reason for this study. The previous studies are reviewed in four main categories: recovery process in the chain (why this process is important in the chain), value strategies, the footwear industry, and principals and generalizations of the lean concept.

End-of-life Strategies

Previous studies have stated that numerous business organizations are concerned about the environmental impacts the final disposal process of their products, so they attempt to create appropriate processes to reduce waste at their products' end-of-life cycle. Pigosso, et al. (2010) presented the eco-design concept, which focused on remanufacturing. They concentrated on products' end-of-life as a part of product life cycle. The end-of-life strategy includes processes such as reuse, repair, refurbishment/reconditioning, remanufacturing and recycling. This concept attempts to close the loop, thereby reducing adverse environmental impacts and cost of life cycle manufacturing processes. The following definitions for these terms are used in this study: ***Reuse*** is the process of using materials, products or components by a second customer without prior repair or as formerly designed (Rathore, et al., 2011). ***Repair*** is the process of bringing damaged components or items back to a functional condition (Rathore, et al., 2011). ***Refurbishing/Reconditioning*** is the process of recovering components to a functional state to the original specification. (e.g. repainting, reconstruction) (Rathore, et al., 2011). ***Remanufacturing*** is the process gathering used products or components, assessing their condition, and replacing worn, broken or obsolete parts with new or refurbished parts (Pigosso, et al., 2010) ***Recycling*** is the process taking used products, components and materials to fieldstrip, separating them into categories, and processing them to make the same material or useful degraded material (Pigosso, et al., 2010; Rathore, et al., 2011; Silva, et al., 2012).

Nowadays, numerous business establishments are proposing to follow up their end-of-life strategies because they realize that it can decrease their business costs and waste while lessening environmental impacts. Therefore, they try to add value to the recovery products and complete processes in less time. Little existing research delves deeply into second hand

products; therefore, this study focused on the reuse, recycling, repair and refurbishment of used shoes supply chains.

Value Chain Strategy and Value Stream Mapping Concepts

Due to today's highly competitive businesses environment, organizations must efficiently create value in their chain. Generally, a value chain is a strategy used for analyzing the chain from the beginning to the end. Value chain analysis focuses on processes and how inputs are changed into the outputs purchased by consumers (Porter,1985). After analysis of the value chain, companies will know the value added at each part of the chain and how they operate. Elements in Porter's value chain are divided into primary and support activities. Primary activities are inbound logistics, operations, outbound logistics and marketing/sales. Support activities are secondary activities and can drive a role in primary activities. Support activities include procurement (purchasing), human resource management, technological development and infrastructure. Walters and Lancaster (2000) reported that several businesses (such as the Bluegum Group, members of the automotive industry, the McKesson Corporation, Caterpillar, and Freedom Furniture) have more detailed value chain processes than Porter's model. Each of them has some differences in the model. Value chains are not specified for the business chain. It can be used to analyze network value by defining value linkages of players in the network (Peppard and Rylander, 2006).

Value Stream Mapping (VSM) is a principal tool of the lean concept for reviewing the overall processes. It starts with creation of current state mapping. Analysis and defining processes are then sorted into three categories: non-value adding (NVA), necessary but non-value adding (NNVA), and value-adding (VA). Subsequently, procedures are created to eliminate seven wastes in systems: overproduction, waiting, transport, inappropriate processing, unnecessary inventory, unnecessary motion, and defects. Finally, creation of future state mapping is performed to adjust the process. The expected result includes minimizing time and costs in the chain (Hines and Rich, 1997; Abdulmalek and Rajgopal, 2007). The VSM concept is considered as a significant tool in the improvement stage of this research.

Waste Management in the Footwear Industry

The footwear industry is part of the overall fashion industry. In recent years, demands and competition in this industry have rapidly increased. The life cycle of shoes is relatively short, leading to a higher level of waste in end-of-life. Despite this, very few studies have investigated the impact of footwear waste on the environment. Staikos and Rahimifard (2007) aimed to create an optimal method for waste management in the footwear industry.

They presented a decision-making model using analytic hierarchy process (AHP), which is a multi-criteria decision-making (MCDM) method. Normally, shoes waste management models consist of four options in end-of-life: reuse, recycling, energy recovery, and disposal. As a result, they developed a general model into a more appropriate model. In addition, they used an associate software tool to support the decision-making model. Their research provided an optimal model for a waste management process to represent environmental responsibility and help the company to reduce costs in the waste disposal process. However, this research focuses mainly on the reuse, repair, recycling and refurbishment of used shoes.

Lean Concept Applying

Lean is a concept which focuses on eliminating wastes in processes in order to increase efficiency and productivity. Moreover, this concept can reduce costs occasionally. Toyota, a Japanese automobile company, was the first company to apply the lean concept into their line production. Three preliminary concepts that Toyota used were JUST IN TIME (JIT), automation (*jidoka*), and stability (*heijunka*). These concepts formed the basis that supported Toyota's famous lean manufacturing system: Toyota Production System (TPS). TPS is a flexibile production system, so many industries are interested in TPS and applying this model to their processes. There are several tools and techniques in lean other than the three concepts that Toyota used, such as Value Stream Mapping (VSM), Total Productive Maintenance (TPM), 5S practices, Kanban, Kaizen, Visual Management, and Take-time Analysis. (Kumer et al., 2006). Each company adapts the tools and techniques of lean differently. For example, the food industry has used VSM to identify value added and non-value added activities in their processes. In addition, inventory, lead time and customers' demand are evaluated. As the result, lean concept can reduce inventory, waste and costs in the supply chain. Furthermore, customer service can be enhanced by shortening lead time (Lehtinen and Torkko, 2005).

Lean is not only suitable for big industries. Hospitals are also interested in lean to solve problems. For instance, lean can be applied to eliminate waste in communication processes such as waiting time, critical path related queues, and erroneous data or information (Gîfu and Teodorescu, 2014).

The literature review of lean application provided insight regarding the purpose and concept of lean. The tools and techniques of lean were illustrated. Moreover, the review gave some examples of applying lean in various industries which may be useful for the footwear industry.

Material and Methods

Finding the optimal solution for waste management in the footwear industry is interesting because shoes' life cycle is short. This case leads to a higher level of waste in end-of-life. A lot of used shoes are disposed of in landfills—even if they still have value. The end-of-life strategies include processes in previous studies such as reuse, repair, refurbishment/recondition, remanufacture and recycling are interesting. These processes can add value to used products. Therefore, they can be used as a guideline for this research in used shoes supply chain before re-marketing. Value chain strategy will be applied to analysis of value added activities in used shoes supply chains. The activities in the chain will be categorized into two groups: primary activities and support activities (following value chain theory). Value chain analysis can describe how the chain operates to create value for used shoes before re-marketing. Moreover, value added activities can produce margins in used supply chains. Thus, the margins in the chains will be analyzed. Increasing operation efficiency can build higher margins. Improvements in used shoes supply chains start from applying value stream mapping (VSM), which a principal tool of the lean concept for reviewing the overall processes and identifying activities into three categories: value adding (VA), necessary but non-value adding (NNVA) and non-value adding (NVA). As a result, the actual state of the used shoes supply chains will be shown. Finally, the researchers will adapt another technique of lean (ECRS) to give some suggestions for adjustments in the operation in used shoes supply chains. The methodology of this study can be described as follows:

1) Preliminary Data Collection

This section is a review of the used shoes supply chain from secondary databases and documents such as academic research, websites, journals, etc. The researchers observed at Rong Kluea market—especially they used shoes section at Dech Thai market. Moreover, a sample of merchants and customers were surveyed and interviewed at the important second hand markets of Thailand in Bangkok and Nonthaburi areas to collect data for the final price of used shoes. Observations were conducted in realistic places and in-depth interviews were used for more details with 26 random stakeholders in the chain, including middlemen who imported used shoes from other countries and representative merchants at Dech Thai market in each group to study their processes and their margins.

2) Value Chain and Value Added Analysis

Value chain analysis starts from observation in realistic places and analyzing activities which occur. Two categories are identified: primary activities and support activities. This part will show value added activities of the used shoes supply chain. After that, in-depth interviews of stakeholders (same groups following step 1) were conducted for investigating value added in the chain. Value added of the used shoes is focused on by looking at value change in each step in the chain and margins of each stakeholder.

3) Process Analysis

Value Stream Mapping (VSM) is used to define and analyze processes. Processes are identified into three categories: value added activities (VA), necessary but non-value added activities (NNVA) and non-value added activities (NVA). Moreover, the operation time is recorded by applying activity time estimation, shown in equation (1). Value Stream Mapping (VSM) will show the overall current state of used shoes supply chain. Therefore, this step will enable the researcher to find the waste in these processes.

$$Te = \frac{a+4m+b}{6} \quad (1)$$

wherea = optimistic time estimate

m = most likely time estimate

b = pessimistic time estimate

4) Improvement Processes by Lean Concept

Improvement processes work by setting the situation and briefing the performers to operate following the processes model in that setting. This examination repeats five times. Processes time will be recorded and computed as an average. Lean and ECRS concepts will be applied to improve processes to increase efficiency and decrease process time.

5) Discussion and Report

This step will give some suggestions and concepts to help improving the process, after implementation and reporting.

Results

1) Overview of The Used Shoes Supply Chain

Preliminary data collection by researching secondary data and other documents include surveying in realistic places contributed overall information about the used shoes supply chain. In addition, primary data was collected regarding Rong Kluea market, which is the most important place for the used shoes supply chain.

Rong Kluea market is located in Sakaeo, near the Aranyaprathet border. There are six sub-markets: Old Rong Kluea market, Golden Gate market, Dech Thai market, Thesaban II (New Rong Kluea market), Benjawan market, and Indochina market. Each market can be divided into specialty markets. For example, Golden Gate market sells new and second hands items; Benjawan market sells second hands clothes and accessories; and Dech Thai market is specific to used shoes. The used shoes supply chain starts from middlemen in Dech Thai market who import used shoes from other countries such as Korea, Hong Kong and China through Laemchabang port in approximately 45 containers per month. Middlemen sell used shoes to four groups of merchants at Dech Thai market. After modifying processes, used shoes are resold to tourists and merchants from around the province. Finally, used shoes are distributed to other second hand markets.An overview of the used shoes supply chain in shown in Figure 1.

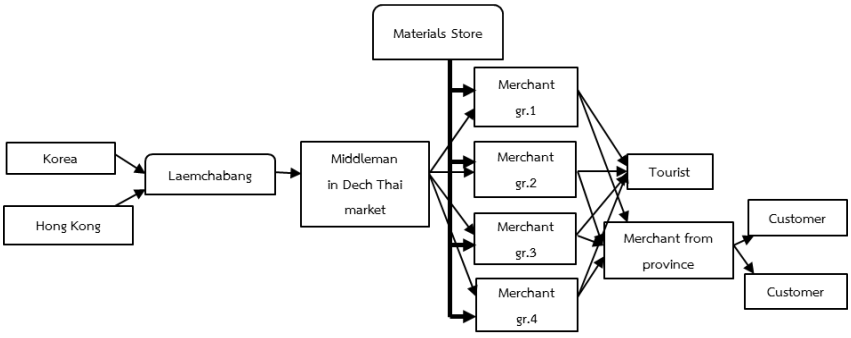

Figure 1. Used Shoes Supply Chain

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2) Value Chain and Value added Analysis

Observation in realistic places and interviews with stakeholders in supply chain were conducted to find value added activities in the supply chain to understand the current value chain. Nowadays, stakeholders try to create several activities to support their businesses. Starting with primary activities, middlemen attempt to purchase good quality used shoes from other countries. Moreover, good quality and low cost of shoes materials are considered. Processes in operation are the main point which this research focused on because value added activities occur in this part. (e.g., repairing, washing, ornamenting and painting) These processes are conducted before re-marketing. Moreover, human resource management by training laborers and making them satisfied is shown in this value chain. Table 1 illustrates more details for the used shoes value chain analysis.

Table 1. Used shoes' Value Chain Analysis

Support Activity	**Procurement:** - Middleman contacts with suppliers on aboard by email - Each group of merchant supplies materials and parts of shoes from material store				Margin
	Human Resource Management: - Employ flexible labors and hire them fairly - Teach technique and skill to labors				
	Firm Infrastructure: - Business model of middleman and merchants				
	Inbound Logistics	**Operations**	**Outbound Logistics**	**Marketing and Sales**	**Services**
	- Used shoes from other countries - Materials and parts of shoes from store	- Selecting by each merchant - Value added activities such as; Soles repairing, Washing, Repairing and Ornamenting heeled shoes & Painting	- Reselling by retail and wholesale	- Select used shoes in good quality for customers when they can't come to select by themself - Delivery for province customers	- Compensate to customers in case deliver incomplete quantity
	Primary Activity				

Value added in the used shoes supply chain was then analyze by using information from in-depth interviews. The researchers interviewed 26 stakeholders in the chain: 3 middlemen; 3 merchants in group 1; 6 merchants in group 2, which were separated into merchant groups 2.1, 2.2, and 2.3 (2 merchants in each sub-group); 12 merchants in group 3, which were separated into merchant groups 3.1, 3.2, 3.3, and 3.4 (3 merchants in each sub-group); and 2 merchants in group 4. In the beginning, used shoes are imported from other countries at low prices. Cost is about 19.63 Baht/pair. The middlemen sell them to 4 groups of merchants in Dech Thai market at different prices. Subsequently, merchants push them into processes for added value. Each value added activity has approximate operation costs as

follows: 5 baht/pair for sole repairing, 2 baht/pair for washing, 4 baht/pair for repairing, and 1.25 baht/pair for painting. Therefore, the total cost of used shoes for each merchant consists of the imported used shoes' price and operation costs. Moreover, 0.1 baht/pair is required for moving the used shoes to the merchants' shops at Dech Thai market, and a materials cost of approximately 7.75 baht/pair is included. Trading of the used shoes is similar to retail prices and wholesale prices depending on the quantity requested by customers. Each stakeholder benefits differently (Table 2). Details of value change of the used shoes supply chain are shown in Figure 2.

3) Process Analysis by Value Stream Mapping

Value Stream Mapping was used to understand the current processes in the used shoes supply chain. The chain starts from middlemen in Dech Thai market who imports used shoes from overseas suppliers through Laemchabang port. After paying the import duty, the used shoes are forward to warehouses in Dech Thai market. The middlemen sell the used shoes to merchants in Dech Thai market, who can freely select used shoes with the grade and price that they need. These merchants are separated into four groups. The used shoes are selected in order to be improved by washing, repairing and painting before reselling. The Value Stream Mapping of the used shoes supply chain at the current state is shown in Figure 3.

Following the current state map of used shoes supply chain can identify activities in the chain into three categories: value added activities (VA), necessary but non-value added activities (NNVA) and non-value added activities (NVA). Table 3 shows the grouping of activities, which were investigated by the VSM concept. There were 21 total activities in this chain. There were 11 activities of VA (52.38%), 7 activities of NNVA (33.33%), and 3 activities of NVA (14.29%). Time in each activity came from observation and interviewing of stakeholders in the supply chain. Processes time was uncertain. Therefore, to estimate activity time, Te (equation 1) is suitable. The last section of this study is improving processes. Processes in the chain were separated into two parts: processes occurring at middleman storehouses and processes at merchant's shops in Dech Thai market. However, processes at Laemchabang port and shops of merchants in the province are not improved because they are just simple shortening activities.

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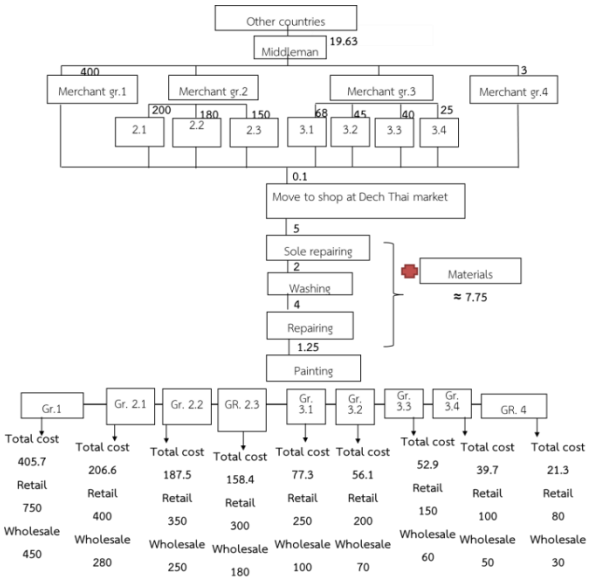
Table 2. Margins of Each Stakeholder

Stakeholders	Cost	Selling price (Avg.)	Margin
Middleman	19.63 THB/pairs	121.74 THB/pairs	520.17%
Merchants in group 1	405.7 THB/pairs	Wholesale (80%): 450 THB/pairs Retail (20%): 750 THB/pairs	25.71%
Merchants in group 2.1	206.6 THB/pairs	Wholesale (80%): 280 THB/pairs Retail (20%): 400 THB/pairs	47.14%
Merchants in group 2.2	187.5 THB/pairs	Wholesale (80%): 250 THB/pairs Retail (20%): 350 THB/pairs	44.00%
Merchants in group 2.3	158.4 THB/pairs	Wholesale (80%): 180 THB/pairs Retail (20%): 300 THB/pairs	28.79%
Merchants in group 3.1	77.3 THB/pairs	Wholesale (80%): 100 THB/pairs Retail (20%): 250 THB/pairs	68.18%
Merchants in group 3.2	56.1 THB/pairs	Wholesale (80%): 80 THB/pairs Retail (20%): 200 THB/pairs	85.38%
Merchants in group 3.3	52.9 THB/pairs	Wholesale (80%): 70 THB/pairs Retail (20%): 150 THB/pairs	62.57%
Merchants in group 3.4	39.7 THB/pairs	Wholesale (80%): 50 THB/pairs Retail (20%): 100 THB/pairs	51.13%
Merchants in group 4	21.3 THB/pairs	Wholesale (80%): 30 THB/pairs Retail (20%): 80 THB/pairs	87.79%



Unit: Baht/pair

Figure 2. Cost-Benefit structure of each stakeholder

Table 3. The categories of activities in used shoes supply chain by VSM concept (Unit: hour)

No.	Activities	Activity Time Estimate (T_e)	VSM
1	Middleman order used shoes from oversea supplier	1.66	VA
2	Shipping	372	NNVA
3	Paying import duty at Laemchabang Port	1.35	NNVA
4	Transport to middleman storehouse at Dech Thai market	4.70	VA
5	Move product out of container and stacking in 1 ton	3.5	NNVA
6	Merchant gr.1&2 selected	5.04	VA
7	Separating	4.01	NNVA
8	Storage (waiting for merchant gr.3 selected)	15.0	NVA
9	Stacking in 10 bulks	2.89	NVA
10	Merchant gr.3 selected	4.42	VA
11	Merchant gr.4 buy the bulk remaining	2.0	VA
12	Moved used shoes are selected into merchant's shop at Dech Thai Market	0.25	NNVA
13	Separating to repairing sole	1.25	NVA
14	Repairing sole	4.07	VA
15	Washing	7.43	VA
16	Drying	26.58	VA
17	Repairing and ornamenting heeled shoes	12.0	VA
18	Painting	8.55	VA
19	Preparing used shoes to merchant in province	3.75	NNVA
20	Transport to merchant in province	24.83	NNVA
21	Merchant in province setting figure by chopsticks/ newspaper and packaging	6.27	VA
Total		511.55	

4) Processes Improvement

This study concentrated on middleman storehouses and merchants' shops at Dech Thai market. Most activities in these parts are operations and value added activities in the value chain. Therefore, abbreviating processes in the supply chain will be more effective and satisfy customer needs. Process improvements in this study were conducted by designing the target processes model. After that, situations were set to examine the model (repeated 5 times for examining the model). ECRS and lean were applied in this step, depending on simulation of labor processing.

Process Improvements at Middleman Storehouses

Process improvements at middlemen storehouses included elimination of stacking used shoes in 10 bulks which is a non-value added activity. In addition, the processes of selecting used shoes by merchants in group 1 and 2 and separating were switched to re-arrangement procedures. As a result, processes will be shorter and simpler. Moreover, merchants in group 3 can select used shoes immediately following merchants in group 1 and 2. Therefore, waiting time at storage is eliminated. Figure 4 illustrates processes improvements at the middleman storehouses.

Process Improvements at Merchants' Shops in Dech Thai Market

Processes at merchants' shops in Dech Thai market are important because these processes are value added activities. Therefore, increasing efficiency is necessary to reduce cost and shorten process time. Elimination of non-value added activities is the technique used in this stage. Separating for repairing soles was removed from the processes. Moreover, combination and re-arrangement were applied along with the procedure of repairing soles, repairing and ornamenting heeled shoes. Subsequently, redundancies were eliminated and operation activities were facilitated. Improvements is processes at merchants' shops in Dech Thai market are shown in Figure 5.

A summary of used shoes supply chain improvements are illustrated in Table 4. Figure 6 shows overall activities at a future state after adjusting these processes in accordance with the suggestions and concepts in this study. Following Table 4, a reduction of 21.75 hours (4.25%) of total operating time was made, which is broken into two parts: middleman storehouses and merchants' shops at Dech Thai market. Reducing times are 19.6 and 2.15 hours, respectively.

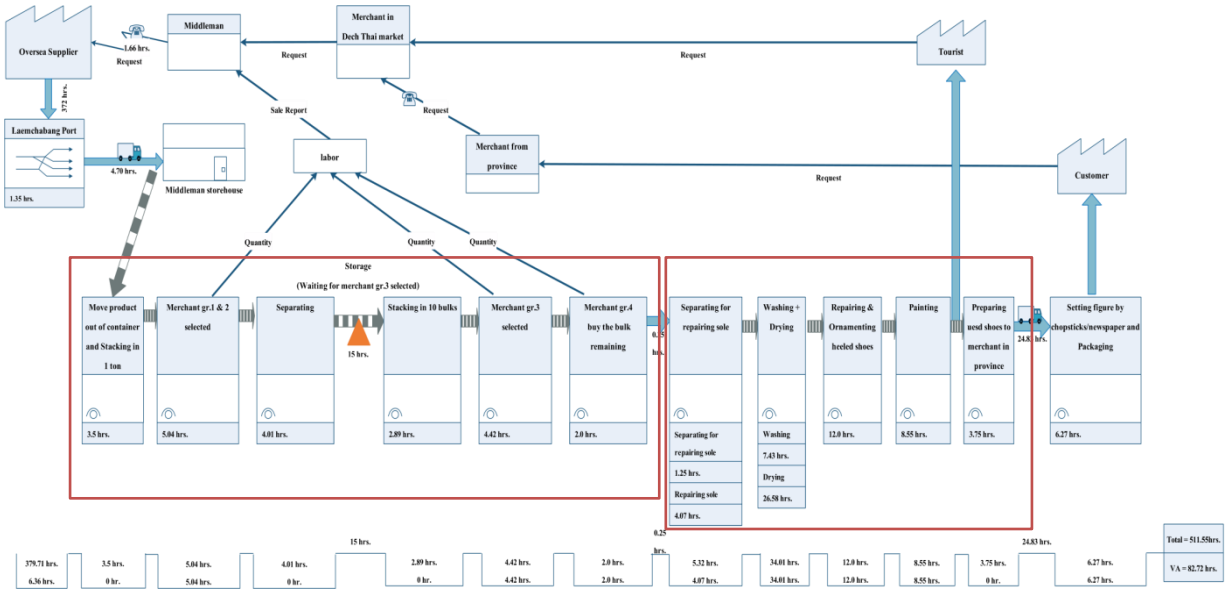


Figure 3. Current State of Used Shoes Supply Chain

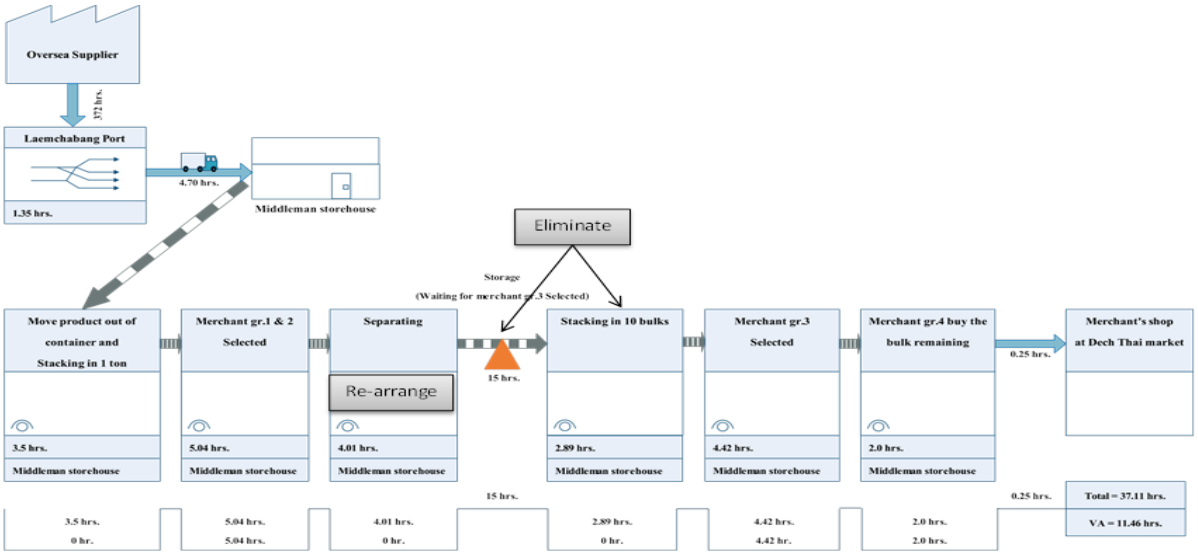


Figure 4. Process Improvements at Middlemen Storehouse

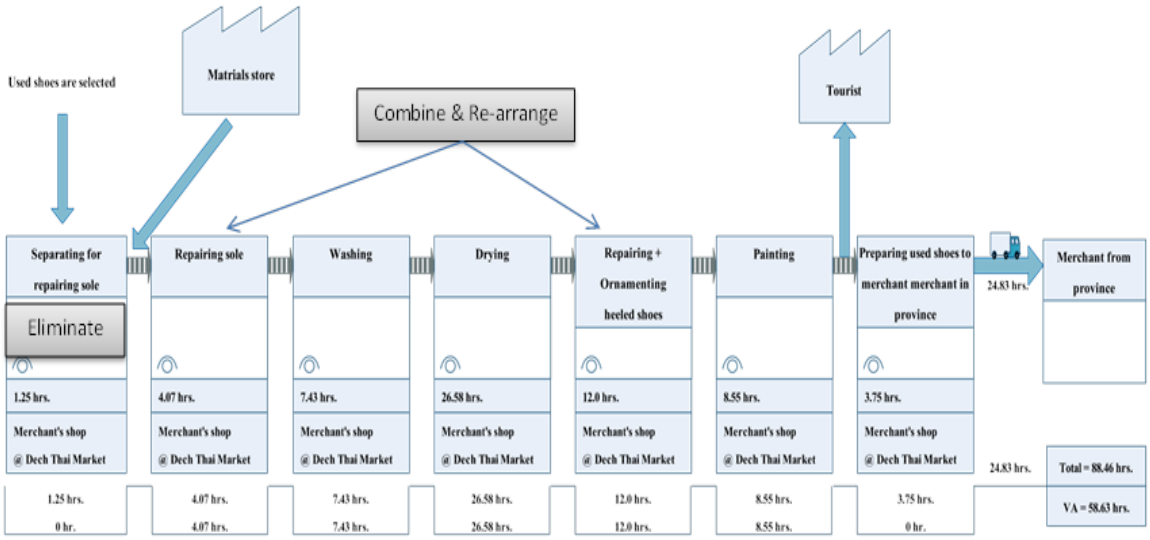


Figure 5. Process Improvements at Merchants' Shops in Dech Thai Market

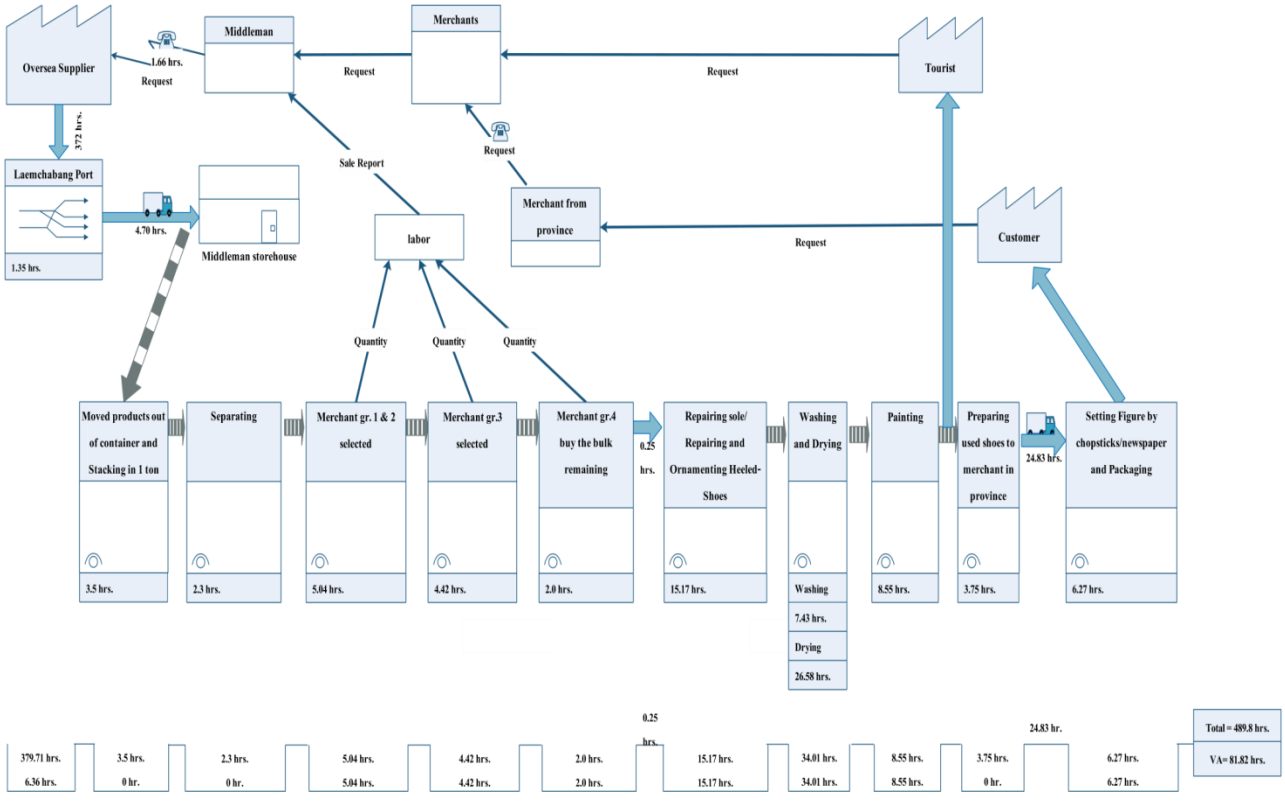


Figure 6. Future state of used shoes supply chain

Table 4. Summary of used shoes supply chain

Stage	Estimate operating time at current state (Hrs.)	Estimate operating time at future state (Hrs.)	Reducing time (Hrs.)	Percentage of reducing time (Hrs.)
Middleman storehouse	37.11	17.51	19.6	52.82%
Merchants's shop at Dech Thai Market	88.46	86.31	2.15	2.43%
Total operating time in supply chain	511.55	489.8	21.75	4.25%

Discussion/Conclusion

Used shoes are imported in approximately 45 containers/month (16 tons/container). Processes before reselling include sorting and repairing. There are no definite patterns within the supply chain. Some activities take a long time to process. Moreover, there are many wastes from the imported goods that could cause severe damage. For sellers, each pair of shoes has different prices, which depend on merchantability and brand. Each stakeholder has similar processes, but they do not benefit equally. The highest margin appeared among middleman (520.17%) and the lowest margin (25.71%) was in merchant group 1. Last section, processes in the supply chain were defined into three categories: non-value adding (NVA), necessary but non-value adding (NNVA) and value adding (VA). These processes may be defined to eliminate non-value adding processes and to reduce process time. ECRS and lean concepts were applied to adjust the chain. As a result, it can decrease 21.75 hours of total operating time. Thus, stakeholders will gain higher benefits and get higher customer satisfaction.

Concepts regarding improvements in the used shoes supply chain in this study can serve as a guideline and be adapted by others for recycling products. Moreover, the margin of used shoes in each stakeholder shows that used products still have value. Thus, recycling processes and re-marketing are interesting alternatives to managing waste in the shoes industry instead of disposing of old items, obsolete items or worn out items in the landfill. For further research, environmental effects may be investigated in two main ways—as how recycling and re-marketing can reduce waste in the shoes industry. There is a considerable amount waste in the importation of used shoes. Therefore, it will continue to impact the environment. Finding a suitable solution to solve this problem is extremely important for sustainability in this business.

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