ENGINE OIL CHANGE LEAD TIME REDUCTION OF COMMERCIAL VEHICLE SERVICE CENTER IN THAILAND

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การลดเวลาเข้ารับบริการสำหรับเปลี่ยนถ่ายน้ำมันเครื่องที่ศูนย์บริการรถยนต์เชิงพาณิชย์ในประเทศไทย

น.ส.ซูฟีย์ ดาโต๊ะ

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ซูฟีย์ ดาโต๊ะ : การลดเวลาเข้ารับบริการสำหรับเปลี่ยนถ่ายน้ำมันเครื่องที่ศูนย์บริการรถยนต์เชิงพาณิชย์ในประเทศไทย. (ENGINE OIL CHANGE LEAD TIME REDUCTION OF COMMERCIAL VEHICLE SERVICE CENTER IN THAILAND) อ.ที่ปรึกษาหลัก : ศ. ดร.ปารเมศ ชุติมาPh.D.

ในภาวะปัจจุบันที่มีการแข่งขันที่สูง เวลาในการให้บริการเป็นหนึ่งในปัจจัยสำคัญที่ลูกค้าบางส่วนมีแนวโน้มที่จะกังวล วิทยานิพนธ์นี้ต้องการตรวจสอบสาเหตุที่แท้จริงของกิจกรรมที่ไม่จำเป็นในศูนย์บริการมาตรฐาน ซึ่งสามารถปรับปรุงระยะเวลาในการให้บริการโดยรวมโดยเฉพาะบริการเปลี่ยนถ่ายน้ำมันเครื่องสำหรับรถยนต์เพื่อการพาณิชย์ขนาดเล็กเท่านั้น (ปิคอัพและรถยนต์อเนกประสงค์เอสยูวี) และเพื่อเป็นต้นแบบของการปรับปรุงขั้นตอนการทำงานที่สามารถแนะนำศูนย์บริการมาตรฐานอื่น ๆ ในประเทศไทยได้ในอนาคต ขั้นตอนการให้บริการเปลี่ยนถ่ายน้ำมันเครื่องจึงถูกแบ่งออกเป็น 3 ช่วง ได้แก่ ขั้นตอนการตรวจสอบก่อนการบำรุงรักษา, ขั้นตอนการบำรุงรักษา และขั้นตอนหลังการบำรุงรักษา ซึ่งได้มีการนำแนวคิดการผลิตแบบลีนและการวิเคราะห์สภาพแวดล้อมภายนอกและภายในโดยมีการใช้เครื่องมือต่างๆ เช่น แผนผังสายธารคุณค่า (Value Stream Mapping), กิจกรรมใดๆ ที่กระทำขึ้นแล้วไม่ก่อให้เกิดมูลค่า (Muda), การปรับปรุงอย่างต่อเนื่อง (KAIZEN), หลักการลดความสูญเปล่า (ECRS), เครื่องมือการวิเคราะห์ทางการตลาด (Five-Forces model), การวิเคราะห์สภาพแวดล้อมภายนอกและภายในขององค์กร ณ เวลาปัจจุบัน (SWOT analysis) และแผนภูมิก้างปลา (Fish bone diagram) ถูกใช้เพื่อค้นหาปัญหาและกิจกรรมที่สิ้นเปลืองในกระบวนการปัจจุบัน นอกจากนี้ศูนย์บริการยังสามารถใช้แนวคิดของช่างสองคนในการซ่อมบำรุง (Dual mechanics) เพื่อลดเวลาให้บริการลงครึ่งหนึ่ง โดยหลังจากมีการตรวจสอบและวิเคราะห์ พบว่าปัจจัยหลักที่ขาดประสิทธิภาพสามารถแบ่งออกเป็น 3 กลุ่มใหญ่ ๆ ได้แก่ ปัญหาการขาดประสิทธิภาพของเจ้าหน้าที่ปรึกษาบริการ, ปัญหาการจัดการโรงซ่อมที่ไม่มีประสิทธิภาพ และปัญหาการจัดการอะไหล่ในโรงซ่อม ซึ่งสามารถแบ่งออกได้เป็น 10 กลุ่มย่อย ดังนั้นงานวิจัยนี้จะให้คำแนะนำและเปรียบเทียบผลลัพธ์ระหว่างก่อนและหลังของแผนปรับปรุง รวมถึงข้อแนะนำในอนาคตสำหรับการปรับปรุงกระบวนการเปลี่ยนถ่ายน้ำมันเครื่อง ซึ่งปัญหาที่เกี่ยวข้องทั้งหมดนี้จะถูกพัฒนาให้มีประสิทธิภาพมากขึ้นและจะช่วยให้เวลาในการให้บริการรวดเร็วขึ้นเพื่อแข่งขันในธุรกิจหลังการขายสำหรับอุตสาหกรรมรถยนต์

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Sufee Datoh : ENGINE OIL CHANGE LEAD TIME REDUCTION OF COMMERCIAL VEHICLE SERVICE CENTER IN THAILAND. Advisor: Prof. PARAMES CHUTIMA, Ph.D.

In the high competition, the service time is one of many important factors that some customers are likely to concern. This thesis would like to investigate the root causes of the unnecessary activities in a selected authorised service centre which can be improved overall service lead time especially engine oil changing service and light commercial vehicles only (Pick-up and SUV) and to be a prototype improvement plan to suggest other authorised service centres in Thailand in the future. The procedure of engine oil change service can be grouped into 3 phases including the pre-checking, maintenance and post-checking phase. The idea of lean, some lean strategies and the analysis of the external and internal environments, for example, Value Stream Mapping, Non-value activities (Muda), The continuous improvement (KAIZEN), ECRS method, Five-Forces model, SWOT analysis and Fishbone diagram are utilised for finding issues and wasteful exercises inside the current process. Furthermore, the service centre can utilise the concept of Dual mechanics to make servicing time reduce by half in the maintenance phase. Overall, the inefficiency wasteful factors can be divided into 3 major groups namely the issue of inefficiency of service advisor (SA), the issue of poor workshop management and the issue of parts management and the total number of non-value activities is 10 sub-points. So, this research will give recommendations and compare the result between before and after and future improving the engine oil change process. All related issues will decrease which can enhance the faster service time of engine oil changing to compete within the after-sales car business.

Field of Study:	Engineering Management	Student's Signature .....
Academic Year:	2020	Advisor's Signature .....

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CHAPTER 1
INTRODUCTION

According to Marklines (2019) vehicle plays an important role in the transportation of Thailand, sales volume in Thailand increased by 19.2% or around 1,039,158 units between 2017 and 2018. By brand sales in 2018, Toyota was up 31.3% to 314,498 units. Isuzu was up 10.8% to 177,864 units and Honda was up 0.4% to 128,290 units. Mitsubishi sales were up 21.3% to 84,560 units, and Nissan sales were up 21.2% to 72,394 units.

In year 2019, vehicle sales in Thailand slightly declined from 3.3% to 1,007,552 units. By brand sales in 2019, Toyota was up 5.5% to 331,878 units. Isuzu was down 5.4% to 168,215 units and Honda was down 1.9% to 125,833 units. Mitsubishi sales were up 4.4% to 88,244 units, and Nissan sales were down 11.0% to 64,414 units. Although the decrease of the number of vehicle sales happened, customer needs have convinced many car companies from other countries to come into the Thai automotive market, resulting in high competition for both sales and after-sales business. In addition to the fierce competition in terms of a car after-sales business, several authorised dealers are facing a decline in the number of car service units that come for maintenance or repair. (Marklines, 2020)

According to Thai industry overview in Table 1.1 and 1.2, although the market volume in 2019 was decreased at 9.20% from 2018, the overall market value growth trend of Thai automotive market was increased by 15.50% and it will continuously rise over the next 5 years.

Table 1.1: Thai Car Market Value and Volume from 2015 to 2019

Year	Thai Car Market Value		Thai Car Market Volume	
	$billion	%Growth	thousand units	%Growth
2015	12.1		772.3	
2016	13.4	10.60%	805.0	4.20%
2017	13.6	1.30%	818.4	1.70%
2018	18.9	39.30%	877.0	7.20%
2019	21.8	15.50%	796.3	-9.20%

Source: Available from: https://0-advantage-marketline-com.pugwash.lib.warwick.ac.uk/Analysis/ViewasPDF/thailand-car-manufacturing-98454 [Accessed 5 May 2020].

Table 1.2: Forecasting Thai Car Market Value and Volume from 2019 to 2024

Year	Thai Car Market Value		Thai Car Market Volume	
	$billion	%Growth	thousand units	%Growth
2019	21.8	15.50%	796.3	-9.20%
2020	21.6	-1.10%	814.9	2.30%
2021	23.5	8.80%	819.9	0.60%
2022	25.5	8.30%	825.7	0.70%
2023	27.4	7.60%	830.5	0.60%
2024	29.4	7.10%	834.7	0.50%

Source: Available from: https://0-advantage-marketline-com.pugwash.lib.warwick.ac.uk/Analysis/ViewasPDF/thailand-car-manufacturing-98454 [Accessed 5 May 2020].

Nowadays, Company A is one of Japanese leading commercial vehicles and they came to set up the headquarter distribution and plan the business strategies in Thailand since 1960. They supply vehicles, produce parts and have authorised dealers up to 80 companies with 332 branches all over Thailand for selling vehicles and servicing maintenance and repair in terms of after-sales business. The main products can be divided into 2 main segments including light commercial vehicles (LCV) such as Pick-up and multipurpose 7 seats (SUV) and trucks which are highly popular in Thailand by being able to continuously dominate the commercial vehicle market for a

long time with excellent quality and meet the needs of the market. In the current situation, it cannot deny that the business disruption is likely to happen quickly and the after-sales business becomes to be key important of business sustainability. The operation of the company and the authorised dealers' income who are under the control of company A are revealed from the number of served cars at the service centres which has continued to decline over the past 8 years. Therefore, this situation cannot be ignored. So, both Company A and authorised dealers should adapt themselves to the rapid change of customer behaviour including the faster service time, tools & equipment, the skills of mechanics, workshop management to increase customer satisfaction resulting in the sustainability of after-sales business.

1.1 Problem Statement

The current problem is the significant decline number of LCV service units to come to do service with authorised dealers under Company's A from year 2009 to 2019 in Table 1.3. Moreover, the competitors in the after-sales car business increase especially for LCV whether it is branded garages namely B-quick, Cockpit, Fit-auto, A.C.T, etc. Not only just the famous garages but also the local garages open in Thailand and it can be seen that the branded garages also have many branches in Thailand in Table 1.5 comparing with Company A's authorised branches in Table 1.4. Customers can have a choice to do maintenance service for their vehicles, resulting in the disruption of Company A's after-sales market share.

Table 1.3: The number of nationwide LCV service units from 2009 to 2019

Year	Total Service Units	%Change
2009	2,430,809	
2010	2,758,942	13%
2011	2,795,766	1%
2012	2,577,386	-8%
2013	2,509,491	-3%
2014	2,396,253	-5%
2015	2,306,240	-4%
2016	2,215,925	-4%
2017	2,200,889	-1%
2018	2,139,289	-3%
2019	2,192,221	-2%

Table 1.4: The number of authorised service centres under Company A in Thailand (data as of 1 May 2020)

Region	**Service branches (s)**
Central (Bangkok province)	78
Central (Other provinces)	42
EAST	47
Northeast	63
Northeast	50
South	52
Total	**332**

Table 1.5: The number of branches from many car workshop brands

Brand	**Number of branches**
B-quick	140
Cockpit	196
Fit auto	22

Source: B-quick, Cockpit and Fit auto official website (as of 15 May 2020)

However, in year 2019, Company A surveyed to find the issue of why some LCV came to do a maintenance service in year 2017 and did not come back to the service centre again in 2018. These vehicles absented to come into authorised service centres over 12 months. From the secondary summary, the top 3 priority reasons are location, price and time accordingly in Figure 1.1.

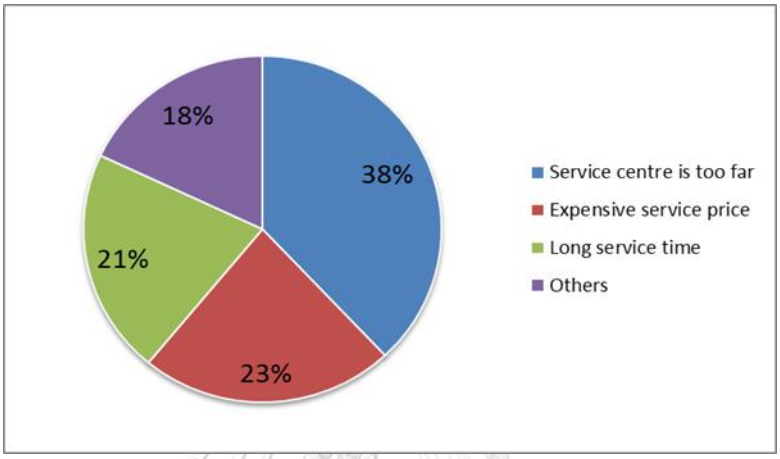

Figure 1.1: Top 3 reasons from absent LCV service units

In fact, location is the hardest issue to solve because the workshop was invested by an authorised dealer. Some service centres may far for some customers which is the reason why they do not come to service centres. It may not convenient for them but others may not. Second, price is a sensitive issue due to each dealer's policy. Actually, the main policy will come from Company A but the management of dealer can set the internal target income and discount relies on each dealer's policy due to each fix and variable expenses which may differ in each area. For example, the labour fee of mechanics in Bangkok which is the city of Thailand is higher than other provinces. So service price of the service centre in Bangkok is more expensive than others. Therefore, time will be the issue that this research can help to find the root causes and create the conceptual improvement plan from the secondary service history of a selected authorised dealer to be a prototype model before implementing it with other service centres in the future.

1.2 Research Objective

This research focuses on the service time reduction of the highest majority of service jobs namely the engine oil changing which is the preventive maintenance job, especially on the car workshop problems. The project aims to achieve the main objectives as follows:

1) To reduce the lead time in car workshop and suggest the new conceptual service time especially for changing engine oil service in the service centre with light commercial vehicles (LCV) only such as Pick-up and multipurpose (SUV).

2) To investigate non-value activities over the whole process of engine oil change service that it should be improved in the service centre and suggest the future improvement plan for the current car workflow.

3) To investigate and improve authorised service providers to respond customers' needs in terms of quality, price, and time to get a competitive advantage.

1.3 Target Group

This project aims to clarify the activities which may not make any value-added in the car workshop from authorised car service centres in Thailand. 42.43% of personal and light commercial cars in Thailand were registered to be cars as of September 2019. (Department of Land and Transport., 2020). Apart from the importance of the automotive industry and their greater sensitivity towards servicing time in terms of after-sales service is the considerable point of this project.

1.4 Value of Project

For the project value, the expectation of short-term and long-term benefits is displayed in the Table 1.6.

Table 1.6: The value of the project

Stakeholders	Expected Short and Medium Terms Impacts	Expected Long Term Impacts
Automotive Industry	- Introduce a new arrangement to resolve the bottleneck of after sales services which is developing superior services within the after-sales viewpoint.	- Improve overall commercial vehicle industry servicing standards and make it more effective to retain existing customers and obtain the new target groups
Authorized Dealers (Direct Sellers)	- Increase the productivity of servicing operations which can lead to a decrease of overheads - Increase the revenue of service centres from absent customers who change to come back to authorized dealers rather than other garages	- Diversifies revenue channels that it can help to reduce risks by having an increase return rate of customers who come back to service with dealers
Automotive Companies (Indirect Sellers)	- To get a competitive advantage in terms of after sales services - To increase the number of loyalty customer with the brand	- Enhance the servicing value of brand to make a confidence to buyers about the time and quality.
End customers (Buyers)	- Reduce vehicle downtime spent in servicing and avoide uncertainty of vehicle downtime spent in servicing - Be able to arrange and use their vehicle more effectively and with lower costs lost	- Saving costs from the unnecessary costs for repairing their cars due to the improper preventive maintenance

1. Automotive industry

To make a service development in short term perspective, this project will present a new arrangement to declare non-value-added activities and give the solution to make a superior customer satisfaction.

In the long term, the standard of servicing for the commercial vehicle industry will progress and hence makes it more effective to retain existing customers and obtain the new target customers, leading to higher sales volume.

2. Authorised Automotive Dealers (Direct Sellers)

This project will help authorised dealers to reduce unnecessary costs from cutting wastes and increase the operation productivity in the short-term advantage. The response of customers' requirements can increase dealers' income due to the high rate of customer satisfaction that they would like to choose an authorised dealer rather

than other competitor garages. The satisfaction of customers can be a major factor which causes them to be loyalty of car brand.

In the long term, service centres will have the opportunity to expand income as better servicing standards rather than other competitors. This will help to reduce risks by having an increase return rate of customers who come back to service with dealers

3. Automotive Companies (Indirect Sellers)

From the viewpoint of short-term, it can increase the opportunity to get a competitive advantage for both sales and after-sales in terms of faster servicing time which is likely to be one of the major factors that some customers are likely to concern. Moreover, this project can make more loyalty to customers that they may come back to buy more vehicles due to the high satisfaction with the brand.

In the long term, this project will create an obvious core value of the brand as high quality with faster servicing time and a reasonable price that it can enhance the companies to be a leader among the industry.

4. End-Customers (Buyers)

Customers can get the direct benefit from the reduction of changing engine oil service time that they can have more time to arrange and utilise their own car effectively.

By the way, for the foreseeable future, it is expected that customers can save costs from the unnecessary costs for repairing their cars due to improper preventive maintenance because their cars can get an effective engine oil change service which is a job in preventive maintenance.

1.5 Research Question

To investigate the internal ineffective factors which should be improved and it will convince customers to choose and come to do a car service at the service centre.

1) What is the current situation and how to improve the service time for engine oil changing in the car service centre for LCV?

2) How will customers know that authorised dealers have developed the workshop management of the service centre to make the time efficiency within the service centre?

1.6 Hypothesis Development

According to the research questions and main objective, they can be hypothetically developed base on the existing related research and knowledge that are:

1) Improve the whole process from the reception area to workshop area such as service advisor, chief mechanic, bay utilization, and parts which are related to engine oil change job in car workshop to get the faster service time.

2) The new conceptual faster time of changing engine oil can help the authorised dealers to retain the existing customer groups and convince customers who concern about time and not come to the service centre to come back again, resulting in business sustainability..

1.7 Scope of the research

Among the high competition, this conceptual idea will enable authorised dealers to reduce lead time in oil changing jobs and respond to the needs of customers as accurate, fast and reasonable prices. So, this research can help to improve the time for a popular service job.

In this research, it will be focused on LCV only including Pick-up and multipurpose (SUV) because the majority of sales volume of Company A is Pick-up and SUV up to 80% and 20% for trucks.

To get a more effective study of this research, Company B, is an authorised dealer under Company A where will be a selected authorised dealer that this research will utilise the secondary information from them to improve the engine oil change lead time. Company B is located in the heart of Bangkok, Thailand, and has the largest workshop area and the highest number of car service units among dealers in Thailand in year 2019. However, refer to Table 1.7, the trend of LCV service units from Company B slightly decreased year on year over 9 years following the overall trend of nationwide LCV service units in Table 3.

Table 1.7: The number of Company B's light commercial vehicle service units from 2009 to 2019

Year	Total Service Units	%Change
2009	41,918	
2010	55,723	33%
2011	48,643	-13%
2012	48,809	0%
2013	45,901	-6%
2014	43,737	-5%
2015	41,566	-5%
2016	32,441	-22%
2017	30,065	-7%
2018	29,162	-3%
2019	28,151	-3%

Considerably, the difference number of service units from 2009 to 2019 is a huge gap up to -33% which could be an abnormal situation because every LCV should come to change the engine oil and general check as a maintenance service every 6 months or 10,000 kilometres (whichever comes first) following the vehicle manual.

To scope the after-sales service types, the service jobs can be divided into 3 main types namely maintenance, repair and overhaul. Maintenance means the periodical maintenance in every 6 months or 10,000 kilometres (whichever comes first) to change engine oil, do a general check, change some consumable parts and lubricants which may degenerate due to the car usage following the vehicle manual guidance book of Company A while repair means fix something or change some parts which may happen unusual symptoms to a user when they use their car, for example, user cannot start or hear the abnormal sound from the engine. Then, mechanics need to diagnosis the vehicle's symptoms and find a way to solve this issue. It means that each car will have a different problem due to the usage characteristic. Furthermore, overhaul means a big repair or a big change that is related to significant parts such as change engine or change gear.

Table 1.8: the maintenance Table for LCV model (data as of 31 January 2020)

Symbol O Change ▲ Inspection		Maintenance period (whichever comes first)									
	Month(s)	6	12	18	24	30	36	42	48	54	60
	Kilometres	10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000	100,000
1. Engine oil		O	O	O	O	O	O	O	O	O	O
2. Engine oil filter			O		O		O		O		O
3. Air filter				O			O			O	
4. Air conditioner filter		▲	▲	▲	O	▲	▲	▲	O	▲	▲
5. Brake/Clutch oil			▲		O		▲		O		▲
6. Gear oil	Manual		▲		O		▲		O		▲
	Automatic	Inspection every 120,000 km. or 72 months									
7. Differential gear oil				O						O	
8. Differential gear oil (For 4 wheel drive)				O						O	
9. Power steering oil		Inspection every 30,000 km. or 18 months or change every 180,000 km. or 108 months									
10. Power steering hose				▲			▲			▲	
11. Cooling system		First change at 160,000 km or 96 months and then change every 80,000 km. or 48 months									
12. The distance between inhaust-exhaust (For engine 3.0 litres)							▲				
13. Slow gear oil (For 4 wheel drive)				▲			▲			▲	

Refer to Table 1.8, to make a clear understanding, the change of engine oil needs is one sub-job of maintenance service that it should happen in every 6 months or 10,000 kilometres (whichever comes first) while other lubricants may not change in every maintenance time following the vehicle manual from manufacturer. Nowadays, many service providers offer to do engine oil change job for customers who prefer to do this job only for taking care of the car.

Furthermore, the proportion in maintenance type in Table 1.9 and 1.10 was calculated from the number of changing oil service with other periodical maintenance items. So, the meaning of the percentage of maintenance job was counted every service job that it had the engine oil change record. Therefore, the reason why this research would like to focus on engine oil change lead time because this job is the highest proportion of car service jobs of all dealers for LCV over 5 years from Table 1.9. In the same way, over 65% is for a selected authorised dealer as well in Table 1.10.

Due to the engine oil change which is the majority of jobs in the service centre, this project aims to reduce the servicing lead time of changing engine oil in Thailand by improving the internal workflow to eliminate unnecessary activities, leading to the shorter service lead time especially engine oil changing.

Table 1.9: The percentage of 4 service jobs from after-sales service centres in Thailand from 2015 to 2019

Job type(s)	2015	2016	2017	2018	2019
Maintenance	84.26%	83.29%	81.70%	63.73%	65.46%
Repair	15.33%	16.51%	18.01%	35.99%	34.28%
Overhaul	0.15%	0.13%	0.15%	0.16%	0.15%
Others	0.25%	0.07%	0.14%	0.12%	0.11%

Table 1.10: The percentage of 4 service jobs from a selected authorised dealer (Company B) from 2015 to 2019

Job type(s)	2015	2016	2017	2018	2019
Maintenance	69.03%	75.85%	75.58%	81.67%	68.10%
Repair	30.40%	23.67%	23.87%	17.64%	31.28%
Overhaul	0.31%	0.30%	0.39%	0.41%	0.49%
Others	0.26%	0.18%	0.16%	0.28%	0.13%

Moreover, in a highly competitive situation, this research will be potential for dealers about increasing customer satisfaction and more income to build the brand image that customers seem to understand wrongly about slow service as clear as possible for coming back to use service centre in foreseeable future.

1.8 Expected Outcomes

From the approach of this research, the expectation of results which is intended to accomplish as follows:

1) To reduce the current service time of engine oil changing to compete in the market.

2) To improve the workshop management to make a better bay turnover rate about oil changing resulting in getting more service units and more income from customers.

3) To compete in the car after-sales business and get a competitive advantage.

4) To create a good brand image which is able to convince absent customers to come back to the service centre, leading to brand loyalty.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A review of literatures from many researchers will be illustrated that they have studied about the definition of lead time, the importance and impact of lead time, and how this factor impacts to customer satisfaction, and the methods to reduce unnecessary time in operations.

2.2 The importance of Lead time management

2.2.1 The relationship between the management of lead time and customer satisfaction

From the management of supply chain, the definition of lead time is the period from placing an order to receiving products by customer. Recently, customer behaviour was changing rapidly and many companies try to offer better value and faster time to get a competitive advantage and also gain more profit with the improvement of quality and time. In the industries, shorten lead time will help the company to increase sales volume. Some researchers explain that the way to reduce the lead time in manufacturing is not a new thing to learn. They might want to remind organizations to discover the chance to wipe out inessential time in the process. The time for providing a service is very important to customers. They suggest that the firm should reduce lead time through a company strategy to define this issue more efficiently. (Mfwaya, 2013)

2.2.2 Customer satisfaction

Customer satisfaction is one of the organisation's directions to drive the company reach target. It may differ based on the types of products or services. A customer can satisfy in some journey such as product quality, a purchase moment, an environment, etc. Some firms may focus on the whole experience with customers to serve a better time with them and every detail as customer's touchpoints. (Mfwaya, 2013)

2.2.3 Increasing customer satisfaction in term of after-sales business

To get a competitive advantage, customer satisfaction and loyalty are the key issues for after-sales business in order to an increase of profit and make a sustainable business. Hardly, the satisfaction of the client shows the difference between perceived and expected perspectives. Therefore, concerning about the vehicle service maintenance based on customers' requirements will be the main objective. In terms of the importance to the car owners bringing their cars to service workshop is under 5 principles such as Reliability, Responsibility, Assurance, Empathy and Tangible. The way of controlling the service process may require the system to support many activities and quality control is the main successful factor of the process. So quality controller and operational checks can save the risk to make any mistakes. (Igor, Darko and Aleksandar, 2013)

2.3 The methods of Lead time reduction

2.3.1 The reduction of lead time by using the principles of lean management

Han and Zhu (2017) show one of the principles of Toyota's core from Figure 2.1, the primary goal of lean concept is to decrease the wastes and improve the operation and furthermore learn about the client conduct to expand productivity and limit the non-esteem costs, prompting getting the return on advantages.

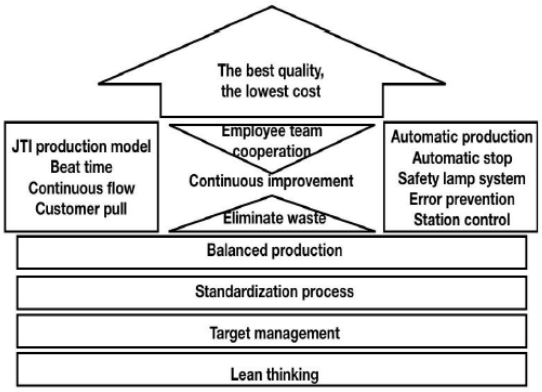

Figure 2.1: The principle model of Lean production

Source: Research on Optimisation of Production Process and Warehouse Management System (P.37) by Han and Zhu (2017)

The basic elements of the production process include three stages. First, the operation process may have to be more flexible for responding to the market changes relating to the modular design of the production line which may improve the responsiveness of the firm to the market and improve the efficiency of utilisation of the company resources. Developing the production flow is the second priority. Third, unnecessary activities should be eliminated. And the production and processing process should stable, so both of them can make a reference processing route. After analysis of the processing technology, the non-value actions were removed.

2.3.2 The framework of DMAIC

To get a competitive advantage in the manufacturing and service industry, Total Quality Management (TQM) has related to the approach of strategy to respond to the challenges in the business world. TQM has become to be a part of the strategic management in the company which can lead to continuous improvement and the involvement of the organisation by focusing on quality to make awareness in each step from the beginning of production and service to the end customer. The continuous improvement can outrun from other competitors in the market that the company can provide products or services with high quality and low prices by culminating Six sigma which means 99.99927% defect-free targets in production.

The main consideration is about the improvement of quality and adds a Six Sigma approach which is a business improvement strategy to improve the financial business in terms of profit and cash flow, to reduce unnecessary costs from waste, to improve the adequacy and productivity of all things considered, leading the better consumer loyalty to cover nearly the TQM components. (Desai and Shrivastava, 2008)

So, the methods of TQM has divided into 5 phase with the following details;

2.3.2.1 Define Phase

For the first one, it will define the research's objectives and scope from collecting information on the process, the requirements from customers and finding other factors from both internal and external environments. (Desai and Shrivastava, 2008)

Many researchers claim that it cannot avoid the high competition among the industry, many companies are likely to consider the shorter lead time, the cost-saving and the response customers' requirements, leading to business sustainability for the long-term. The lead time may clarify the time spent from ordering until receiving products or services. This factor can impact to customer's decision that it may convince them to buy products or services which relate to the cost of inventory management.

In many case studies, some companies explained that the longer lead time came from unnecessary activities in the whole process. So, they have reviewed the current situation all the time from Value Stream Mapping, Task Time, FIFO.

In this project, Value stream mapping (VSM) will be the methodology to use which is a model to identify the waste and losses within operation and plan to improve the flow of production process and the information of materials through the process. VSM is different from other tools that can show only the tasks that are accomplished to complete a process. It can show the interaction between functions in the manufacturing process such as planning, scheduling, production, purchasing and etc. VSM can help coordinate in-process materials which are likely to be a common source of significant loss. This effective tool can visualise the limitation factors and highlight problems within complex systems.

The integration of information and materials flow including cycle time and each lag between tasks will be shown in the VSM which can investigate the bottlenecks and other factors that stakeholders can easily visualise and the management team can create short-term and long-term plan to enhance to be more effective and efficient by focusing on the policy and goals from supervision and senior management for continuous improvement. (IndustryWeek., 2020)

However, every problem cannot be solved by VSM. This tool has some consideration points before making a final decision. It cannot map the diversity of products that do not have verified in the production flows. It fails to make a relationship between transportation and material handling queuing, and transferring in batch sizes from poor plant layout or manufacturing system. The company cannot use only VSM which unlike the Flow Process Charting technique to measure economic factors such as profit, operating costs, etc. It fails to help the management team to allocate or utilise an internal resource such as Work-In-Progress storage, floor space, and electrical aisles. This tool tends to be a special method to focus only on high-volume and low-variety functions and design a factory that will consider only continuous flow, the pattern of an assembly line, Pull scheduling, Kanban, etc. (Irani and Zhou, n.d.)

To summarise, VSM is a fascinating device that can embrace breaking down this project. Composing VSM accurately will assist the creator with understanding procedure stream more clearly, see the cooperation of multiple functions in an organisation which these things will help to investigate and implement a lead-time reduction plan

2.3.2.1.1 Non-value added activities

Nallusamy and Adil Ahamed (2017) go to explain that in a rapid change of business, many industries give importance to reduce lead time, low costs and get better customer satisfaction. Considerably, the firm can find the main problem issue up to 90% to make high lead times which came from the existing non-essential activities and these problems should eliminate. So the lean concept idea may have to apply to increase the value perception of customers and reduce the unnecessary things of the products refer to Table 2.1. This principle is based on performance to increase profit and competitiveness through eliminating seven wastes, reduce non-value time

and save costs. Another production, for example, refers to the automotive industry at Chennai, they used the Value Stream Mapping (VSM), 5S, the standardisation of process in the manufacturing area. VSM is one of the effective tools to see the time cycle of process and investigate how a process operates with one by one step. So the combination of lean and VSM can enhance the improvement of the process.

Table 2.1: 8 types of manufacturing wastes

Types of wastes	Explanation
1. Overproduction	Produce the non-order items
2. Waiting (time on hand)	Waiting for the next process, switching on tools or materials
3. Unnecessary transport	Transferring with long distances between processes or work in process
4. Over processing	Processing with unnecessary steps to prepare the parts from poor design or tools
5. Excess inventory	Producing excessiveness of raw materials, work in process, or finish goods in the inventory
6. Unnecessary movement	Not effective for employee perform during their work
7. Defects	Scrap or replacement from defective materials
8. Unused employee creativity	Not develop skills, ideas, or ignore the engagement of employees leading to less employee satisfaction

2.3.2.2 Measure

Desai and Shrivastava (2008) explain that this stage presents each procedure mapping, operational definition, information assortment, assessment of the current framework, evaluation of the present degree of procedure execution, etc.

2.3.2.3 Analyse

This stage depicts the potential causes which have a huge effect on the low procedure yield, cause-and-effect diagram (Fishbone), the analysis of Pareto, Why-Why methodology and so on. These models will help to distinguish the essential root causes of the problems and decide which elements have to be controlled to bring about the ideal improvement.(Desai and Shrivastava, 2008)

2.3.2.3.1 Five-Forces Model

In the high competition, achieving the competitive advantage and give the objective direction to an organisation are known as the strategic management by managing capacities to provide satisfaction to shareholders and end consumers. (Johnson, Scholes and Whittington, 2008) Furthermore, three stages including formulating, implementing, and evaluating will help to accomplish its goals.

Starting with the overview of external analysis in the automotive industry is The Five-Forces Model. This framework can investigate significant points, that have affect rivalry in the organisation and industry and assess every segment for the firm before preparing the strategy of competitiveness to evaluate of internal and external attributes and forecast the future improvement plan. (Fred and Forest, 2017)

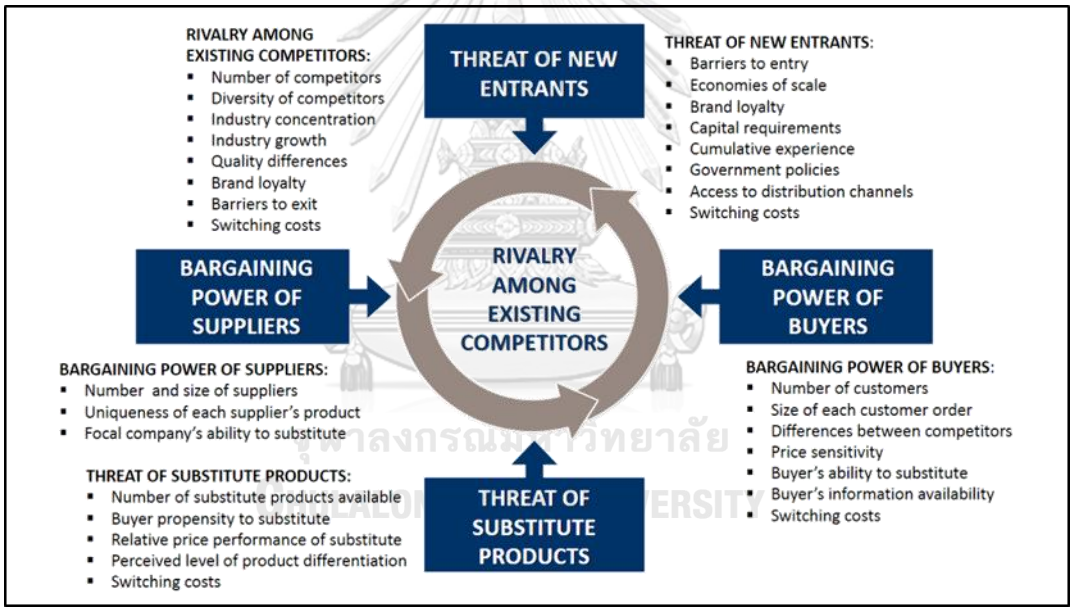

Figure 2.2: The model of Porter's Five-Forces

Source: Available from: https://www.business-to-you.com/porters-five-forces [Accessed 23 June 2020].

2.3.2.3.2 SWOT Analysis

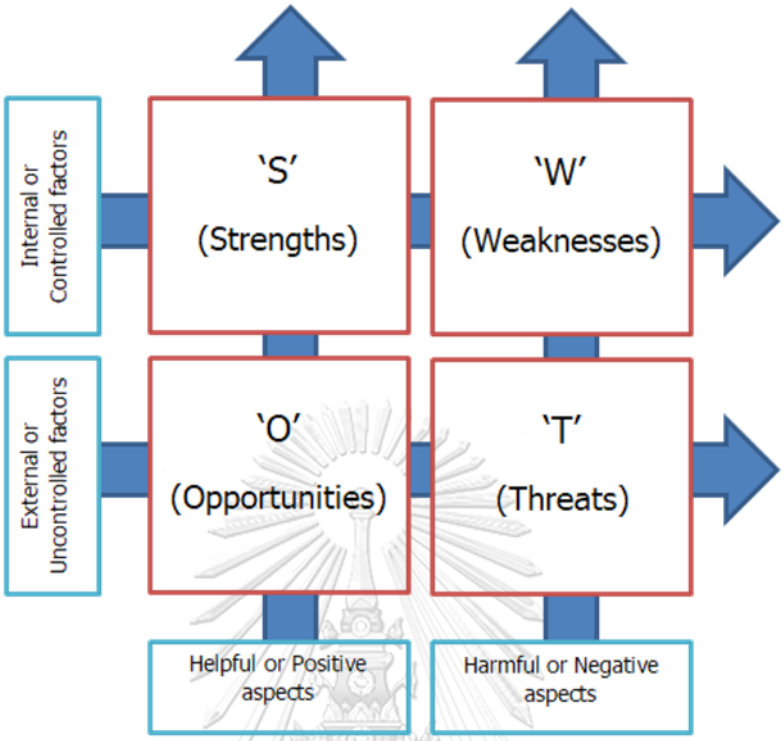

Figure 2.3: The framework of SWOT

Source: Adopted from A Useful Guide to SWOT Analysis (P.9) by Sarsby (2012)

The analysis, decisions and actions are the three key elements of the strategic management to create and get competitive advantages in the market. The process of strategic management is a successive arrangement of analysis and decisions that can improve the probability that a firm can select a 'great plan' to generate competitive advantages. It starts with the vision of the company which depicts the ideal future situation of the organisation. The second step is a mission which is a long-term aim. Mission characterises both what an association tries to be and what it needs to maintain or reduce in the meantime. Goals are the third step to concrete objectives and seek to reach. (Phadermrod, Crowder and Wills, 2019)

The framework of SWOT is one of the numerous methodologies that can be utilised in a company's key arranging process. With respect to review directed by the Competitive Intelligent Foundation which got 520 professional persons to make a survey, up to 82.6% of respondents selected to use SWOT as a second tool after the

competitor analysis tool. Moreover, many Chief Executive Officers in the UK show that SWOT is a powerful tool to generate the business strategy. To examine the internal and external environments, SWOT Analysis can investigate the critical threats and opportunities from the outer. It additionally inspects how the external factors are likely to involve and what solutions which should prepare for the threats and opportunities that the company is facing while the internal analysis enables an association's strengths and weaknesses. It can help the organisation understand the current situation of their resources and capabilities and plan the next solutions to sustain a competitive advantage. (Gurel and Tat, 2017)

However, David (2011) says this matrix still has some limitations. SWOT does not present the best way to accomplish a competitive advantage. This structure should be the early phase for a discussion on how proposed procedures could be realized. This analytic tool may lead the company to focus too much only 2 factors including internal and external in the process details which may not enough to compete the market. Both internal and external factors may have the significant relationship that the tool cannot reveal.

2.3.2.3.3 Fish bone analysis

The chart of Cause and Effect (Fishbone) is a practical framework and is a decent structure to find a very basic level affecting elements in recognizing the characteristics of value. The fishbone graph has a comparative model like a fish, which has a head (as an effect) and a body as bones, appeared as explanations behind realized issues to characterize the underlying driver, referring in Figure5 which is the deepest reasons of positive or negative factors any procedure which may include the popular reasons from 'machines, materials, methods, environment, manpower and measurements' that it would bring out and make consideration of the side effect. This project will imply to discover most roots.

Subsequently, it is hard to keep a single issue, and oftentimes it is possible to perceive a couple of causes that in blend about a symptom. The organization may find alternative operations that can be applied to improving the existing procedure. In overseeing issues, a symptom is normally a gap between wants and reality. An essential method has three parts: input, value esteem creation, and output. So the

organization needs to concentrate in the root causes to enhance the effect. (Slameto, 2016)

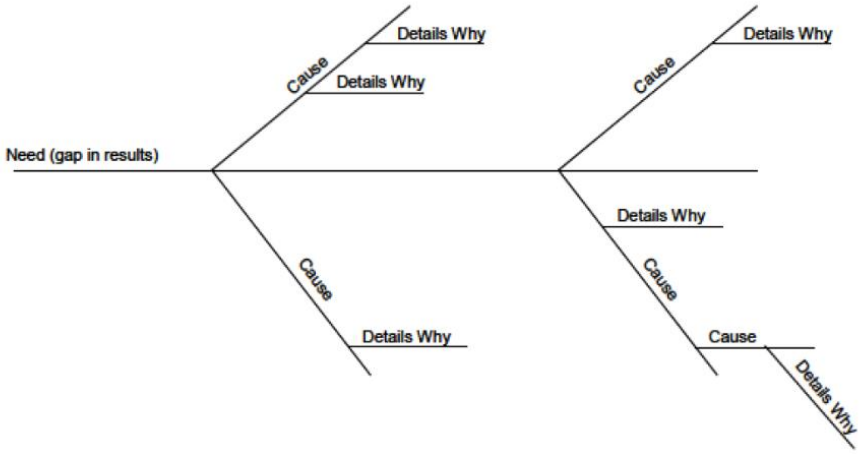

Figure 2.4: The fishbone diagram

Source: Adopted from The application of fishbone diagram analysis to improve school quality (P.62) by Slameto (2016)

2.3.2.4 Improve

Abdulmouti (2018) explains that the methodology of continuous improvement is called Kaizen which is in Japanese characters to imply great or better. Thus, this principle can help the company to focus on the improvement plan for short and long term. In 1902, Sakichi Toyoda invented a verification framework that changed production forever. It was built from Toyota company. This turned into the Jidoka idea of Toyota Production System (TPS) that it can help firm to review what the current operation is and how to reduce some unnecessary activities (Muda) in system.

Kaizen philosophy focuses on rearrangements by separating complex procedures into their sub-procedures and improving them with the little or no extra costs. Generally, Kaizen starts with how to convey gainfully with restricted assets, for example, man, material, and machine. It is not essential to utilize all the accessible resources assets and labour. Despite what might be expected, it should find a plan to save the existing resources as much as possible. For instance, if something is seen as

unused, it is better not to attempt to utilise it. Saving investment of Kaizen can be accomplished by asking how much labour and what number of products are expected to accomplish a target level of productivity.

The targets of this principle are summarised as follows:

• Continuous improvement

• The decrease of pointless waste in operation leading to saving resources such as human resource, area, equipment, material and other costs.

• To be a leaning organisation from internal training and education for the employees to increase productivity.

Most firms effectively occupied with continuous improvement to utilise the arrangement as Plan, Do, Check, Act for critical thinking. The cycle contains the following steps:

Plan: The important groups or sections pick a procedure that needs improvement and afterward chose measure by researching data, characterizing objectives for advancement, and inspecting various ways to deal with achieve the goals. To clarify the benefits and costs of company, the team should to set the measurable key performance index to follow and evaluate for the improvement.

Do: The team executes the arrangement and follows progress intently. The way toward gathering information needs to assemble to gauge the enhancement. During implementing time, members should to record current steps and some changes in plan to conclude in further recommendations to be key successes and learning points to protect the risk in the future.

Check: The group needs to break down the data accumulated to find the overall progress situation and how far to reach the targets from ‘Plan’ step. Moreover, the group may need to re-evaluate the plan, change, or stop some functions on plan.

Act: After getting the outcomes, the group needs to records the modification of the process with the objective that it transforms into the standard strategy. The team may instruct various staffs in the use of the altered strategy.

2.3.2.4.1 ECRS Method

In 1901, the Toyota Production System (TPS) was presented as the improvement strategy in manufacturing. Toyota applied and built up the improvement strategies in the automotive industry. Moreover, it was uniquely in 1990 that the lean

manufacturing framework was first presented which showed three categories including efficiency, quality and waste. This concept not only convinces top managers but also service organisations to apply in the company resulting in a new improvement. Lean techniques are a significant method that can help improve profitability in organisations. Furthermore, organisation can improve the management policy and continuous improvement (Kaizen) to make a better internal culture to encourage lean strategies and productivity.

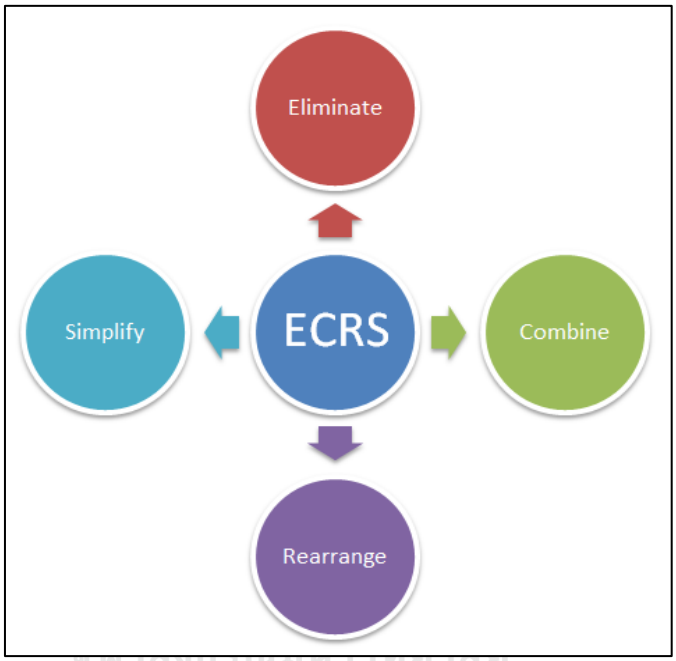

Figure 2.5: The framework of ECRS method

ECRS is one of the motion procedures used to investigate the production line. ECRS examines procedures and activities utilizing the accompanying centre standards: E = Eliminate, C = Combine, R = Rearrange and S = Simplify the essential activities from Figure 2.5. Some researchers say that utilizing the ECRS procedure and single moment trade technique can help to diminish inactive time during the frozen yogurt making process. Refer to waste in the process, it is basic to distinguish the worth including and non-value activities in a procedure. They decided to utilise ECRS to assist the company with concentrating on separating each progression into conceivable future enhancements and extricating the value from the procedure. Some

researchers proposed to receive ECRS in expanding human resource productivity of the cleanroom assembly that influences the decrease of labour expenses of one hardware maker in Philippines. ECRS can be applied to decrease the total distance transport and the number of administrators for the canned natural fruits production. In this manner, ECRS utilised as an improvement apparatus can be utilised likewise in managerial procedures to get rid of the non-value activities. In request to dispose of waste, it is basic to recognise the worth including and non-esteem including exercises in a procedure. (Bârsan and Codrea, 2019)

2.3.2.4.2 Scheduling in automobile maintenance and repair

Importantly, in the automotive industry, preventive maintenance is basic activity to reduce the opportunity of machine breakdown. This maintenance is relevant to the inspection, engine oil changes, oil gauging, cleaning, and checking the bolts and nuts and so on. The earlier examination can investigate the degradation of machines. It can help to make more efficiency of flow operations.

To more effective resource allocation, scheduling can be the tool to support the automobile part. It can help to minimise the time completion, mean flow time, costs and it is the popular tool to use in construction, hospitals, sports and traffic. For the automobile environment, the jobs may vary and process at different points of time. The jobs may need to get a certain stage of each operation following the sequence with the specific machines. The rules of scheduling can define the operation times, due date, number of stages. So, the improvement way may consider the operation performance by using the time range of inter-arrival, set of due date and processing time. (Akinyemi and Oyebola, 2011)

2.3.2.4.3 A simulation in automotive service workshop

According to a car service provider, Jeddi et al., (2012) go to explain the improvement flow chart operation of after-sales service for car repair workshop refer to Figure 2.6 including periodical maintenance, inspection, and test services. Moreover, some shops may have many car inspection stations to work with other stations. Considerably, the reduction of waiting time should be the first priority to improve to get more customer satisfaction and the simulation can be the key tool for investigating and developing processes that the tool becomes one of the popular tools among service industries. Simulation can show the current situation of process and

analysis the operation under different criteria in order to get the results that the company would like to deal with through modeling application and illustrate the upcoming outcome as well as refer to Figure 2.7 and Table 12.

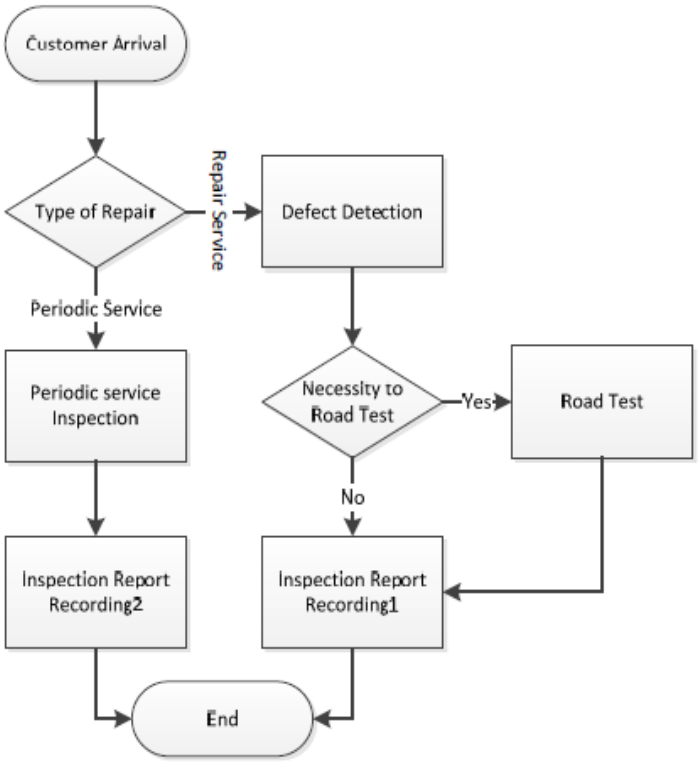

Figure 2.6: The example flow chart of car workshop process

Source: Adopted from A discreet event simulation in an automotive service context (P.143) by Jeddi et al., (2012)

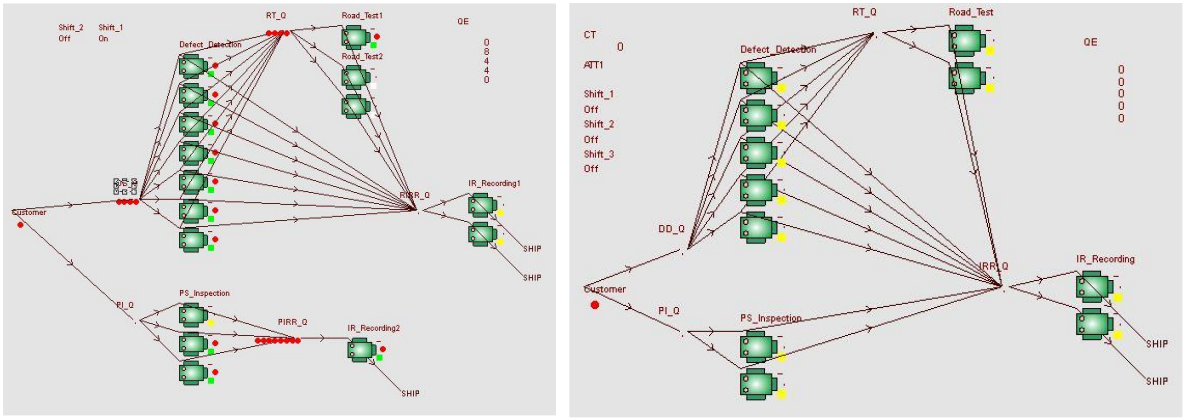

Figure 2.7: The comparison between original and improvement workshop simulation model

Source: Adopted from A discreet event simulation in an automotive service context (P.144,146) by Jeddi et al., (2012)

Table 2.2: The comparison between original and improvement workshop results

No. of replications	Initial		Improved		Improved %	
	Ave. WIP	Ave. Time	Ave. WIP	Ave. Time	Ave. WIP	Ave. Time
1	7.5	22.5	6.8	17.3	10%	30%
2	16.4	49.1	8.7	22.2	87%	122%
3	10.9	32.7	7.7	19.7	41%	66%
4	11.1	33.2	7.4	18.9	49%	76%
5	11.2	33.7	7.1	17.9	59%	88%
6	10.0	30.1	6.7	17.1	49%	76%
7	9.4	28.2	7.2	18.3	30%	53%
8	13.0	38.9	8.0	20.4	61%	90%
9	12.3	36.8	8.8	22.2	40%	65%
10	10.8	32.5	7.0	17.8	54%	83%
11	11.2	33.5	7.4	18.7	51%	79%
12	10.9	32.8	6.5	16.6	67%	98%
13	10.8	32.4	7.3	18.4	49%	76%

Source: Adopted from A discreet event simulation in an automotive service context (P.146) by Jeddi et al., (2012)

2.3.2.5 Control

After implementing all improve plans, periodic solutions should be reviewed the standardisation of work procedure need to review to sustain the long-term profit. The business quality management carried the control of strategy by reviewing the mission and targets of each process which may impact the overall business goals. (Desai and Shrivastava, 2008)

The relative departments may need to generate the instructions of old and current procedures to prepare for the continuous improvement plan. This may lead to use control charts and check sheets to remind what staffs have to do regularly and also make awareness through internal training as well. (Mandahawi et al., 2011)

2.3.3 The customer service attributes of a car maintenance service provider

This paper explores the activities in car workshop and client decision after the end of the guarantee period and sees at any factor why customers select independent garages or branded car dealers and what service keys determine customer choice. Exactly, most customers would like to prefer good service quality and reliable price but the perceived value as an offer and relationship between the service provider and customer is quite hard to clarify and prove. So the factors were identified and assessed based on the quality and car maintenance services.

For example, in Brazil, one attribute of customer perception factors knowing about the branded dealers is good and reliable equipment whereas other independent garages claim that they also have other better factors such as save money, reliable prices and mechanical skills. They go to explain that they can provide the same value with a lower price. Importantly, branded dealers have to reconsider the strategy or still lose customers to others. First, customer perception is the one important thing to change. They have to modify service design and other attributes such as price guarantee, service packages, revise the flow of service, promote direct contact between customer and mechanic. Second, they can announce to customers to consider the car specialist especially for their own car brand and also improve the relationship with car suppliers to get a better brand image for updating technology and reliability. (Brito, Aguilar and Brito, 2007)

CHAPTER 3
RESEARCH METHODOLOGY

In this chapter, the author would like to investigate the objectives and questions of this research which influence the selected structure of research methodology. So, the research technique, alternatives to research strategies that are utilised extensively will be outlined in this part. Moreover, the author will indicate the required information for the entire research and decide the strategies for collecting data. Also, in order to select the approach methodology, the creator will show the research plan in this project toward the finish of this section.

3.1 Research goals

To discover improvement plan for increasing efficiency and removing unnecessary activities leading to the reduction of service time for oil changing in Thailand, the methodology of the research will be intended for finding the appropriate answer to research questions. Then, discovering non-valuable activities and impacting factors in the process can use to diminish engine oil changing service time. Furthermore, finding the best possible arrangements can make a procedure to be progressively effective. Finally, finding potential supporting tools can improve the current process. So, the author will start with the examination of the current workflow for recognizing waste in the process to discover the main drivers sensibly. After the causes and affected variables are found, the author will build up a legitimate arrangement by applying from writing surveys, conceivable contextual investigations for both the same and different industries. Toward the finish of the research, the recommendation and continuous improvement plan in the future will be explained in order to make the reader understand and may apply some functions in actual operations.

3.2 Research methods

To decide a suitable methodology for this research, the research must be planned under the comprehension of research objectives and questions. A literature

review will assist the author to choose the most suitable exploration strategy that can give the required answer. Before choosing the research methodology, the author needs to comprehend sorts of research techniques which possibly use in this research. This dissertation will clarify 5 unique ways for characterizing research and the methodology can be isolated in multiple points of view

3.2.1 Predictive, diagnostic, and explanatory research

Thai Ministry of Education (2009) claims the objectives of the research can be characterised in 3 types including predictive, diagnostic, and explanatory. First, the Predictive method is the exploration that expects to utilise the consequence of assessment or examination for foreseeing future results. Second, the Diagnostic method aims to study root causes to improve understanding about the issue and discover a solution to resolve the problem. This examination regularly utilises in learning about social conduct and network improvement. For the explanatory, it will consider with causes that occurred in the past and demonstrate the variables and relationship between those components and results. Generally, the researcher will utilise the concept of causes and effects as a fishbone diagram. (Sainani, 2014).

3.2.2 Descriptive and analytical research

Kumar (2008) explains that while thinking about the idea of the study, the methodology can be arranged in 2 ways to be descriptive and analytical research. Starting with the descriptive way, it will manage the clarification of a complex issue for what it is worth. Moreover, the descriptive examination will identify the focus group in order to study and attempt to discover the improvement plan. Analytic research is fundamentally appearing differently in relation to the descriptive method because the researcher will break down existing information or data that is accessible for looking analytical issues.

3.2.3 Qualitative, quantitative, and mixed approach

The characteristic of information will be defined the proper approach. Williams (2007) says that there are three types of data including qualitative, quantitative, and mixed methodologies. Beginning with qualitative concept relies upon encounters, acknowledgment, want, or endless viewpoints. In this way, it will write in a book to explain the information that cannot be clarified by logical strategies or insights. This methodology may occur from any occasions which do not sufficient

to assemble believed information while quantitative examination will deal with the quantifiable information. The clarification, conclusion, and arrangements are produced using taking a gander at numbers and contemplating the potential results. Regardless, using either qualitative or quantitative data is not adequate. In this way, a few analysts utilize both together so as to locate the most dependable answer for their inquiries of the examination. To make a decision of the suitable methodology of research, the author will select the mixed approach to analyse secondary service records from Company B's system which may enough to see reliable outcomes as a quantitative and pick to use the qualitative methodology for gathering additional research information.

3.2.4 Empirical and Non-empirical research

Starting with the empirical method, it will utilise essential information to do an examination and discover realities. The author will get the secondary historical information from Company B's records and analyse data until an issue is found. Initially, empirical methods are related to the use of quantitative approaches such as surveys and primary data collection. However, secondary data is considered as the empirical and qualitative approach. It appears to be conceivable to arrange qualitative research as empirical to demonstrate that researchers give adequate data to analyse. Actually, non-empirical research will utilise various information types. This kind of research will utilise literature review, article, case study, etc. It should not utilize numerical or factual aptitudes to investigate information however it should utilize summing up abilities to finish up results for the reader. (Dan, 2017)

3.2.5 Inductive and deductive method

Significantly, the deductive will make a concentration on the current theory and will be investigated from quantitative data while the inductive philosophy will analyse the information from the qualitative data to make another model or new speculation. (Gebriel, 2013) Regardless, there is no rule that inductive method must use the qualitative information or deductive method needs to use quantitative data. A few specialists may use the deductive technique to analyse qualitative information. Besides, Thomas (2006) clarifies that there are various methodologies that scientists can decide to explore subjective data. Some symptomatic techniques are exceptional

and are not one of the conventional strategies. The inductive technique is just one of the overall strategies that numerous scientists use to sum up information.

3.3 Research method selection

Table 3.1: The research methodology selection

Research methodology	Research plan		
	Current workflow diagram	Define and analyse root cuases	Develop solutions and future improvement plan
Research objective	Explanatory and analytical research		
Research data			
- Characteristic	Qualitative and quantitative		
- Data level	Empirical	Empirical and Non-Empirical	
- Data summary	Inductive		

From Table 3.1, generally, the goal of research may need to review procedure and find impacting elements or factors that make slow service time, analyse root causes deeply, and generate an enhancement of service time. These reasons show noticeably that the thought of the project adjusts to idea illustrative research with a selected trial dealer.

Another important point, the analysis of data in the project will utilise existing service history information as secondary data and its factors follow to the analytical research. To summaries selected research methodology by separated into 3 stages. The first stage is drawing the current workflow. This progression needs to utilise secondary data of both qualitative and quantitative. The author will choose to analyse secondary information which will show the approximate actual servicing time from a selected trial dealer in Thailand referring the reason from the scope of this research as the quantitative and it will be used a secondary survey in the qualitative phase. For the summary phase, it should use the inductive framework.

The second stage is characterizing issues and examining the root causes. Then, quantitative and qualitative data will be utilised. The characteristic of quantitative data will be utilised from recording the real service history in a selected service centre during October 2019 to December 2019 and qualitative data will be

used as the secondary summarisation of the Company's A survey. Moreover, this research will estimate the new engine oil changing service time under the improvement concept.

The last stage is improving the current work process. Journals, articles and case studies which are the qualitative information and non-empirical will be used in this part. Furthermore, it can infer to the method of problem investigation and final stage which can use both empirical and non-empirical data. For the condensing approach, this stage will utilise inductive methods same as 2 previous stages.

3.4 Research plan

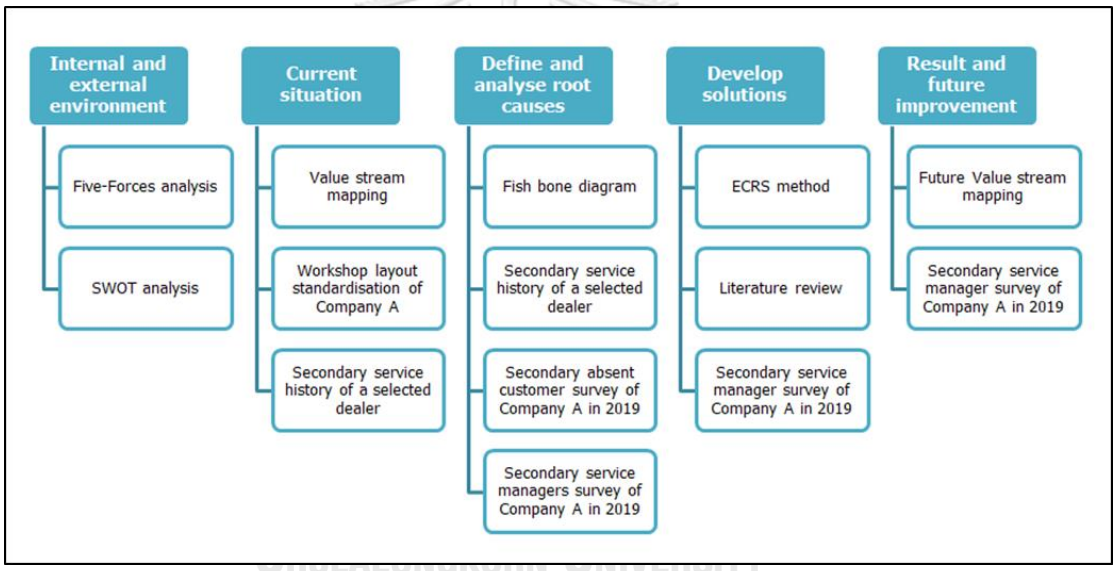

Figure 3.1: The diagram of the research plan

In terms of the research plan, it will be classified into 3 stages. Figure 3.1 plans to clarify further tools and notions that will be received for accomplishing the research targets and questions. The initial step is the analysis of internal and external factors through the Five-Forces model and SWOT analysis SWOT to clarify weaknesses and threats of the current service centre situation and bring the strengths and opportunities to generate the possible development plan in the next step.

For the next step, it will illustrate process flow which will use the value stream mapping which is one of Lean principle to represent overall operational procedure in service provider. In order to clarify each operational process effectively, the value stream mapping of process flow requires enough data in terms of time used from service history data. Then, distinguishing factors that generate downtime or wasteful methods will be identified. The VSM is analysing the secondary service history to find a bottleneck over the whole process. Moreover, the secondary survey of Company's A will help to create Fishbone diagram to recognise root causes following the issue in VSM. One of the pain points from customers is time. This project might convince customers who do not come to do maintenance service back to the service centre again. The final step is creating a solution for solving the research objectives and mapping future outlines. This author will make arrangements by thinking about all data. Moreover, some solutions will be proposed by referring to literature or case studies previously to provide the optimal solutions. In the last section, the future structure of value stream mapping and recommendations of all reduction points will be shown in the end.

3.5 Research strategy

This research will concentrate on the reduction of oil changing lead time for light commercial vehicle in Thailand by utilizing secondary service history data support from a selected dealer and the summary of a secondary survey of Company A. Consequently, the concerning method will be practical solutions which the organisation can use it in the future development of the operation. The author will concern in terms of investment in improving existing processes and internal culture among organisation. So, these two criteria will be the significant issues which always aware at the top of the priority list during finding the possible solutions for improvement.

3.6 Data utilization

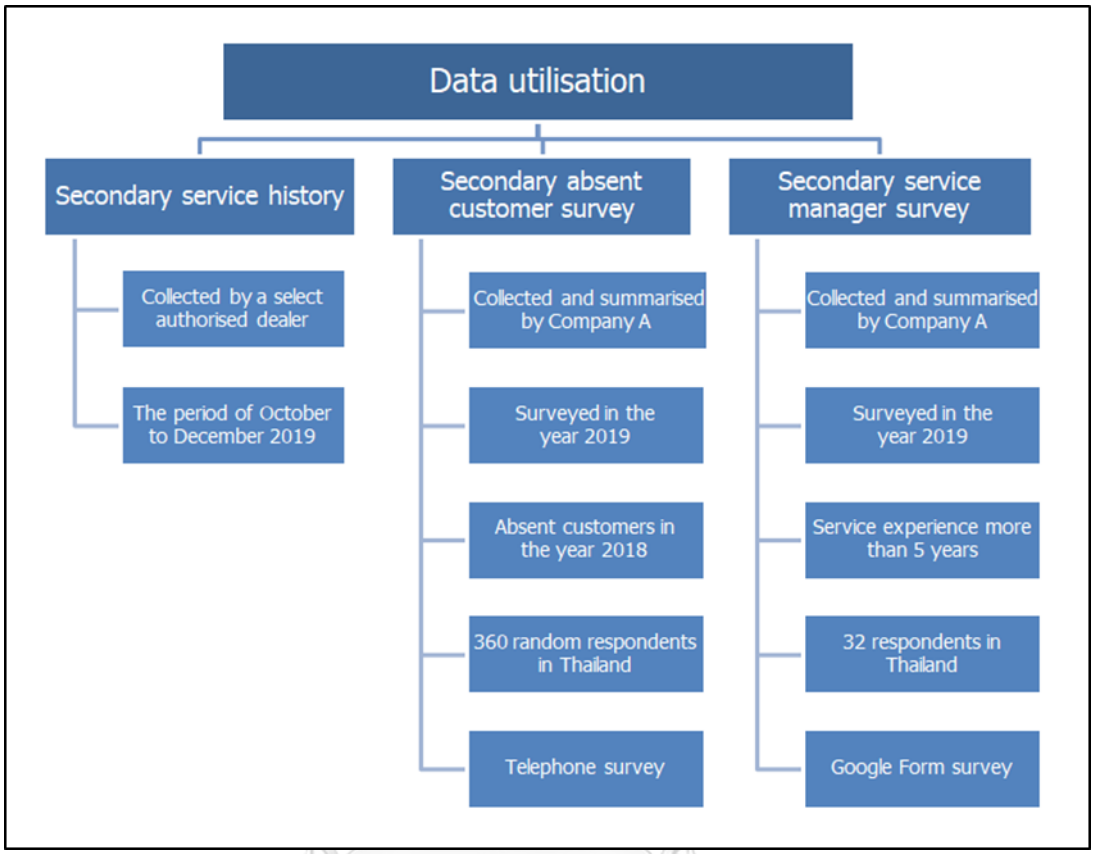

Figure 3.2: The diagram of data utilization in the research

The project intends to utilise 3 sources of information from Figure 3.2. First, Secondary service history gathers from staff in a chosen trial service centre which has been recorded inside the organisation system. Next, the secondary result of absent customer and service manager surveys which can show the external and internal perspectives about the current service centre situation accordingly. Company A has the specific department to do a survey, collect and summarise for monitoring and reporting to the management team. So, this research can bring the summary results to declare some interesting internal and external factors in the root causes section and find a way to improve. For the secondary absent customer survey, it was surveyed customers who came to the service centre in year 2017 and not come in 2018 with the random sample size 360 respondents over Thailand via telephone survey method in

2019 while the survey department also collected the service manager suggestions with 32 respondents who have the service experience more than 5 years over Thailand via Google form which is a survey electronic administration application on Google platform in 2019. (Google, 2020)

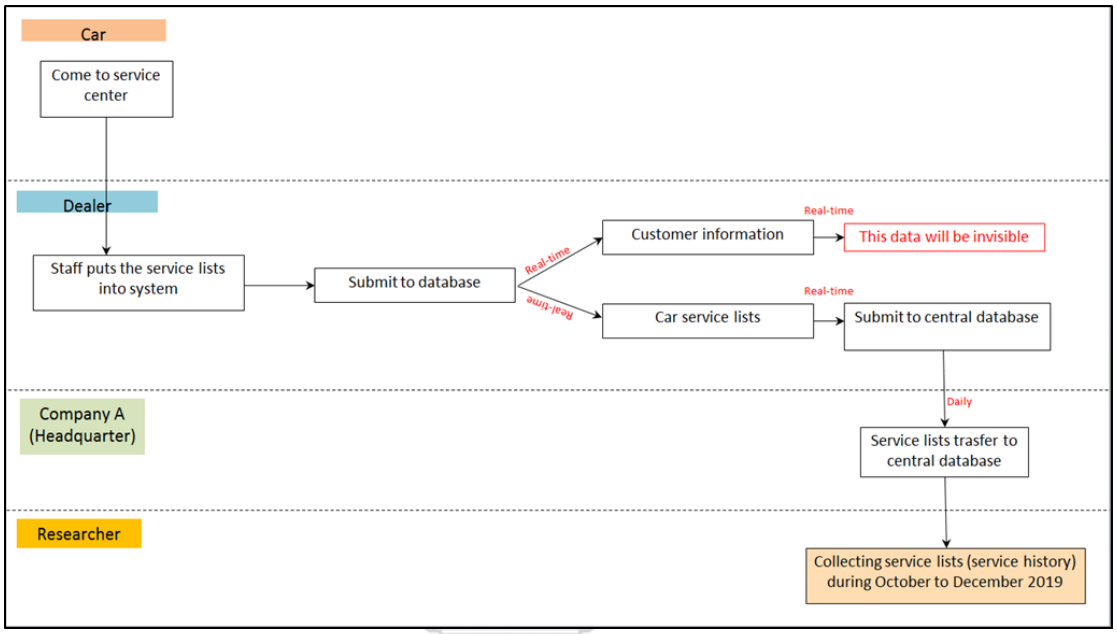

Figure 3.3: The collection process of secondary service history data

To make a clear understanding, when some vehicles come to do some services at authorised service dealers, staffs have to put the maintenance or repair records to be as evidence. After the record is kept in their own database, the system will not allow staff to see customer's personal information. They can see only the maintenance or repair history data such as the previous engine oil brand used, previous quantity of engine oil used. Figure 3.3 is the process for collecting data that the author expects to gather. The arrangement is set to base on the reliability of data and feasibility of information assortment. Figure 3.3 is being shown of the methods, details, and expectations of the plan. For the expectation, the author intends to have enough dependable data to draw the framework of value stream mapping. The author will collect the information of service time in each internal process to seek the issue and find a possible solution to implement further.

3.7 Summary and discussion

The last step is to interpret the result of improvement, making discussion, conclusions and recommendations. Therefore, the conclusion and findings will be answered the research question.

Chapter 4

The current internal and external situation of the authorised dealer's service centre

4.1 Five-Forces analysis

This framework can analyse the external environment of business to let the organisation know the company's position for both strengths and weaknesses through 5 competitive topics in Figure 4.1.

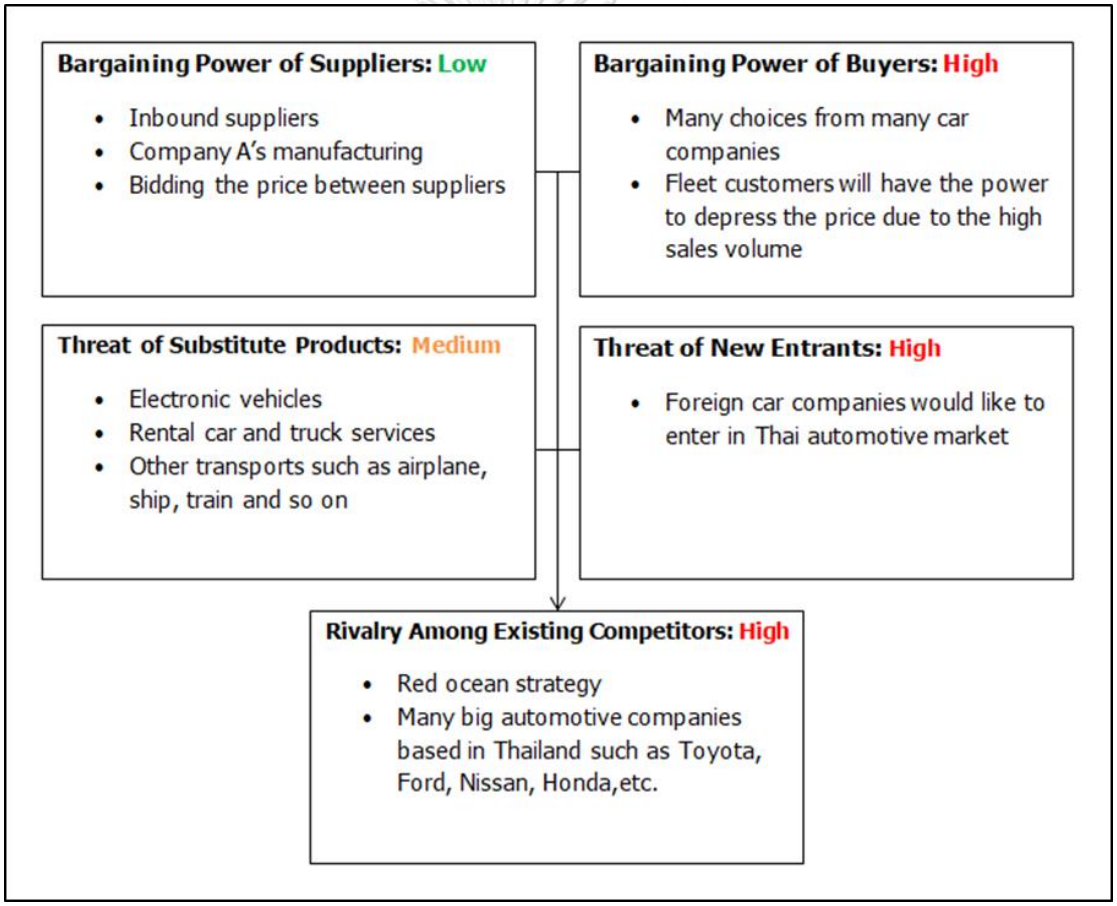

Figure 4.1: Authorised dealer's Five-Forces analysis

1. Bargaining Power of Suppliers:

Low risk; currently, the majority of vehicle parts is produced by Company A because they have their own manufacturing in Thailand and send the product to

authorised dealers to sell for the customer. So the suppliers of raw materials may not have more power to bargain with them.

2. Bargaining Power of Buyers:

High risk; refers to the new entrants, it can say that the customer has many choices to compare and select which brand can support their requirement. The usage characteristics may differ depending on customer's occupation such as agriculture, tourism, trade, logistics, etc. They might concern about quality or price and compare the brands before making a decision.

3. Threat of Substitute Products:

Medium risk; the products are delivered by electronic cars or other transports such as trains and plans which can replace LCV.

4. Threat of New Entrants:

High risk: Many countries are interested to invest and do an automotive business in Thai market. For example, MG is the Chinese automotive company that is new entrant in Thai market and launched the same type of products as Pick-up and SUV with a lower price since August 2019. (MG, 2019)

Figure 4.2: MG new model pick-up

Source: Available image from: https://mgcars.com/en/News/Detail/new-mg-extender [Accessed 23 June 2020].

5. Rivalry among Competing Firms:

High risk; due to the Red ocean market, both Company A and authorised dealers cannot avoid the high competition that other brands can compete and get the market share to them.

4.2 SWOT analysis

For one of the most popular internal and external analysis tools, the framework of SWOT can clarify both strong and weak points of the internal organisation and define opportunities and threats from other competitors to find the short and long term plan that can bring to apply for improving shorter servicing lead time.

	Strengths	Weaknesses
Internal factor(s)	- Quality of innovative car technology - Service readiness of mechanic's skills, tools, equipment, and facilities - Up-to-date car knowledge - Specific knowledge with senior mechanics - After sales service warranty for both of jobs and spare parts - Preliminary vehicle check - Quality control checking after maintenance - Price standardisation - Parts inventory - Customer waiting area and room - Strategic branch location in Thailand	- A lot of procedures - Require many documents - Strict to the workflow standard - Employee turnover - New mechanic's skills - Staffs' communication skills - Inappropriate tools and equipment maintenance
	Opportunities	**Threats**
External factor(s)	- Brand reputation - Many service centre branches in Thailand - The network of authorised dealers - Low Bargaining power of suppliers - Brand Advertisement from Company A	- New automotive companies from other countries - The increase of branded and local garages who are new competitors - Offerring well-trained mechanics to join competitors - The increase of new mechanics in service centre - Rapid change of customer behaviors - Replica spare parts

Figure 4.3: The SWOT diagram of authorised dealer's service centres

From Figure 4.3, it shows the SWOT diagram of dealers under Company A. For the strong points, the quality of service centre including innovative vehicle technology and the service readiness of mechanic's skills, tools, equipment, and facilities which is likely more than third party providers. This readiness make authorised service centre has availability enough to create a learning organisation for improving up-to-date skills. However, in the threat area, it shows up the risk as far as taking too much internal process. Both threats and weaknesses urge the service centre to make some solutions for retaining chief mechanics and improve new mechanics'

skills to support customers' demand and prepare them to replace retired chief mechanics in the future.

Consequently, improving internal culture to be a learning organisation is an interesting idea of the service centre. The diagram shows another shortcoming that ought to be concerned which is about maintenance tools and equipment. Preventive maintenance tools and equipment are significant things that service centre should take care and support consistently because it may lead to damage in long term and furthermore in a training class that must utilise these tools and equipment to show in the classroom.

4.3 Competitive benchmarking

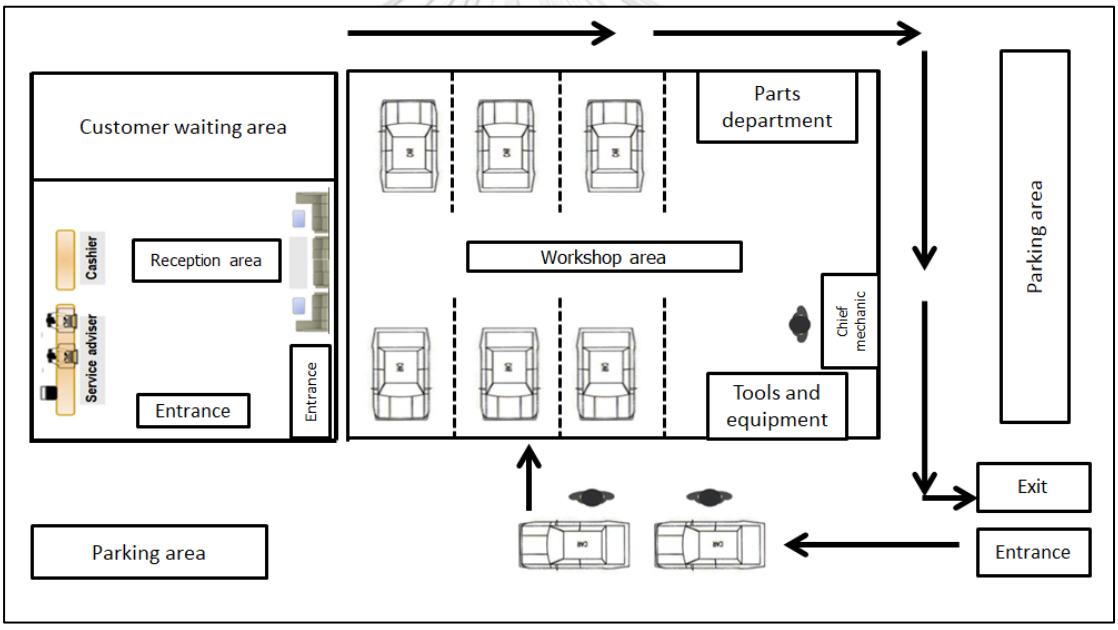

Figure 4.4: The layout of the competitor's service centre

Interestingly, some points in SWOT are likely to relate to this research scope and it can give the idea to improve the current workflow in the next following part. From Figure 4.4, it can see the detail of the competitor's layout. They divided the customers into 2 groups namely appointed and non-appointed customers. Interestingly, for a customer who makes an appointment, this car will go to 'Fast

track' bay to do an engine oil change service immediately and parts staff can prepare items in advance which can save a lot of time and the service centre can manage their bay turnover rate and capacity in a workshop for each day. For a non-appointed group, the customer can come into the service centre and park the car in the available bay directly or they may need to wait for available bay in the parking area. After that, SA will come to ask the customer service request and they will come to the reception area with customer to input the information into the system while the car and mechanic in a workshop area are ready to start service. So, both SA and mechanic can do their own job concurrently. They do not wait for each other.

Significantly, the benchmark of competitors, it can see that they motivate and influence customers about the service time to change engine oil within 60 minutes which is shorter than a trial service centre in Table 4.1. So, some customers who concern about time may change their minds to come to do service at competitors instead of the authorised service centre.

Table 4.1: The engine oil change service time of other competitors

Brand	**Time spent**
B-quick	60 mins
Cockpit	60 mins
Fit auto	45 mins

Source: B-quick, Cockpit and Fit auto official website (as of 15 May 2020)

Chapter 5

Current workflow situation

5.1 Layout of authorised service centre

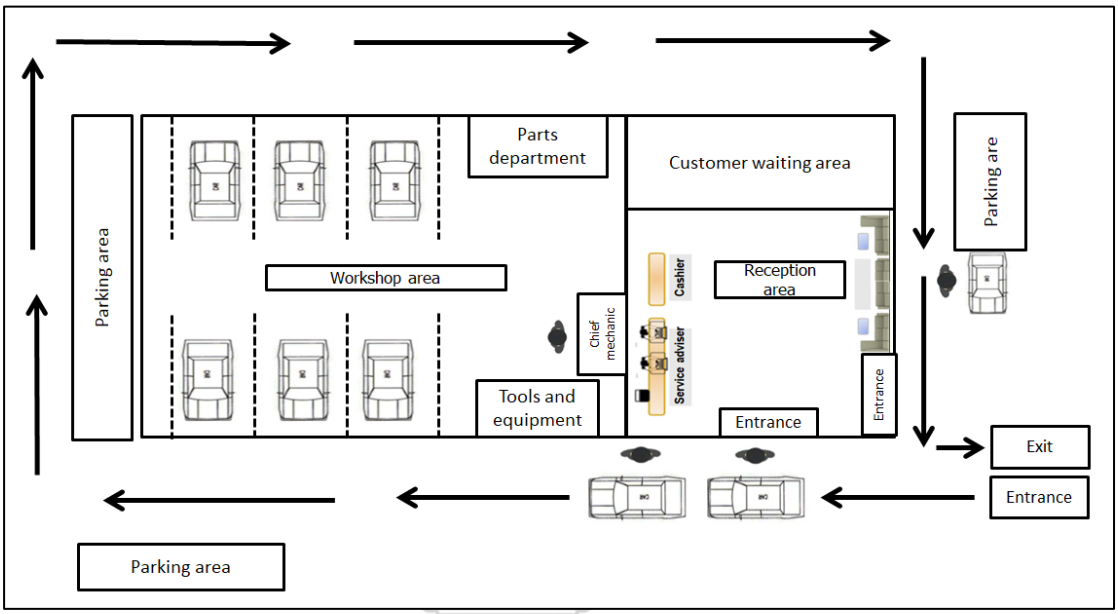

Figure 5.1: The layout of the authorised service centre

Generally, Company A has the standard of workflow process in a workshop to be a prototype workflow that it can lead all authorised dealers to operate the same way under the control. So the layout comes from the Company's A workshop layout standardisation which is illustrated in Figure 5.1. A service centre comprises 2 significant sections. First, the reception area is the primary section which will have service advisors (SA) who have the responsibility to take care of customers at the first time. Nearby the section of SA, there is a customers' waiting area to prepare a comfortable area for customers including chairs, tables, beverage and snack, televisions, newspapers, etc. while some customers may wait for servicing order or payment at the cashier table. The next section is the workshop area which includes 4 significant zones namely bays, parts department, tools and equipment room and parking place. The customer demand and service centre's location will be defined the

number of bays, the size of parts department, mechanics and service advisors. Sometimes, the peak hour may occur, leading to inadequate resources. So, these vehicles need to wait in the parking place where locates nearby workshop.

5.2 Current value stream mapping (VSM)

Refer to Table 5.1, it can see that the majority of service jobs for a selected dealer sill be maintenance job for 3 months with the average at 76.68%.

Table 5.1: The percentage of 4 service jobs from a selected authorised dealer (Company B) from October to December 2019

Job type(s)	October'19	November'19	December'19
Maintenance	67.45%	78.44%	84.17%
Repair	31.95%	20.33%	14.55%
Overhaul	0.50%	1.18%	0.78%
Others	0.10%	0.05%	0.50%

Currently, Table 5.2, the customer groups for authorised service centre can be divided into 2 groups same as competitors. However, it can see that the proportion of non-appointed customers higher than the appointed group which may make a difficult to manage the overall management. Furthermore, both of them will get almost the same service procedure but the service centre can prepare some processes for the appointed group which can make shorter lead times than other groups.

Table 5.2: The percentage of Company's B appointment and non-appointment from October to December 2019

Month	Day	% of appoinment	% of non-appoinment
October'19	Monday	43.52%	56.48%
	Tuesday	42.66%	57.34%
	Wednesday	52.86%	47.14%
	Thursday	46.01%	53.99%
	Friday	48.97%	51.03%
	Saturday	61.49%	38.51%
November'19	Monday	33.33%	66.67%
	Tuesday	48.77%	51.23%
	Wednesday	44.23%	55.77%
	Thursday	49.75%	50.25%
	Friday	46.55%	53.45%
	Saturday	68.87%	31.13%
December'19	Monday	44.14%	55.86%
	Tuesday	53.72%	46.28%
	Wednesday	46.69%	53.31%
	Thursday	57.01%	42.99%
	Friday	52.78%	47.22%
	Saturday	67.24%	32.76%

From the current value stream mapping, the author plans to show the image of the flow of the engine oil change progression of LCV comes into a selected service centre until it is delivered to the customer. The time process of VSM can be divided into 2 types including appointed and non-appointed groups. For the booking in advance, customer can make a booking from 07.00 am to 3.00 pm before 1 day prior. However, a few constraints may occur as far as the length of the whole cycle and the current unpredictability of the process. Hence, the explanation of VSM will be isolated into 3 phases; pre-checking phase, maintenance phase (engine oil change), and post-checking phase.

Due to the research of methodology, all information in VSM was gathered from secondary service history records of a selected authorised dealer into the system. Each phase will be shown VSM of non-appointment and appointment customers.

5.2.1 VSM in the pre-checking phase

5.2.1.1 VSM in the pre-checking phase for non-appointment

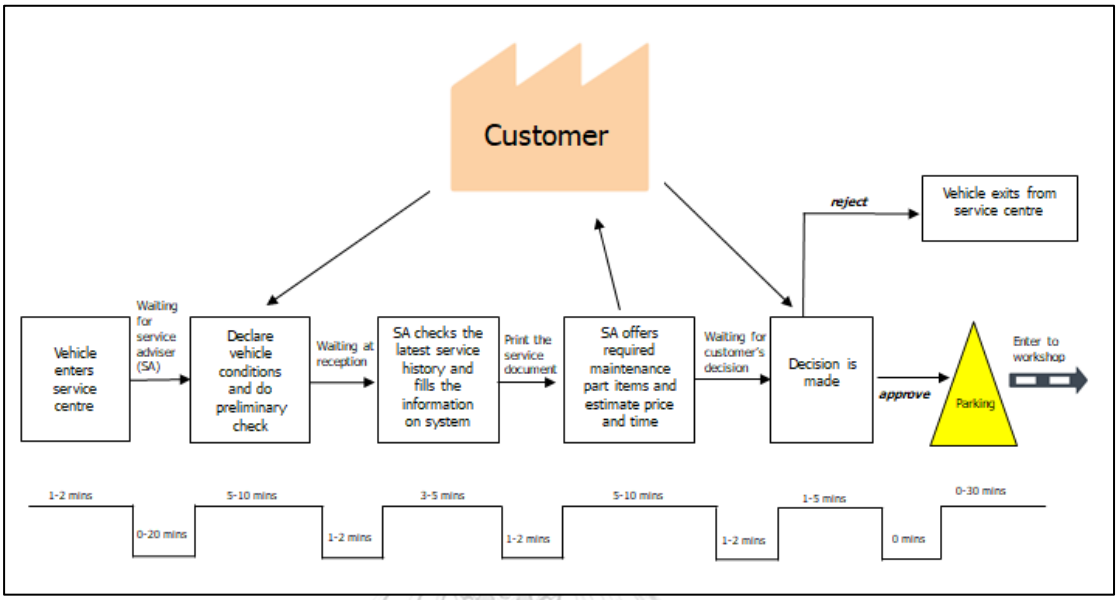

Figure 5.2: The current VSM of the pre-checking phase for non-appointment

For the pre-checking stage, the procedure begins from vehicles enters to a service centre and give the approval service acceptance to SA. Car will be moved to park in the available space and holds up until bay is accessible refer to Figure 5.2. From VSM in Figure 16, this stage consists of 6 sub-stages including car enters in the service centre, customer reports car condition and SA starts doing a preliminary check, SA and client come into the reception area to fill the necessary information into their system and check the latest repair history. SA explains and offers required maintenance part items and estimate price and time to make a choice for customer's decision. On the other hand, customers may refuse to do any car services, so they can get their own car and go out without paying any fee while some customers give the approval to do services, the vehicle will be moved from the parking area to the front of the workshop.

The majority of steps in Figure 5.2 are probably going to utilize time under 5 minutes with the exception of the welcome from SA and doing starter vehicle check,

offering service lists and waiting for moving car into the workshop zone. Regarding the client welcoming at the first step, lead time may rely upon the quantity of clients in that period. For peak hour, SA may not uphold all clients with the short lead time, resulting in client disappointment.

5.2.1.2 VSM in the pre-checking phase for appointment

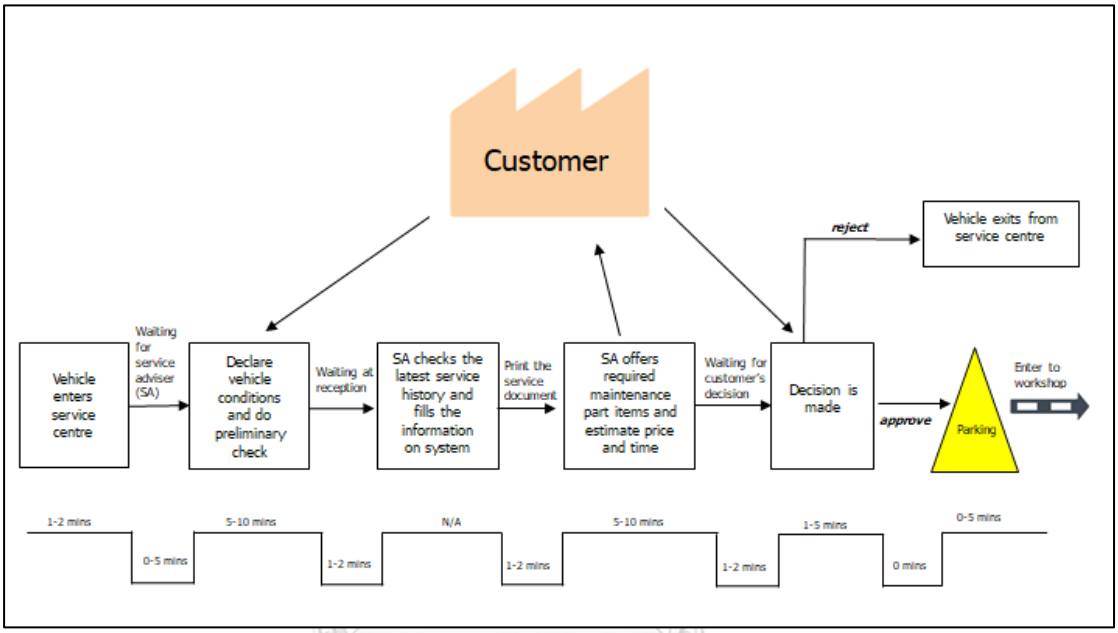

Figure 5.3: The current VSM of the pre-checking phase for appointment

Figure 5.3 seems to have some point that these use time less than non-appointment. Customers do not wait SA for greeting to long because they will come to the service centre on booking time and SA has to do the process for this group with the appointed time as well. Moreover, Book in advance can reduce the process to check the latest history and fill information because customer relations who are likely to be a call centre can fill the lists that customers would like to do into system previously. So, SA just prints the documents to explain and get approval from customers only.

5.2.2 VSM in the maintenance phase

5.2.2.1 VSM in the maintenance phase for non-appointment

In this phase, the VSM begins from car get into the workshop until the activity is done, the car passes the quality control (QC) section and brings to the parking area to return customers. Overall, in some cases, this stage is the longest service time procedure. The procedure comprises of internal operational activities and external correspondence. After the car is left in a parking area, the chief mechanic, who has the responsibility of managing available bay and assigning mechanic who has the proper skills for each job, will receive the maintenance order from SA and assign the accessible bay and mechanic into that area while the vehicle will be moved into the selected bay as appeared in Figure 5.4.

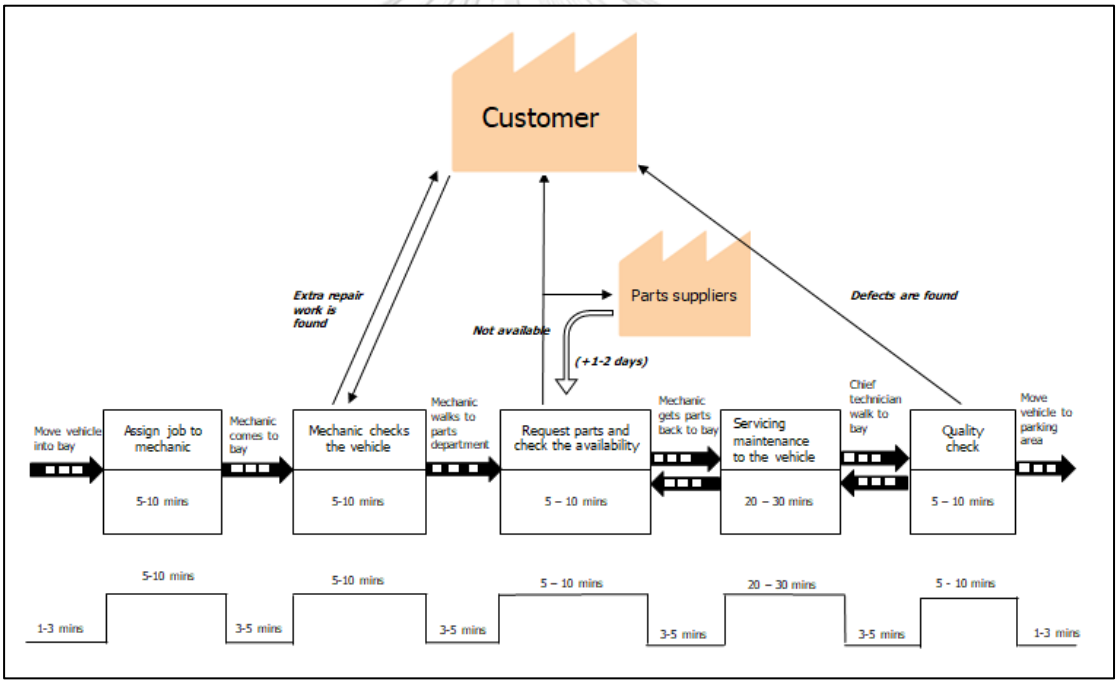

Figure 5.4: The current VSM of the maintenance phase for non-appointment

After bay and mechanics are ready, they will start a vehicle check which follows the standard checklists from Company A and take around 10-15 minutes to finish all checking things. If they find malfunctioned symptoms which not the types of maintenance, SA has to contact the customer, explains them and get the final approval

before starting the job. In this case, it will change the status from maintenance job to repair or overhaul job automatically after the customer's approval. If the customer gives consent to do services, SA has to calculate the new price and new estimated time to inform customers again. Back to the normal maintenance situation, mechanic will walk from bay to parts store to order preferred parts and wait for checking the availability of stock. Once in a while, a few parts are not accessible in the parts shop. Thus they have to make an order to the central warehouse while central warehouse to deliver parts to the service centre within 1-2 days. Moreover, SA has to contact and notify the customer directly and may make the next appointment for getting a remaining service job.

Refer to engine oil changing process in maintenance service, after job is done, chief mechanic will do quality check (QC) and record to complete this job in the system. In the worst case, mechanics will do nothing about QC which it may lead to the defect and they have to repeat maintenance jobs in the future. For example, mechanic forgets to tighten the bolts of the engine tank and chief mechanic ignores the quality check before delivering. Engine oil may leak out into the road, leading to accidents for customers. This is the serious step that they cannot ignore, leading to a negative brand reputation.

Some jobs may not pass QC and mechanic needs to adjust and sometimes it may need to arrange additional extra parts and times. If this case happens, the chief mechanic has to take the responsibility to estimate the situation, give suggestions to mechanic and make a judgment. If the vehicle cannot complete on the estimated time, SA will call to customer to give an apology and inform the postpone delivery time.

5.2.2.2 VSM in the maintenance phase for appointment

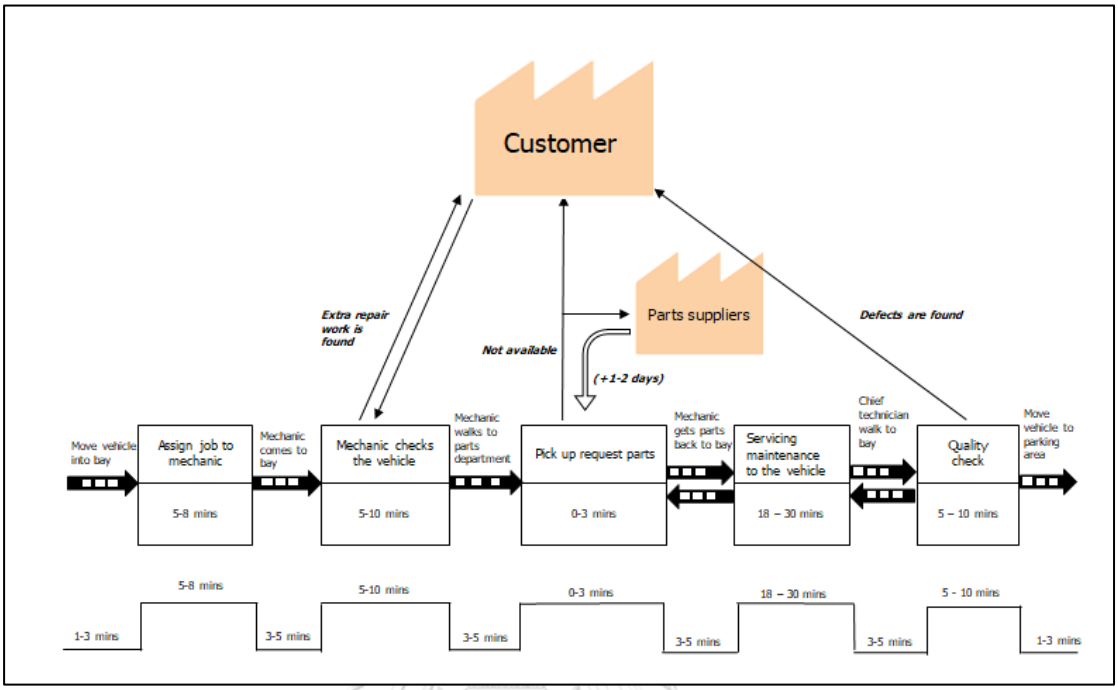

Figure 5.5: The current VSM of the maintenance phase for appointment

In this case, there have some different points. Chief mechanic has to assign job for mechanic into system. However, in Figure 5.5, time in this step may not differ much more than non-appointment. It may need to concern how chief mechanic manage this kind of services. Differently, mechanic still needs to walk to get parts but they do not wait to request because parts staff will know which car will do an engine oil change and prepare items in advance. Mechanic will use less time in this step. The time for changing oil may not different because mechanics have to do the same process as non-appointment customers.

5.2.3 VSM in the post-checking phase

5.2.3.1 VSM in the post-checking phase for non-appointment

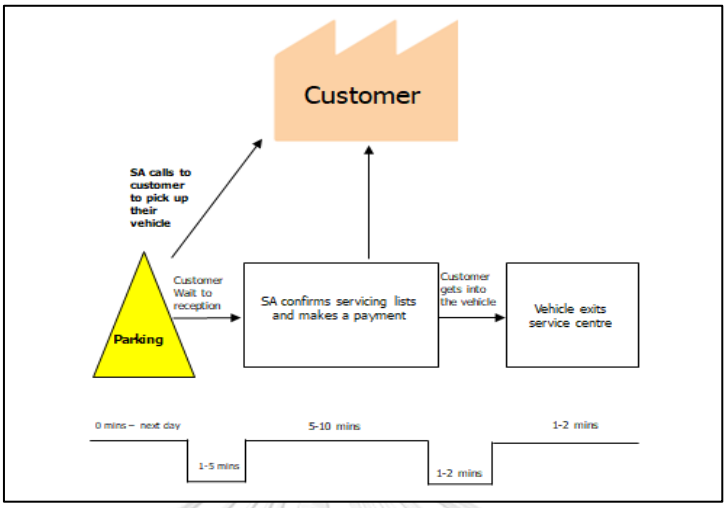

Figure 5.6: The current VSM of the post-checking phase for non-appointment

In the last step, after completing QC, car will move from the workshop and SA will make a call to customer to let them know the complete job and they can get their own cars as represented in VSM. After that, SA will confirm the finished jobs and precede payment at the cashier. So, SA and client will check the vehicle condition together before leaving again. After the client sign name to accept the condition, SA will return the vehicle key and it leads to the finish service activity. (see Figure 5.6).

5.2.3.2 VSM in the post-checking phase for appointment

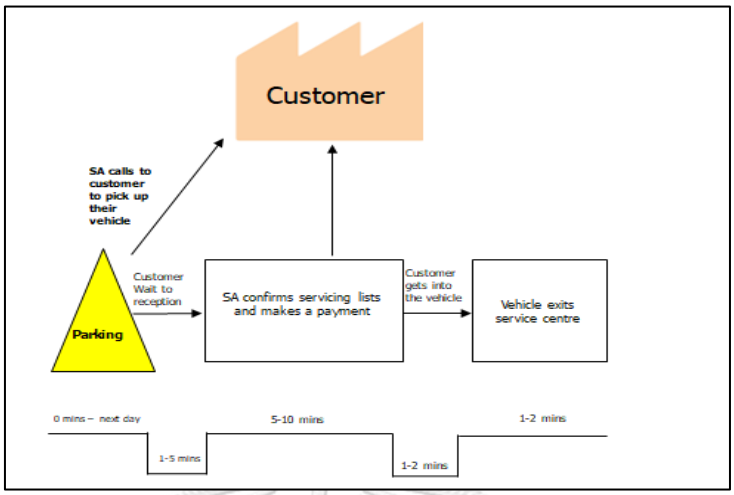

Figure 5.7: The current VSM of the post-checking phase for appointment

In the last phase, comparing Figure 5.6 and Figure 5.7, it does not have any different points because both customer groups have to confirm servicing items and make a payment to get a car back. Then, the time spent in post-checking phase is not taking a long time comparing with the phase of pre-checking and maintenance. Waiting customers to receive their car is likely to be the longest step in this phase. Some customers cannot come to pick up their own car immediately and it may vary factors depending on customer's convenience. So, it cannot estimate the delivering time precisely. It could be an uncontrollable factor.

5.3 Current flow of servicing vehicle flow from secondary service history

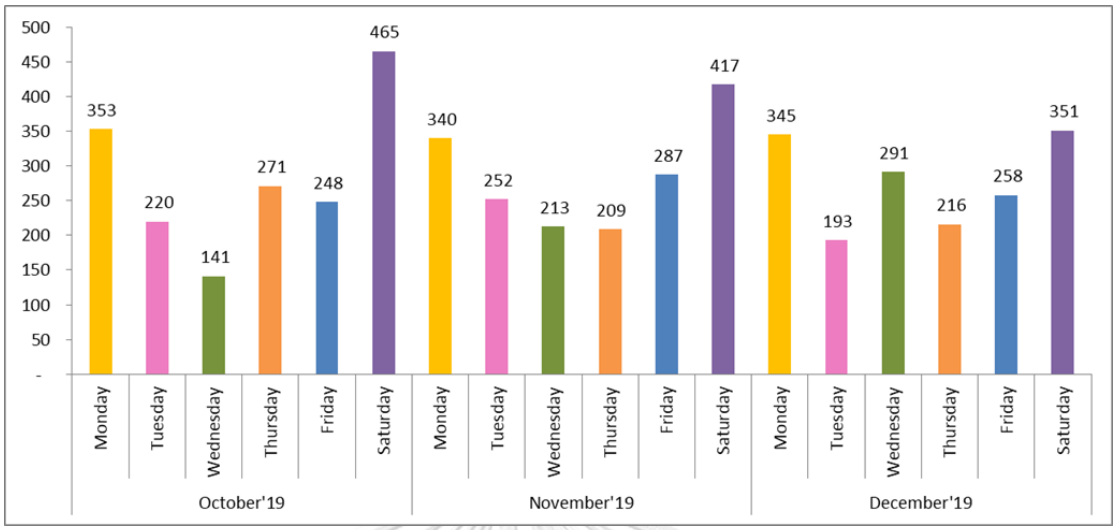

Figure 5.8: The number of LCV service units in each day from October to December 2019

Interestingly, the secondary service history can tell the trend of time that LCV comes to do an engine oil change service. This information will focus on both appointment and non-appointment groups to come to change LCV engine oil during October to December 2019. It may help to focus on the peak day and the peak hour period to improve the bay utilisation and other workshop issues. Currently, a selected service centre opens from Monday to Saturday during 07.00 am to 05.00 pm. If looking at Figure 5.8, it can be seen that cars come to do engine oil service on Monday and Saturday more than others. Moreover, the analysis of secondary data can show the peak hour seems to be the period during 7.00-11.00 am along with the entire 6 business days. (See Table 5.3 and 5.4) The volume of LCV service units between 7.00-11.00 am is the average of about 70.26% of total LCV service units. So, the workshop should be improved workflow to support service in the peak hour and peak day to make a service flow smoother. If the workshop management is insufficient, it may affect a longer lead time to other vehicles that come to the service in the afternoon.

Table 5.3: The percentage of LCV service units from a selected authorised dealer (Company B) in each time period and each day from October to December 2019 for non-appointment customers

		Time period									
Month	Day	07.00-08.00	08.00-09.00	09.00-10.00	10.00-11.00	11.00-12.00	12.00-13.00	13.00-14.00	14.00-15.00	15.00-16.00	16.00-17.00
October'19	Monday	12.24%	16.33%	14.29%	14.29%	11.73%	10.71%	7.65%	7.65%	3.06%	2.04%
	Tuesday	9.02%	13.11%	24.59%	15.57%	9.84%	8.20%	7.38%	7.38%	1.64%	3.28%
	Wednesday	14.06%	14.06%	20.31%	15.63%	9.38%	7.81%	12.50%	4.69%	1.56%	0.00%
	Thursday	12.14%	20.71%	12.14%	12.86%	10.00%	8.57%	6.43%	10.00%	4.29%	2.86%
	Friday	15.45%	15.45%	17.89%	9.76%	7.32%	8.94%	6.50%	8.13%	3.25%	7.32%
	Saturday	16.00%	15.43%	22.86%	19.43%	7.43%	2.86%	9.14%	2.86%	3.43%	0.57%
November'19	Monday	14.57%	13.91%	16.56%	13.91%	10.60%	8.61%	9.93%	4.64%	5.30%	1.99%
	Tuesday	12.90%	16.94%	16.94%	14.52%	12.90%	8.06%	6.45%	6.45%	2.42%	2.42%
	Wednesday	14.91%	12.28%	15.79%	12.28%	11.40%	10.53%	7.89%	8.77%	4.39%	1.75%
	Thursday	13.86%	12.87%	19.80%	13.86%	6.93%	13.86%	4.95%	8.91%	2.97%	1.98%
	Friday	12.33%	12.33%	14.38%	15.07%	13.01%	8.90%	10.27%	4.79%	5.48%	3.42%
	Saturday	18.40%	16.00%	18.40%	16.80%	8.00%	4.00%	7.20%	3.20%	4.00%	4.00%
December'19	Monday	12.97%	19.46%	17.84%	11.89%	9.73%	10.27%	5.41%	5.95%	4.32%	2.16%
	Tuesday	11.49%	18.39%	19.54%	14.94%	11.49%	8.05%	6.90%	3.45%	4.60%	1.15%
	Wednesday	16.00%	9.33%	16.00%	16.67%	9.33%	6.00%	8.67%	8.67%	7.33%	2.00%
	Thursday	17.78%	18.89%	17.78%	10.00%	7.78%	8.89%	4.44%	7.78%	2.22%	4.44%
	Friday	17.09%	17.09%	18.80%	9.40%	9.40%	6.84%	5.13%	8.55%	4.27%	3.42%
	Saturday	13.16%	18.42%	18.42%	12.28%	13.16%	5.26%	7.02%	9.65%	2.63%	0.00%

Table 5.4: The percentage of LCV service units from a selected authorised dealer (Company B) in each time period and each day from October to December 2019 for appointment customers

		Time period									
Month	Day	07.00-08.00	08.00-09.00	09.00-10.00	10.00-11.00	11.00-12.00	12.00-13.00	13.00-14.00	14.00-15.00	15.00-16.00	16.00-17.00
October'19	Monday	29.80%	25.83%	25.17%	7.28%	3.97%	6.62%	1.32%	0.00%	0.00%	0.00%
	Tuesday	37.63%	15.05%	19.35%	10.75%	4.30%	5.38%	6.45%	1.08%	0.00%	0.00%
	Wednesday	32.43%	24.32%	20.27%	6.76%	6.76%	8.11%	1.35%	0.00%	0.00%	0.00%
	Thursday	37.19%	19.83%	14.05%	12.40%	3.31%	6.61%	5.79%	0.83%	0.00%	0.00%
	Friday	29.41%	26.89%	20.17%	8.40%	3.36%	6.72%	4.20%	0.84%	0.00%	0.00%
	Saturday	29.29%	27.50%	11.43%	8.21%	6.79%	8.21%	6.43%	2.14%	0.00%	0.00%
November'19	Monday	28.95%	39.47%	15.79%	5.26%	5.26%	2.63%	2.63%	0.00%	0.00%	0.00%
	Tuesday	31.09%	20.17%	21.01%	10.92%	3.36%	8.40%	4.20%	0.84%	0.00%	0.00%
	Wednesday	38.04%	20.65%	23.91%	4.35%	7.61%	3.26%	1.09%	1.09%	0.00%	0.00%
	Thursday	34.65%	14.85%	24.75%	11.88%	1.98%	8.91%	2.97%	0.00%	0.00%	0.00%
	Friday	35.43%	19.69%	18.90%	12.60%	0.79%	6.30%	3.15%	3.15%	0.00%	0.00%
	Saturday	35.94%	23.49%	11.03%	8.54%	6.76%	5.34%	8.19%	0.71%	0.00%	0.00%
December'19	Monday	27.89%	34.69%	17.01%	10.20%	2.04%	4.76%	3.40%	0.00%	0.00%	0.00%
	Tuesday	35.64%	17.82%	19.80%	3.96%	4.95%	10.89%	3.96%	2.97%	0.00%	0.00%
	Wednesday	33.08%	18.80%	16.54%	11.28%	5.26%	9.77%	4.51%	0.75%	0.00%	0.00%
	Thursday	27.05%	22.95%	20.49%	10.66%	1.64%	10.66%	6.56%	0.00%	0.00%	0.00%
	Friday	38.35%	24.06%	12.78%	7.52%	4.51%	7.52%	4.51%	0.75%	0.00%	0.00%
	Saturday	37.61%	18.80%	16.24%	8.55%	4.27%	5.56%	7.69%	1.28%	0.00%	0.00%

Table 5.5: The comparison of percentage for LCV non-appointment and appointment service units from a selected authorised dealer (Company B) during 7.00-11.00 am in each day from October to December 2019

Customer type(s)	Time	Period during 07.00 - 11.00					
	Month/Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Appointment	October'19	88.08%	82.80%	83.78%	83.47%	84.87%	76.43%
	November'19	89.47%	83.19%	86.96%	86.14%	86.61%	79.00%
	December'19	89.80%	77.23%	79.70%	81.15%	82.71%	81.20%
Non-appointment	October'19	57.14%	62.30%	64.06%	57.86%	58.54%	73.71%
	November'19	58.94%	61.29%	55.26%	60.40%	54.11%	69.60%
	December'19	62.16%	64.37%	58.00%	64.44%	62.39%	62.28%

From VSM, it may say that non-appointed customers have to spend time in the service centre around 1.3-3.3 hours while the appointed group has to spend time during 1.2-2.5 hours. However, both of them still spend more time than competitors leading to lost customer retention. From table 5.5, interestingly, it can see that the congestion of appointment customers higher up to 80% in the morning period which may affect walk-in customers who are around 50% of service units per day. It may be the reason why total lead time for the appointed group is quite not different from others due to the appointment scheduling. Furthermore, SA will record customer waiting status on system either customer requires to wait for picking up their own car or not. The interesting point is most customers that come during peak hours will have confirmation waiting to receive the car at the service centre around 60% refer to Table 5.6.

Table 5.6: The percentage of customers who request to wait at a selected authorised dealer (Company B) from October to December 2019

	% Waiting to pick up car		
Customer type(s)	October'19	November'19	December'19
Appointment	62.19%	60.08%	59.27%
Non-appointment	58.17%	62.31%	63.26%

Chapter 6
Non-valued-added activities

In this chapter, the author would like to explore and define the non-value-activities in the current engine oil change process to discover root causes and find the improvement plan in the next part. In this part, it will be used 3 main sources to declare non-value-added factors including secondary service history of a selected dealer through VSM, secondary absent customer survey of Company A in 2019 and secondary service managers survey of Company A in 2019. Moreover, the investigation of VSM will be the beginning methodology for identifying the main process that makes a long lead time as a bottleneck and the next improvement plan.

6.1 The non-value-added activities investigation from VSM

Refer to VSM, the procedure of engine oil changing job can be arranged into 3 stages include pre-checking, maintenance, and post-checking phase. The time estimation required for the non-appointment group in the pre-checking and post-checking section is 18-88 minutes and 8-19 minutes and for the appointment group are 15-43 minutes and 8-19 minutes accordingly. The maintenance phase occupies the longest time, 54 minutes to 1.6 hours for non-appointment and 47 minutes to 1.45 hours for an appointment. For the total time, the engine oil change may use the service time for both non-appointment and appointment between 1.3 to 3.3 hours and between 1.2 to 2.5 hours accordingly. Table 6.1 outlines every single wasteful movement that is found in the VSM of the oil changing process.

Table 6.1: The summary outline of non-value activities for 3 stages

Pre-checking stage	Maintenance Phase	Post-checking Phase
Waiting for service advisor (SA)	Assign job to mechanic	Waiting customer comes to receive the vehicle
Declare vehicle conditions and do preliminary check	Mechanic comes to bay	Service confirmation and payment
Offer required maintenance parts items and estimated price and time	Mechanic walks to parts department	
Waiting for vehicle's moving into the workshop	Mechanic requests parts and check the availibility	
	Mechanic gets parts and back to bay	
	Insufficiency of parts	
	Quality control check	

Pre-checking phase

Refer to the diagram of VSM in chapter 5, Waiting for greeting from SA and moving vehicle to the workshop area are stages that cause extreme lead time and clients need to hold up with no extra worth for both customer types. Looking into the detail, from Table 6.2, it can be found the duplication of work. SA has to do a preliminary check which is the same process in workshop area that mechanic has to do as well. The inefficiency of these causes utilised time in waiting for SA, doing preliminary check with SA and moving car into workshop up to 60 minutes which approaches 68% of all-out utilised time in pre-checking stage for walk-in customers but booking group may wait up to 20 minutes because they already reserved time slot to do a service. It can clearly show that these 3 main steps are the bottleneck in this phase.

Table 6.2: The preliminary checklists from the standard of Company A

Section	Vehicle check lists	By Service advisor	By Mechanic
Interior	1. Starting, idling and acceleration check	√	√
	2. Clutch pedal free play check	√	√
	3. Steering wheel free play check	√	√
	4. Brake pedal & Parking brake lever travel check	√	√
	5. Safety belt operation check	√	√
	6. Brake and reversing light check	√	√
Under the hood	7. Power steering fluid and oil leakage check	√	√
	8. Fan belt / Accessory belt tension and damage check	√	√
	9. Radiator and radiator cap check	√	√
	10. Engine coolant and leakage check	√	√
	11. Air cleaner element check	√	√
	12. Brake-Clutch fluid and oil leakage check	√	√
	13. All hoses and pipes damage check	√	√
	14. Engine oil contamination and leakage check	√	√
	15. Wind shield cleaner fluid check	√	√
	16. Battery, distilled water, voltage and cold cranking amp check	√	√
Suspension	17. Rubber bushes and joint ball for wear or damage	-	√
	18. Steering ball joint, front axle shaft and rubber boot check	-	√
	19. Steering operation and looseness check	-	√
	20. Gear oil check	-	√
	21. Transmission or transmission with transfer case oil leakage check	-	√
	22. Universal joints and splines for wear and loose connection check	-	√
	23. Leaf / Coil springs and mount looseness or damage check	-	√
	24. Front and rear axle oil leakage check	-	√
	25. Exhaust system check	-	√
	26. Shock absorber oil leakage and mount check	-	√
Wheel & Brake	27. Wheel hub bearing looseness check (all wheel)	-	√
	28. Wheel and wheel nut damage check (all wheel)	-	√
	29. Brake pipe, connector and all hose check	-	√
	30. Brake pad check	-	√
	31. Brake disc check	-	√

Maintenance phase

From the VSM, it can see that the main section of the service which is servicing maintenance stage utilises the time only for 18-30 minutes but other processes are likely to make total service time longer. Then, there are numerous methods that ought to be improved. The primary point is the job assignment which should be finished within 3-5 minutes from chief mechanic whereas due to the inefficiency of chief mechanic make this procedure requires lead time up to 10 minutes. The second considering point, the mechanic has to walk and order parts by themselves. They have to walk to the parts department, order and wait for parts staff to check the availability, get parts and come back to the bay which leads to use the time up to 25 minutes. Considerably, in peak hour, every mechanic has to queue up to order parts. It might take longer than 25 minutes in these steps. It absolutely wastes of

time. Then, this progression may not be ignored and may have some strategies to diminish lead time. Comparing with Figure 5.5, it can see that the appointment group can help service centre to prepare parts items prior and mechanic just walks to get the request items immediately which will no need to wait parts staff checks the availability and collect it for them. However, the percentage of the walk-in group still higher up to 50% for 3 months. So, the service centre has to concern about how to increase the proportion of the appointment group. Another point that may non-value procedures and effects on longer lead time is the lack of spat parts. Parts shortage may lead to increase in extra service time up to 1 or 2 days which should not happen for engine oil changing because this service job is likely to occur every day in the service centre. For this situation, the service centre will lose an opportunity to make a high turnover pace of bay and technician which these are fixed cost that will be charged each day. The last non-regard action is reworking job. This job causes when a vehicle does not pass QC or client returns to claim the incomplete work. At the point when a deformity is found, it will lose the time from dismantling, keep fixing, referencing additional parts, and re-gathering again. These things intrude on the current working arrangements, make the procedure longer, and waste resources inefficiency, resulting in a negative effect on brand reputation.

Post-checking phase

There are 2 waste points in this stage. The first is that customers cannot come to receive the car back immediately or on the same day. It makes total lead time per car higher than the normal situation and sometimes the car parking area may not available to support new vehicles. But it seems like external factors depending on the customer's convenience. The second waste causes in the progression of confirmation and payment from the customer. Typically, this step can be finished within 5 minutes, anyway, it may require more time as long as 10 minutes because of the waiting queue and service document.

6.1.1 The summary of all inefficient activities from VSM that requires improvement solution

From the investigation of VSM, there are 10 points in the servicing process that ought to be improved. Figure 6.1 to 6.6 illustrates all inefficient activities in VSM.

6.1.1.1 VSM in the pre-checking phase

6.1.1.1.1 VSM in the pre-checking phase for non-appointment

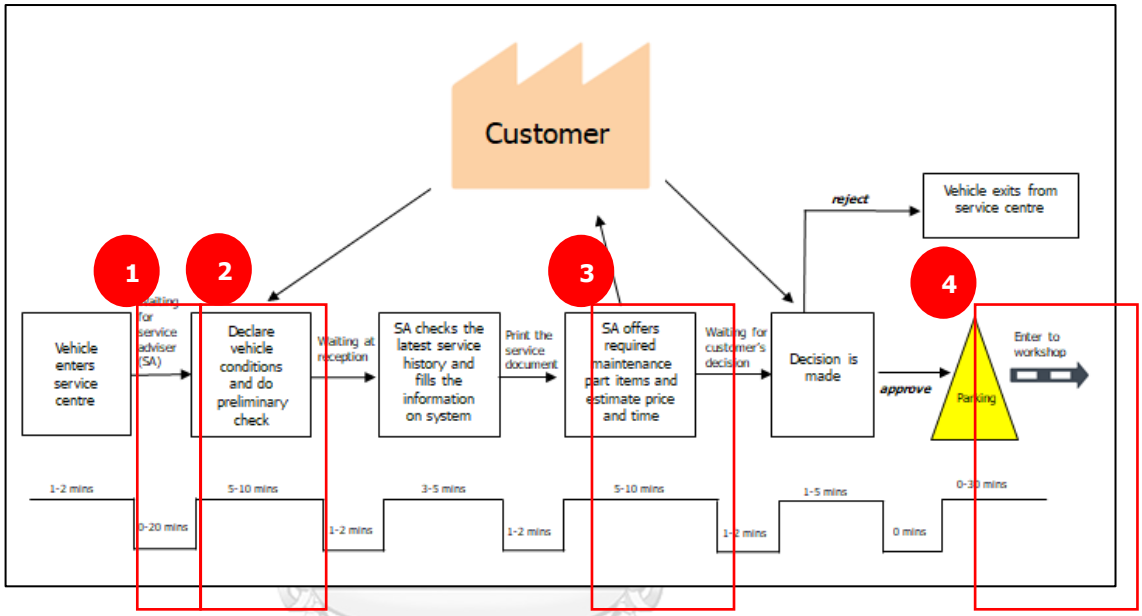

Figure 6.1: The summary of all inefficient activities of VSM in the pre-checking phase for non-appointment

6.1.1.1.2 VSM in the pre-checking phase for appointment

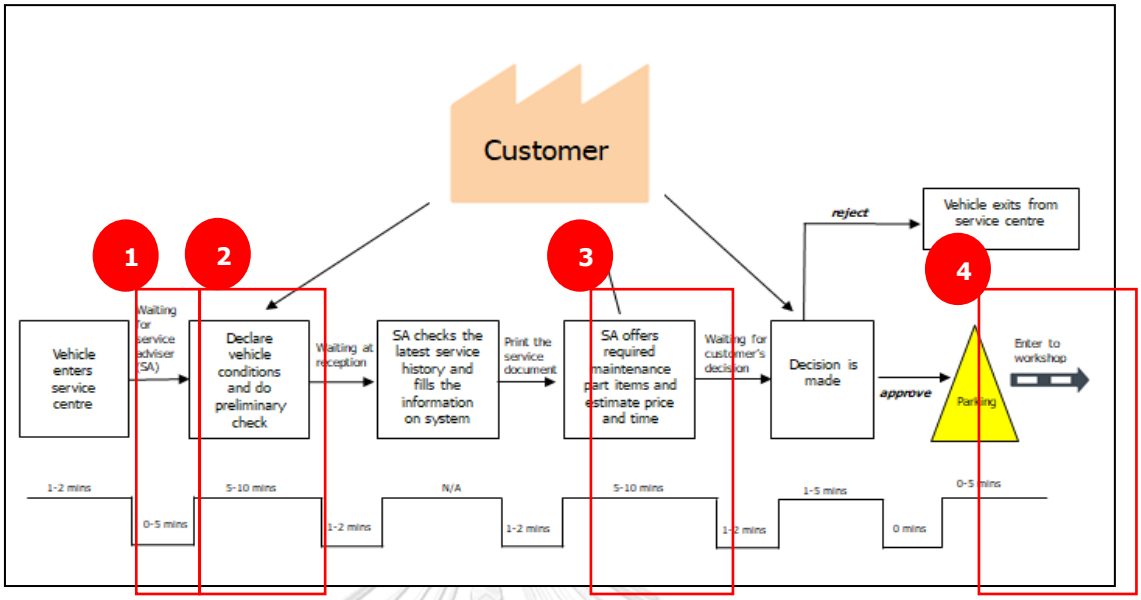

Figure 6.2: The summary of all inefficient activities of VSM in the pre-checking phase for appointment

6.1.1.2 VSM in the maintenance phase

6.1.1.2.1 VSM in the maintenance phase for non-appointment

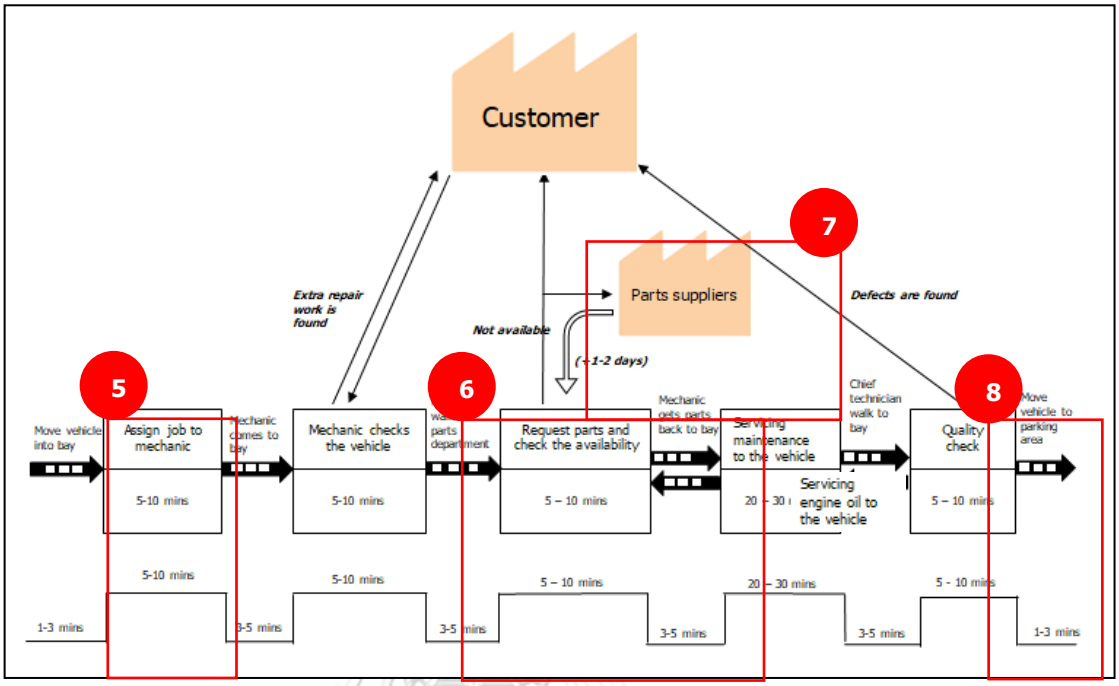

Figure 6.3: The summary of all inefficient activities of VSM in the maintenance phase for non-appointment

6.1.1.2.2 VSM in the maintenance phase for appointment

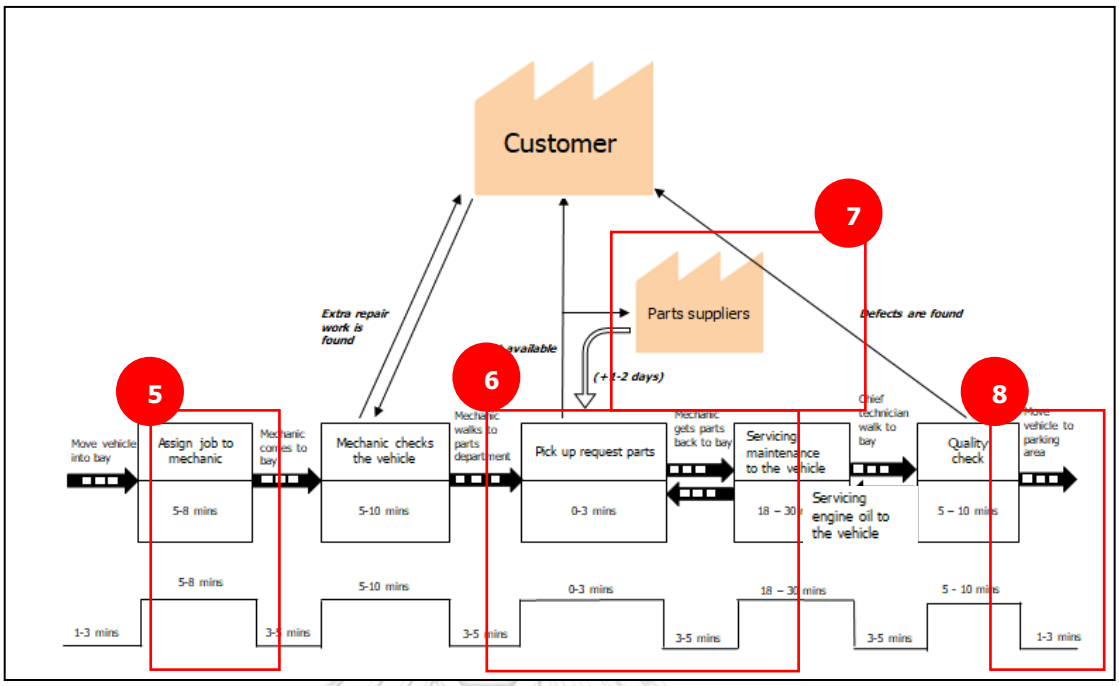

Figure 6.4: The summary of all inefficient activities of VSM in the maintenance phase for appointment

6.1.1.3 VSM in the post-checking phase

6.1.1.3.1 VSM in the maintenance phase for non-appointment

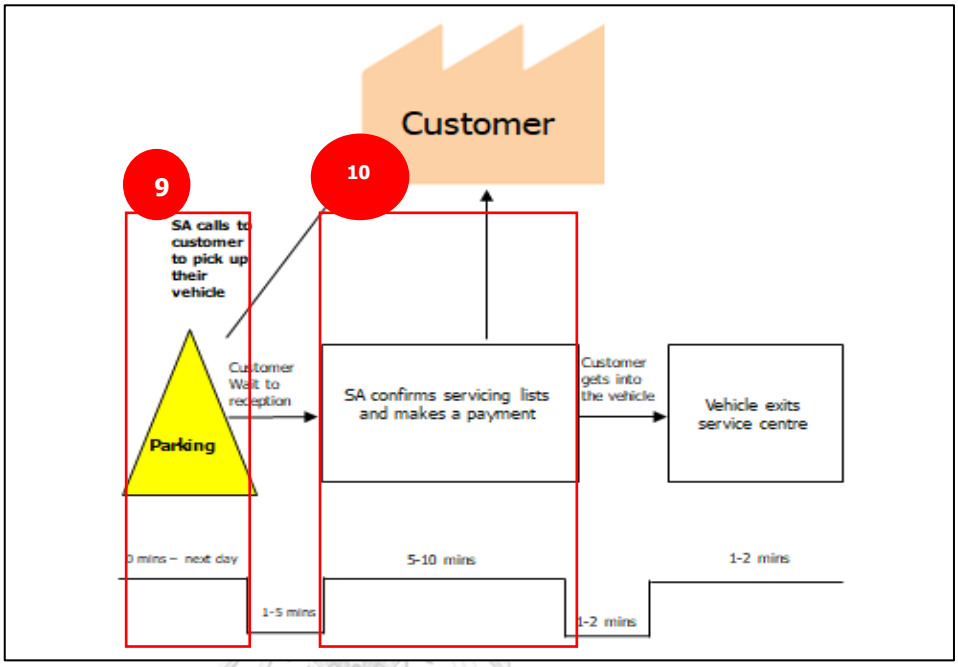

Figure 6.5: The summary of all inefficient activities of VSM in the post-checking phase for non-appointment

6.1.1.3.2 VSM in the maintenance phase for appointment

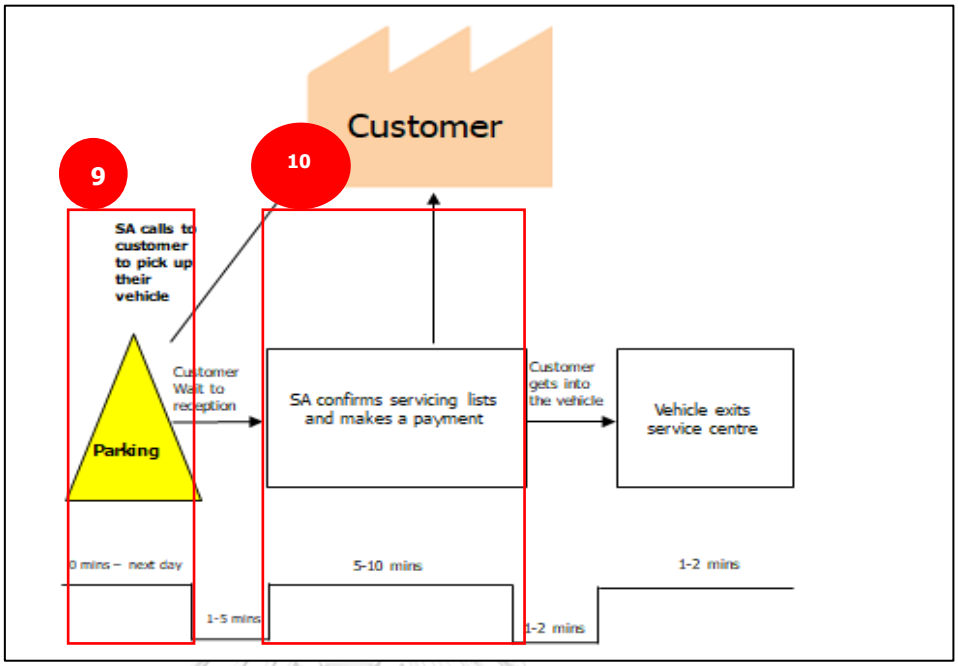

Figure 6.6: The summary of all inefficient activities of VSM in the post-checking phase for appointment

From the investigation, principal problems of these 10 exercises for both types of customers can be isolated into 3 subjects to be specific the issue of inefficiency and communication skills of SA working, the issue of poor workshop management and the issue of parts management in Table 6.3.

Table 6.3: The summary main issues from non-value activities investigation

Phase	No.	Non-value activities	Main problems
Pre-checking	1	Waiting for service advisor (SA)	- Issue of inefficiency and communication skills of SA working
	2	Declare vehicle conditions and do preliminary check	- Issue of inefficiency and communication skills of SA working - Issue of poor workshop management
	3	Offer required maintenance parts items and estimated price and time	- Issue of inefficiency and communication skills of SA working
	4	Waiting for vehicle's moving into the workshop	- Issue of poor workshop management
Maintenance	5	Assign job to mechanic	- Issue of poor workshop management
		Mechanic comes to bay	
	6	Mechanic walks to parts department	- Issue of parts management
		Mechanic requests parts and check the avalibility	
		Mechanic gets parts and back to bay	
	7	Insufficiency of parts	- Issue of parts management
	8	Quality control check	- Issue of poor workshop management
Post-checking	9	Waiting customer comes to receive the vehicle	- Issue of inefficiency and communication skills of SA working
	10	Service confirmation and payment	- Issue of inefficiency and communication skills of SA working

6.2 The non-value-added activities investigation from a secondary survey of Company A

Starting with the absent customer survey in 2019, it shows the result of LCV came to do the engine oil change at service centres in 2017 and not come back again in 2018 and 20% of samples had been to do a service in Bangkok area where a selected dealer is located on.

49% of the responders changed the engine oil at regular maintenance time (6 months) and 24% changed the engine oil between 7 to 12 months. Moreover, 92% changed mind to come to a local garage and 7% came to the branded garage and did service by themselves 1%. In terms of lead time focus, the secondary review result from Company A's survey shows that 21% of the responders have ever felt unsatisfied with lead time management in the service centre. 51% of responders felt that the last time at the service centre took more than 2 hours. And almost 51% interested in 90 min engine oil change service.

Refer to the issues of lead time management, the overview result demonstrates that there are 3 primary causes of the bottleneck in service centre process. First, from a secondary survey result, 24% said that they did not clearly understand the vehicle condition, what they need to do and why they have to do. It may concern about SA working efficiency. SA is likely to be a middleman between the customer and internal operation of the service centre. The working of SA can be reflected successfully by clients. The essential driver of gradualness may procure from the shortcoming of the vehicle checking and waiting for SA to precede a job request in system.

72% of the samples concurred that clear explanation and update their own vehicle status causes them to feel satisfied and appears to complete faster. However, 67% of samples feel increasingly fulfilled because the service centre has first vehicle check, anyway, this procedure seems duplicate in the workshop and it should be eliminated from the VSM process. The result of the study affirms that the statement of consideration of service centre and SA influences to client's feelings altogether. Therefore, in spite of the fact that this strategy makes lead time longer and it should not have in the pre-checking stage. For resolving the root cause, improving SA knowledge or soft skills can enhance the work more effective.

In terms of mechanic skills, this topic is not relevant to engine oil change service because this job is the fundamental knowledge that every mechanic has to pass at the beginning class and everyone can have a chance to practice every day in a car workshop. However, due to a new model or new innovative technologies of cars, it is important to make an opportunity for mechanics to update information and practice continually and have a chief mechanic to monitor the service process. They may let new mechanics start working without checking from chief mechanics. This is another essential issue of errors.

Second, the deficiency of parts can lead to the slow operation, the number of secondary survey demonstrated that 24% of respondents concerned lead time and it made them feel unhappy to come to service centre. One considering point is that there are a few examples confronted the maintenance items shortage which regularly should consistently prepare in the service centre. In fact, the percentage of parts shortage for engine oil change service should be 0% while the information from secondary service history shows the percentage at 1.12%, 0.79% and 0.88% for 3 months accordingly in Table 6.4. From VSM, the expansion of lead time which happens from the unavailability of parts is about 1-2 days for each request.

Table 6.4: The percentage of parts shortage of a selected authorised dealer from October to December 2019

Type	October'19	November'19	December'19
% Parts shortage	1.12%	0.79%	0.88%

Third, the reason for too long lead time is the inefficiency of QC up 16% that the customers felt chief mechanic does not focus enough to do quality control and monitor overall procedure in the workshop due to ineffective time management which can make the service centre absence of control workshop and do QC. Seriously, if the defect is be found, the vehicle has to come back and start every process from the beginning step again as reworking, leading to the unnecessary cost and time. This issue may lead to the error in car servicing and also the rate of bay turnover. So, chief mechanic should give the importance to control the overall workshop flow and do QC

every car. However, to make a flow process, the management of bay is one issue that chief mechanic has to make a high bay turnover rate as much as possible. If the bay cannot available to serve engine oil service quicker, the remaining vehicles have to wait with the waste of time.

However, the percentage of reworking about 2.22% over 3 months which should not happen for engine oil change service from Table 6.5. This information is calculated from LCV which came back to complain and need to rework the job again. This service is the fundamental knowledge that every mechanic can do. It should be 0% reworking case for this job type. Chief mechanics should take action on this issue seriously.

Table 6.5: The percentage of reworking of a selected authorised dealer from October to December 2019

Type	October'19	November'19	December'19
% Reworking	2.69%	1.80%	2.22%

6.2.1 Fishbone diagram

From a secondary survey result, after knowing what customer is feeling to a service centre, then the author will utilise the fishbone chart to discover and clarify the weak points in the work process. This diagram of Figure 6.7 can illustrate 3 significant issues to impact on servicing lead time including the issue of the inefficiency of service advisor (SA), the issue of poor workshop management and issue of parts management.

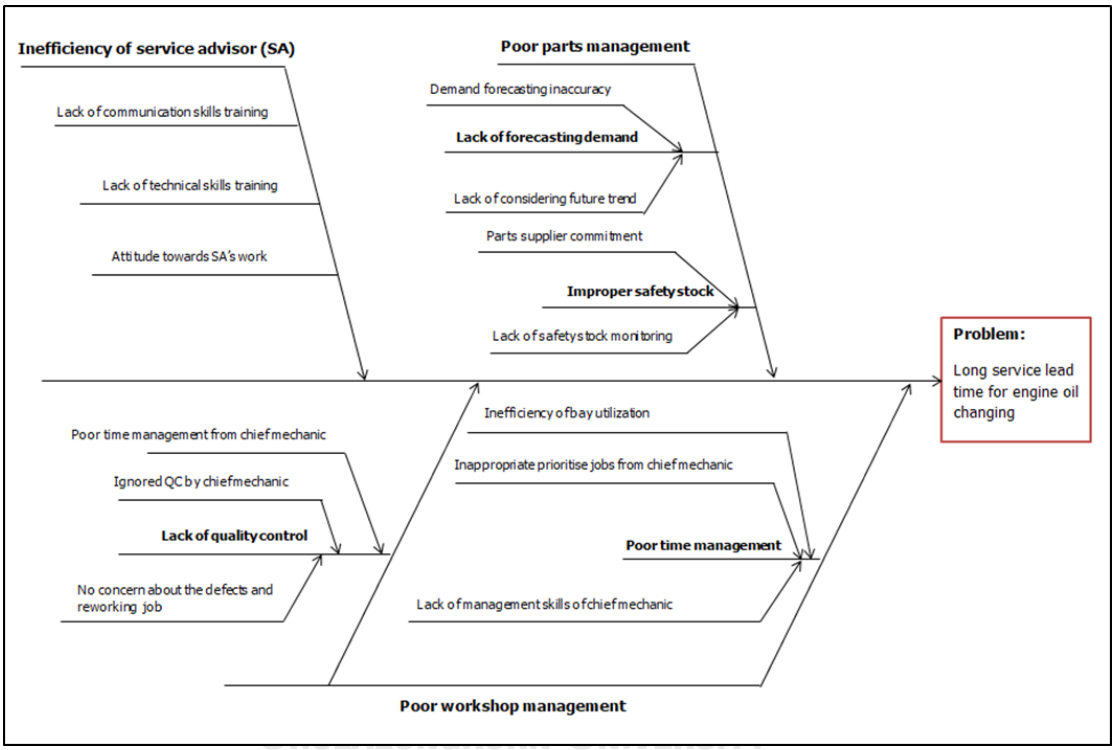

Figure 6.7: The fish bone diagram of long service lead time for engine oil changing

6.2.1.1 Inefficiency of service advisor (SA)

Incapable working and correspondence will be the reason for non-value-added in the service centre. Great correspondence can cause clients to feel better and refreshing vehicle status oftentimes can cause them to feel that the finished service faster. Subsequently, the improvement of correspondence among SA and customers will impact both direct and indirect decrease in service lead time.

(1) Lack of communication skills training

At this point, soft skills mean good communication skills, the management of time, critical thinking ability, and self-confidence. These aptitudes are extremely vital for being good SA. Moreover, SA who has these abilities can control the situation, offer additional assistance strategically, and have the option to bring a deal to their customers. But, not every SA has these skills. From Table 6.6, it can see that new graduates or some staffs would like to be or change to be service advisor (SA). Interestingly, new graduates and mechanics are the majority of data. They may have insufficient communication skills due to their background. Soft skills require a lot of preparing and practice to cause them to feel confidence when they use it. So, staffs must do both practicing and training from experts that headquarter should prepare for them. Therefore, having a specialised trainer educates in explicit subjects, show real example cases, and show the role plays will help SA talks and adapts to circumstance effectively and carefully.

Table 6.6: The proportion of changing old jobs to be SA

Old role job(s)	% of changing to be SA
1. New graduate	26.76%
2. Mechanic	25.46%
3. Customer relations	21.02%
4. Administrator	18.12%
5. Others	8.64%

(2) Lack of technical skills training

SA has to explain the technical details and first vehicle checking result to let the customer know about their vehicles. The comprehension of communication through technical knowledge between SA, mechanics, and customers is likely to cause this issue to get one of the primary issues of slowness. For the expectation, SA should have the ability enough to comprehend basic technical knowledge and make an interpretation to customers clearly. In the event that SA cannot understand the specialized clarification obviously, the data that will be passed to the customers will not right and may make the fault in the vehicle due to the wrong service request.

Normally, instructional classes for SA are intended to energise SA's work which essentially focuses on work procedure, for example, generating repair order, general vehicle checking, generating price quotation, and so on but basic technical knowledge for SA are not be prepared for them.

Furthermore, there are no tools to help SA and customers to understand during the explanation. The understanding of vehicle symptoms becomes a key issue to make a development plan. However, the service centre can improve the flow of information for SA. If customers have too little knowledge of mechanic background which is not predictable and nit controllable, then lead time will be used longer to explain them. Furthermore, having some tools that can assist SA to show the pictures of damages will influence the customer to approve their jobs easier and quicker. In conclusion, the issue may happen from SA since they do not give importance to their skills. Communication practicing will enhance speakers to arrange and point the important points without any problem.

(3) Attitude towards SA’s work

Another point is the mind-set of SA. They seem like the middleman between customer and mechanic. If they cannot explain some information to customer or mechanic, it will affect overall service lead time surely because customers cannot understand and give the approval while the mechanic does not know customer’s requirements from SA clearly. Then, practice will improve the quality of communication and make a summary more effective to make the customer understand. This improvement communication plan will help SA feel confident, organise the working steps to save the lead time and have the option to include some influencing points during the discussion which help the client make a decision quicker.

6.2.1.2 Poor workshop management

Generally, the management of the workshop is under the chief mechanic’s responsibility. From the investigation of the author shows that the reasons are likely to happen from the wastefulness of the chief mechanic’s working. The reasons for the issue can be grouped into 2 principle things in things; poor time management and lack of quality control (QC.)

(1) Poor time management

One of the significant KPI which assess the service centre performance is the turnover rate of the bay. Higher bay turnover shows a faster process which leads to the expansion of service centre income. Furthermore, observing the usage of the bay is a significant issue of chief mechanics. For instance, some vehicles cannot be fixed quickly because of waiting parts ordering or customer approval while these cars are parked in the bay. These vehicles ought to be parked in other areas until all of them are ready to be prepared. Second, the inefficiency of bay utilisation is deficient with regards to utilizing the control workshop system. Control workshop system is an effective tool that helps each worker to see the current job status to let mechanic see the overall circumstances in the workshop as a real-time and show on an electronic device. However, if chief mechanics do not have time enough to monitor, it may lead to the inefficiency of controlling workshop. Moreover, the most significant thing is the understanding of current mechanics' abilities. Thusly, recording and refreshing information consistently are important to provide a suitable job assignment to each mechanic. Actually, most chief mechanics have good technical skills but they may have low experience in terms of management skills. Due to the background of chief mechanics, most of them are promoted from mechanics in the service centre which may lack business management skills.

(2) Lack of quality control (QC)

The higher cost may come from the mistake of servicing process and it might impact the security of customer’s life. So, quality control is a significant methodology that cannot be skipped in the internal process. Additionally, QC must be finished by a skilful mechanic who has enough experience and understanding QC procedure which is taken by chief mechanic from Company’s A standardisation. From the investigation, The QC ignorance may happen from 3 factors. First, poor time management, chief mechanics have numerous assignments to take care of each day. Some tasks are routine jobs but a few assignments are on requests, without arranging and planning will prompt missing in certain tasks or making extra time which this issue makes chief mechanics cannot focus on QC appropriately. Second, comprehension of chief mechanics’ jobs, chief mechanics are advanced experience from other mechanics however they may good at the practical jobs in the workshop

area but they may not familiar with the business management skills, leading to the neglect of controlling time to do QC before vehicle's leaving. Third, the last reason that makes QC ignorance is that the management does not set the serious standard on quality evaluation before delivering a car to clients. This might be called organisational culture.

6.2.1.3 Poor parts management

Refer to the lead time diagram in VSM, the lack of parts can bring about extra lead time 1-2 days for every request. This extra lead time may happen from the production in case of no stock in the central warehouse. So, having safety stock in the service centre can diminish a longer service lead time. The issue of insufficiency of parts may bring about 2 primary causes including lack of forecasting demand and improper safety stock.

(1) Lack of forecasting demand

The incorrect demand forecast may happen from choosing the forecasting method improperly. Considerably, choosing an appropriate forecast technique is a significant method. The review of current and change forecast results following the seasonal trends properly are progressively important. If the company does not push their own staffs to active, rethink and improve, they may not think to make a better approach to get the increasingly precise outcome to support the current and future situation which realise lack or unnecessary parts stock and extra non-value-added activities.

No thinking about the real market, future, and seasonal trend which will be a guide that can tell the information in the future. No considering future trends will lead to frequent reordering parts which may happen because the service centre may not prepare suitable stock for future calculation then it will bring about parts lack. So, choosing a technique appropriately will lead result that near real situation which makes the assurance of stock management is progressively reasonable and increasingly the correctness.

(2) Improper safety stock

The second reason for lacking parts in the service centre may not appropriate for buffering safety stock. This issue happens for 2 significant reasons. The first is the lack of safety stock monitoring. One of many factors that uses in the calculation of

security stock. In the event that the estimate is not the same as the real number, the possibility of achieving extreme stock or lacking stock from inadmissible anticipating security stock level will increase.

Another reason for improper safety stock level is the unpunctual delivery time which is factor from suppliers. For the most part, this factor is cannot control because it relies upon the commitment of suppliers. So, the supplier relationship will be one issue that company cannot overlook. The firm may need to negotiate and make a agreement about the preferred quality or spec of parts and proper delivery time after sending request. If suppliers cannot send the parts on-time, it will directly affect to lead time which will take more time with unworthy. This issue prompts parts inadequacy in two or three days. Moreover, suppliers may not achieve the request orders due to both quality and quantity which this issue will acknowledge returning parts or parts deficiencies in certain things.

Chapter 7
The solution for engine oil change time reduction

After the discovering of root causes are happened, the following stage is determining effective solutions for improving service time. The proposed arrangements will appraise fundamentally on the probability of current resources and represent by corresponding with all causes that were found in chapter 6.

7.1 Solution for improving inefficient activities from VSM

Pre-checking phase

From Figure 6.1 and 6.2, it can see that the first and second points are likely to take time up to 30 minutes. During the peak hour, customers have to wait for SA for greeting and checking one by one. It seems to be non-value activities. So this research would like to apply the ECRS method from a literature review to eliminate, combine, rearrange and simplify the procedure to get an optimal solution. For more detail, SA has to check the vehicle condition and do a preliminary check in this phase. However, preliminary checklists of SA are likely to same as the mechanic's checklists in the workshop from Table 6.2. Although some customers are feel good that the service centre has a preliminary check, the service centre should eliminate and rearrange the duplicated process to be a single process for the reduction of service time. In fact, some SA may not have sufficient technical knowledge due to their background and mechanic can do it better than SA due to their direct skills and responsibility. So, it may need to eliminate this process in the pre-checking phase. However, SA still should check the vehicle condition such as dented points and distorted points to let the customer accept before sending a car into a workshop which can use only 2-3 minutes and it can reduce the time in these 2 points up to 80%. Moreover, appointment customers will get a direct advantage from the ECRS method which can reduce the lead time from 15-43 minutes to 12-36 minutes.

For the third point, it may not a significant impact but the service centre can utilise the exiting tool which is a mobile application to be more effective. Currently,

SA has to print the service lists, estimated price and time to confirm with customers. If SA can fill the information and send the detail into the customer's mobile to get approval directly, it can save both times and cost in terms of paperless refer to Figure 7.1.

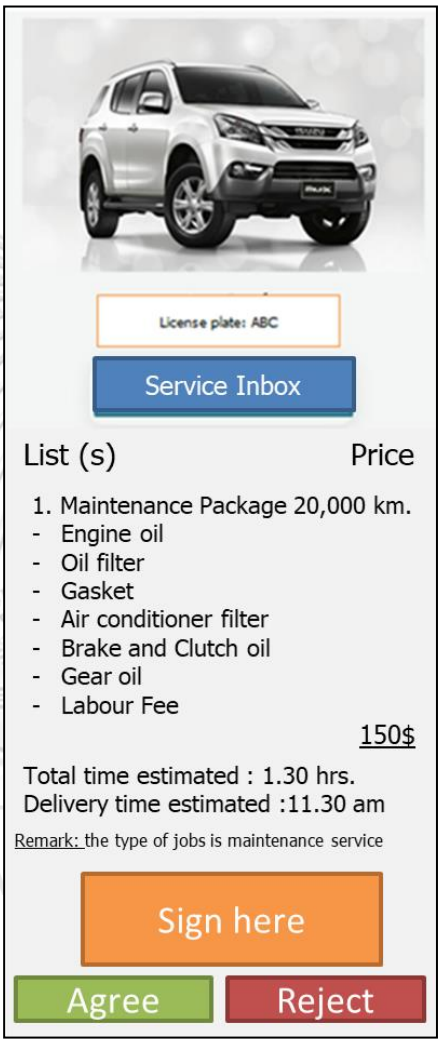

Figure 7.1: The mock-up service confirmation function via a mobile application

Moreover, the improvement of first, second and third points will affect the fourth point directly because SA can manage the flow of the reception area smoother and they can send the car into the workshop quicker. It may expect to reduce time in the fourth point by up to 30% for walk-in customers.

Maintenance phase

This phase is likely to control overall engine oil change service time. Chief mechanics seems to be a key man to control every step in this phase. They should utilise the historical data to prepare resources and plan the workflow. From Table 5.5, it can show the peak day which is Monday and Saturday and peak time which is the time between 07.00-11.00 am clearly. It can apply some strategies to develop in this specific period. Starting with the fifth point, chief mechanic should make an assigned queue to each mechanic every day relating to the secondary historical data. Moreover, chief mechanics can set up the morning meeting before starting work as 10-15 minutes to let other mechanics know the expected walk-in service volume, appointment service for that day, plan to handle and assigned mechanic queue to let them run their own business immediately and they do not need to wait for the command during the peak period which can finish within 3-5 minutes in this fifth point. For the next point, it can be divided into 2 situations. For the walk-in group, after SA fills the service lists into the system, the data should transfer into the parts department immediately to let parts staffs prepare the requested items. Moreover, the service centre should prepare staff who will send the requested parts from the parts department to mechanic each bay directly that it will combine and rearrange the unnecessary activities to be more effective. Mechanics can focus their jobs and do not waste the time to walk and get back from the parts department. However, during peak hour, mechanics may need to wait the staffs to send them the items but it is not likely to use much more time. It can reduce the time from 25 minutes to 10 minutes or less along with this point. While parts staffs can prepare the parts set for engine oil change for customers who make a reservation in advance and this group can get the benefits same as non-appointment if service centre provide one staff to bring the items to each bay. It will save the time that mechanics have to walk to the parts department because most customers come into service centre during 7.00-11.00 am. For the seventh point, it seems to be an issue from VSM and secondary survey. Then the solution will be explained the solution in section 7.2.

Interestingly, to be more effective, Company A launched the Dual mechanics in 2018 which is the conceptual idea of using 2 mechanics to do an engine oil service together because both of them will work in different service lists for one

car and they do not need to wait for each other in the example of Figure 7.2. So, the engine oil change time can be reduced by a half. Authorised service centres may feel the concept will make a higher cost because they need to utilise one more mechanic to run this concept. But if dealers use this concept to make a high rate of bay turnover, it means that they will get more income due to the increase of service volume and high customer satisfaction in terms of quicker service time. The author would like to suggest that engine oil change service is the majority job rather than others. So, service centres should apply this concept into the peak day or peak hour to reduce the bottleneck in the workshop. It may not need to use this concept all the time but they can plan when and what time that Dual mechanics should apply. Not only for servicing maintenance, but they can check the vehicle together that it means to combine vehicle check and maintenance from two sub-processes into one sub-process. Moreover, every mechanic can do this kind of job because it is the fundamental mechanic knowledge. Mechanics do not prepare much to use this concept which is not affected to dealer's cost but they should know when they have to apply this concept. Relating to the assigned queue, chief mechanics should let them know the plan for each working day through morning meetings to them. From a case study about the improvement of car workshop functions in chapter 2 and Figure 2.7, it will lead to the idea of the engine oil isolation section in the service centre. Engine oil change is the majority job of the service centre that will get the highest service units for each day. So, service centre should separate this kind of job to be an individual section to do engine oil change only as an 'Engine oil fast track station' in workshop area to support customers who concern about service time and help the service centre can manage better workshop flow competing with competitors. Engine oil fast track station may convince and change customer behaviour from 50% walk-in to 100% book in advance because this station will dissociate from other services to reduce the complexity in the workshop and it will show an obvious engine oil change demand for each day to make effective management, leading to the reduction of engine oil change service time.

No	Example of job contents for Mechanic A
1	Checking the alarm system before getting car on the lift
2	Peliminary check For example; brake pedal and clutch pedal for travel and play, steering condition, parking brake condition, and horn
3	Discharging engine oil
4	Refill engine oil
5	Check tire pressure

No	Example of job contents for Mechanic B
1	Preparetion tools and instruction sheet.
2	Peliminary check For example; light, emergency light, turn signal indicator, internal lights controls, internal condition controls, operation of wiper and washer jets, and gear control mechanism for looseness
3	Replace oil filter
4	Replace engine oil gasket
5	Check tire pressure
6	Start the engine and check the engine condition

Figure 7.2: The example of dual mechanics' work for engine oil change service

For the eighth point, from Figure 6.2, it is likely to use only 5-10 minutes to do quality check but chief mechanics may not control the workshop management, leading to the run out of time and the ignorance of quality control. So, from the previous solution in each step can eliminate and combine some necessary and unnecessary activities and affect to the eights point in maintenance phase which helps chief mechanics control the service time better and have the time to do a quality check by themselves, leading to the percentage reduction of reworking.

Post-checking phase

For the ninth point, it seems to be an uncontrollable factor that the service centre may not directly involve because it depends on customer's convenience to pick up their own car. For the last tent point, as the suggestion in the third point, the service centre can apply the function on a mobile application to confirm actual service lists and final price and they do not wait to print the document. Moreover, customers can make a payment via credit card or direct bank transfer on this application immediately (See Figure 7.3) which may reduce the risk of internal corruption in the

organisation because cash will transfer into the company's bank account directly. Moreover, all evidence will be kept in the dealer's system and customer's application. So, both of them can check the service history with each other.

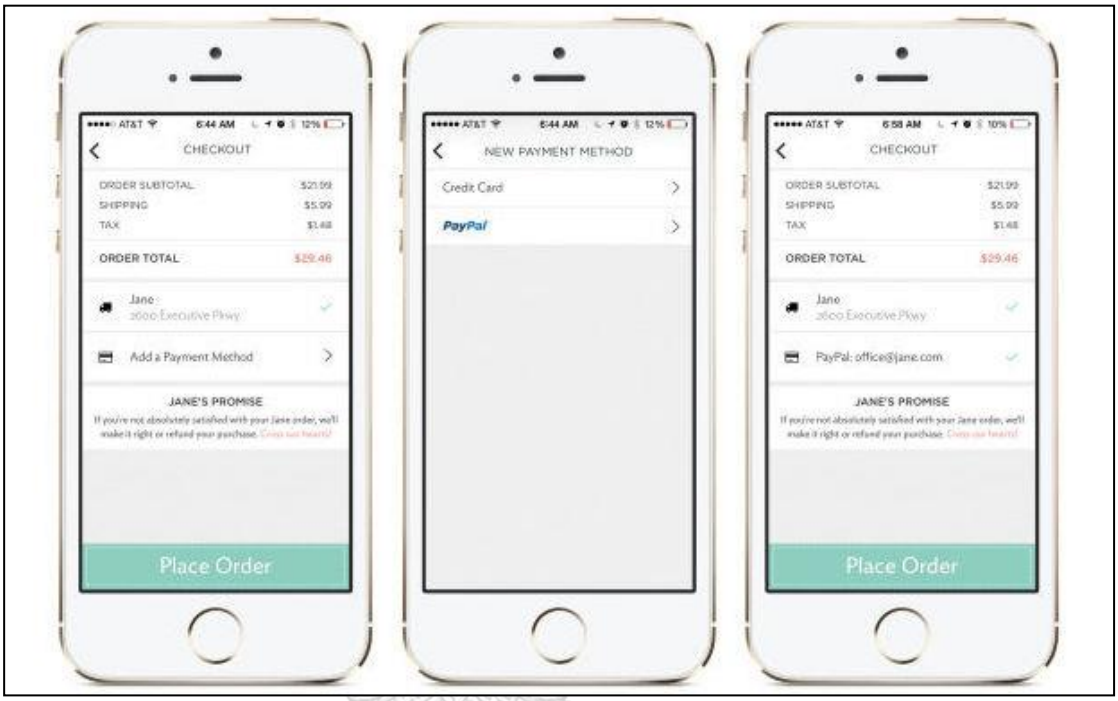

Figure 7.3: The example of payment function via a mobile application
Source: Available from: http://thinkapps.com/blog/development/payments-app-definitive-guide [Accessed 27 June 2020].

7.2 Solution for improving inefficient activities from Fish bone diagram

7.2.1 Solution for improving the efficiency of service advisor (SA)

In order to enhance the good communication between SA and customers, the solutions are divided into 2 topics; improving the current SA communication skills and creating a tool for enhancing communication.

(1) The enhancement of SA skills

Insufficient working and correspondence among SA and customers occur from absence of SA's aptitudes with respect to relational abilities and specialized information. The two causes can improve by offering training to them. The content

ought to be instructed by experts. Despite the way that, SA cannot viably improve without experience. SA's capacity especially specialized aptitudes and delicate abilities consistently require real practice. Subsequently, after the course finish, service centre should keep the rehearsing guideline to them by giving internal training and have senior staffs to screen and give the proposals.

(2) Creating a tool to enhance communication via a mobile application

Refer to the analysis of root causes in chapter 6, the communication between SA and customer may not ineffectual correspondence which may come from the lack of background about technical knowledge for both of them. Therefore, making a tool to help SA which can help to explain easier will upgrade comprehension of the customers leading to make a decision quicker. there are a couple of apparatuses that can be applied and utilized, in any case, the most noteworthy part that requires in the instrument is a visual capacity. SA must tell the name of parts, mechanical information, and negative impact about their vehicle if the customer would not change some parts or repair some points to make a clear understanding to the customer.

Accordingly, the visual function will be the key thing that customers can see the image during the clarification which will improve the correspondence to satisfy this shortcoming issue. In the present, there are a ton of instruments, for example, sending photographs, VDO call, the comparison picture between old and new parts. Currently, most companies are likely to have a mobile application. So, SA can take a picture or VDO of damage parts and send through a mobile application might be the possible way to do and save costs that it does not need to invest more but it just applies to use the existing tool. This tool can utilise either engine oil change or repair service. Moreover, they can develop this tool to let the customer know the service lists, estimated service time, estimated price and push the confirm button in this application to make an approval directly, leading to save time to call and paperless refer to Figure 7.4.

Figure 7.4: The visual mock-up function of additional repairing service lists via a mobile application

7.2.2 Solution for improving the workshop management

From the investigation in Figure 6.3 and 6.4, the inefficient workshop may happen from 2 significant causes. So, the solution must be made for reducing wastefulness of these 2 causes point by point in order to resolve this problem.

(1) The enhancement of chief mechanic's skills

For this issue, the fundamental factor is the ability and consideration regarding workshop management of controller or chief mechanic. Due to the background of chief mechanics, most of them are promoted from mechanics in the service centre which the ability of business management skills seems to be a weak point for them. Thus, there are 2 answers to this issue to rely upon appropriateness and status of chief mechanic. For the chief mechanics hat seem to be able to get familiar with the knowledge of management, the service centre ought to send them to train from experts and keep on observing the capacity of them by service manager. Unfortunately, some chief mechanics that appear to have no capacity to learn this subject but service centre still needs to choose them to be a chief mechanic due to the limitation of human resources. Moreover, the service centre may get extra staff to satisfy and deal with the control system. The extra staff can emerge out of either inside or outer recruitment relies upon current human resources and workload at that time.

(2) Set the KPI for non-reworking for engine oil change service

The utilisation of bay becomes one of the main problems. This issue can be settled by utilizing similar arrangements which are changing perspectives and training chief mechanics or utilizing staff to carry out the responsibilities that they cannot progress admirably. Moreover, to make it consciousness, the management should give a policy that the percentage of reworking must be 0% for this kind of service. This KPI will be one way to convince a chief mechanic back to give the concentration on quality control and reflect their performance, resulting in higher customer satisfaction.

7.2.3 Solution for improving parts management

(1) Better forecasting demand by improving internal culture and selecting appropriate forecasting methods

The reason for forecast error happens from the wrong choice to select an estimate technique which is related to current, seasonal or future patterns of parts. These causes may happen from the internal culture, attitude and understand of parts staff. Thus, training staffs is a staffs is a decent method to make starting appreciation of parts staff before monitoring them reliably and content in the instructional course

ought to involve the explanation of parts, life cycle, future patterns and proper forecasting methods.

Boylan, & Syntetos (2008) clarify in the perspective of service characteristics, parts can be detached, for example, such as maintenance groups and repairing groups. Indeed, different sorts of parts are less predictable than maintenance parts due to the majority of service jobs. Along these lines, the quantity of maintenance parts can assess from the desire for number of the customers in every period. This number of customers can be resolved from deals volume and retention rate. In this manner, parts inventory staffs ought to be settled by ascertaining from chronicled information and modify a few figures as indicated by occasional pattern as promotion and campaign.

The forecasting techniques can be classified into 2 significant groups namely qualitative and quantitative methods. For the qualitative method, it uses experiences, opinions, and individual judgment from specialists or without calculation while the quantitative technique will utilise repair historical information or assumption to compute and conjecture future trends while the quantitative strategy includes 2 primary sorts namely Time-series model and Associative model. (Boylan and Syntetos, 2008) explain about the life cycle of product. For the introduction stage, estimated by utilizing the time-series model should use rather than the associative model due to the existing historical data. After request begins, the service centre is likely to have enough recorded information to calculate a moving average, exponential smoothing, etc. can be implemented. In the last phase, the regression model might be applied by expecting that the sales volume will diminish.

(2) Proper level of safety stock

(2.1) Life cycle of parts

To improve the correctness of stock estimate, the life cycle of parts in Figure 7.5 is another point that ought to be educated in the training. As indicated by Boylan, and Syntetos (2008), the product life cycle comprises 4 stages to be specific introduction, growth, mutuality, and decline.

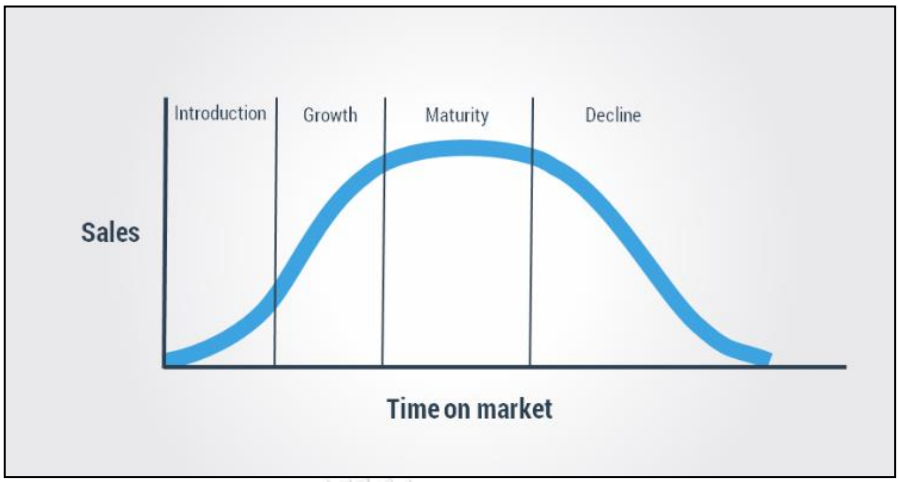

Figure 7.5: The stages of the product life cycle

Source: Available from https://www.toolshero.com/marketing/product-life-cycle-stages/ [Accessed 1 May. 2020].

This idea can be applied in safety stock levels and control. For example, the stock should focus on things that should be the accessible and the underlying measure of requesting in the first stage. For growth and maturity stages, the association may make a boundary condition to ascertain the requesting amount and recurrence reliably. For the last stage, requesting ought to send a one-time order to cover all requests in the last time frame since providers appear to reduce the old model production and change to convey the new model.

(2.2) The commitment between the company and parts suppliers

Overall, lacking wellbeing stock may occur from the vulnerability of supply and demand. For the stock side, the obligation of suppliers as far as lead time and amount are the central factors that keep away from exorbitant or deficiencies of security stock levels. If providers can continue as their responsibility continually, it is inconsequential to store extra stock. Besides, if there is no issue with the obligation of suppliers, the association will have chance to focus on demand estimation particularly for maintenance parts which are probably going to utilize each day.

There are a few different ways to improve the performance of supplier with them. To begin with, improving correspondence among association and suppliers, sharing and clarifying are the key things that will enhance supplier relationship. The organisation must state and disclose working to suppliers unmistakably. Second, in terms of the service agreement, the weakness of supplier relationship management between the company and suppliers will make suppliers feel unwilling to make long term commitments or investments. Furthermore, the arrangement consent is a good method to make confirmation to the providers and for the organisation, it is a decent method to control and keep the relationship together along with the agreement. Moreover, the data of the agreement will permit the providers to work and plan their resources to satisfy the necessity of organising in advance. However, the organisation should evaluate the performance of suppliers by setting measurable key performance indexes such the acceptable percentage of defects per time and delivery on-time.

Last, the organisation should review the correctness of suppliers' information. Accordingly, cross-checking information will assist with lessening mistakes which may affect the organisation. For the demand side, it may uncontrollable. Thus, the answer for this issue is improving the exactness of forecasting which the writer has just clarified in the past segment. Moreover, another arrangement that can improve the accessibility of parts makes a service appointment. Explaining clients to make an appointment before 1-2 days will assist staff to prepare items and plan to order parts ahead and the customer can do it via a mobile application conveniently.

After improving the operational details in the car workshop, next step should be the 5S concept which will be a valuable idea to improve all strategies to be faster and turn into the optimal standard model. From a literature review, this idea is appropriate to work and will make environment improvement and cause representatives to have great conditions. The reception and workshop areas should be implemented 5S significantly because the reception space will be used by customers and SA. The document should be sorted following category to make it easier to find and make a good environment while the cleaned workshop will decrease accidents which lead to the high security rate staff during working and improve a workplace which will diminish the interruption time of working day.

Furthermore, it will help chief mechanic to arrange workshop effectively and help staffs to find equipment or required items simpler and quicker. (Falkowski and Kitowski, 2013)

Chapter 8
Expected result and future development

Generally, the writer proposed the solution that it does not change any business strategies inside the car service provider, however, it makes the current workshop flow to be progressively productive, decline risks from mistakes which may lead to reworking, resulting in the lead time reduction. As indicated by chapter 6, there are 10 wasteful activities from the current operation pre-checking phase, maintenance phase, and post-checking phase. From chapter 7, the arrangements are intended for improving the rate of productivity of working for 10 wasteful factors. Figure 8.1 is shown the improved layout of the service centre. The following paragraph will clarify the result of improvement inside the process after proposing the first 2 weeks between 7.00 – 11.00 am in August 2020. With the limitations, some solutions may not happen during August 2020. However, some steps can implement and get the results in this chapter.

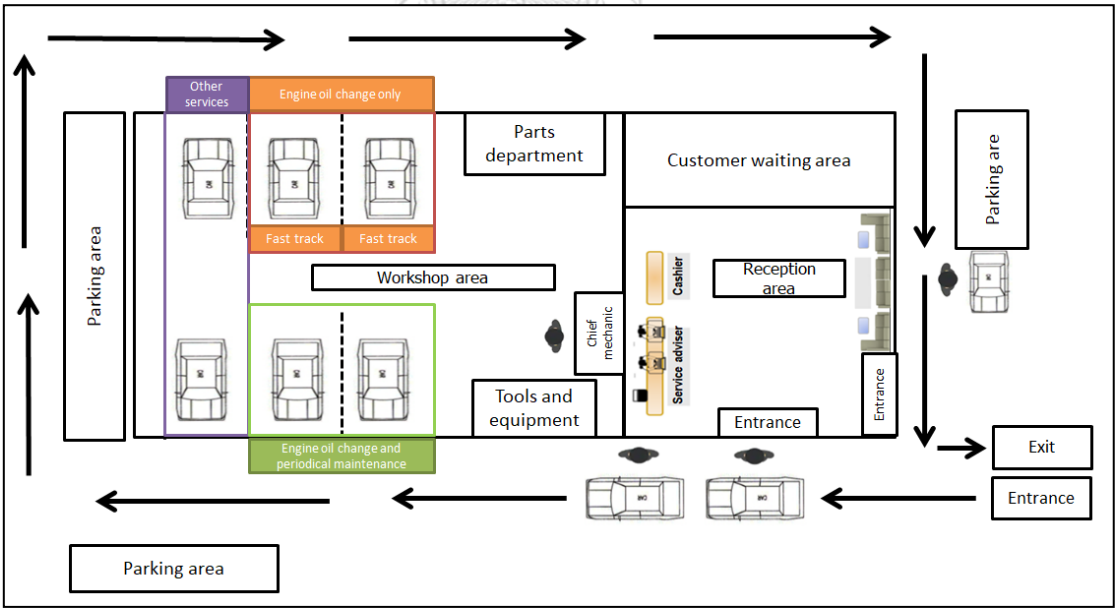

Figure 8.1: The improvement layout of authorised service centre

Pre-checking phase

For this stage, both of the SA's abilities and workshop management improvement will be the main factors to decrease client's waiting time. 4 main points of these non-value activities will decrease because of the improvement of SA's working, better communication skills, reduce some duplicated work and apply a function on a mobile application.

For the principal purpose of lead time decrease, because of utilised effective time for doing faster vehicle condition check, offering and explaining service. So, SA will have more opportunities to manage different cases which means the idle time for welcome will diminish and the case that clients need to queue up to 20 minutes in the peak hour will not occur surely. Second, lead time of doing preliminary vehicle conditions will absolutely decrease due to the reduction of duplicated checklists which are the same as in the workshop. SA has to walk around the vehicle and confirm scratch and dent on the vehicle with the customer before sending it to the workshop to protect the customer's complaint after finishing the service.

In the third point, the improvement of mechanical knowledge skills for SA and the communication improvement will enhance the discussion among SA and clients better. It will assist SA with using time in the discussion and make offering service easier and faster. Moreover, the idle time for moving vehicle into workshop in pre-checking phase will be improved. The decrease of lead time occurs from the improvement of workshop management to make a faster service time in the maintenance phase.

The reduction of time management in terms of quicker maintenance time and workshop management brings about the increased rate of bay turnover which means service centre will have increasingly accessible spaces for responding jobs smoothly. This improvement brings about the diminishing of waiting time for getting in the workshop. Figure 8.2 and 8.3 are shown the results after implementation.

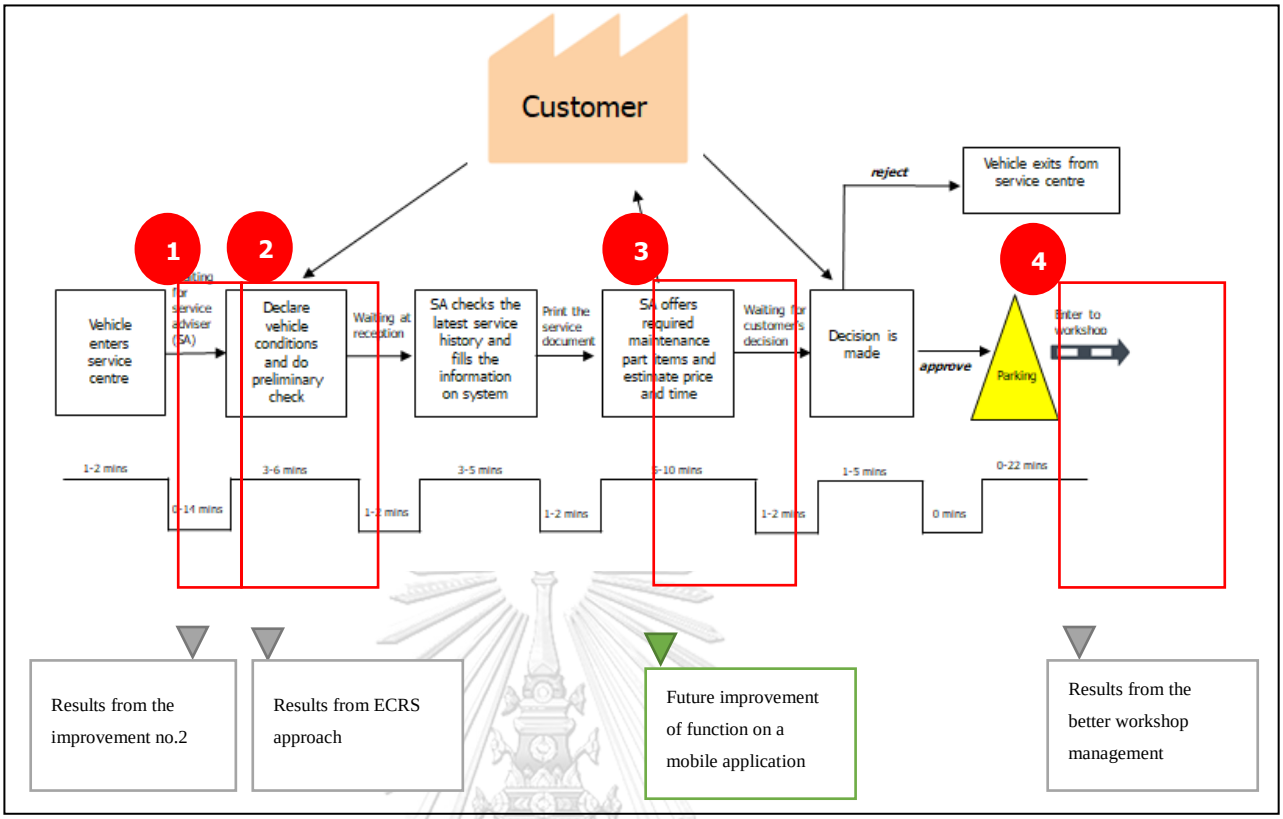

Figure 8.2: The results of engine oil change process in the pre-checking phase for non-appointment

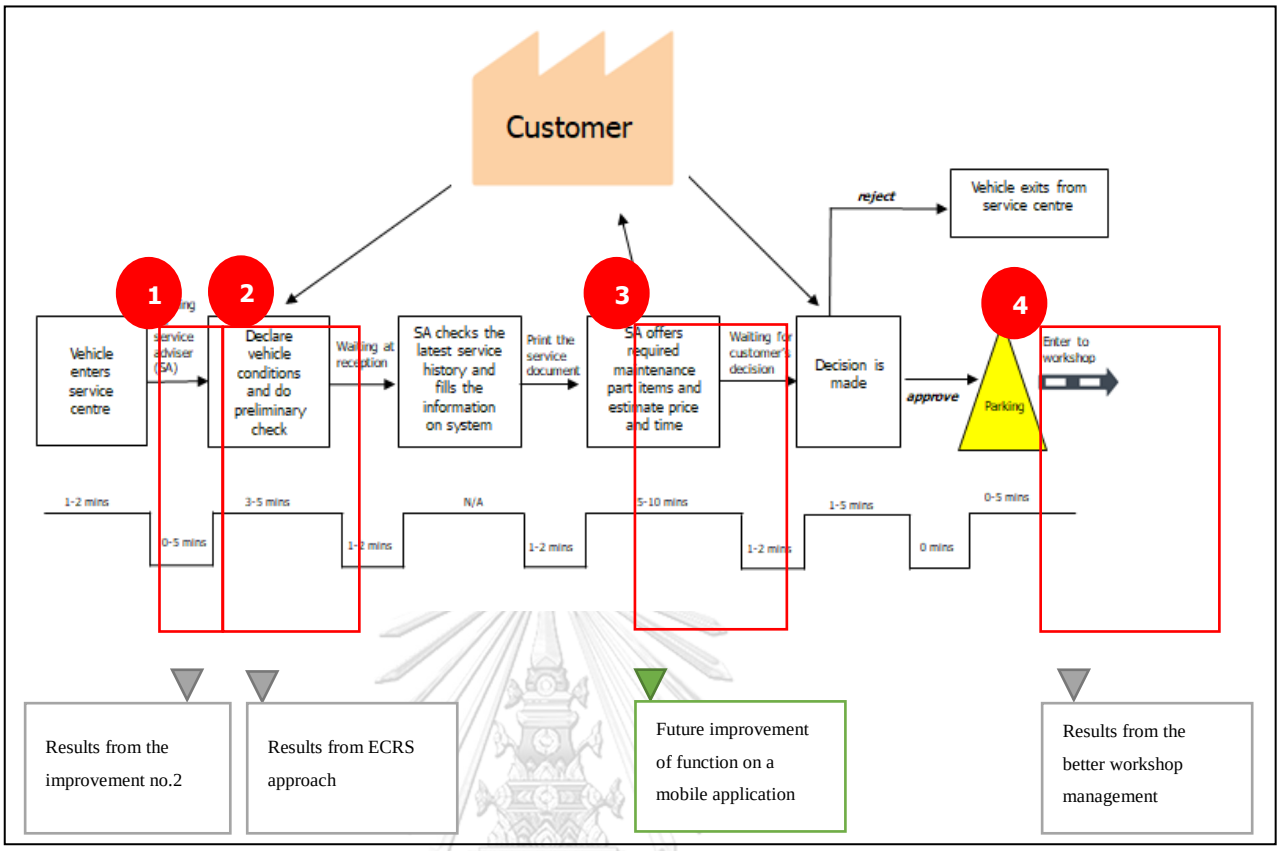

Figure 8.3: The results of engine oil change process in the pre-checking phase for appointment

Maintenance phase

In this stage, the solution of lead time reduction will happen in 4 points. It will be divided into the solutions for non-appointment and appointment customers from Figure 8.4 and 8.5. Starting with non-appointment, the fourth point is job assignment. In the current VSM, this progression needs to use at least 5 minutes or maybe up to 10 minutes to finish. After improving the queuing system of job assignment, utilised time may diminish to only 3-5 minutes in engine oil change jobs and tasks will be implemented through the framework. For the sixth point, currently, it seems to make the waste time that mechanic has to walk to order parts, wait for getting parts and then back to the bay which may utilise the time between 11 to 20 minutes. For the improvement plan, part staffs will receive the parts order from the system since service advisor fills the service lists into the system, parts staff can

prepare the order immediately and then they can walk to bring the order to mechanics or service centre can set one staff to bring the items to mechanics. In this case, the time will be reduced till 5 minutes that the mechanic may need to wait for part staff to bring the order at the bay.

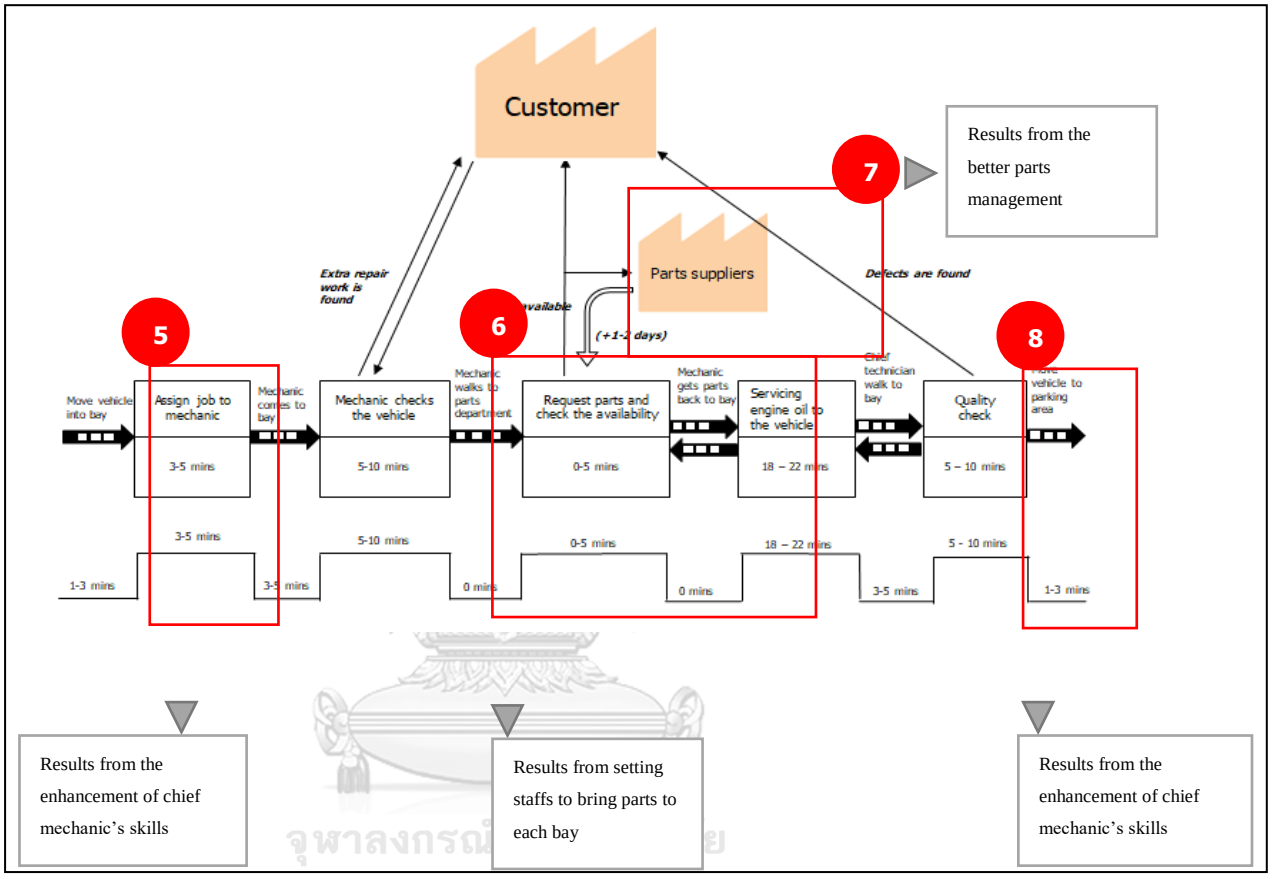

Figure 8.4: The results of engine oil change process in the maintenance phase for non-appointment (Non Dual mechanics)

Moreover, for appointment customers, they can come into the fast track lane along with the booking time immediately. From Figure 8.5, it can see that mechanics just wait for the request items at bay which is already prepared from the booking in advance. Moreover, 'Dual mechanics' can do vehicle checks together and then change engine oil to reduce congestion and make the flow of workshop smoother. This concept can help to reduce service time of checking the vehicle and servicing maintenance in this phase up to 50%.

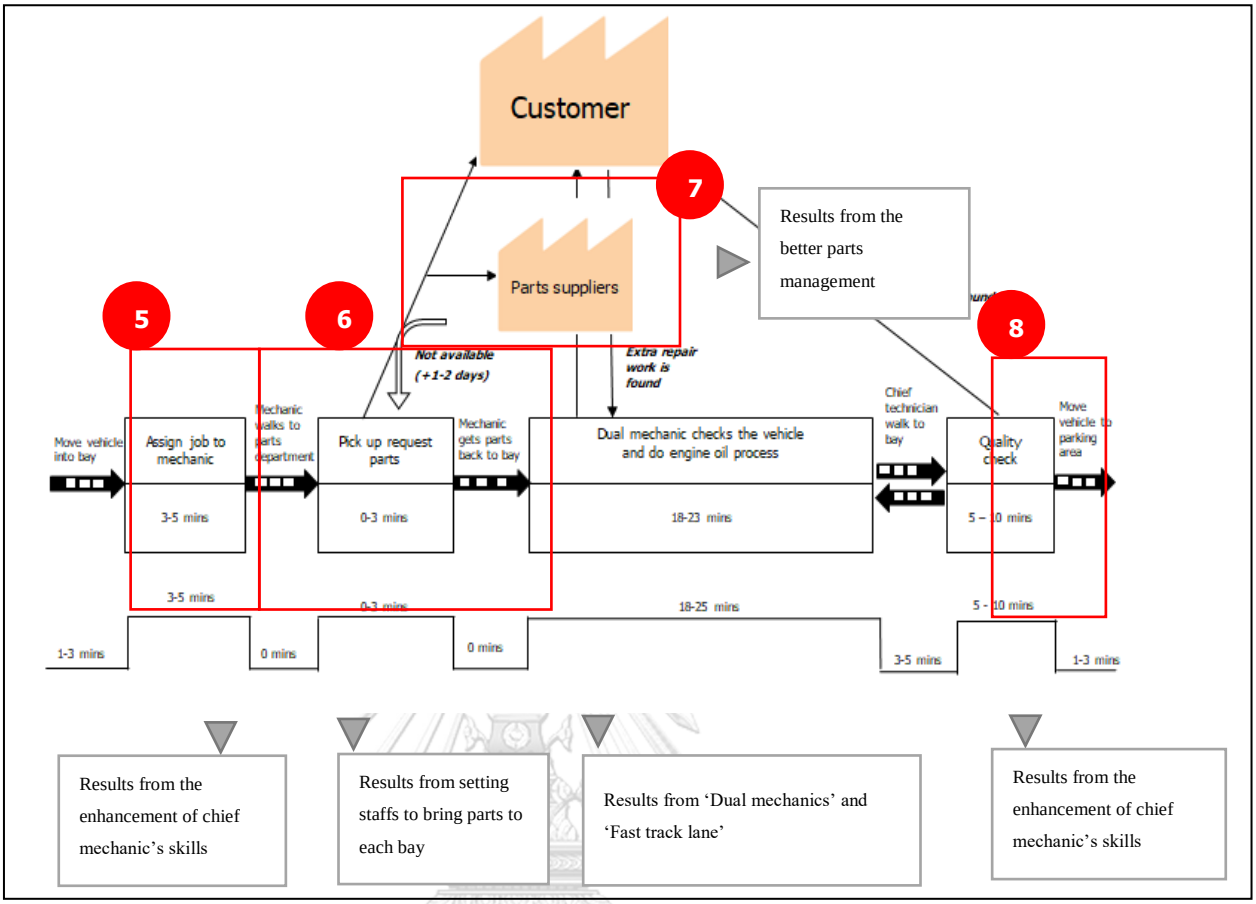

Figure 8.5: The results of engine oil change process in the maintenance phase for appointment (Dual mechanics)

For the seventh point, the decrease of part shortage, the correctness rate of forecasting, safety stock, and supplier relationship will make overall parts inventory better. When parts have been ready to supply for most of the jobs, waiting time for requesting additional parts will recover which make the process speedier. Finally, the eighth point, the decreasing number of cases such as QC failure and repeat maintenance job, in terms of better workshop management will make chief mechanic has more opportunity to be counsel other mechanics in troublesome cases including doing quality control. This advancement will enhance the rate of reworking jobs which should be 0% for engine oil changing service. When the maintenance phase complete quicker, it will prompt the expansion of bay turnover which make an advantage to the fourth purpose of pre-checking stage. The effect of change will not

only affect one step, however it additionally influences to other stages which make generally lead time to decrease.

Post-checking phase

For the post-checking stage in Figure 8.6, both of non-appointment and appointment are not different. Waiting time for delivery finished car to the customer and the procedure of confirmation serviced lists are 2 wasteful activities. In this case, the customer will come to get the completed vehicle, there is no specific solution to reduce lead time because the company cannot control when the customer will come. In any case, the methodology of customer's confirmation can upgrade by the improvement of working of SA and utilise a mobile application of the company to make it more convenient.

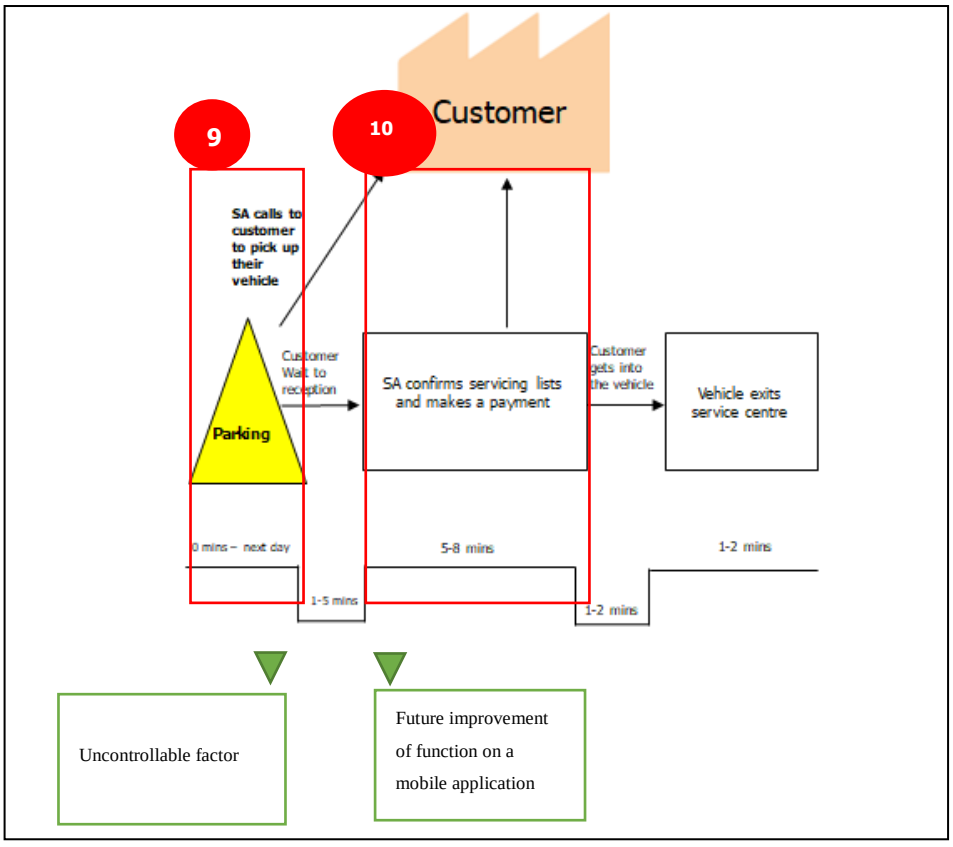

Figure 8.6: The results of engine oil change process in the post-checking phase for both non-appointment and appointment

In conclusion, from the expected result in Table 8.1 and 8.2, it can show the difference between current and future improvement and it may say that the advantage for the customer can be divided into 2 main groups. First, customers who would like to wait at the service centre during servicing time are likely to concern about the time and this research can improve over the whole process for engine oil changing service from 1.3-3.3 hrs. to an estimated 1.1 to 2.6 hrs. for walk-in customers and from 1.2-2.5 hrs. to 0.9 to 1.8 hrs. for booking customers. This customer group will get the advantages after improving 10 main issues directly because the overall service time will be diminished. So they may not consume the time at the service centre too long. However, second, some customers would not like to wait at the service centre. They will get the advantages after improving the main issues in the pre-checking and post-checking phases only because they do not consume time during maintenance phase. However, either customer waiting or not waiting can get the advantage of the reduction of engine oil change lead time, resulting in business sustainability. For future suggestion, dealer should implement 100% appointment which can be an effective tool to help staff manage internal operations. Parts shortage and longer lead time may not happen if dealer can know the demand for each day and prepare the effective staffs and parts in advance. Furthermore, dealer can arrange the time slot to move the congestion in the workshop especially the period of 7.00-11.00 am to the afternoon session. From Figure 8.5, Toyota in Brunei would like to convince customers to do a service from 1 pm to 4 pm. So they will offer up to 20% discount for customers who make pre-appointment during the time period. So, dealer may offer the guarantee finishing time with afternoon booking customers to make some special points rather than customers who come in the morning session. For example, if the customer comes to do an engine oil change at 1 pm, your car will be done within 45 minutes. This statement can convince customers who are convenient to come after 11 am and concern about the time to change their minds to join in the afternoon period which can reduce both morning congestion and afternoon idle time through the appointment scheduling.

Figure 8.7: Toyota's afternoon promotion for pre-appointment in Brunei

Source: Available at: https://toyota.com.bn/promotions-and-events [Accessed 26 July 2020].

Table 8.1: The comparison between before and after improving engine oil change service time

Phase	No.	Non-value activities	Main problems	Solutions	Time used (before)		Time used (after)	
					Non-appointment	Appointment	Non-appointment	Appointment
Pre-checking	1	Waiting for service advisor (SA)	- Issue of inefficiency and communication skills of SA working	- Result from second and third points	0-20 mins	0-5 mins	0-14 mins	0-5 mins
	2	Declare vehicle conditions and do preliminary check	- Issue of inefficiency and communication skills of SA working - Issue of poor workshop management	- The enhancement of SA skills - Eliminate duplicated preliminary check	5-10 mins	5-10 mins	3-6 mins	3-5 mins
	3	Offer required maintenance parts items and estimated price and time	- Issue of inefficiency and communication skills of SA working	- The enhancement of SA skills - Creating a tool to enhance the communication via mobile application	5-10 mins	5-10 mins	5-10 mins	5-10 mins
	4	Waiting for vehicle's moving into the workshop	- Issue of poor workshop management	- Result from second and third points	0-30 mins	0-5 mins	0-22 mins	0-5 mins
Maintenance	5	Assign job to mechanic	- Issue of poor workshop management	- The enhancement of chief mechanic's skills	5-10 mins	5-8 mins	3-5 mins	3-5 mins
		Mechanic comes to bay			3-5 mins	3-5 mins	3-5 mins	3-5 mins
	6	Mechanic walks to parts department	- Issue of parts management	- The enhancement of chief mechanic's skills	3-5 mins	3-5 mins	0 mins	0 mins
		Mechanic requests parts and check the avalibility			5-10 mins	0-3 mins (Pick up request parts)	0-5 mins (Wait for request parts at bay)	0-3 mins (Wait for request parts at bay)
		Mechanic gets parts and back to bay			3-5 mins	3-5 mins	0 mins	0 mins
	7	Insufficiency of parts	- Issue of parts management	- Better forecasting demand by improving internal culture and selecting appropriate forecasting methods - Life cycle of parts - The commitment between company and parts suppliers	1-2 days	1-2 days	0 mins	0 mins
	8	Quality control check	- Issue of poor workshop management	- The enhancement of chief mechanic's skills - Set the KPI for non-reworking for engine oil change service	5-10 mins	5-10 mins	5-10 mins	5-10 mins
Post-checking	9	Waiting customer comes to receive the vehicle	- Issue of inefficiency and communication skills of SA working	N/A	0-next day	0-next day	0-next day	0-next day
	10	Service confirmation and payment	- Issue of inefficiency and communication skills of SA working	- The enhancement of SA skills - Creating a tool to enhance the communication via mobile application	5-10 mins	5-10 mins	5-8 mins	5-8 mins

Table 8.2: The total engine oil change service time before and after improving engine oil change service time

Phase	Total time used			
	Before (Non-appointment)	Before (Appointment)	After (Non-appointment)	After (Appointment)
Pre-checking	18-88 mins	15-43 mins	16-70 mins	13-38 mins
Maintenance	54-96 mins	45-87 mins	39-68 mins	31-54 mins
Post-checking	8-19 mins	8-19 mins	8-17 mins	8-17 mins

Chapter 9
Conclusion

Enhancing the standard and procedure of the service centres in Thailand by reducing engine oil changing service time is the highest expectation of this research. Starting the examination with VSM, it illustrates the overview of the service process and clearly shows non-value activities in the procedure. After analysis, the maintenance phase has the longest service time which impacts overall lead time. All out utilised time for this phase can be up from 0.9 to 1.6 hours from the whole process during 1.3-3.3 hrs. of non-appointment and from 0.8 to 1.5 hrs. from overall during 1.2-2.5 hrs. of appointment which cannot compete with other branded and non-branded garages in the market.

The 10 non-value activities come from the analysis of VSM which uses the secondary repair history service and fishbone diagram from secondary customers and service manager surveys. Both of these sources can show the issues on different sides. After wasteful factors were demonstrated from VSM, the outcome was summed up by utilizing inductive methodology and it demonstrated that 10 wasteful activities including 4 points in pre-checking, 4 points in maintenance, and 2 points in post-checking phase. So, there are 3 significant reasons for excessive engine oil change lead time namely the issue of the inefficiency of service advisor (SA), the issue of poor workshop management and the issue of parts management.

For the summary, in the pre-checking and post-checking phase, it slightly impacts on all lead time. However, the procedure can be abbreviated by diminishing lead time in preliminary vehicle condition which is the duplication of work between SA and mechanic and improve the communication skill of SA to make a better service explanation. The explanation behind long lead time is the failure of SA working and technical abilities. This issue occurs from the capacities of SA regarding both mechanical aptitudes and technical abilities which can improve through training and rehearsing. Using a visual tool on a mobile application will support the clarification and comprehension of clients to reduce the explanation time.

For the issue of workshop management, root causes come from poor time management and lack of doing quality control. The primary method is preparing the management training for enhancing chief mechanic's management skill. Moreover, the management should evaluate their chief mechanics' skill to stimulate the staff and monitor the current situation of the company closely as the idea of nonstop improvement in Lean guidelines. In case of reworking, the management should give 0% reworking for engine oil change service to chief mechanic which is the direct responsibility to force them to give importance on this issue. In addition, the improvement of training quality and retention plans are another significant thing that continues the quality of service jobs in the long-term. Furthermore, chief mechanics should analyse the service historical data to see the trend of service volume each day and prepare workshop management during peak hour. Moreover, Dual mechanics and Fast track lane can be an effective choice to support the workshop process during the congestion time and make the workflow smoother. Both of these can utilise time from 0.9 to 1.8 hrs. to compete with other brands. So, for future improvement, the service centre should convince customers to make a reservation 1 day in advance up to 100% to make an effective workshop time scheduling and relevant staff can prepare bay or parts prior.

The last reason is the ineffectiveness of the parts management. This issue happens from 2 fundamental factors namely inaccuracy of forecast and inappropriate safety stock level. To determine and upgrade this issue, parts staff is the key man to resolve these issues. Parts staff should be trained in a significant topic appropriately. Part staff ought to comprehend and bring to apply in conjecture in forecast namely parts categories differentiation, the life cycle of parts, suggestion plan to select forecast method appropriately. For improper stock level management, this issue happens from the unpredictable demand and supply. Refer to customer demand, the improvement of forecast precision will make organisation can arrangement wellbeing stock easier. Moreover, refer to supply side, the development plan should consider the collaboration between the company and the supplier to generate better service level agreements, reduce defects by cross-checking and planning together. These things will improve the working management of providers and lead to monitor stock levels properly. Furthermore, the solution for enhancing organisational attitudes and skills

by training and provide the tools to support their work will be useful in an actual situation. Overall, for the improvement, it can be reduced the total engine oil change service time to utilise only 1.1 to 2.6 hrs. without ‘Dual mechanics’ for non-appointment and 0.9 to 1.8 hrs. with ‘Dual mechanics’ and ‘Fast track lane’ for an appointment which can lead to higher customer satisfaction.

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APPENDICES

Ethical approval confirmation

wmg-overseas Resource
Mon 1/27/2020 6:49 PM

To: Datoh, Sufee
Cc: Chula Systems Engineering CUSE <cuse.chula@gmail.com>

Dear Miss Datoh,
Warwick ID Number: 1838796
This is to confirm that your Supervisor's Delegated Approval form has been received by the WMG Overseas Programmes's Office, confirming that your project: ENGINE OIL CHANGE LEAD TIME REDUCTION OF COMMERCIAL VEHICLE SERVICE CENTER IN THAILAND **does NOT require ethical approval.**
When you submit your project please write N/A against the ethical approval field in the submission pro-forma and include a copy of this email in the appendices of your project.

VITA

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