

In-night spare parts distribution for automotive service centres

Mr. Sorachet Kongkiatpaiboon



บทคัดย่อและแฟ้มข้อมูลฉบับเต็มของวิทยานิพนธ์ตั้งแต่ปีการศึกษา 2554 ที่ให้บริการในคลังปัญญาจุฬาฯ (CUIR)
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การศึกษาการจัดส่งอะไหล่ให้ศูนย์บริการรถยนต์ในเวลาฉุกเฉิน



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การจัดส่งชิ้นส่วนอะไหล่รถยนต์เป็นกระบวนการสำคัญในการดำเนินงานของธุรกิจหลังการ ขายของบริษัทรถยนต์ ในปัจจุบันนี้บริษัทรถยนต์หลายบริษัทหันมาสนใจการพัฒนาและปรับปรุงการ ทำงานในส่วนของบริษัทหลังการขายมากขึ้นเพื่อเพิ่มความได้เปรียบในการแข่งขันในตลาด เหตุผล สำคัญเหตุผลหนึ่งคือ ธุรกิจหลังการขายนั้นเป็นส่วนสำคัญในการรักษาลูกค้า โดยปกติแล้วนั้นลูกค้าจะ มีการติดต่อและใช้บริการในส่วนของบริษัทหลังการขายมากกว่ากระบวนการขายซึ่งลูกค้าจะเข้าไป เกี่ยวข้องเพียงในช่วงการตัดสินใจซื้อขายหลังจากนั้นจะเป็นส่วนของบริษัทหลังการขายที่จะมีส่วน สำคัญต่อลูกค้าจนกระทั่งสินค้าเสื่อมสภาพ ดังนั้นธุรกิจหลังการขายจึงเป็นส่วนงานที่ควรจะมีการ พัฒนาอย่างต่อเนื่องเพื่อให้มีการทำงานที่ดียิ่งขึ้นไป

บริษัทกรณีศึกษาเป็นผู้นำตลาดรถเพื่อการพาณิชย์ในประเทศไทย บริษัทมุ่งมั่นที่จะพัฒนา ธุรกิจหลังการขายในทุกปีเพื่อรักษาตำแหน่งผู้นำในตลาดรถเพื่อการพาณิชย์ เวลาหยุดรอคอยของ รถยนต์เป็นสิ่งที่ถูกจับตามองมากขึ้นเพื่อเพิ่มความพึงพอใจให้กับลูกค้า โดยในวิทยานิพนธ์ฉบับ ก่อกล่าวถึงการสร้างวิธีการทำงานใหม่ในส่วนของการจัดส่งสินค้าให้ถึงมือลูกค้าเร็วขึ้นด้วย "วิธีการจัดส่ง ในเวลากลางคืน" วิธีการดังกล่าวนี้ยังไม่เคยนำมาใช้ในธุรกิจรถยนต์ในประเทศไทยมาก่อน ซึ่งบริษัท กรณีศึกษาจะเป็นบริษัทแรกในประเทศไทยที่นำมาประยุกต์ใช้จริง วิธีการต่างๆทาง Logistics and Supply chain ได้ถูกนำมาใช้ในงานวิจัยฉบับนี้ การทดลองการดำเนินงานตามขั้นตอนที่กำหนดไว้ เป็นส่วนสำคัญของการทำวิจัยในครั้งนี้โดยได้มีการดำเนินการส่งสินค้าเวลากลางคืนจริงในช่วงเดือน กุมภาพันธ์ 2559 ที่ผ่านมา

ในส่วนของผลการทำวิจัยนั้นพบว่า การดำเนินการจัดส่งสินค้าในเวลากลางคืนทำให้ต้นทุน การขนส่งลดลงถึงร้อยละ 35 เทียบกับปีกรณีที่ไม่ได้ใช้การจัดส่งเวลากลางคืน รวมไปถึงระยะเวลา การรอคอยของลูกค้าที่ลดลงไปโดยรวมถึง 124 ชั่วโมงต่อวัน นอกจากนี้จำนวนรถขนส่งและเส้นทาง ขนส่งก็จะถูกลดลงไปจาก 11 เส้นทางเหลือเพียง 5 เส้นทางเท่านั้น

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Spare parts distribution is one of key processes in after sales service of automotive business. Nowadays, many automotive companies are focusing on improving after sales function to gain competitive advantage over competitors. Therefore, after sales business has to improve continuously for better customer service. The Case Study Company is a market leader in commercial vehicle products. They aim to improve after sales business processes every year for retain position of firm in market. Vehicle downtime was used as a key indicator to measure customer satisfaction rate because longer downtime is not acceptable for commercial vehicle users. The longer vehicle downtime results in less revenue of vehicle users because they cannot use vehicle for operating their job appropriately. Hence, the Case Study Company and after sales function concerned on downtime monitoring and generate solution to reduce vehicle downtime.

This research studied for creating new transportation scheme “NIGHT TIME DELIVERY”. It has never been used by automotive firms in Thailand before therefore, night time delivery is a most recent innovation of Thailand’s automotive firms and the case study company will be the first company in Thailand for using night time delivery. In conclusion, the spare parts waiting time of service centre will be reduced 124 hour per day and It also resulted in reduction of transportation cost which reduced 35%. Lastly, the number of transportation routes was reduced from 11 routes to 5 routes because of longer operation time of transporter.

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CONTENTS

	Page
THAI ABSTRACT	iv
ENGLISH ABSTRACT	v
ACKNOWLEDGEMENTS	vi
CONTENTS	vii
LIST OF FIGURES.....	xi
LIST OF TABLES	xiii
CHAPTER I Introduction.....	1
Company Background.....	1
Current parts distribution processes	2
Statement of the problem	5
Research objective.....	12
Scope of study	12
Expected benefits.....	13
CHAPTER II Literature and Theoretical Review.....	1
Theoretical and Literature review	1
Customer service and Logistics.....	1
Operation Strategy.....	6
Problem Solving Tools.....	8
Lean concept: ECRS	11
Supplier Selection and Evaluation.....	14
Management of Changes.....	15
Best Practices Review.....	20

	Page
CHAPTER III Existing Conditions & Methodology.....	1
Existing conditions.....	1
Delivery commitment and order type	1
“One Day Two Trips” delivery scenario.....	3
Operation hour of Service centres	3
Current Transporter	4
Transportation costing	4
Methodology.....	6
Overall Workflow	6
Operation strategy	7
Create new transportation scenario.....	16
Operation design.....	19
Container design	24
Pilot service centre selection method.....	27
The criteria of pilot service centre selection	31
Evaluation method.....	37
Chapter IV Implementation	1
The Blue Print of Changes.....	1
Delivery Time Table of night time delivery.....	1
Delivery and receiving process.....	3
Pre-Implementation processes of Night Time Trial Delivery	4
Discussion with concerned parties.....	4
Pilot service centre selection.....	8

	Page
Selection of Transporter for Night time delivery service.....	12
Plan of delivery	17
Equipment.....	19
User training on Operation process during Trial.....	21
Schedule of implementation	21
Implementation processes of Night Time Trial Delivery	24
Order Receiving	24
Execute Plan of Delivery	25
Delivery Process	26
Feedback process	27
Chapter V Results & Discussion.....	1
Actual Trial Result.....	2
Delivered Volume.....	2
Actual Shipment Time.....	4
Parts Waiting Time	6
Simulated Results	8
Loading Efficiency	9
Cost-Performance Index (CPI).....	10
Estimation of new transportation cost.....	11
Feedback of customer.....	12
Chapter VI Conclusion & Recommendation.....	1
Conclusion.....	1
Obstacles	5

Recommendations.....	7
Appendix.....	1
Appendix A Raw test result data	2
Appendix B Example of customer feedback survey form.....	4
REFERENCES	15
VITA.....	17



LIST OF FIGURES

Figure 1: Major products of The Case Study Company	1
Figure 2: The organisation structure of The Case Study Company	2
Figure 3: Parts distribution process of The Case Study Company.....	4
Figure 4: Causes of downtime in service centres.....	6
Figure 5: Examples of one-stop service garage in Thailand.....	7
Figure 6: The company customer survey: Reasons for choosing non-authorized service centres	8
Figure 7: The ratio of spare part waiting time of service centre in Bangkok area	9
Figure 8: Ratio of Order type and ordering time of Service centres in Bangkok	9
Figure 9: Average loading efficiency of Bangkok Route (May - Oct 2015).....	10
Figure 10: Percentage of delay delivery of Bangkok routes	12
Figure 11: The comparison between Core Product and Logistic Element on the importance of firm element [Form: (Rushton, et al., 2015)]	15
Figure 12: The components of customer services.....	17
Figure 13: The seven right of customer service.....	18
Figure 14: Example of Fishbone Diagram [From (Richards & Grinsted, 2013)]	23
Figure 15: Example of 5WHYs method [From: (Richards & Grinsted, 2013)].....	24
Figure 16: PUDOs of DANX in Scandinavia area.....	35
Figure 17: Night time delivery research work flow	44
Figure 18: Cause and Effect diagram of Vehicle downtime problem	48
Figure 19: Factors which cause of downtime in after sales of commercial vehicle business	49
Figure 20: The comparison of current and new operation work flow.....	60

Figure 21: New delivery time table for using in night time delivery.....	61
Figure 22: Sample of container which used in night time delivery.....	62
Figure 23: Layout of spare parts store with receiving area	63
Figure 24: The first option of pilot service centre selection scheme “Select by current transportation route”	65
Figure 25: The second option of pilot service centre selection scheme “Select by specific service centres”	67
Figure 26: The comparison between two options of pilot service centres selection scheme	68
Figure 27: The percentage of loading efficiency of Bangkok route during January to October 2015.....	69
Figure 28: Percentage of delayed delivery of Bangkok route during January to October 2015.....	71
Figure 29: Average total delayed time per month during January to October 2016 ...	73
Figure 30: Five process of Night time trial delivery pre-implementation process	79
Figure 31: The proposed steps of Transporter bidding process	88
Figure 32: The four main processes of Night time trial delivery.....	99
Figure 33: Delivery Process Flow and time schedule	100
Figure 34: Delivery Process of Transporter.....	102
Figure 35: Average delivered volume of Bangkok Route 3	104
Figure 36: Delivered volume of Night time trial delivery (only pilot service centre). 105	
Figure 37: Arrival time of each destination of Bangkok route 3 during Night time trial.....	108
Figure 38: Benefit of night time delivery referred to customer's point of view	116
Figure 39: Compared work flow between current operation and night time delivery	119

LIST OF TABLES

Table 1: Order and Delivery time of spare parts distribution	3
Table 2: Delivery time of Bangkok service centres.....	39
Table 3: Criteria of customer satisfaction factor for spare parts business.....	52
Table 4: WHY-WHY method for finding roots cause of three main problems.....	55
Table 5: HOW-HOW method for finding solution to avoid Traffic jam problem.....	56
Table 6: Improvement action for new transportation scheme by using ECRS.....	58
Table 7: Delivery timetable of trial period.....	77
Table 8: Delivery timetable of full implementation period.....	77
Table 9: the result of applied pilot service centre selection model	84
Table 10: The quoted transportation price of four transporters for bidding of night time delivery.....	90
Table 11: The comparison between two selection options of transportation bidding	91
Table 12: Table of estimated arrival time of night time trial delivery	93
Table 13: Driver schedule for night time trial delivery	94
Table 14: Implementation schedule of night time trial delivery	98
Table 15: Delivered volume of Bangkok routes during Trial Delivery Period	106
Table 16: Arrival time and actual shipment time of Bangkok route 3 during Night Time trial delivery.....	107
Table 17: Comparison between current receiving time and new receiving time	109
Table 18: Delivered volume of simulated routes in case of full implementation.....	111
Table 19: Benefit comparison between current operation and night time delivery..	114

CHAPTER I

Introduction

Company Background

The Case Study Company is one of the most well-known automotive distributors in Thailand. The Case Study Company sells vehicle and spare parts to nationwide dealers, provide technical information for service centre and responsible on all marketing activities. The major products of company are commercial vehicle, light-commercial vehicle and PPV. There are various product lines in each product segment, but the most popular product in Thailand market is Pick-Up vehicle. The company first-tier customers are nationwide dealers. Currently, the company has more than three hundred nationwide dealer network. The company has a role to facilitate dealer's operation in vehicle sales and after sales services. The dealer delivers product and services to end customers, which are vehicle users. For commercial vehicle, main target customers are company users which use for transportation. Light-commercial vehicle focuses on both company and working professionals. PPV mainly focuses on executive managements and wealthy families



Figure 1: Major products of The Case Study Company

Company does not operate on vehicle sales only, but it also includes spare parts sale which is a part of After-sales businesses. For all spare parts operations, they are controlled and operated by Parts Supply and Logistics department (PSL). It includes five sections in department, namely; Administration, Stock control, Order management, Parts information and Parts Logistics. For parts logistics section, it

controls warehouse operation and transportation which are in charge of parts distribution process from warehouse to nationwide dealers. The structure of company is showed in Figure 2.

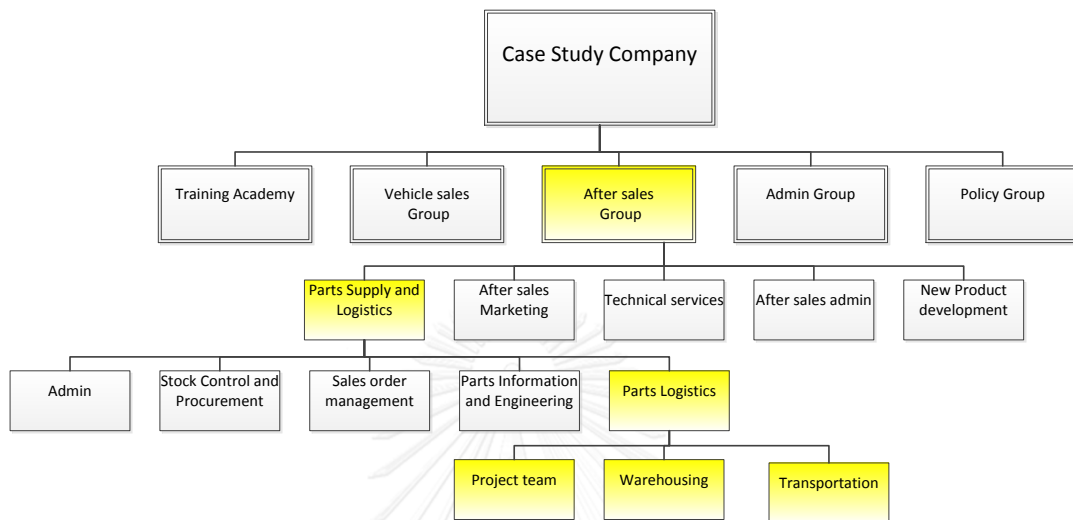


Figure 2: The organisation structure of The Case Study Company

Spare parts operation has become a vital part of company for a long time. Availability and responsiveness of spare parts are key factors to maintain customer relationship which results in the high market share in automotive market. Commercial vehicle customers demand shortest waiting time when their vehicles have to be repaired. The longer waiting time result in higher loss of income. Therefore, the high parts availability rate and responsiveness will reduce waiting time of repairing and customers can get vehicle back to operate faster. The company aims to improve parts distribution process continuously for the sustainability of business growth.

Current parts distribution processes

The Case Study Company's main warehouse is located in Bangkok area, and another warehouse is located in Bangkok's suburb. Both two warehouses have a key role to supply spare parts to nationwide dealers. In parts distribution processes, there are

four transporters deal with company, each transporter handle different areas as follow;

Bangkok route

There are 12 routes for parts distribution in Bangkok area. Modified pick-up called “ECONOVAN” is used in Bangkok area as a main transportation mode. All trucks deliver spare parts to service centre by door-to-door. The transportation model of Bangkok area is “One Day Two Trips”. This model allows service centres in Bangkok and suburb areas to order with two order cut times per day. First order cut time is 11:00 and second order cut time is 16:00.

All orders which are received before morning order cut time will be distributed to service centre on the same day before 16:00. Orders which are received before second order cut time. They will be distributed on next day morning. The detail of order time is showed in Table 1.

Table 1: Order and Delivery time of spare parts distribution

Transportation route	Order Time	Delivery time
Bangkok Routes	08:00 – 11:00	13:00 – 16:00
Bangkok Routes	11:01 – 15:00	08:00 – 11:00 Next working day
Bangkok Routes	15:01 – 21:00	13:00 – 16:00 Next working day

Central route

Central route cover central, eastern and western areas of Thailand. There are 8 routes operate in mentioned areas. Main transportation mode is 6 wheels truck. Door-to-door scheme is used in this area as well. For this area, company distributes to all customers one trip a day. The orders which are received today will be distribute to service centre on next working day before 16:00.

Upcountry route

Upcountry area is the rest of the area in Thailand, excludes Bangkok and Central area. There are over 170 service centres included in this area. 6 wheels truck and 10

wheels truck are used for receiving parts from warehouse to main depot, and from main depot to regional depots. Pick-ups are used for supplying from regional depot to service centres. All goods supplied from warehouse will be delivered to service centres on next working day.

Parts Dealers

Parts dealers are big spent customers with official authorisation to sell genuine spare parts. Parts dealers are located in auto parts market in Bangkok area. For parts supplying from warehouse, company distributes goods to Parts dealer's warehouses located in suburb area. Therefore, it is possible to use 6 wheels truck for parts distribution without illegal case. All goods from warehouse will supply to Parts dealers when volume is full capacity or almost full.

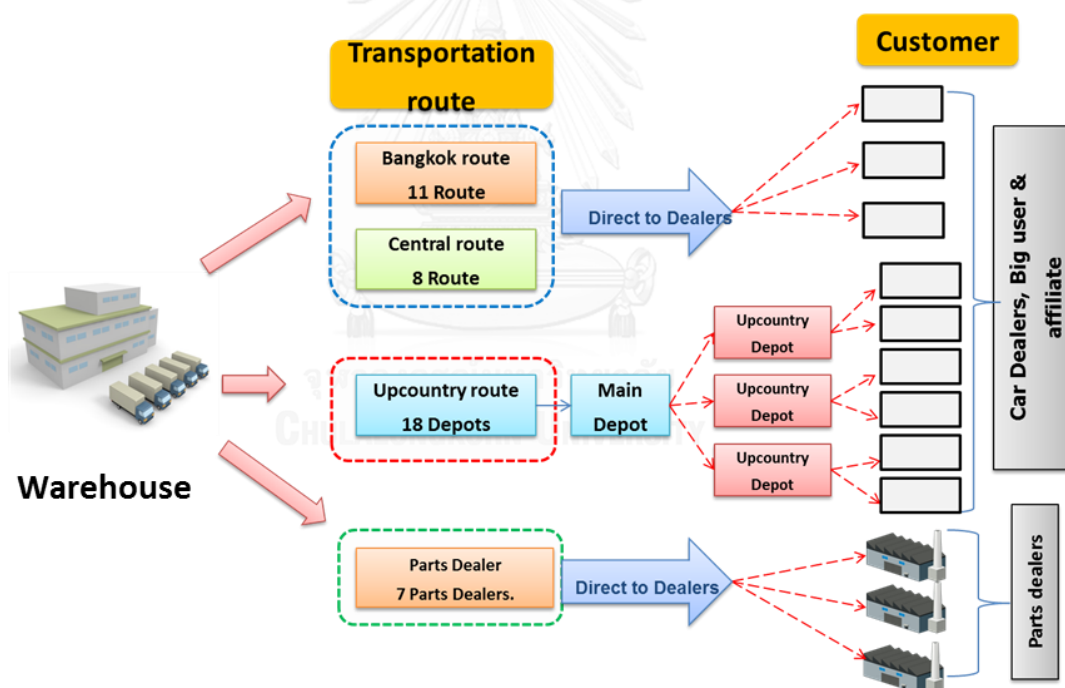


Figure 3: Parts distribution process of The Case Study Company

Statement of the problem

Vehicle downtime cause of lost customer

The vehicle downtime is outage duration of vehicle under services. In order to create better customer satisfaction, service centre has to provide quality services with short lead time. As a commercial vehicle distributor, the company always monitors the cause of downtime closely in order to seek for downtime minimisation method. Vehicle downtime is an important factor for commercial vehicle's users because users or business owners will lose income on the day that vehicle is unavailable. If vehicle downtime is very long, customers will lose a lot of money and they will not be satisfy with products and service centre.

According to service centre survey in 2014, about 50% of downtime reason came from service centre issues; for example, under repairing by technician, under investigation or lack of preparation in service centre. 30% was happened by customers were under making decision. 13% was occurred because service centre waited spare parts from company. Normally, service engineers and technicians should spend their working time on investigation and repairing rather than waiting spare parts arrival at service centre. For this portion, it is initially happen because there is no available of required spare parts at service centre. Then service centre staffs have to place order to company for required parts. Service centres in Bangkok and suburb are will receive spare parts with in half day if they order as emergency order. For upcountry service centres, they will receive goods on next working day. Even though company realises that current delivery performance is pretty well, but company management always seek for continuous improvement and any possible solutions to help service centre repair vehicle faster.

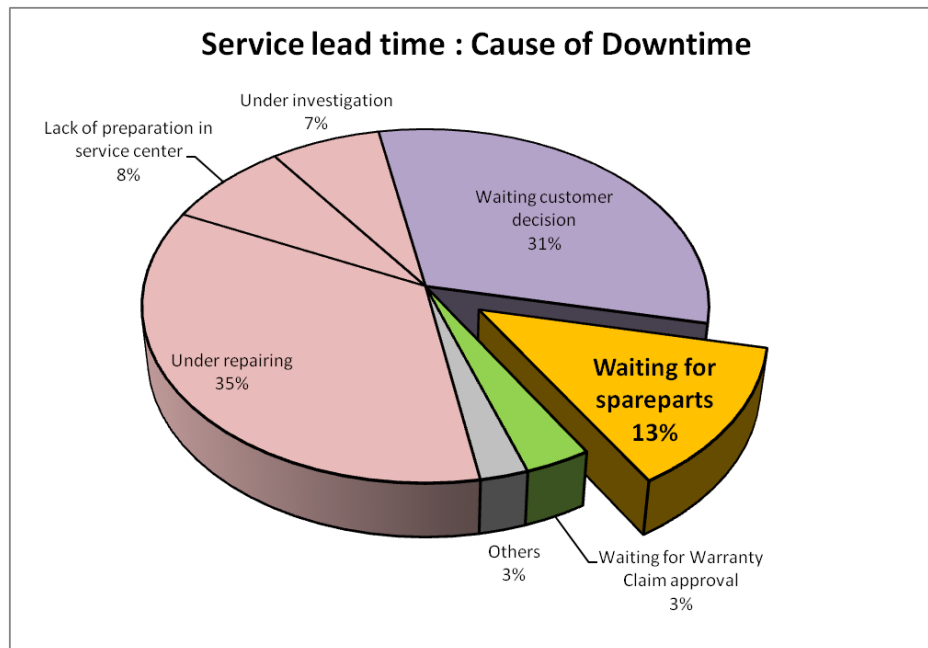


Figure 4: Causes of downtime in service centres

Furthermore, the current market situation indicates that company is one of the well-perform companies in Thailand, but customer losing is a problem that impact on company's after-sales business. The key reason of lost customer is; out-warranty customers choose one-stop service garage and non-authorized service centre rather than service centre. On-stop service garages draw customer from dealers by providing maintenance services as same as company with lower price and faster. In addition, one of the key competencies of one-stop service garage is location of service centre. They opened service centre in many areas in Bangkok and big provinces that let customers easy to approach, and they have shorter process to establish new branch compared with company processes. It is reasonable to select service centre which is near or comfortably to reach.



Figure 5: Examples of one-stop service garage in Thailand

Regarding to customer survey in Figure 6, it illustrated the reason for choosing non-authorized service centre rather than dealer's service centre. The first reason of not choosing dealer's service centre is **location of service centre** and **service lead time issue** is come second. The service centre location is difficult and costly to change, but service lead time issue is a problem which can be solved. In order to service lead time is depend on performance of company and service centres. They must responsible on any late deliveries or high service time. They have to improve in many areas to pull customer back to authorised service centre. For example, improve technical skills, wastes elimination, arrange more marketing activities and improve logistics operations.

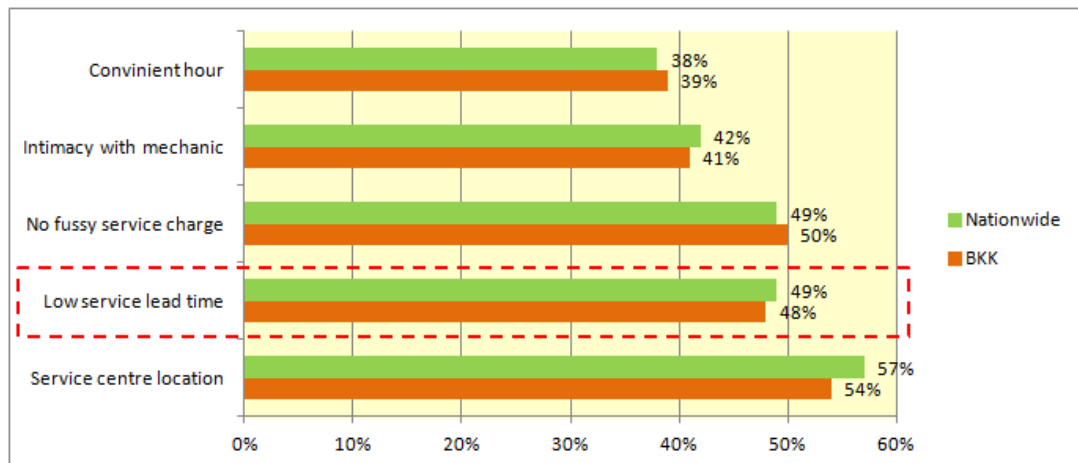


Figure 6: The company customer survey: Reasons for choosing non-authorized service centres

Service centre receiving time

Regarding to current distribution scenario of Bangkok area “One Day Two Trips”, there are 89 destinations in Bangkok but over half of them will receive spare parts after 8:00 onward. It is mean that technician cannot start working and they have to wait until spare parts arrive at service centre. They may lose service time on waiting for a long time. The arrival time of each service centre depends on the sequence of each service centre in route. The longest waiting time is about 4 hours after start working.

In Figure 7, it illustrates ratio of customer receiving time in each period. There are only 11 service centres or 12% always receives parts before 8:00.

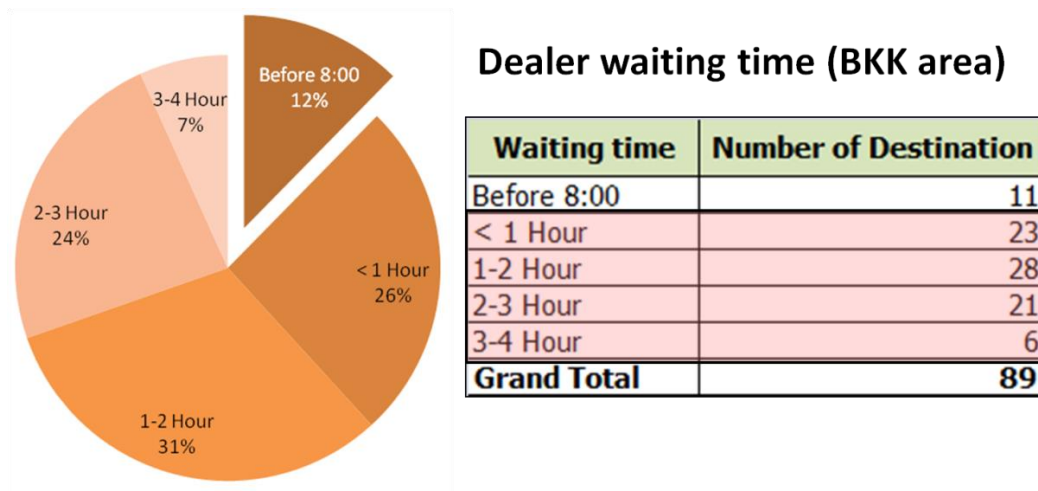
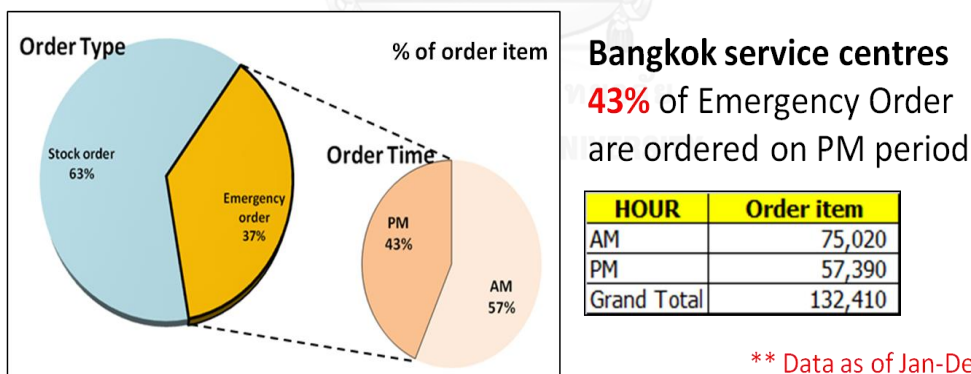


Figure 7: The ratio of spare part waiting time of service centre in Bangkok area

According to the Figure 8, the emergency orders are ordered approximately 37% by service centres and rest of them are stock order which company deliveries on next 2 days. In addition, 43% of all emergency orders are ordered after 11 o'clock afternoon. This portion is the order which will be delivered on next day morning. So, it is inequality for some service centres which are located far away from warehouse.



** Data as of Jan-Dec 2014

Figure 8: Ratio of Order type and ordering time of Service centres in Bangkok

Actually, it is not a major problem for company but improvement is possible to be done in order to increase service level and customer satisfaction. The faster availability will result in decreasing of waiting time in service centre and increasing of customer satisfaction.

Transportation efficiency

Currently, company hires services from transporter companies. For Bangkok and Central area, Door-to-Door model is used as a current distribution process. There are over twenty pick-up trucks deliver spare parts to 89 service centres in Bangkok area and 61 service centres in Central area. All routes are set and arranged based on optimised route with time constraints. Route review period is set once a year. By this model, all service centres in mentioned areas will receive their orders on time as commitment.

However, current model cause some problems to company. The first problem is loading efficiency of each truck. It is only 46% of full capacity used in each trip. Transportation fee is calculated by number of trip therefore, the lower percentage of volume in each truck will refer to the higher cost of transportation per cubic metre. According to last year record, company spent 647 baht per cubic metre delivered.

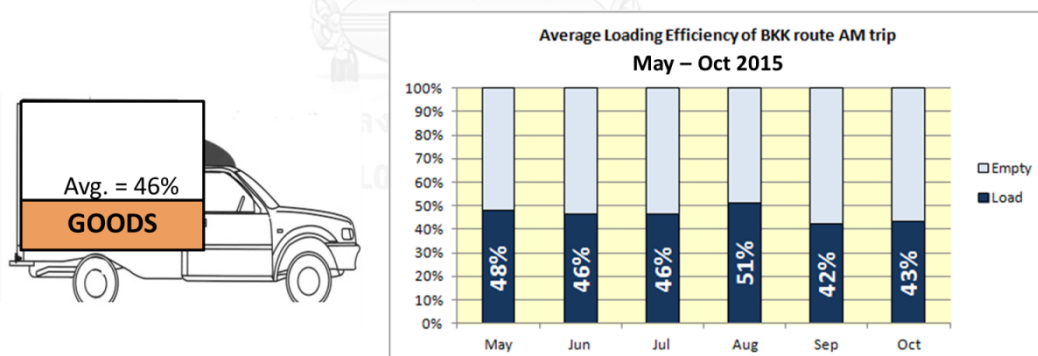


Figure 9: Average loading efficiency of Bangkok Route (May - Oct 2015)

If company increases efficiency of loading, number of pickup will be reduced and it will result in cost reduction. This problem is a normal problem in road distribution and company has to maximise loading capacity to reduce cost per cubic metre, in case of transportation fess calculated by trip. Redesigning transportation route is a practice to increase efficiency of loading. However, in company's situation, company has limitation on various factors namely commitment time with service centre, traffic

congestion in Bangkok and demand fluctuation. After many attempts on route optimisation, company reduced number of Bangkok route from 14 to 13 routes in 2011 and reduced to 12 routes in 2013. As a result, company can increase efficiency to the current level but it is still poor in financial aspect. Even though, the current performance is better than other company in same industry but in market leader's point of view, company has to improve performance and reduce cost concurrently.

Lastly, the reduce number of vehicles will result in reducing of environmental impact. Carbon emission and fuel consumption are two major concerns in this aspect. Currently, supply chain sustainability has become famous in many companies, especially in environmental sustainability. Therefore, increasing of transportation efficiency will result in better sustainability of supply chain.

Delivery precision of Bangkok routes

Bangkok route is the most difficult transportation route for the company because there are over seventy service centres have located in Bangkok and suburb areas. Furthermore, the number of service units is quite high in Bangkok area. Therefore, order frequency and spare parts demand are also high. However, the road traffic of Bangkok area is very poor and there are many of sky train construction side around Bangkok. Therefore, it is very difficult to delivery to each destination on time. Transporter cannot design transport route to deliver spare parts to too many service centres in one route because it will impact to delivery time.

Delay delivery causes difficulty of service centres to commit accurate repairing finish time to customers. If technicians know spare parts arrival time, they will exactly estimate repairing time and easily making commitment to customers. Customers can make their plan during waiting for repairing.

Normally, the company commits delivery time with service centres that arrival time must not late than 15 minutes from commitment time. However, the company

realises that there are some delay delivery occurred in all transportation routes. The key reason is traffic congestion in Bangkok area. In Figure 10, the graphs show percentage of delay delivery occurred in Bangkok area during January to May 2015. There are three routes which usually delay on delivery.

Even though current delivery situation is acceptable by service centres but the company must reduce delay problem, because delay delivery leads to delay repairing and customers have to wait for spare parts longer. Therefore, the company has to solve delay problem and keep delivery to be always on time.

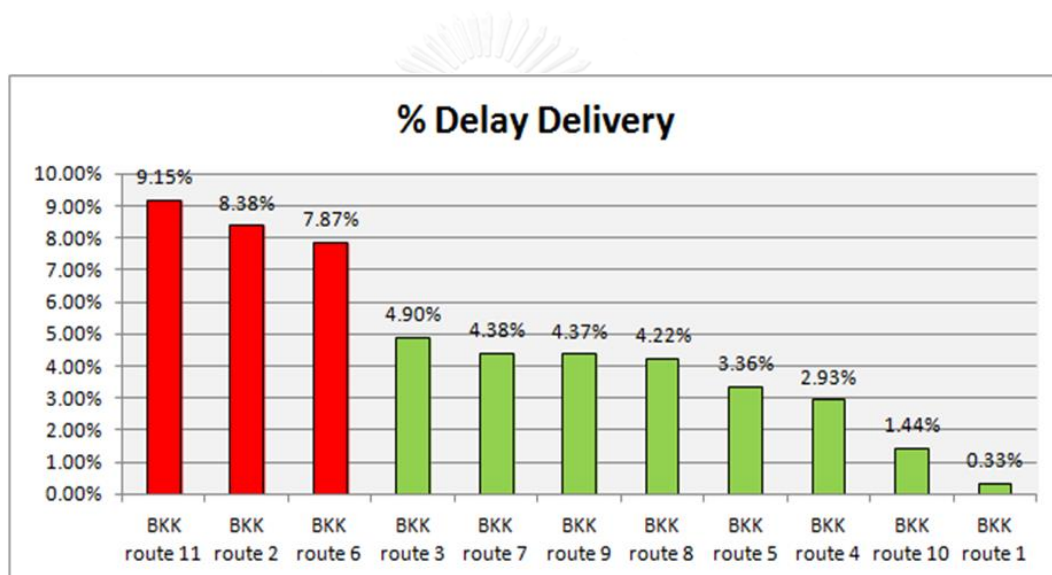


Figure 10: Percentage of delay delivery of Bangkok routes

Research objective

The objective of this research is to improve spare parts distribution by implementing in-night distribution practice.

Scope of study

The scope of this research will be focused on applying In-night distribution as a guideline to improve performance of parts distribution. Transportation model design, vendor selection, routing process and operation process design will be involved in

this research. This research plans to do real implementation with some service centres in Bangkok area. In the final part, the research includes evaluation method and analysing of cost and benefit in term of business performance.

Expected benefits

For expected benefit of this research, author defines as;

S - Satisfaction of customer

P - Parts Available faster

E - Efficiency in operation and cost

E - Energy saving

D - Downtime reduction

In term of performance index, there are four indicators which relevant with SPEED.

Spare parts waiting time (Hour)

Cost-performance index (Baht/M3)

Percentage of Loading Efficiency (%)

Transportation cost (Baht/Year)

CHAPTER II

Literature and Theoretical Review

Theoretical and Literature review

Customer service and Logistics

Supply chain and logistics are the core process of Case Study Company and the area which author focused. Customer services or after sales services both need logistics and distribution operation to drive process to achieve target. For any firms which have after sales service as one of the core business, they should not avoid interesting in logistics and distribution because they are linked together (Rushton, et al., 2015). The better logistics process will result in better customer service process and the increasing of customer satisfaction as well. In addition, in marketing aspect, logistics operation is capable to make differences not only with market rivals but it also makes differences between cross market segments as well.

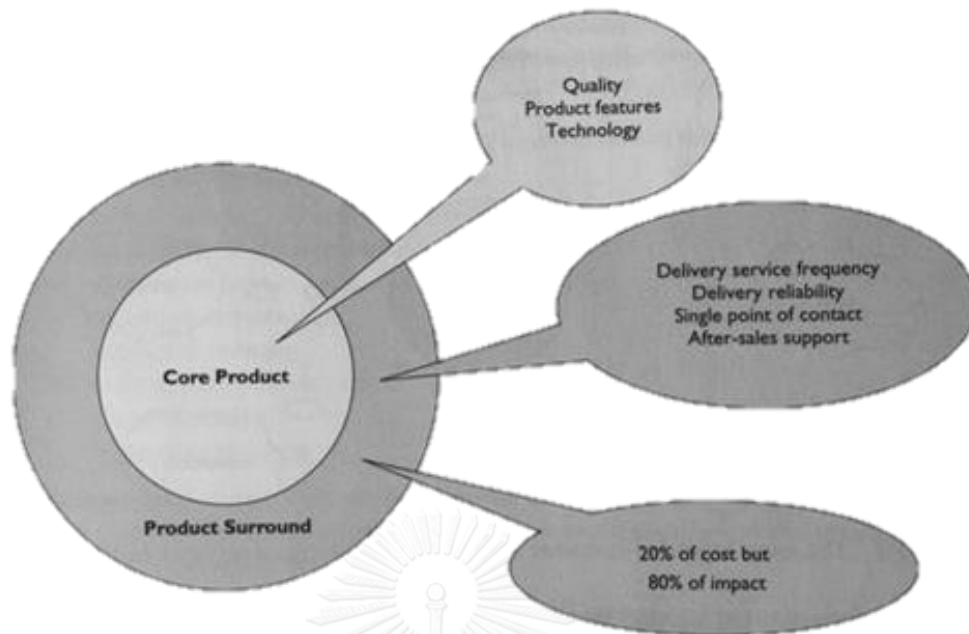


Figure 11: The comparison between Core Product and Logistic Element on the importance of firm element [Form: (Rushton, et al., 2015)]

However, sometimes marketing people claims that product selling is much more benefit than customer service operations. In product point of view, Quality, Product specification, Technology and ability of salesperson are key factors of product selling, but for after sales aspect, frequency of delivery, reliability of delivery, after sales support and speed of order cycle time are just example of all important parts of after sales operation. According to Rushton, et al. (2015), they used Pareto 80/20 rule to determine percentage of impact and cost between core product and logistics process. It was shown that logistics operation represent 80 per cent of the impact but only 20 per cent of the cost. Therefore, logistics operation has a vital role in impact of customer service and it is a key factor to improve customer satisfaction as well.

For the customer service's components, they are separated as shown in Figure 12. Logistics process of manufacturing industry is different from customer service business in some elements because of difference of objectives. However, for the core

concept of both businesses, they still keep the key concepts of logistics as a core of operation. The logistics process of customer service are classified into three elements; Pre-transaction, Transaction and Post transaction. They are categorised based on function aspect. Pre-Transaction elements are the preparation processes of customer service business. Policy setting, operation design and various conditions must be prepared before operation processes are used. Transaction elements are the physical transaction which related with logistics and distribution namely; stock availability, delivery conditions and ordering process. Lastly, Post-Transaction elements are the supportive actions of customer service after distribution and reverse logistics process are also included. For example, return policy, claim process and invoicing process.



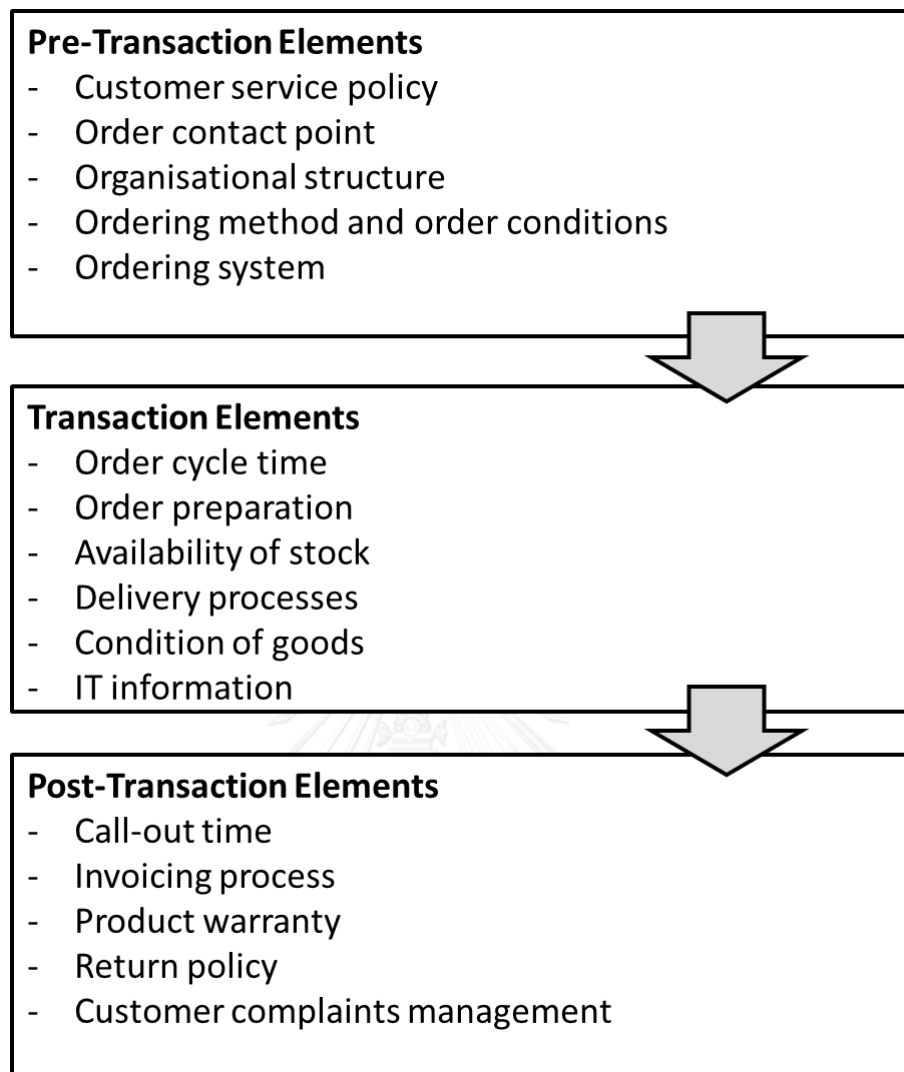


Figure 12: The components of customer services

For the key elements of customer services, according to Rushton, et al. (2015), they described the seven rights of customer service which are important part of customer services. They are expansion elements of logistics definition which determine the essential needs in customer services regarding to logistics operation. The seven rights are showed in Figure 13.



Figure 13: The seven right of customer service

The seven rights are the basic elements which firm has to ensure that firm are capable enough to achieve them if firm would like to win market and gain customer satisfaction. It should be used as key measurement of any logistics based company for monitoring performance of operation.

One of the most important measurement index of logistics of customer service is **The order cycle time**. It measures time since order receipt until goods arriving at customers. Currently, some processes of distribution which concerns of order cycle time are operated by computer system such as ERP and WMS. For example, order receipt process and order allocation for picking can be operated through ERP system froms Sales and Distribution module (SD) to Warehouse Management Systems (WMS). Therefore, once order was submitted to Sales Portal, order will be passed to WMS for allocating stock for each order immediatelly. In addition, required information namely; order acknowledgement, back order alert and credit checking result, they will be sent back to customers for acknowledge them on the progress of their order. By the explained process, it results in faster operation and shorter order cycle time.

Furthermore, by using computer system, supervisor can trace and fix problem quickly because it will inform supervisor when there is a problem occurred in process.

For the researches about relation between customer service and logistics operation, there are many researches which explained about the close relation of both elements. Micu, et al. (2013) described about the influence of logistics services on customer satisfaction and resulted in customer retention of E-commerce business. Miricescu (2013) and Jang, et al. (2013) both expressed the relationship of quality of logistics service which generates customer loyalty. There are many cases that used customer satisfaction rate for evaluating quality of logistics services namely; Logistics service integrator and Functional logistics service provider (Liu & Xie, 2013), measuring customer satisfaction by analysing attribute of refrigerated transport (Lisinska-Kusnierz & Gajewska, 2014), Statistical analysis on various factors of logistics for evaluating customer satisfaction (Switąła & Klośa, 2015) and Fuzzy analytic hierarchy process (Lan, et al., 2016)

For the production logistics system, Hadas, et al. (2014) focused on the production and logistics strategy for improving internal and external service and encouraging customer satisfaction in the mean time. Lastly, the psychological empowerment and employee stewardship were used for improving logistics outsourcing and determined the impact of them on customer service (Bolumole, et al., 2016).

Operation Strategy

Operation strategy plays a vital role in business nowadays as same as Business strategy and Marketing strategy. It is a key guideline for operational functions which are key drivers for business. According to customer service and logistics which author explained in previous section, it is obvious that logistics and marketing link together and the impact of any sides, it will impact to each other as well. If marketing people operate by did not concern on operational function, it will result in drawbacks of business namely; high operating cost, high inventory and low profitability. For

example, marketing people would like to stimulate sales volume by announcing new campaign of product but they did not inform logistics department before. Production and warehouse team will not prepare stock enough for sales campaign and it will result that firm cannot supply products to customer on time. There will be a lot of back order and customers have to wait for production. Marketing plan of marketing team will not achieve as well. Thus, Operation strategy is a key connector of logistics function and marketing function by generating strategy of operation which results in both operation and marketing.

In addition, Operation strategy also link with business strategy or corporate strategy which are the direction of company in top management point of view. Vision and Mission of firm are included for formulating operation strategy as same as marketing strategy. Operation strategy should follow the current direction of company for receive good support from other functions. If operation strategy aims to the different way, other function may not give full support because they might have to work follow corporate strategy. For example, top management of company announce corporate plan that cost reduction is the main focus for the next three years because of economic downturn. Therefore huge investment will not be allowed for this period. However, logistics department set a plan that they would like to developing WMS for increasing overall productivity of logistics operations. The investment plan of logistics department will be rejected because company is focusing on cost reduction and management do not want to invest on huge development during economic crisis. Therefore, operation strategy has to concern on current corporate strategy as well.

According to Hill (1993), The Hill's framework was introduced for using in developing operation strategy. One of the key factors of operation strategy is Order winner concept. Order winner concept or called competitive priority is used for evaluating the priority of each criteria which related with competitive strength over competitor. For using this concept, user has to list all criteria up and identify that each criteria is

order winner, qualification or less important for winning market. the criteria which is identified as order winner is the element which has to be concerned because it will result in competitive advantage if firm improve it on the right way. For example, if quality and design of Product A are classified as order winner, firm has to formulate strategy which improve or maintain quality level and design output to be the best in market and aim to develop them to the company's competitive advantage in the future.

Infrastructural and Structural elements are both core parts of operation strategy. Structural elements are consisted of vertical integration, facilities, process choice and Information and technology. If firm would like to improve supply availability, Supply network strategy will be a good choice for structural elements. For infrastructural element, it consist of several elements namely; Production planning and control, Quality management, New product introduction Resource allocation. Both elements should link with corporate strategy and marketing needs for generating good operation strategy.

Problem Solving Tools

Cause and Effect analysis or Fishbone diagram is one of the most well-known problem solving tools which was introduced in 1960. It was initially developed for quality management and expanded to other areas such as risk management, process improvement and problem solving (Richards & Grinsted, 2013). It can be used for exploring the root cause of problems which users are currently concerning. User has to list problem and causes of problem in several related area then put them into diagram. After fishbone diagram is developed, user will realise potential root causes rather than the basic problem which is obvious and easy to understand. In practical aspect, Cause and effect diagram does not involve only quality management but it is also widely used in various industries because Cause and Effect diagram has been generally used in real industry for initiating development project, solving problems and improving processes.

Cause and Effect diagram is normally used by mixing with other problem solving tools such as Brainstorming, 5WHY and Pareto. Seyis, et al., (2016) and Chemweno, et al. (2016) were commonly used Cause and Effect diagram as one of problem solving tools for analysing root cause effect in different businesses such as building construction and maintenance strategy developing. Cause and Effect diagram was integrated with other problem solving tools namely; Brainstorming and Analytic Hierarchy Process (AHP) method, for realising problem in organisation and creating the most appropriated approach for solving mention problem (Yazdani & Tavakkoli-Moghaddam, 2012). It was also mixed with other well-known tools such as ISO2000, Failure, Mode and Effect analysis (FMEA) and Pareto concept for using in risk assessment in pastry manufacturing (Varzakas, 2011). Pareto analysis and Cause and Effect diagram also applied together for minimising raw material rejection in lamp manufacturing (Mohiuddin & Nafis, 2011).

Cause and Effect diagram also used in initiating a development project, for example; Gusarov, et al. (2015) used it as a systematic approaching of production technology development in pharmaceutical industry, Baker & Jayaraman (2012) also success in applying Cause and Effect diagram in the first step of the development of information management in supplies inventory operation. As a result, they gained benefit from it by improving profitability, better quality of work and reduce failure in operation.

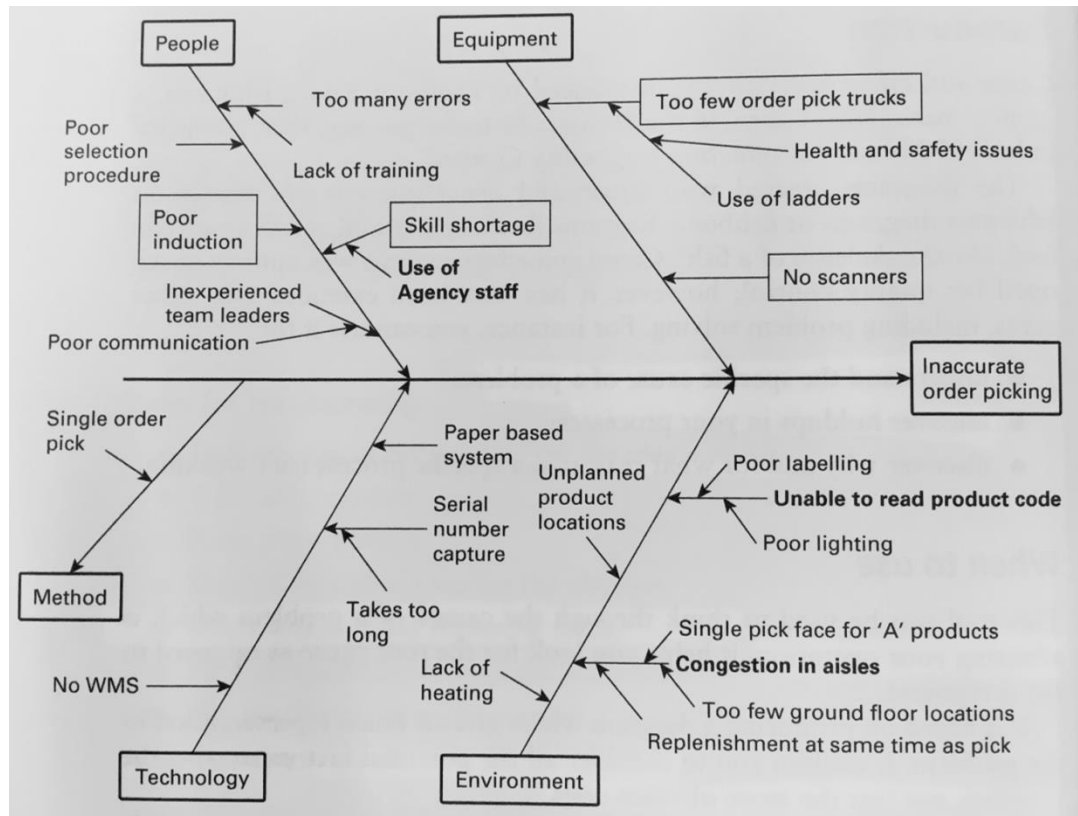


Figure 14: Example of Fishbone Diagram [From (Richards & Grinsted, 2013)]

In term of developing sustainability in business, Cause and Effect diagram was also a contributing factor for that development as well. Sustainability processes should have an effective risk and failure identifying and try to prevent them for ruining business. In oil and gas business, sustainability of process is an important requirement of operation process. Cause and Effect diagram supported user by playing a vital part of creating cause-effect relationship map to improve sustainability of supply chain (Ren, et al., 2013).

Another important problem solving tool which author selected is **5WHYs**. It is general management tool which aim to find out root cause of problem as same as fishbone. However, the 5Whys tool is much easier and faster than fishbone because it focuses on particular problem which user need to understand (Richards & Grinsted, 2013). It just keeps asking why on the selected problem until there is no more answer. It is basic tool which save time and manpower for using it but it is effective for real

business cases as well. The final answer of each problem is a root cause of problem which we need to solve. It will be more effective if user uses it with other problem solving tools such as cause and effect diagram and brainstorming.

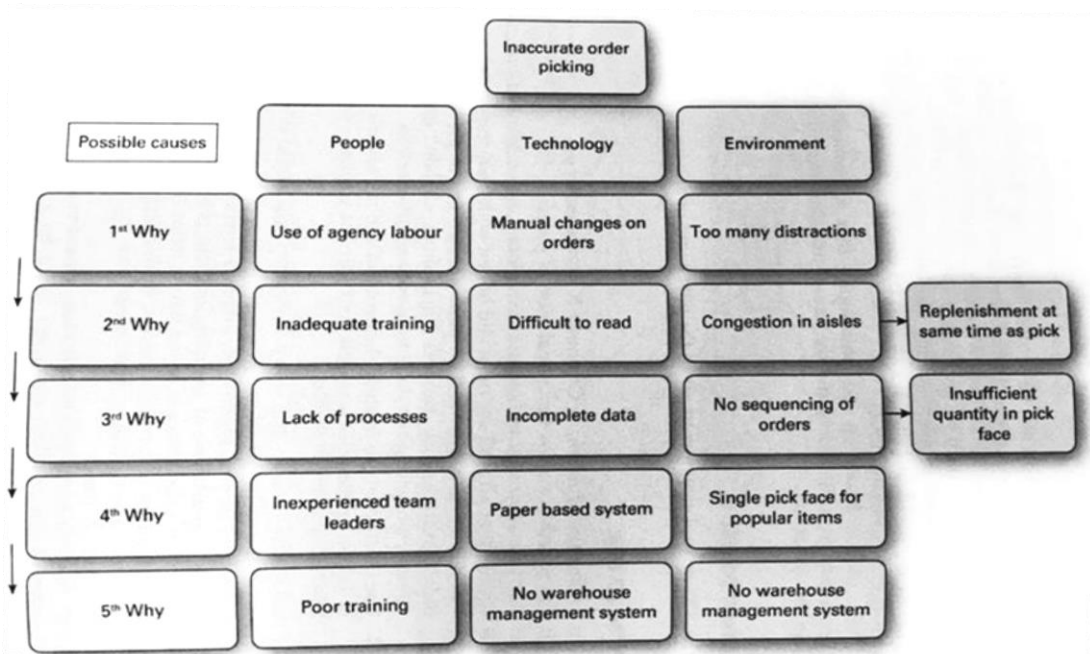


Figure 15: Example of 5WHYs method [From: (Richards & Grinsted, 2013)]

Lean concept: ECRS

Lean concept has played vital role in many firms for a long time. It has been applied and developed based with different situations and environment. The key objective of lean is to add value together with eliminate waste in business. Lean principle was developed into many theories and management models in the world. It does not work well with manufacturing only but it also suitable for any businesses. Lean was made obvious and well-known by the Toyota Production System (TPS) which has Lean thinking concept as a core of TPS. ECRS is a part of Lean thinking for generating practical improvement. It stands for Eliminate, Combine, Rearrange and Simplify. ECRS also use in Kaizen concept for improve processes in organisation continuously. ECRS also seeks for bottle necks of the process which cause of waste in operation. In addition, it also works well for changing some factors which impact to working processes. The description of ECRS is explained below.

E-Elimination aims to find wastes or reasons of waste and try to eliminate it from normal operation if possible. In addition, over-specification components should be eliminated in order to cut insignificant cost from operation.

C-Combine focuses on combining common steps together if they cannot be eliminated. Firm has to indicate common or similar steps then try to combine them. It will result in shorter and faster process.

R-Rearrange allows user to rearrange processes to be more efficient. Rearranging also includes changing sequence of work and operation time as well.

S-Simplify is the last step of ECRS to simplify the new created process to be easier. Simplify can be measured by the reduction of operation time. Easier process should result in shorter operation time as well.

ECRS concept has been widely used in industry for many years. It improved productivity by reduce waste associated to operation processes and system, reduce operation time and increase profitability of company (Laxman & Ramnath, 2012). According to Laxman & Ramnath (2012), mentioned firms was facing problem in manufacturing process which lead to extra working hour, delivery delay and high operating cost. ECRS was used as a core for internal process improvement. It resulted in better cycle time, decreasing of operating hour and cost.

It is not only manufacturing industry which needs ECRS and Lean, but it also important for reducing transportation wastes in other businesses such as food distribution (Villarreal, et al., 2009), patient transportation in Hospital (Chiarini, 2013). They also did identify transportation wastes as a factor which should be reduced or eliminated. Sordy (2007) also studied to adjust appropriated inventory level and

reduce cost of operation on the same time. In addition, lean organisation also lead to well-designed warehouse with add value process (Sordy, 2007). Dotoli, et al. (2015) also used Lean thinking method for warehouse improvement by combining Lean and Value Stream Mapping (VSM) tool to identify non-value added process. The study resulted in increasing of profitability and better quality of work. Real time Delphi (RTD) and analytic network process (ANP) were applied for improve warehouse operation based on Lean concept. ANP was applied to measure leanness of operation (Sharma & Shah, 2016). Lean concept also used in multinational firm for transferring process from headquarters to subsidiaries. Author aimed transfer lean concept and practices to multi plants of company (Boscari, et al., 2016).

For road freight, Lean and ECRS also played vital role for improve road transportation. Gulyani, (2001) and Villarreal, et al. (2016) identified effect of poor transportation then improved road transport operation by using lean concept. Transportation efficiency, VSM and waste elimination also included in their case study.

However, there is argument of the old fashion lean transportation and the modern green transportation. Lean seeks for optimise of resources for good output, on the other hand Green focuses on environmental effect from logistics operations. Fahimnia, et al. (2015) created trade off model for comparing green and lean on both economical view and environmental view. Ugarte, et al. (2016) critiqued and analysed pros and cons of both models by focusing on impact of lean logistics on green logistics.

Form mentioned cases about ECRS and lean, they practically applied ECRS in various businesses for improving internal processes of firm. As a result, the common benefit of ECRS is better process efficiency which leads to increasing of profitability of firm.

Supplier Selection and Evaluation

In distribution industry, supplier is a key part of logistics and supply chain process in order to fulfil logistics cycle to be completed. Supplier has a key role to supply goods to serve demands of buyer. Buyers always expect on time and in-full delivery to operate internal process for serve the next customers. The well-performed supplier leads to the better operation process of logistics cycle. However, the too much supplier's bargaining power may result in several drawbacks to the firm, for example; the expensive price for unique services or resources (Porter, 2008). The bargaining power of supplier is one of the five competitive forces which introduced by Michael Porter in 1979. Therefore, firm has to prevent excessive supplier bargaining power as well as other forces. One of the methods is performing supplier selection and evaluation.

Supplier selection and evaluation was used in various cases about strategic purchasing which normally include outsourcing and subcontracting. Supplier selection is a part of supply management which influences in more suitable operational and strategic criteria (Nair, et al., 2015). It also applied in formal model to support decision making of sustainable supplier selection as well (Zimmer, et al., 2016). For sustainability of business, supplier selection is a required practice which any companies should not ignore. The company's official supplier comparison results in competitive between suppliers which leads to better quality and reasonable price. Therefore, supplier selection benefits firm by better services of supplier and keeping supplier bargaining power in the suitable level.

However, in real business, there are many criteria to be used selection criteria of supplier selection and evaluation. It results in difficulty of selection process of the firm. Therefore, there are several cases which applied mathematics computing methods for optimising complex supplier selection. For example, the supplier pre-selection model for using with multiple products applied the well-known algorithm model called Technique for Order Preference by Similarities to Ideal Solution

(TOPSIS) (Dotoli & Falagario, 2012; Yu & Wong, 2014), the Multi-criteria decision analysis (MCDA) and PROMOTHEE II method were applied to rank suppliers regarding to selected parameters as a part of supplier selection (Silva & Schramm, 2015) and the comparing of the process yield of multiple suppliers by using linear method (Wang & Tamirat, 2016). In the modern day, social media has become an influence factor for many industrial practices including supplier selection. Robaty Shirzad (2014) created framework for using social media to support firm on supplier selection and supplier relationship management.

Management of Changes

Management of changes (MOC) is used as a part of this study especially before implementation period. The major work improvement is also a major change of working process in company, for example; changing operation system, changing working location and changing process of work. Normally, many people in organisation does not wish or reluctant to change anything that they are working with. In consequence, they may not please to change and create resistance on that change. The resistance of concerned parties is important force which becomes an obstacle for any developments and able can turn success to failure of change.

Actually, MOC does not associate only people aspect but it also relates to business process, resources and communication in organisation as well. Basically, in initial step of change, managements have to recognise the changes of operation then thinking about how to involve people in each concerned area. If training is need, firm has to arrange training session to allow concerned staffs understand on changes (Anderson , 2013). In addition, corporate culture must encourage as another important part of MOC as well (Ceptureanu, et al., 2015). Each firm has different corporate culture and it results in different practices of firm. Asian company and Western company have totally different culture and style of work. In consequence, Applying MOC should aware of company culture as one of the key factors.

In practical cases, MOC also variously applied for manage major change of organisation. Many firms make changes on business organisation and business process several times for finding the optimal position of company among intense competitive market places. In consequence, company should apply MOC for support several changes which happen frequently for the best flexibility of company. For example, Manage Business flexibility case (Babalac, 2013), Using MOC with Large international corporation (Ali & Ivanov, 2015) and Applying MOC with Governance system (Jocovic, et al., 2015).

In some cases, MOC generates benefits to R&D business which mainly focuses on new product development (NPD). According to business situation, R&D based companies generally make change several time a year for competing with fast moving markets such as technological product, IT system and Fashion industry. Therefore, MOC has essential role for encouraging success of NPD by supporting related staffs to have sense of urgency and understanding change. Reddi & Moon (2013), create engineering model of MOC for using in NPD. They used engineering change management (ECM) which is a very complex process to manage various independent factors to work well in NPD. The research also included supply chain management, resources allocation and process simulation for successful using ECM with NPD. MOC also used as an important factor of managing information for product innovation process and product assortment management as well. Bartkowiak & Rutkowski (2016) reserched on using information for product development process and they used MOC as a part of implementation as well.

MOC was seem as a Western-Manageral style of working but it was proofed that MOC can be generally used for any style of working without religion barrier (Finlay, et al., 2013). For Japanese style of work, they also has their uniqe culture which associated with MOC as well. **HORENSO** is effective practice for several Japanese firms. HO REN SO is the combination of three Japanese words: **Hokaku (report)** , **Renraku (Consult)** and **Sodan (Discuss)**. It results in working style of Japanese firm and it is

also a part of Japanese Change Management practice. HORENSO also a necessary tool for using in problem solving program as same as Brainstorming. In some Japanese firm, they use HORENSO as a key practice to train newcomer of firm to understand culture and working style. HORENSO is technically used for keeping communication route and interaction with supervisor, team member and expert in each area. It results in effective results which can solve all important issues (Rowland, 2007).

Hokaku (Report) involves staffs to report any progress to related person continuously. Staff has to report progress of work, next step of work and the obstacles which they found during work. Reporting may occur by arranging meeting or sending e-mail to work requester. The benefit of reporting is feedback from other staffs and management which will support work to progress on the right way. In addition, if problem is found during working, it should be reported to concerned person as soon as possible to acknowledge them on any obstacles happened. It is better to report the issue rather than keep it to themselves (Pringle, 2012). Management or requester may give suggestions and recommendations on the happened matter and it will help to work more effective.

Renraku (Consult) is consulting with other associated people or experts when staff unsure about the process or idea of work. It is better to consult with supervisor and not progressing work on the way that is not clear. In some kind of works, initiator has to consult with person in charge in the area of work which initiator is not familiar with. For example, staffs of logistics department have to ask for consulting with customer relationship team when they need to change operation processes which result to impact of customers. In some cases, management or supervisor may become closely involved in each step of work and the need to give advise and detailed information on every step as well (Kopp, 2013).

Lastly, Sodan (Discuss) is making a discussion with internal team or other people for the best option of work. Discussion is work as same as brainstorming practice. Many people discuss together for finding the best answer of work through meeting or talking.

Normally, Japanese managements would like to know progress of work continuously and most of them are process based style of work hence they also need to know process of work not only the result of work. HORENSO is a communication practice between initiator, doer and also management. As a result, HORENSO naturally works like concept of MOC. The consecutive reporting and consulting make a small discussion and feedback together. Initiator will get feedback of their work during it is developing. In addition, doer or worker who receive impact of change will have less resistance if they are informed about the key change of work continuously. If shopfloor worker has a chance to participate discussion, they will understand their job description, the importance of change and the most effective benefit is worker will realise how important of them for company. Kopp (2013) explained the process to cope with micromanaging Japanese management which quite different from Western supervisor. Japanese supervisor prefers to work by using collaboration and teamwork. Meanwhile, in western aspect, many people feel that Japanese style is too much interfere working process of subordinates (Kopp, 2013). Pringle (2012) also described that HORENSO is not appropriate only factory workers but it is also capable for mid-managements and above as well. In addition, HORENSO system improves communication process in decision making process even though it may take time much more than not applying HORENSO.

On the other hand, HORENSO may be looked as slower process compared with Western company. Therefore, in the critical or very short term task, HORENSO may cause problem to overall work because of slow action and it is not flexible to problem too much. In consequence, the company which applies HORENSO should

have clear process to work on the critical period and supervisor should be capable enough to make decisions faster than normal.

According to the mentioned benefits of MOC, the author determined that MOC is one of the key methods for successful development of Night Time Delivery. MOC was decided as a supportive factor for smoothing the implementation process because Night Time Delivery impacts several parties, namely; logistics department, customer relationship team, transporters and service centres. However, corporate culture is also a related issue as well. As the Case Study Company is a Japanese company, there are many Japanese staffs working in the company but the most of staffs are Thai. Therefore, MOC practice which should be applied with the company must be compatible with Japanese culture.

For the Case Study Company, **HO REN SO** concept has been applied as a key process of MOC in the Night time delivery project. There were many meetings periodically arranged during the project was progressing. Those meetings aimed to make clear understanding for associated parties and request for collaborations from them. There are several works which could not be done by the author or logistics team only hence the author had to request cooperation from experts in each area. The progress of the project was reported periodically to management for let them acknowledge the progress and result of each step. Management closely monitored on the progress of Night time delivery because they really interested in this project. Therefore, the author had to keep reporting to management during the project was progressing. The meeting with customer relationship team was arranged for making discussion and demonstrating idea of Night time delivery to them. They are a group of person who have well understanding about dealers and they have strong relationship with them. Therefore, they were assigned as key players for involving customers to understand the objective of night time delivery and willing to participate in implementation.

Best Practices Review

Nowadays, automotive companies in Thailand operate under high pressure from various sources such as competitors, customers and national economy. Many companies are improving internal process continuously for gaining competitive advantage over market rivals. Each company generated different improvement method based on resources and capabilities of company. Night time delivery was decided to be used in this research regarding to problems which company are concerning currently. Night time delivery is a new method for automotive business in Thailand so concerned parties are not familiar with it. However, night time delivery has been widely used in European countries. Night time delivery does not use by automotive companies only, but several businesses which need night time services also.

For automotive business, Yusen Logistics currently distributes automotive spare parts by using night distribution scheme. Yusen Logistics distributes service spare parts of BMW, MINI and BMW motorcycle currently. They use night distribution to distribute spare parts from warehouse in Belgium to over 180 dealers in Belgium, Luxembourg and Germany (Yusen Logistics, 2014). Service engineers of BMW dealers are able to start service jobs at the start of working day because all required parts have been available at service centres since night time. As a result of night distribution, BMW dealers increased productivity of operation in service centre because elimination of spare parts waiting time in the morning. Therefore, BMW dealers finish more service cases with shorter lead time.

TNT Innight is a service of TNT Company which offers night time express services to customer. TNT Innight has established night time delivery in European countries since 1964 (TNT, n.d.). TNT Innight has the biggest night transportation network in Europe by serving services to over 26 countries with over 2,600 vehicles operate every night. Currently, TNT provides services to various sectors such as Agriculture, Automotive

and Healthcare. The main benefits which customer get from TNT Innight is better operation process because all customers receive goods at the opening time. It will result in less downtime of machine, reliable of after sales service and reduce stock of customer due to reduced lead time (TNT, n.d.).

For equipment using in night time delivery, there are various delivery options for TNT's services namely; car boot, doorman and PUDO. PUDO is Pick-Up-Drop-Off point which can be access by transporter and customers only. The concept of PUDO is as same as Dropbox concept of this research. The reason which author agreed to use concept like PUDO is the suitability with current resources of company. For car boot method, author has to ensure that all service centres have mobile service cars for using drop-off point. Furthermore, mobile car is much more expensive than modified Dropbox, so it might not suitable in term of investment cost. For delivery to doorman or guardsman, it has concerned points about the job description of guardsman which each dealer agreed with Security Company, and another point is size of guard box which is different by each dealer. Guard box is difficult to change or build a new one for support night time delivery. In detailed about container design, author explained it on page 61,

Container design.

Another interested case study is night time delivery of DANX. DANX is leading logistics provider in Scandinavia with their own distribution network in Nordic countries (DANX, n.d.). DANX services to several industries such as IT spare parts, automotive parts and home applicant parts. The key competitive strength of DANX is own distribution network which lead to high on-time performance that guarantee more than 99% (DANX, n.d.). DANX normally proposes 4 options of receiving points which customer can make agreement depending on customer's need. The 4 options of receiving point are Service van, Partial access facilities, Dropbox outside facilities and unlocked but safe spot. For spare parts business customer, DANX usually proposes Dropbox

method due to size of spare parts and easy to access for both transporter and service technicians.



Figure 16: PUDOs of DANX in Scandinavia area

DANX starts delivery to customers on early evening and normally finishes before 7 o'clock of next day. However, if DANX cannot deliver at night because of long distance, DANX will guarantee to arrive at customer on following day before 12 o'clock. Therefore, arrival time should be checked carefully before make commitment to customers.

NYK Logistics is another example of night time delivery. NYK has introduced night time delivery for car dealers and service centres in France and Benelux region (Automotive Logistics, 2009). NYK's night time delivery is also include track and trace service to inform progress of delivery to customers. NYK has integrated cross docking centre and milk-run delivery for distribute ordered parts to customer overnight. The operation of NYK is normally finished around 2 o'clock of next day.

British gas also dispatches ordered parts to nationwide repairing sites at night time. There are over 35,000 parts dispatched to over 800 customers in UK every day (British Gas, n.d.). British gas uses service of Royal Mail group for distributing spare parts at night time.

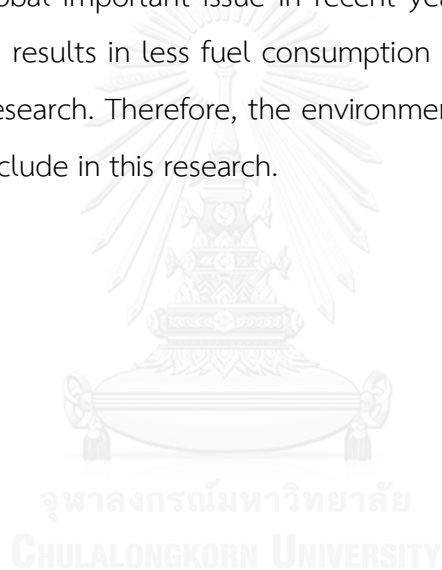
For non-automotive products, WIN BOSMAN also uses night time delivery for supply ordered goods to over 38 different destinations. The key benefit of WIN BOSMAN's night delivery is customer can start working immediately after service centre opening time. (Wim Bosman Netherlands, n.d.)

From all mentioned cases, night time delivery is widely used for supplying spare parts of various products, not only automotive parts. The reason of using night time delivery with spare parts distribution is urgency of after services. Normally, spare parts are used when products broke down. If service parts are not available at the moment, technicians have to order spare parts from distribution centre. The longer spare parts waiting time causes of waste in service centre operations and it also caused dissatisfaction of customer as well. The product which has to use for commercial will urgently require spare parts more than other product groups because commercial product has to be used for generate revenue to company or user. Therefore, distributors have to improve delivery process for serve customer needs as possible and night time delivery became normal practice for several companies.

In environmental aspect, Night time delivery has been tested by two grocery stores in Sweden during 2005 – 2006 for testing reduction of environmental effects. (Blinge, 2007). According to Blinge (2007), the research aimed to study the reduction of gas emission after improves transportation process. The proposed methodology of mentioned research was night time delivery. Night time delivery does not only result in faster availability but it also results in less carbon emission because of less traffic

congestion during night time. As a result of Blinge's research, night time delivery resulted in 20-25% reduction of gas emission and clear reduction of delivery time by 10 minutes (Blinge, 2007).

Furthermore, according to Blinge (2007), the research method also did trial delivery for testing effect of delivery time and the effect of changing to night time delivery. The result of research also demonstrated that late start delivery resulted in shorter shipment time compared with early evening starting time. However, for author's research, author did not focus on environmental issue even though environmental issue has become global important issue in recent year. Because it is obvious that less traffic congestion results in less fuel consumption and gas emission regarding to various automotive research. Therefore, the environmental assessment and emission calculation did not include in this research.



CHAPTER III

Existing Conditions & Methodology

The objective of research is to improve spare parts distribution process by using night delivery. The expected benefit of improvement will result in better service level in after-sales business of company. Regarding to scope of study, author will focus on service centres in Bangkok area. Therefore, informed existing conditions are the condition of service centres in Bangkok area only.

Existing conditions

Delivery commitment and order type

The company made commitment with service centres on spare parts delivery which based on sales order type. In Table 2, it describes delivery time of each order type which order in different time. Emergency order will be distributed to service centres two trips per day. First trip delivers emergency order which submits to company on the previous day afternoon. Second trip delivers order which submit during 8:00 – 11:00 on the same day.

Picking orders are managed by warehouse staffs. They set schedule for each group of order then distribute picking orders to pickers. Therefore, transporters are easy to work because they do not have to set any schedules on all orders. All billed goods which arrive at transporter's area are goods to delivery to customers.

The difference of order type is not only delivery lead time but it also has different discount rate on each order type. Emergency order receives 3% discount less than normal order. Therefore, service centres have to think about different discount rate before order. If they do not want to lose 3% discount, they have to manage stock in service centres very well. They should order emergency order for urgent case only,

for example; specific repairing, technical problems and crucial accident case. Maintenance parts such as oil filter, air filter and lubricant should be stocked at service centres and make sure they are enough to use every day because maintenance parts are regularly used in every day job and over 60% of service unit is periodic maintenance jobs. Therefore, they should be ordered as normal order to gain more 3% discount rate for better profit of service centre.

Table 2: Delivery time of Bangkok service centres

Order Type	Order Time	Picking	Delivery
Emergency	8:00 – 11:00 N Day	8:00 – 12:00 N Day	13:00 - 16:00 N Day
Emergency	11:01 – 15:00 N Day	11:00 – 17:00 N Day	8:00 – 11:00 N+1 Day
Emergency	15:01 – 21:00 N Day	8:00 – 12:00 N+1 Day	13:00 - 16:00 N+1 Day
Normal	8:00 – 17:00 N Day	8:00 – 17:00 N+1 Day	8:00 – 11:00 N+2 Day
Normal	17:01 – 21:00 N Day	8:00 – 17:00 N+2 Day	8:00 – 11:00 N+3 Day

In case of ordered parts are not available, those ordered items will be recorded in computer system as back order then company's staffs will quickly follow up with parts suppliers and estimate new delivery date to service centres. Currently, supply rate of the company is remaining around 98%. It means company has ability to supply spare parts to service centres around 98 orders out of 100 orders.

“One Day Two Trips” delivery scenario

“One Day Two Trips” of “1D2T” delivery scenario is a name of current parts distribution scheme in Bangkok area. The company has operated 1D2T since 2008, it improved supply to service centres in greater Bangkok area. The company has set two order cut times for service centres in Bangkok area as author mentioned in Table 2. Service centres in Bangkok area receive goods twice a day depend on submitted orders. Same day delivery is available for order which is submitted within order cut time. For example, if emergency order is submitted before 11:00, warehouse will operate outbound processes then deliver to transporter before 12:00, after that transporter will start delivery and finish delivery before 16:00.

In customer’s aspect, 1D2T is important for service centre operation especially in parts inventory planning and customer appointment. It has been an important part of service centre operation therefore it is better not eliminated 1D2T or it must be the new method which better than 1D2T because it is not acceptable if service centres get worse services compared with current.

Operation hour of Service centres

Service centres officially operate on Monday to Saturday from 8:00 to late 17:00. Pre-service checking and service registration are start at 7:00 and last service registration time is 16:00. Therefore, customers can drive their car to receive service start from 7:00 to 16:30. Service centre’s staffs working at 7:00 for checking readiness in garage, service bays, tools and also checking cleanness of service centre. Spare parts store also start pre-working on 7:00 and officially start at 9:00. However, they also allows transporter to deliver goods at 7:00 onward depend on convenience of service centre. However, service centres do not allow transporter to deliver goods after 16:30 because they will not have enough time to finish service job. So, service centres requested the company to deliver one hour or 30 minutes before closing time.

Current Transporter

Currently, company has hired 4 transporter companies to operate in different areas of Thailand. Transportation area has been separated into 7 areas and each area has been assigned depend on agreement. Transporter A operates on Bangkok, Suburb, central and Eastern area with door-to-door service. Normally, Transporter A uses pick-up trucks as main transportation mode. Transporter B and C operate in upcountry regions with Door-to-Depot service. Their trucks stand by at loading area until loading finish. After trucks are ready to delivery, transporters drive trucks to main depot then distribute to regional depots. Transporter D also operates with door-to-door service as same as Transporter A. They deliver parts to big customers by using various transportation modes depended on delivered volume but delivered by using fixed routes only.

Transportation costing

There are two types of transportation costing which have been used by company. The first type is fixed transportation cost by route. It has been used by Transporter A and Transport D. Transporters proposed quotation which showed detail of transportation cost by route. The longer distance route is more expensive than short distance route. Number of destinations and truck type are also calculation factors. Transporter allocates one truck per one route only. The extra trucks will be used if delivered volume is over than maximum load of truck. The advantage of fixed type is easy management. Transporters have to delivery even though there is only one box to delivery on that shipment. Company and transporter do not need to rearrange route every day and company ensure that trucks are available to deliver goods every working day. In contrast, the disadvantage of fixed type is higher transportation cost compared with volume based. In case that there is only 1 carton box to deliver to one destination, company will be charged in full amount. Fixed type is suitable costing method in case that company need premium service and delivered volume should be almost steady.

The second type is volume based costing. Transportation cost is calculated based on delivered volume and distance. Transporters determined cost per cubic metre for delivery to each province in Thailand. The larger volume and farther distance is more expensive than small volume and shorter distance. Transporter C and Transporter D are currently using volume based type for calculating transportation cost. The benefit of volume based type is reasonable cost. Transportation cost depends on delivered volume which company and transporters committed together. If delivered good is only one box, company have to pay just only delivered volume. On the other hand, for drawback of this type, transporter requires computing tools to support on calculation process because transportation cost calculation consists of many factors. According to two costing methods, company should have specific computer system to record all information for cross-checking and keep data for further improvement in transportation area. In addition, agreement and costing method can be changed but company have to request transporter in advance and previous agreement will be effect for 6 month before changing. Therefore, author has used current costing method in research. All information about costing has followed current costing method as explained.

Methodology

Overall Workflow

First of all, author created plan for researching as shown in Figure 17. The research process started with formulating operation strategy. In this process, author selected the modified Hill's framework and DMAIC as tools for supporting on creates strategy based on corporate policy and marketing strategy. The strength of the modified Hill's framework is the linkage between company's policy and operation strategy. The good operation strategy should make benefit on both operational aspect and marketing aspect.

For one thing, author changed a part of the modified Hill's framework. Order winner is not well adapted with this research. Therefore, author substituted that factor by using "Customer satisfaction factor" which defines factors to help boosting customer satisfaction.

Next, author created improvement method for solving selected problems. In this research, the selected method is night time delivery. It expected to improve transportation performance which resulted in cost reduction, better loading efficiency and reduce delay. On the marketing side, night time delivery also expected to make benefit on service centre operation which caused in better profit and customer satisfaction.

Operation designing was done after method of improvement was selected. In this process, author created operation flow for using in night time delivery and control method. The last step of planning phase is defining required equipment which is necessary for night time delivery. The main equipment is container which author designed for receiving process.

On the implementation phase, author created trial plan for testing and proving designed process that it is realistic and reasonable. In addition, author checked and recorded problems which happened during trial. For trial delivery, author selected group of service centres as trial nominees or called “pilot service centres” of trial delivery. It was better to reduce impact by using small group in trial period. Therefore, the selection method of pilot service centre was created in this step. Before trial, evaluation method was created to measure result of trial in several points of view then planned schedule of trial. After all preparation process was done, implementation was ready to execute following trial delivery plan. The last step is result recording and analysis.

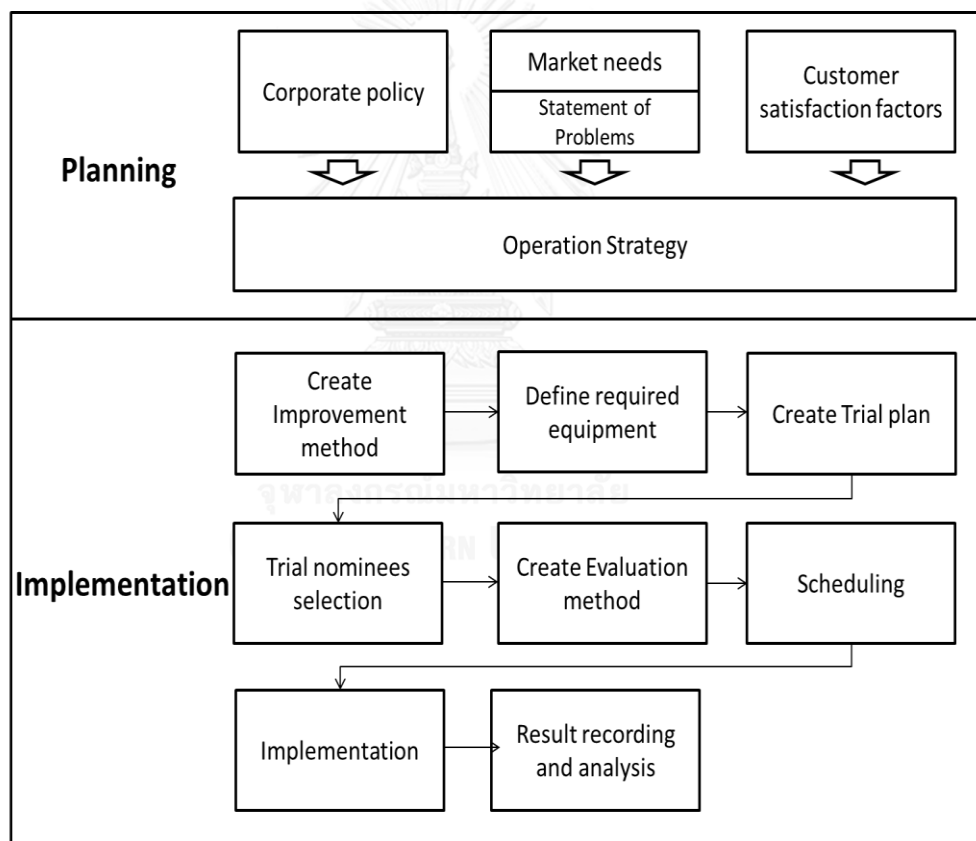


Figure 17: Night time delivery research work flow

Operation strategy

Regarding to The modified Hill's framework (Hill, 1993), there are five steps to formulate the effective operation strategies which lead to new solution. The

modified Hill's Framework assists company to create new solution which link between corporate level and operational level. In this research, author selected the modified Hill's framework as an initial step and a guideline of research for finding out the key element which will lead to new logistics solution in Parts centre. In addition, the new solution should generate benefit to both customers and organisation.

Corporate policy

At start, the first step of Hill's framework is defining the corporate's objectives. According to company's policy, company announced policies to improve business with three main pillars. The first one is retaining profitability level even though the overall economic growth of Thailand is slowing down. The internal process improvement has been become an important task of company. **Cost efficiency** was introduced as key improvement area of all departments in company. The second pillar is **improving work quality**. The mentioned quality is not only product and service quality but it also quality of process which is the fundamental of building product and service quality. Managements need less process mistake and defect of product. The last pillar is **improving customer satisfaction** on both sales and after sales business. For sales business, customer satisfaction leads to attract new customer and draws customers from competitors, but for after sales, customer satisfaction focuses on customer retention which leads to keep buying products and services company in long term.

Marketing needs

The next factor for formulating operation strategy is exploring market needs and demand gap. Regarding to "The Seven Right of Customer service" which author mentioned in **Chapter 2 Customer service and Logistics**, normally, customers in service industry need the seven rights as a basic factor for winning market and gaining customer satisfaction. However, in this research, author did not apply deeply in detail on marketing strategy. Therefore, marketing tools such as The Puttrick grid, The BCG Matrix and product portfolio were not involved in this research. For this

research, author focused on market needs from survey rather than deeply analysed on marketing things. The report of market needs was more important for this research because it was more practical for real business and more timesaving. There were two market survey reports which clearly identified the customer needs in after sales business; Cause of downtime and reason of choosing non-authorized garage. The result was shown in Figure 4 and Figure 5. According to report, about 13% of downtime was happened because of waiting for spare parts. The reasons that service centre have to wait for spare parts are short supply availability and delivery lead time. If two mentioned factors are improved, it will reduce spare parts waiting time of service centre.

Problem assessment

According to **Problem Solving Tools** which author mentioned in **Chapter 2**, author used fish bones diagram or cause and effect diagram for finding out problem of overall spare parts services which lead to vehicle downtime. In Figure 18, author started from listing up the 4M factors consisted of Man, Machine, Method and Material.

For Man Factors, the most associated factor with vehicle downtime is waiting for customer making decision. It may cause of price of repairing is too expensive so customer do need to comparing with non-authorized garage. Technician knowledge may cause downtime because of quality of work. If technician makes mistake on repairing or does not understand the real vehicle problem, it will cause longer downtime as well.

Machine problems are consisted of age of vehicle, Lacking of Maintenance, readiness of service centre's tools and poor specification of vehicle. They have to be solved by technician who expert in technical specification of vehicle. Technician has to analyse real problem of vehicle and fix it properly.

For Material aspect, the mentioned materials are spare parts which are used in repairing and maintenance of vehicle. The quality of spare parts will effect to vehicle downtime directly if spare parts are not ready to use or they make new problems of vehicle in follow. Using of non-genuine parts also a reason of vehicle downtime as well. They are not only impact of vehicle breakdown but they also impact to insurance condition if user used non-genuine parts. Lastly, for very old vehicle which user has used for a long time, spare parts will not available by manufacturers because of obsolete model.

Lastly, working processes in Logistics cycle of after-sales business may cause downtime problem. In distributor side, availability of spare parts and speed of delivery are two main reason of long vehicle downtime. Distributor should prepare right stock to serve customer's demands. As a result of unsupplied stock, customers have to wait for spare parts during repairing. For commercial vehicles, longer downtime is unacceptable because customers cannot use vehicle in their business and it results in revenue loss. Furthermore, service centres sometimes wait for spare parts delivery to their place. This case stock is available but technician wait for distributor distributes spare parts to them. The faster distribution will reduce downtime of vehicle. The main reason of waiting spare parts delivery is logistics operation which consisted of warehousing and transportation process. Lastly, for service centre operation, ordering wrong parts is a reason which results in longer downtime because wrong parts are not fit to purpose and staffs have to re-ordering to distributor again. Therefore, technician has to wait for the right parts arriving at service centre. It does not impact to waiting time only but it also increases transportation cost of return goods and re-ordering as well.

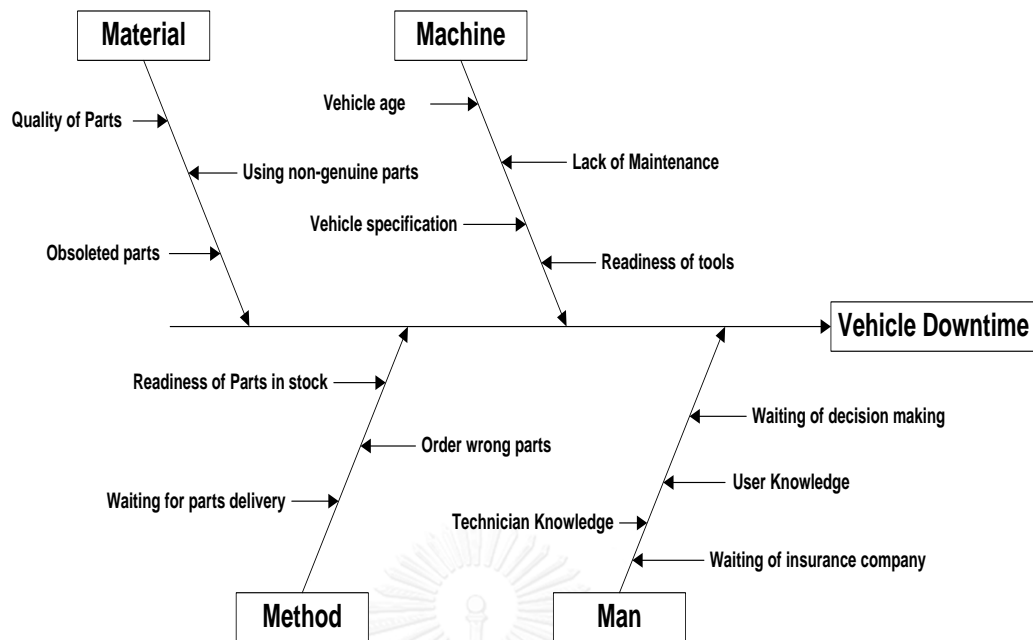


Figure 18: Cause and Effect diagram of Vehicle downtime problem

As a result of using cause and effect diagram, author realised related reasons which cause of vehicle downtime problems. Author used service centre report of after sales marketing team which surveyed in 2014. The result shows that 50% of downtime is the processes of technician which is under process of repairing or maintenance. They are acceptable because they are work in process, not a waste of operation. For other 50% of downtime is consisted of waiting for customer decision, waiting for spare parts and waiting for warranty approval process. The factor caused by distributor is waiting for spare parts which are 13% of all downtime causes. Therefore, as scope of work of logistics department, author decided to focus on distribution problems. Waiting spare parts was selected as major problems which logistics department has concerned.

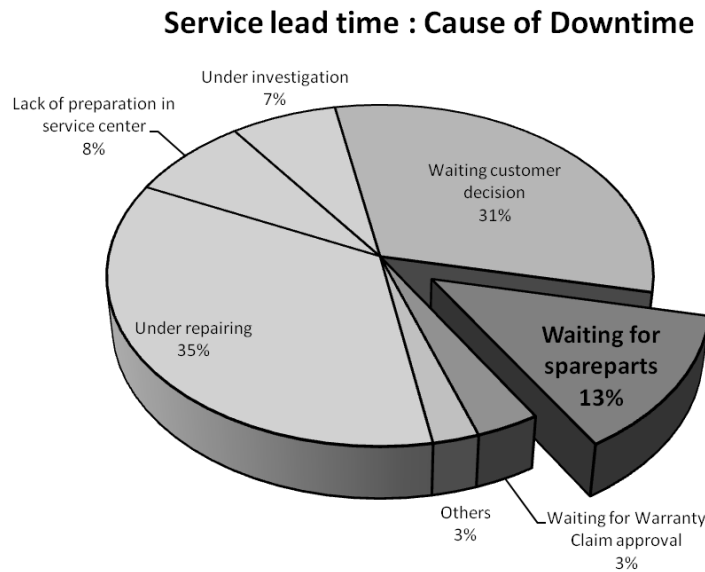


Figure 19: Factors which cause of downtime in after sales of commercial vehicle business

Customer satisfaction factors

Lastly, order winner or competitive priority is a key part of **the modified Hill's framework**. In contrast, for after-sales business, the main objective in after-sales marketing is customer satisfaction which leads to customer retention. Especially in spare parts sales, it is obvious that end-customers cannot choose spare parts of other brands for repairing vehicle purchased from company. Therefore, order winner is not the most suitable in term of definition because company does not compete with market rivals for winning an order, but it is important to retain customers and increasing customer satisfaction by improving services. In this research, author decided to adapt customer satisfaction factors instead of order winner.

For customer satisfaction factor, author proposed key factor in 9 different areas as shown in Table 3.

The selected criteria are almost same as order winner concept of the modified Hill's Framework. In contrast, author changed WQL (Winner – Qualifier – Less Important) to

HML (High-Medium-Low) concept in order to prioritise the important of all criteria based on After-sales business's point of view.

Supply availability, Quality of services and Delivery lead time has been identified as the highest priority because 3 mentioned factors are directly important to after sales business. **Supply availability** is service rate which company can supply spare parts to service centre when orders are submitted immediately. If spare parts availability is almost 100%, service lead time will be shortened and vehicle downtime will be reduced as well. Currently, spare parts availability remains about 97%. For **quality of services**, it includes quality of service jobs in service centre, quality of spare parts delivery and quality of goods. Customers expect to spend money for good quality services and it must be right at first time. Poor services performance may lead to double works and longer service lead time. **Delivery lead time** was also identified as highest priority. Customer satisfaction will not improve if delivery lead time is taken so long even if parts availability is almost reached 100% availability. Shorter delivery lead time will result in shorter spare parts waiting time and decreasing of downtime. However, the party which is perceived highest value from shorter delivery lead time is service centre. Shorter delivery lead time will directly support operation in service centre to be more productive and more efficiency. It also results in increasing of service unit and revenue of service centre. All in all, the 3 mentioned factors were defined as the highest priority of customer satisfaction factor.

Retail Price, Warranty and Technical specification were defined as medium priority because they are still important factors for after sales business but not too much necessary compared with highest prioritised factors. Warranty and Technical specification become regular requirement for any automotive companies but they are not the key customer satisfaction factors. Technical specification does not mean high performance specification but it means suitable specification which fit to purpose. Company has to ensure that specification of spare parts is fit to vehicle correctly. For retail price, normally it should be one of the most important factors for

many businesses, but it may not always true. Low price does not always gain customer satisfaction but sometimes it may ruin brand image of company. Normally, when company reduces price significantly, customers may feel worry about lower quality products which company does not want to keep them in stock. For company's customer needs suitable price rather than very cheap spare parts. Therefore, retail price of spare parts was defined as medium priority.

Lastly, Brand Image, Design and speed of new product introduction are all important for vehicle sales rather than spare parts or after sales business. Therefore, they were defined as low priority in after sales business's aspect.



Table 3: Criteria of customer satisfaction factor for spare parts business

Criteria	Description	High	Med	Low
1. Brand image	The power on branding the products			X
2. Warranty	Warranty period after customer buy products		X	
3. Price	The retail price of products		X	
4. Availability	The products which customer need are saleable at the moment.	X		
5. Design	The Attractiveness of products			X
6. Technical Specification	Right specification and fit to purpose		X	
7. Quality of services	Product must ready to use , No damage from delivery , Right delivery items	X		
8. Delivery lead time	Delivery lead time after order must be short and always on time	X		
9. Speed of NPI	Time to market after product introduce to market			X

Regarding to analysis of three areas, operation strategy was generated by focusing on improving in two areas. The first one is improve logistics operation for reducing operation lead time and another one is improving of supply availability. For improving supply availability, there are several methods to improve supply availability. For example, improve supply network, review capacity planning and import new technology. But in order to reduce cost together, it might be difficult to improve availability without cost addition or big investment. On the other hand, improving logistics operations such as improve transportation is seem to be more suitable because transportation is internal process of company and it also impacts to customer and service centre. Improving transportation process will also result in cost reduction and increasing of profitability. Therefore, author decided to improve

transportation process of parts logistics department in order to improve operation together with cost reduction.

In conclusion, author introduced **SPEED strategy** as new operation strategy of logistics department and it is used as guideline for improvement in operational area. SPEED is consisted of 5 key factors namely;

S - Satisfaction of customer

P - Parts Available faster

E - Efficiency in operation and cost

E - Energy saving

D - Downtime reduction

By using SPEED strategy, author decided to design new transportation operation which is related with SPEED strategy as proposed.

Create new transportation scenario

According to operation strategy which author decided to improve transportation process, author studied on current problems of transportation process. There are three main problems which defined as important problems and still have some gaps to improve. Customer waiting time, Delivery precision and Loading efficiency of truck are three main problems which found in Bangkok route transportation nowadays. Therefore, it will benefit company if the new transportation scenario solves three problems with only one method.

Starting from three mentioned problems, author used WHY-WHY method or called 5WHYs. It is a well-known problem solving tools which is widely used in various industries. According to Table 4, author used **WHY-WHY method** to analyse true cause of problem especially in Bangkok route. The delay of delivery is normally

happen because of traffic jam. It is major problem of Bangkok especially in rush hour period. However, company must deliver spare parts to all service centres following 1D2T scheme which is a commitment between company and dealers. As a result, transporter has to deliver spare parts to all service centres within commitment time and drivers have to start working during rush hour. For service centres which are located in city centre, it is very high chance to face with delay of delivery.

Furthermore, loading efficiency is occurred because of transporter split transportation routes into 11 routes because transporter has to deliver to service centre within time limit. Actually, the distance between service centres is not too far but because of traffic problem, transporter must split route for ensure on time delivery. Lastly, the difference of customer waiting time causes inequality among service centres. It is caused because transporter has to use route transportation for time saving and cost efficiency. Route transportation set fixed sequence of delivery which is created by various methods to optimise route. The reason behinds route transportation is traffic jam as well. In conclusion of WHY-WHY method, it is clearly seen that traffic jam is a root cause of all major problems which author concerned.

Table 4: WHY-WHY method for finding roots cause of three main problems

Problems	WHY	WHY	WHY
Delay delivery	Traffic jam	Operation hour is rush hour	Delivery commitment
Low loading efficiency	Split too many routes	Spend much time between destination	Traffic jam
Different customer waiting time	Route transportation	Spend much time between destination	Traffic jam

After author realised that traffic jam is a key difficulty of transportation problems, author applied **HOW-HOW method** as shown in Table 5. It illustrated method for avoiding traffic jam problem. Firstly, transporter has to avoid rush hour period which normally happened during 07:00 – 10:00. It does not happen only in city centre areas but it is normally occurred at business area and industry area as well. For avoiding rush hour, transporter has to decide to work on other period because it is impossible to solve traffic problem by company. If transporter operates after 10:00 which is after peak period of traffic jam, transporter will not possible to deliver spare parts follow 1D2T commitment. Therefore, transporter has to work much earlier and try to finish spare parts delivery before rush hour.

Night time delivery is a solution which can solve company's problem. According to the idea of night time delivery, transporter will start working at night time after warehouse operation is completed. Transporter will travel to each service centre to deliver spare parts at night time. The night time traffic of Bangkok is totally different with day time especially rush hour. In addition, operation time of transporter is also longer than day time delivery so it is possible to increase delivered volume which lead to less transportation route and higher loading efficiency.

One more thing, all service centres will receive spare parts at opening time. Parts store staffs are not required for night time delivery because company will find out

solution to contain delivered goods when transporter arrives at service centre. Containers should be provided to all service centres for using as receiving point. Night time delivery is widely used in European countries.

Some businesses in Thailand also use night time delivery, for example, convenient stores, supermarkets and new vehicle delivery. However, there is no automotive company in Thailand use night time delivery for spare parts distribution.

All in all, all mentioned problems will be solved by using night time delivery. On the next processes, author studied in detail of night time delivery to create most appropriate operation process.

Table 5: HOW-HOW method for finding solution to avoid Traffic jam problem

Problems	HOW	HOW	HOW
Traffic jam	avoid rush hour	Deliver on other time	Night time delivery

Operation design

Process flow

After the method was selected, author designed new process for using in operation from end-to-end. First of all, author listed up concerned issues in logistics team's point of view. Process flow was designed based on current processes but some points had been changed for more compatible with night time delivery. One of the most concerned points is goods receiving process at night time.

ECRS concept was generally used as a principle for generating idea of improvement. Author expected to use ECRS concept to re-design and formulate new operation process flow which follow Night time delivery scheme. ECRS is a part of Lean concept which aims to reduce waste in process. ECRS was not applied only

operation processes but it was able to use with related factors such as work scheduling, related equipment and operation management system.

Author used cause and effect diagram for exploring waste in operation then applied ECRS concept as a guideline of re-designing process. Author found that the main transportation waste was **cargo's free space**. It is a reason of inefficient loading volume which leads to low cost efficiency of transportation. In addition, spare parts waiting time is also a waste of service centre's operation because parts is available to supply but because delay of delivery result in longer downtime.

According to Table 6, at the start of using ECRS, author studied current process and searched for waste which is occurred in operation process. However, there are only minor wastes which do not make huge impact to operation. In consequence, author decided to combined transportation routes in order to increase delivered volume of each truck. It resulted in better efficiency of loading and decreasing of number of routes. The combination of transportation routes was based on distance between location and average delivered volume. Therefore, author needed re-routing for the best optimal routes before implementation.

Furthermore, delivery schedule was rearranged to early start delivery process according to night time delivery scheme. Normally, delivery process starts on early morning of after ordered day then travel to each service centre on defined route. The new delivery schedule was changed to start around 7 o'clock at night. It resulted in longer operation time and all service centres receive parts at the opening time. Lastly, author remained the strength points of current operation process because author would like operators to work with the same work instruction for familiarity of work. The current key operations such as evidence recording and cross checking process were remained as same. In addition, author kept all operation process to work simply with the same operation processes. Hence, there are few extra processes which added to work instruction of operators. For example, locking

and unlocking containers was operated instead of co-checking with customers, submitting delivery plan and truck number to service centre in advance and recording actual arrival truck by guardsman.

Table 6: Improvement action for new transportation scheme by using ECRS

ECRS	Improvement actions
E - Eliminate	No specific action
C - Combine	Combine transportation routes based on distance and average volume
R - Rearrange	Rearrange delivery schedule
S - Simplify	Remain strength point of current processes - Document and evidence control - Cross checking process Not adding extra process

Regarding to ECRS result, author created operation process flow for transporter and concerned parties. It started with delivery process. Currently, when transporter arrives at service centre, transporter and store staffs do completeness checking together. If all delivered goods are correct quantity and quality, store staffs will sign on transportation sheet as evidence of delivery. However, for night time delivery, there

are no staffs available at night. Therefore, designed process was changed in receiving process. Night time delivery needs container for store and protects goods. The important specification of container is security and locking system which can be opened by transporter and store staffs only. When transporter arrives at service centre, transporter opens container then put goods to container. Transporter was required to check completeness of shipment before putting in container. After checking, transporter signs transportation sheet then put the copy of transportation sheet in container. On the service centre opening time, store staff opens container and check completeness again then sign transportation sheet for confirm receiving and moves goods to parts store.

Furthermore, return goods process was also adapted to suit with night time delivery. Normally, store staff hands returned goods to transporter directly. But, for night time delivery, returned goods was processed by using designed containers as well. Store staff put goods which would like to return to company into container with required documents then closes and locks. Transporter picks them up when transporter delivers goods to service centre.

Lastly, there was a request to security guard of all service centres to record arrival time of transporter and truck license plate number. This process is required for security issue. Company provides delivery plan to all service centres which includes truck information. Therefore, security guard has to check actual truck which coming to service centres with provided delivery plan. In case of not match, security guard has to check information in transportation sheet and record actual truck number.

In this process, it was not the final version of operation process flow because author discussed with other related parties in following processes. This drafted version was a guideline for define other job following with process flow. The comparison between current and new operation was shown in Figure 20

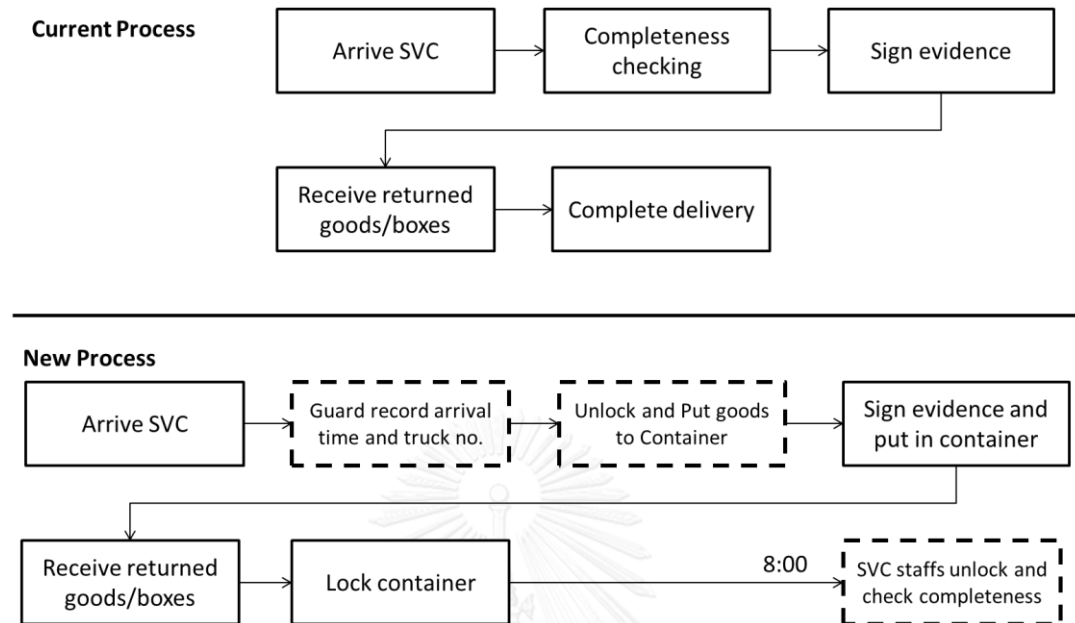


Figure 20: The comparison of current and new operation work flow

New delivery time table

To complete operation designing, night time delivery has needed new time table as a guideline for working. Currently, Bangkok routes have been operated 2 trips per day according to 1D2T scenario. For afternoon trip, it has been kept as current. However, morning trip has been changed from morning to night time. Night time delivery starts on 19:00 and planned to complete delivery before 05:00. For warehouse operation, there is no change in warehouse processes but the key change is transporter's tasks. Delivery time table was adapted and used again in implementation period

Figure 21 was used as a guideline in implementation period. The key change is delivery time which change from 8:00 of next day to 19:00 of ordered day. In addition, operation time was longer than current. Currently, transporter operates about 3 to 3.5 hour per trip. For new operation, transporter had to work around 8-9 hour per trip. The timetable was adjusted again before implementation and it was made more obvious for operation.

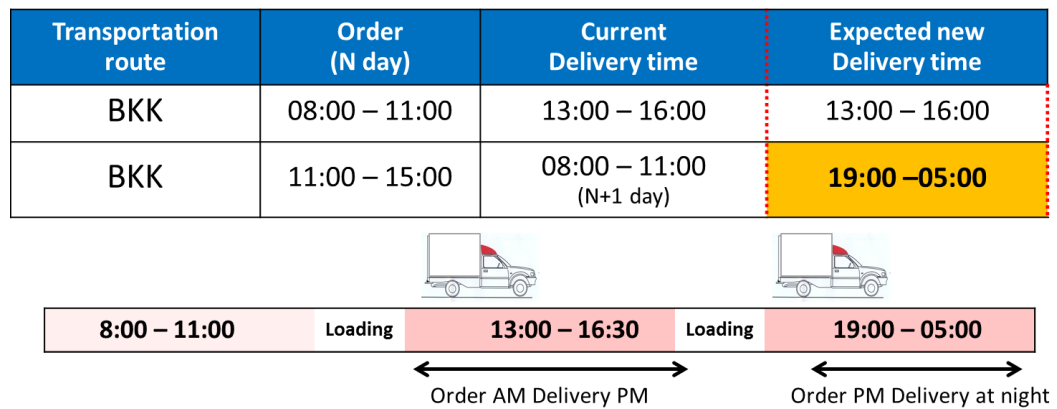


Figure 21: New delivery time table for using in night time delivery

Container design

According to designed operation, night time delivery requires containers for using as receiving points for each service centre. There are many ideas of the European companies which existing transport at night. Container was designed as goods receiving point which is located in customer's area. It is called "Dropbox". Dropbox is used for two functions; drop off and pick up. Transporter drops delivered goods into Dropbox then closes it. After that, customer unlocks it and pick up goods inside. On the other hand, customer can drop goods for return them to company into Dropbox then transporter picks them up to return them to company's warehouse. Dropbox can be purchased from blacksmith's shop or it can be modified by using existing equipment. After Dropbox is ready to use, company have to locate it at service centre area. The drafted idea of container is showed in Figure 22.

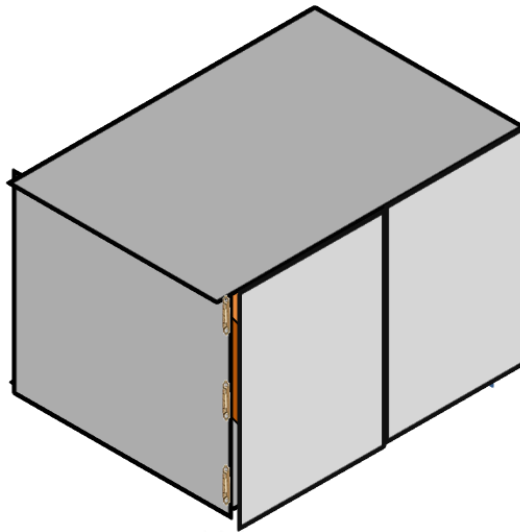


Figure 22: Sample of container which used in night time delivery

Some transport companies deliver goods to guardhouse at customer's area. Guardsman is a receiving person which receives goods from transporters. However, this idea will not available for service centres which do not hire guardsman.

Lastly, author created new idea of receiving area which commonly use between transporter and service centre staffs. The parts store is partially access with two gates at parts store. The first gate is commonly used by transporter and staffs. The area behind the first gate is receiving points which transporter drops goods and transportation sheet. Furthermore, this area also allows service centre staffs to entry for pick up goods and evidence as well. The second gate is located between receiving area and store. This gate can be accessed by service centre staffs only in order to secure theft and it does not allow transporter to pass this gate.

On the other hand, this idea will cost much money on renovation the existing spare parts store. In consequence, it is not a suitable idea for trial delivery even though it is the most secure solution for pick up and drops off delivered goods. If night time delivery is fully implement, the receiving point idea should be included in establishing plan of new service centre in the future. So, new service centre will have

receiving point for supporting night time in the future. The sample layout shows in Figure 23

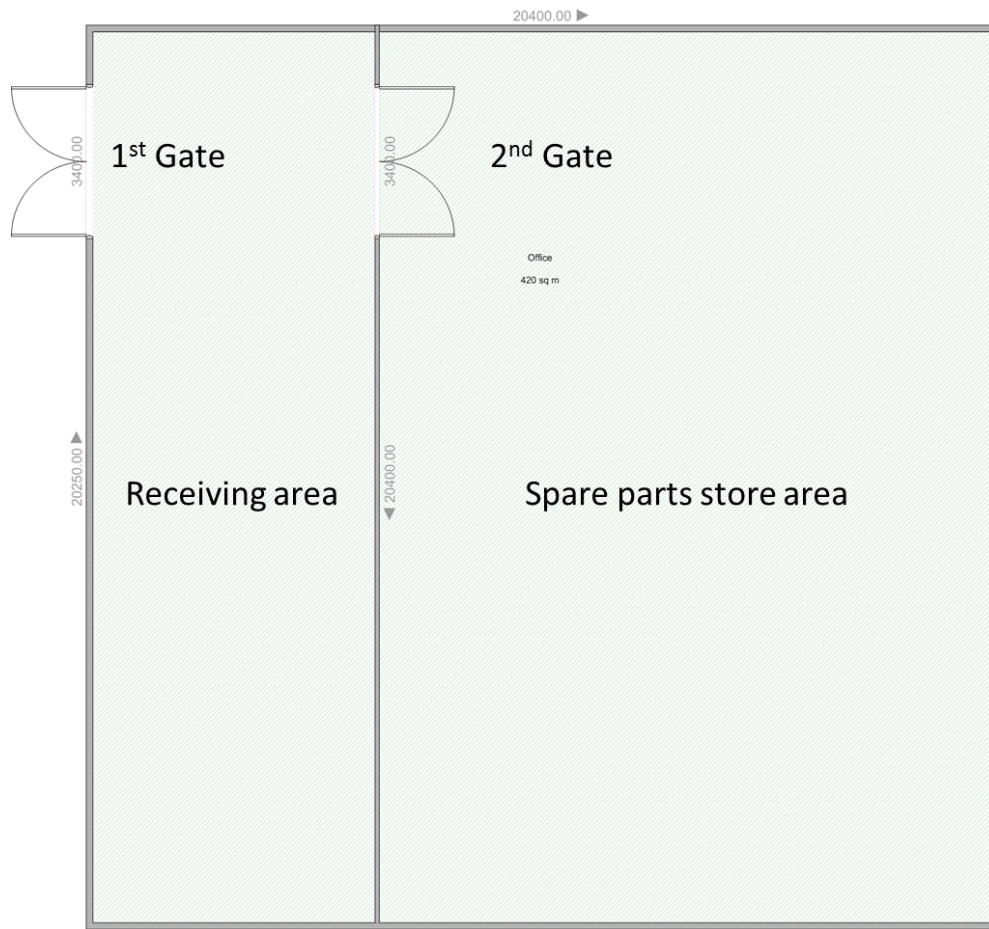


Figure 23: Layout of spare parts store with receiving area

According to all ideas, author decided to use Concept of Dropbox as containing method in trial delivery because it is the cheaper method compared with building receiving area. It is also safe method in order to protect delivered goods. Delivery to guardhouse will result in the increasing of effort of guardsman to receive delivered goods instead of staffs. Furthermore, each service centres hire different security companies, so author cannot fully trust in all security company and it will take much more effort for checking trustworthiness of all security companies. In addition, guardhouse of each service centre may different on size of guardhouse. Author cannot prove that it can totally contain delivered goods. Finally, author decided to modify existing equipment for using as container in trial delivery.

Container will be placed outside service centre area but it must be safe, well protection and secure access for only authorised person. In addition, Thailand is located in tropical area and rainfall is normally happened in most area of country. In consequence, the container of night time delivery must have well water protection and it must have clearance between container and floor. Size of container was calculated by using historical data and possible maximum size of parts. Therefore, the final size which author calculated is around 4 cubic metres with 1.4 metre width, 1.9 metre length and 1.5 metre height.

Pilot service centre selection method

The research requires trial with selected service centres therefore the selection of pilot service centres is required process before implementation. In selection process, author has two options for selecting pilot service centres.

Select by current transportation route

Regarding to current transportation routes, there are about six to ten service centres in one route. By the first option, author will select one route to operate night time delivery during trial period under several criteria. The selected route will be operated by Night-time delivery scenario together with “One day two trips” scenario. Therefore, orders of Morning period are still delivered with the same time, but sales orders which submit before order cut-time on the afternoon will be delivered on 8 o'clock at night onward by using night time delivery process.

The advantages of this option are no modification on operation system and master data, because current operation system is able to support project's requirement. The cost of system modification is expensive and it may take longer time for processing on system modification. Therefore, it is better in term of cost and time if any parts of program can be avoided. In addition, this option does not make impact to non-selected service centres which are not involved in project.

On transporter's aspect, transporter is not required to re-route transportation route to support night time delivery because current routes is compatible to operate with night time scenario. For the customer relation's aspect, service centres which are not involved in this project will not receive any impacts during trial and they can operate their process as normal. The goods receiving time of service centre also remain as the same because there is no re-routing process required in this option. Therefore, the customer relationship staffs will not put extra effort to manage complaints from service centres due to change on receiving time.

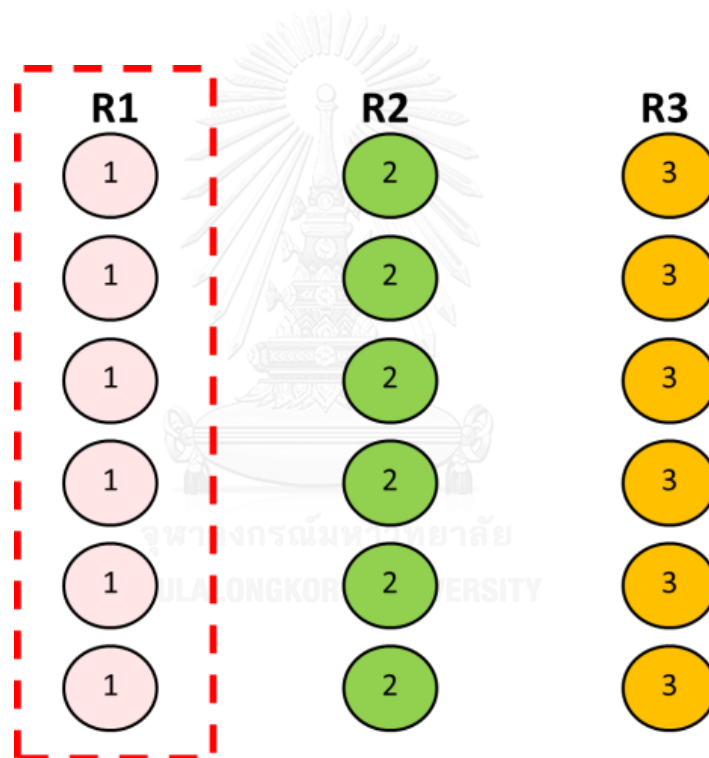


Figure 24: The first option of pilot service centre selection scheme “Select by current transportation route”

Select by the specific service centres

For the second option, author will select service centres from all routes by various criteria and rearrange transportation routes to operate on night time delivery. The selected service centres are the service centres which usually found problem about spare parts delivery and service centres which willing to attend this project. By this

option, author has to create selection criteria to select the most appropriate service centres then author selects a group of service centres and creates new transportation route on night time delivery. On the other hand, author has to rearrange route because this option will affect to receiving time of many service centres especially non-selected centres.

The advantage of the second option is the customer's opinion. The selected service centres will get better services compare with current services. Therefore, they will give opinion and share experiences which compared between current and new services.

However, the second option will result in several drawbacks. First of all, the change in receiving time will cause complaints from service centres especially service centres which will receive later than usual. The customer relationship team has to put more effort to negotiate with service centres. It also makes impact to transportation cost which will be higher than current due to the longer distance in each transportation routes. Lastly, the second option requires operation system modification because the new scenario does not fit with the current program and master data.

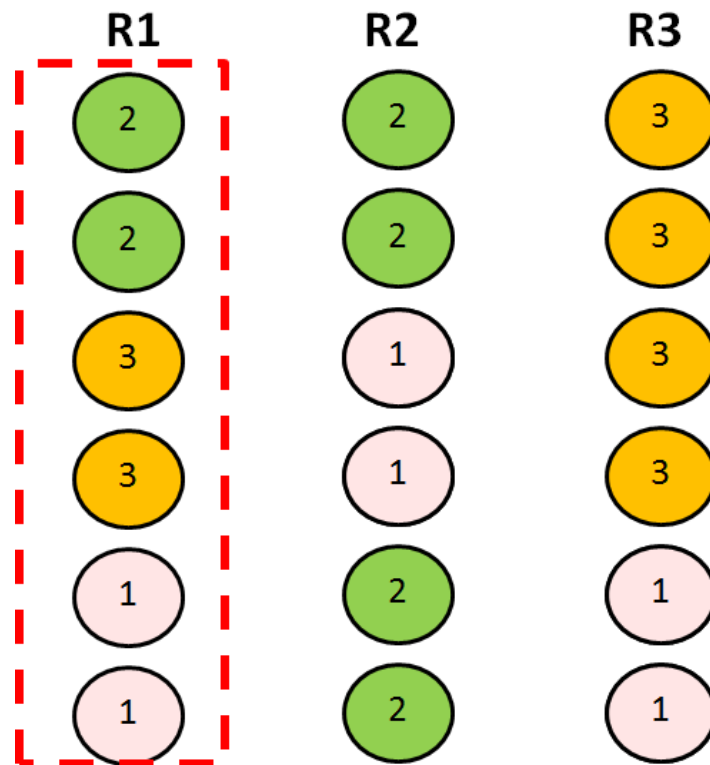


Figure 25: The second option of pilot service centre selection scheme “Select by specific service centres”

After author compared two options, the first option is much better than the second option because of several reasons. Firstly, the estimated trial cost of the first option is less than the second option, especially transportation cost and system modification cost which are the large amount of money. Secondly, the second option will make some complicated issues on many service centres. They have to change receiving time which will also make impact to repairing time of technicians and accuracy of customer appointment time. Customer relationship team has to put more effort to explain all service centres both selected and non-selected service centres. Change management must be applied in detail to prevent further problems from service centres. As a result, author decided to select pilot service centres from current transportation route.

Select from current transportation route	Select specific dealers
System modification is not required	System modification is required
Receiving time of Non-selected Service centres will not be changed	Receiving time of Non-selected Service centres must be changed
Re-routing is not required	Re-routing is required
No additional cost on current route	Additional cost for longer route compared with current

Figure 26: The comparison between two options of pilot service centres selection scheme

The criteria of pilot service centre selection

After pilot service centre selection scheme is selected, the criteria to select pilot by transportation route must be defined. This process is to select the most suitable transportation routes to be used in trial process. The selection criteria must be relevant with concerned problems in current distribution situation and it must be appropriate with trial process. However, there are not only measurable indicators but customer relationship is also important for research as well. Author set three criteria as selection criteria; loading efficiency, delivery variation and customer relationship.

Loading efficiency

Loading efficiency is measurable method which determines the ratio of loading volume and total volume of one shipment. The higher figure results in better capacity utilisation of each shipment. In this research, author collected data from all transportation routes in Bangkok area. There are eleven routes operate in Bangkok area. In each route, service centres are arranged and set by parts logistics team with various conditions. Each shipment operates by pick-up truck which can deal with a maximum capacity of six cubic metres.

The reason to use loading efficiency as selection criteria is to see clearly difference between before and after applying night time delivery. The higher loading efficiency means that company better utilises resources and it will result in the reduce numbers of vehicle and transportation cost.

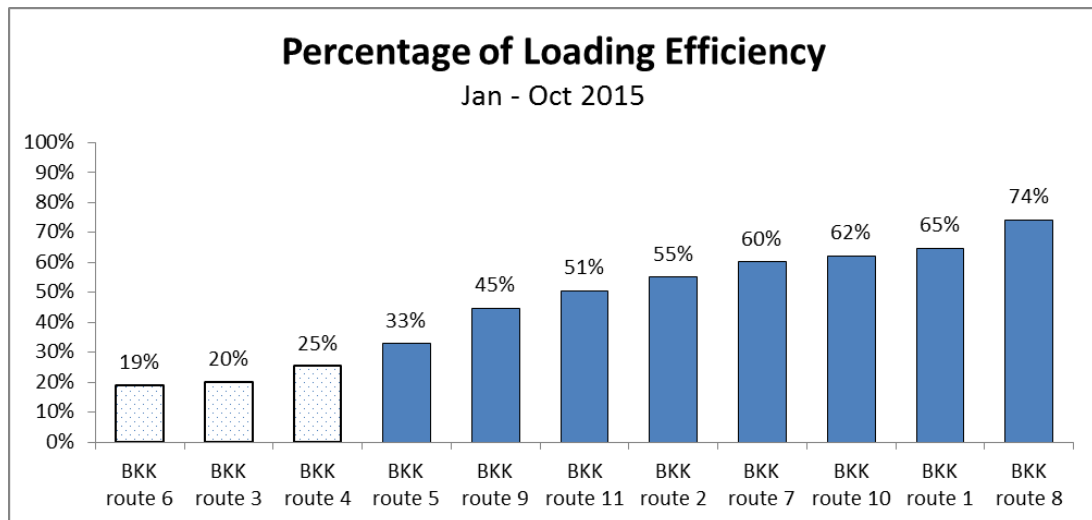


Figure 27: The percentage of loading efficiency of Bangkok route during January to October 2015

Author analysed information in detail of each route and found that there were differences in loading efficiency of each route. In Figure 27, route number 6, 3 and 4 were the worst three routes with fewer than 25% of loading efficiency of each shipment or about 1.5 cubic metres per shipment. On the other hand, Route number 8 was the best efficiency among eleven routes with 74% in average.

Service centres in route number 6 have ordered less than other service centres. It is a main reason of lower loading efficiency in route number 6. Furthermore, traffic congestion and delivery time commitment are two reasons which have caused the lowest percentage of loading efficiency. Service centres in route number 6 are located in the worst traffic congestion area of Bangkok. It is very difficult to increase loading capacity by arranging more service centres in route number 6, because Bangkok routes are operated by “one day two trips” scheme and transporters cannot

deliver goods to all service centres by 11:00 for morning trips and 16:00 in the afternoon for afternoon trips. It may also have a chance to make delay of delivery.

To conclude, loading efficiency was a clear and effective measurable method on transportation. It results in performance of transportation planning team and designed transportation routes. Therefore, loading efficiency is important indicator to define the effectiveness of transportation improvement. The lowest efficiency route should be as representative in improvement.

Delivery variation

Delivery variation is mainly used in transportation performance evaluation. Company uses it to determine the variation of goods delivery in two points of view; Percentage of delay delivery and Average delay time per month. Both indicators are selected as selection criteria because they clearly result in delay problems which occurred during specific period.

Percentage of Delayed delivery

The percentage of delay on delivery is ratio between total delayed delivery and total delivery of each transportation route. The high percentage of delayed delivery results in the low performance of that route. Delayed delivery impacts to the variation of service centres receiving time and it also impacts to longer service time of service cases. Service advisor will difficult to estimate the most accurate finish time if delayed delivery is regularly happened. Therefore, the percentage of delayed delivery is an indicator which transporters must aware. Normally, the company has commitment with transporters and service centres that delivery truck must arrive at service centres on commitment time with fifteen minutes allowance. If arrival time is delay from commitment time over than fifteen minutes, company will record that delivery as delayed delivery. In one shipment of each route, transporter delivers to over seven service centres. If transporter makes delayed delivery, he has to recover as possible to prevent delay on next destinations.

Author gathered information of delayed delivery as show in Figure 28. Route number 11 made the poorest performance in term of delayed delivery by 9.15% of total delivery. However, route number 6 which is the worst route in term of loading efficiency also made high percentage of delayed delivery as well.

In detail of problems, traffic congestion is the main reason of high delayed percentage. The locations of some service centres are located in poor traffic area. Author also found that delayed problems were happened in rush hour period in the morning or during 7:30-9:00 more than other period. In addition, most of delays were found at the first and second destination of each route. Even though, transporter try to avoid rush-hour period by departing from parts centre earlier but it still made delays.

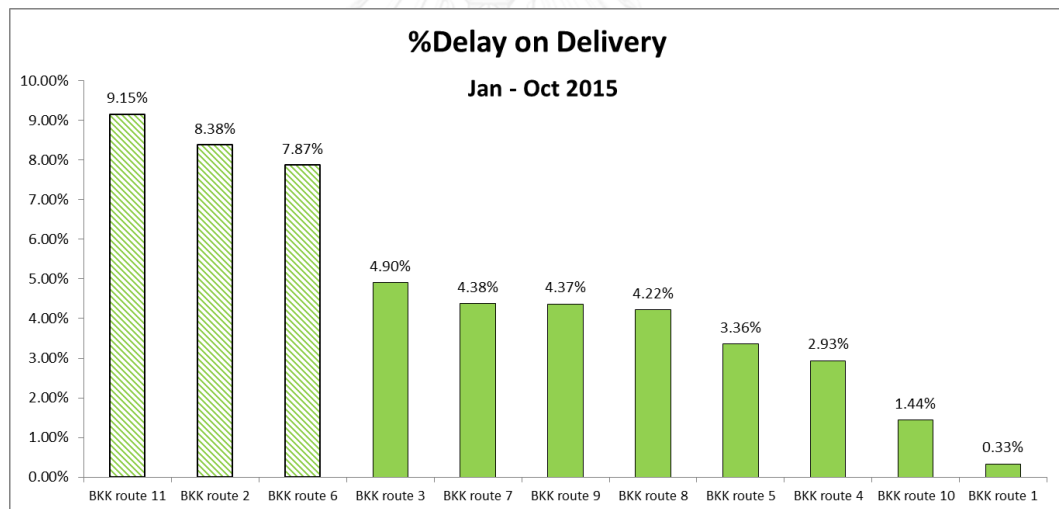


Figure 28: Percentage of delayed delivery of Bangkok route during January to October 2015

Percentage of delayed delivery has been included in selection criteria because night time delivery is the solution to solve delay problems. Normally, road traffic at night is better than rush hour period in the morning, therefore travelling time from service centre to next service centre will be shorten. It will result in a longer distance of each transportation route with same working hour. In addition, good receiver is not

required in night time delivery because transporter will deliver goods to container near parts store. Therefore, delayed delivery is not a concern point for night time delivery. In conclusion, the highest delayed percentage route should be selected as pilot service centres in the trial of night time delivery because it will solve delayed problem which happen frequently at selected service centres.

Average total delayed time per month

The average total delayed time was selected in research as selection indicator with the same reason with the percentage of delay but it gives a different aspect with the delayed percentage. It is valuable for analysing problem in transportation. Average total delayed time is calculated by accumulating delayed time of each drop in each month then makes the average of all records in the period of time.

Average total delayed time is another point of view of delivery variation. It measures delayed impact in term of amount of time but the percentage of delayed delivery determines the frequency of delays which happen in period of time. The higher amount of delayed time is the longer waiting time and vehicle downtime. The longer customer waiting time results in decreasing of customer satisfaction which is the most important factor of company's customers. According to transportation results, some transportation routes encounter the high amount of delayed time but low delayed percentage. It mean those route have low delayed chance but when delayed is happened, delivery will be late for longer time. Therefore, the two mentioned indicators should be solved by different solution.

The high delayed time is occurred by accumulating of delayed time on goods delivery. The more frequent in delay of delivery will result in the high delayed time. However, the high delayed time is also happened because of one or two delays in each month but it spend very long time in each delay. Therefore, the delayed time and the delayed frequency would be used together in transportation analysis.

Regarding to transportation result, Route number 11 is the top in term of delayed time and it also the top in percentage of delay as well. Therefore route number 11 is the most critical transportation route with the top in two delayed indicators. Route number 2 is ranked in second place in delayed time as same as percentage of delayed. Route number 3 is ranked in the third place with about average four hours and fifteen minutes delayed time.

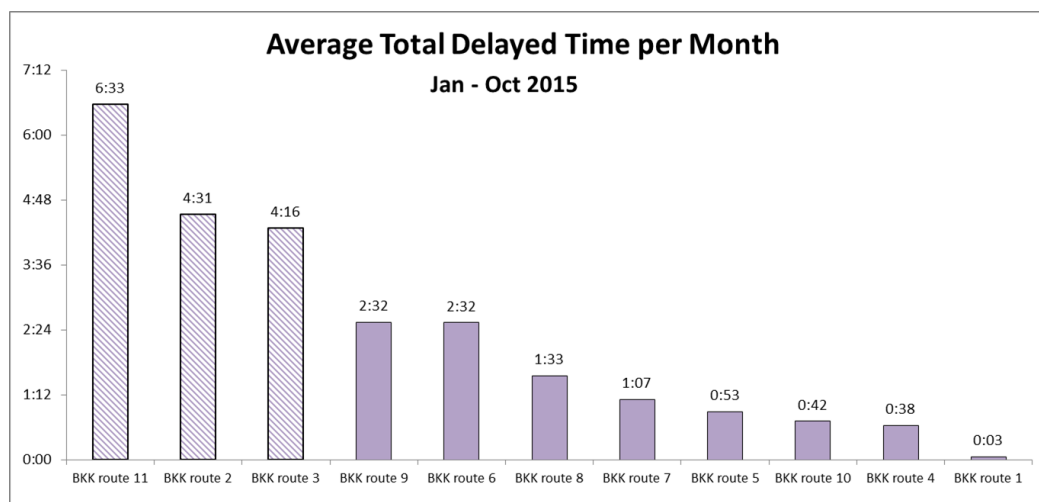


Figure 29: Average total delayed time per month during January to October 2016

Customer Relationship

Lastly, the intangible factor such as customer relationship has been selected as pilot service centres selection criteria. Even though measurable indicators is important to indicate how much transportation problem impacts to service centres, the relationship between company and service centres is also important factor. The research requires trial of delivery to prove that night time delivery practice works well with service centre in real situation. However, trial delivery needs well collaboration of service centres to complete the trial. Service centre's staffs have to put their effort during implementation. There will be some problems happen during trial and they may impact to regular operations in service centres. Therefore, the selected service centres must be well cooperated service centres and they willing to give opinions for improvement.

However, customer relationship factor must be concerned about bias because it cannot measure by any indicators. Even if there are many CRM tools exist nowadays, it is scored by customer's opinion, disposition and perception. All of those are tangible factors. Therefore, customer relationship factor must be used carefully.

For customer relationship factor, author discusses with customer relationship team. Customer relationship team works closely with all service centres in Thailand. It is separated into six teams which in charges of six regions in Thailand. Author mainly discussed with Bangkok team for getting information about each service centre in Bangkok area. In addition, author made drafted options which are based on gathered transportation information. Drafted options are list of service centres which are delivered by the lowest performance transportation route. Then customer relationship team gave their opinion on each service centre about past collaborations, work performances, attitude of service centre staffs and the opportunities to join night time trial delivery.

In conclusion, the pilot service centre selection criteria are related with delivery performance of company because the night time delivery method is an improvement method to solve delivery problem. If research aims to acknowledge that the new method can solve the problem, the selection criteria must focus on the highest impact transportation route as a first priority. However, customer relationship must be included in selection method for better effectiveness of selection. In implementation phase, the selections criteria will be applied then select the worst performance transportation route in all area as a draft option. After that, author will discuss with customer relationship team to finalise the pilot service centre selection.

Evaluation method

For evaluation method, author separated evaluation method into two groups. The first group is actual trial results which are consisted of Delivered volume, Actual

shipment time and Parts Waiting time. For another group is result from simulation in case of full implementation. The simulation of night time delivery is based on new transportation route which plan to be used if night time delivery actual apply in real business. The results from simulation are consisted of Cost-performance index, loading efficiency and estimated transportation cost. Evaluation method was applied in

Chapter

V

Results & Discussion



Chapter IV

Implementation

The Blue Print of Changes

The key changes of this research are almost related with transportation processes and some service centre operations. In this part, author explained the key changes of process which happened during trial period and also included operations which different between trial period and full implementation.

Delivery Time Table of night time delivery

The time table of night time delivery was separated into two tables. The first one was used during trial period and another will be used for full implementation in the future. The main difference of two tables is operating time of transporters. The operating time of transporters in trial period is shorter than full implementation period because there is only a group of service centres have been involved in trial period. Therefore, transporter operates during 19:00 to 23:00 for deliver goods to all pilot service centres. However, the operating time will be expanded to 05:00 in the morning if night time delivery is completely implemented. Distance of each route will be longer compared with trial period and it results in reduction of number of transportation routes.

According to Table 7, during trial period, transporter worked under two scenarios. The current scenario was used for delivery spare parts to non-selected service centres. On the other hand, the trial scenario was applied for pilot service centre route. It operates two trips per day. The first trip is afternoon trip as same as the current scenario. The second trip is night trip which start shipment on 19:00. By this scenario, all sales orders which are submitted to company during PM order cut-time will be delivered during night time.

Table 7: Delivery timetable of trial period

Scenario	Morning	Afternoon	Night
Current	8:00 – 11:30 (3.5 Hr)	13:00 – 16:30 (3.5 Hr)	X
Trial	X	13:00 – 16:30 (3.5 Hr)	19:00 – 23:00 (4 Hr)

According to Table 8, it demonstrates the time table which will be used if the full implementation of night time delivery is applied. The key difference of new timetable is delivery time. Transporter will operate longer than trial period. It will start at 19:00 and shipment will be end around 05:00 in the morning. The commitment of company and customers is also remained as the same. Therefore, delivery date of order depends on order time as the same.

Table 8: Delivery timetable of full implementation period

Order Type	Order Time	Picking	Current Delivery Time	New Delivery Time
Emergency	8:00-11:00 N Day	8:00-12:00 N Day	13:00-16:30 N Day	13:00-16:00 N Day
Emergency	11:01 - 15:00 N Day	11:01 - 17:00 N Day	8:00 - 11:30 N+1 Day	19:00 - 05:00 N Day
Emergency	15:01 - 21:00 N Day	8:00 - 12:00 N+1 Day	13:00 - 16:30 N+1 Day	13:00 - 16:00 N+1 Day
Normal	8:00-17:00 N Day	8:00-17:00 N+1 Day	8:00 - 11:30 N+2 Day	19:00 - 05:00 N+1 Day
Normal	17:01 - 21:00 N Day	8:00-17:00 N+2 Day	8:00 - 11:30 N+3 Day	19:00 - 05:00 N+2 Day

Delivery and receiving process

Another different point is delivery process at service centre area. Currently, transporter delivers goods to service centres during working time then service centre staff checks and receives goods from transporter. However, the new process does not require service centre staff to wait until midnight for receiving goods but transporter delivers goods to containers which are provided by company. Provided container is located in service centre area and it can be unlocked by service centre staffs and transporters only.

For receiving process, currently, staffs have to sign on transportation sheets when shipment is checked and no deficits. After that, staffs and transporter keep copy of transportation sheet as evidence of delivery. On the new process, transporters will leave transportation sheet in container then lock container's doors. At the opening time, staffs have to check as same as current process then check completeness of delivered goods. If they are all correct, staffs have to sign on transportation sheet and keep their copy as evidence. For the transporter's part, staff will hand to transporters on afternoon trip when transporter arrives for delivery afternoon shipment. The detail of change was explained in following topics.

Pre-Implementation processes of Night Time Trial Delivery

There are five major processes to be completed during pre-implementation period. The main purpose of pre-implementation is preparing readiness of implementation. Pre-implementation process applies methods which created in previous process. Some processes in pre-implementation are mainly focused on discussion and information sharing to specific parties. They are parts of change management which is important process that should be done because night time delivery is a very new transportation scenario in automotive business in Thailand. Lack of information may lead to opposition on new scenario and it may result in unsuccessful on implementation. The five steps to success in pre-implementation of this project are showed in Figure 30

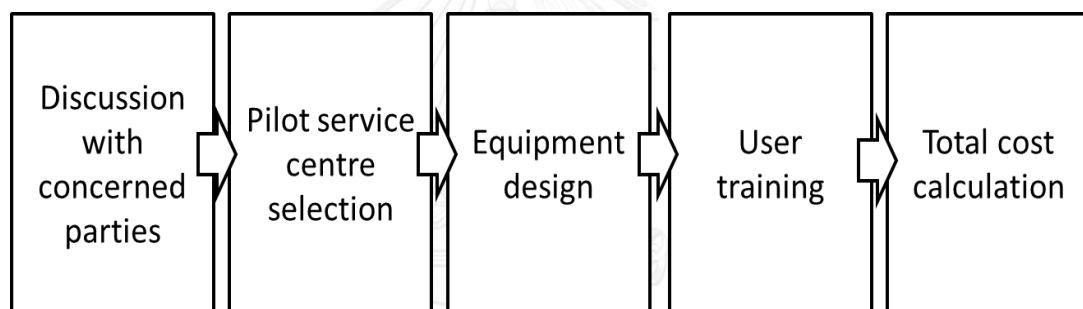


Figure 30: Five process of Night time trial delivery pre-implementation process

Discussion with concerned parties

For this step, it is a part of “HO REN SO” concept which author mentioned in Chapter II. HO REN SO guides that project team has to make clear communication to all concerned parties and allow them to be a part of project. It is very significant for project which make huge impact and big change to company. Therefore, author and project team had to keep communication and make them understand what project causes impact to their process. This process is a key factor to success in implementation. It follows the key idea of change management by letting all concerned parties acknowledge and realise on the changes which will be happened during implementation.

After all methods have been drafted completely, pre-implementation phase was started. Firstly, the detail of research was explained to all concerned parties. There are five parties which decided as concerned parties of night time delivery. The discussion with concerned parties is a part of change management which is important for changing processes smoothly. It lets related parties understand key changes of process. Meeting also allows all parties to discuss openly on night time delivery, share opinion in different point of view and also reduce contestation during project is in progress. The selected parties are related with night time delivery in different part and they also have different role in project as well.

Managements of Logistics department

First of all, the detail of research was explained to management team for getting approval on night time delivery concept and trial delivery plan. Meeting with managements was arranged periodically for updating the situation of project and getting opinion from management's point of view. Furthermore, the meeting with managements helps on improving the drafted methods and shares important information from management's experiences.

The first meeting with top managements was arranged for asking for company's policy and direction. It is a necessary part of applying Modified Hill's framework. The top managements who related with night time delivery include Vice President, After-sales group manager and Logistics Department Manager. After that, meeting was arranged fortnightly for updating with Logistics department manager and related managers in logistics department. During each meeting, there were some changes in method of project but it was not too many. Lastly, the meeting with top managements was arranged again after all information and concept of project were done. In the last meeting with top management, project was approved for continue studying and trial.

However, meetings with managements were arranged by monthly for informing current situation of project and progress until the last step.

Customer relationship team

Customer relationship team is a vital party as coordinator between company and service centres. The meeting with customer relationship team mainly focused on two points. The first one is pilot service centres selection and the second is the collaboration with selected service centres. The meeting with customer relationship team was arranged after project was gotten an approval from managements. Information was explained to customer relationship team in detail. After pilot service centres selection was applied following defined method, the result of selection was discussed with customer relationship team. The result of meeting was the final selected service centres which involved in trial delivery.

In addition, customer relationship team also had another role to get feedbacks from service centre's staffs and report to related parties.

Transport companies

Transport companies are transporters which company hires them for delivery goods to nationwide service centres. They have an important role in night time delivery because there are many changes which make impact to transporters. For example; transportation routing, manpower management, transportation costing and controlling process of night time delivery. The major meeting with transporters happened in two periods, and there are several sub-meetings with transporters happened along the project was running. The key objectives of discussion with transporter is a discussion about feasibility of night time delivery, concerned points of transporter and operation process design.

The first period aimed to explain scope of project and detailed information. The current transporter called "*Transporter A*" was a main party of the first meeting. Transporter A was assigned to operate night time delivery in trial period regarding to

the authority which company has assigned. Transporter A and author made plan for operating on night time delivery and also did route surveying after the first meeting. Author and Transporter A worked and studied together to find the most suitable processes. Lastly, Transporter A proposed transportation price for using in night time trial delivery. The operation process from end-to-end was explained to transporter in meeting as well.

Another major meeting with transporters was arranged for proposing new quotation of night time delivery. The objectives of transportation quotation are price comparison and total cost and benefit calculation. Transportation quotations were submitted by three transportation companies then they were compared in term of cost, service warranty and other conditions.

Warehouse operators

Warehouse operators are currently controlled and managed by Third Party Logistics Company. They did not have a role in night time trial but the meeting was arranged just for sharing information about night time delivery project. Warehouse operators are one of the main parties in spare parts supply chains, therefore they have to acknowledge and understand the research and the changes which happen during trial.

Selected service centres

The selected service centres was explained after the selection process was done. Author finalised the selection process following the designed methods then arranged meeting with selected service centres and customer relationship team.

Pilot service centre selection

The pilot service centre selection operated by the defined methods. It started with applying selected information. Then, calculated data was discussed with customer relationship team and lastly cooperated with selected service centres.

Applying selection method

According to pilot service centre selection model, author filled red colour on the top five of each criteria then arranged from the poorest performance route to the best performance route. In Table 9, result shows that Bangkok route number 3 and 6 are the worst five in all criteria. The percentage of loading efficiency of both routes was around 20% in average. Both route number 3 and 6 were the worst in loading efficiency compares with all Bangkok routes.

In term of delays, Route number 11 is the worst in percentage of delay. It also made over six hour delayed time in average delay per month. However, the loading efficiency of route number 11 was about 50%. It was better than route number 3 and 6 in loading aspect.

To conclude, according to selection model, author has selected service centres in route number 3 and 6 as pilot service centres. However, it is only one route to be selected as pilot route. Therefore, in the following process, customer relationship team was involved in selection process.

Table 9: the result of applied pilot service centre selection model

Route	%Loading Eff	% Delay	Total delay (HH:MM)
BKK route 3	20%	4.90%	4:16
BKK route 6	19%	7.87%	2:32
BKK route 2	55%	8.38%	4:31
BKK route 11	51%	9.15%	6:33
BKK route 9	45%	4.37%	2:32
BKK route 5	33%	3.36%	0:53
BKK route 4	25%	2.93%	0:38
BKK route 7	60%	4.38%	1:07
BKK route 10	62%	1.44%	0:42
BKK route 1	65%	0.33%	0:03
BKK route 8	74%	4.22%	1:33

Discussion with Customer relationship team

In this process, Customer relationship team and author discussed result of pilot service centre selection. The main objective of discussion is to finalise the selection process. Author explained process of selection again and reported a result of applying selection method. According to the result of selection, route 3 and route 6 have been prioritised as a first choice. The list of service centres in route 3 and route 6 also provided to customer relationship team. During discussion, customer relationship team informed their opinion and past collaborations between company and focused service centres. There are two points which customer relationship team made recommendations and used as important factors for finalising service centre selection.

Past collaborations

Firstly, customer relationship team informed the past experiences about collaborations between company and service centres. In the past, customer relationship team conducted several projects with service centres. It lets customer relationship team has well understood the attitude and capabilities of each service centres. They can anticipate that which service centres will give well collaboration to us on night time project. The kind of past collaborations are namely Social responsibility activities, marketing activities or pilot service centres of project in the past.

For route 3, there are four service centres which customer relationship team has indicated as well collaborated service centre. On the other hand, there is only one service centre which cooperated with company in the past.

Performance of service centres

Customer relationship team measures the performance of each service centres by using several indicators. Basically, parts retail sales amount and service unit are two basic indicators which measure performance in sale aspect. Furthermore, staff's skill map is another tool to measure the ability of service centre's staffs. Skill map was firstly developed by training centre of company. It has been shared to customer relationship team for planning in skill development program. In night time trial, skill map is important tools for guide customer relationship team for selecting pilot service centre. The high skilled service centres are capable to encounter with unexpected matter which may happen during trial. In addition, they may provide valuable recommendation on new transportation scheme which will use for future improvement.

For performance aspect, customer relationship team informed that service centres in route 3 have better performance than route 6 in overall according to result in the past.

In conclusion, author and customer relationship team decided to select service centres in **route 3** as pilot service centres of night time trial delivery. Regarding to selection method, it consists of delivery performance as tangible factor and customer relationship as intangible factor. As a result, route 3 is the most suitable route for using in trial and eight service centres are selected as pilot service centres.

Cooperating with selected pilot service centre

After discussion with customer relationship team, author and customer relationship team arranged meeting with service centre staffs at each service centres. In this process, author and customer relationship team arranged plan to visit eight selected service centres. The main objective of meeting was project detail explanation, operation processes during trial and benefit of project. In addition, author also received opinions of service centre managers and staffs on night time delivery project. Security was common issues which most of service centre managers informed. They concerned about theft because night time delivery has never been operated with service centres in Thailand before. However, the theft prevention solution was informed to service centre managers and staffs. Furthermore, there were some concerned points which they need more obviousness. For example;

Short delivery of goods

Damaged goods

Weather condition, especially rainy season

Author explained solutions to response on their concerns and they also accepted solutions which author proposed and willingly gave full cooperation on night time

trial delivery. After explanation, author received all recommendations from selected service centres then used that information for adapting operation processes. For more detail of security issues, author explained in following subtopics.

Selection of Transporter for Night time delivery service

According to the current situation, company has hired 4 transporters to deliver spare parts to nationwide service centre separated by regions. In order to launch new transportation scheme, company has to select transporter to response for night time delivery in Bangkok area even though Transporter A is currently delivering for Bangkok area. Supplier selection increases competitiveness and lead to better purchasing performance of various aspects namely; cost, quality, delivery, flexibility and innovation (Nair, et al., 2015). Each transporter provides different benefits to company and they result in better services which company will receive. It is a good opportunity to arrange bidding between current transporters. Company will get the better services with suitable price because each transporter company will proposed price and service to get the right to deliver spare parts in Bangkok area which will cost more than 10 million THB per year. The price bidding will put pressure to current transporter of Bangkok route to not propose overpriced cost to company even though Transporter A has long time relationship with company.

Regarding to Rushton, et al., (2015), author adapted step of service provider selection process as Figure 31. Author defined scope of work under requirement of night time delivery and also indentified type of required services. In this selection, company informed the scope of work to bidders as follow;

Pick up goods at warehouse of company

Distribute goods to designated destination in Bangkok area with Night time delivery

Proof of Delivery (POD) is required

Operational report and KPI report are required

Working Monday to Saturday night

Payment term is 30 days

For the potential transporters, author proposed 4 current transporters as potential transporters because of the background and relationship. It shortened time to understand company background and culture so transporters did not spend time for adapting with company. After that, author created Request for Information(RFI) and Request for Quotation (RFQ) documents which consisted of detail of requirements and selection process then submitted to potential transporters. Next, all transporters submitted quotation for night time delivery to author. Author checked proposed information and compared price of all quotation.

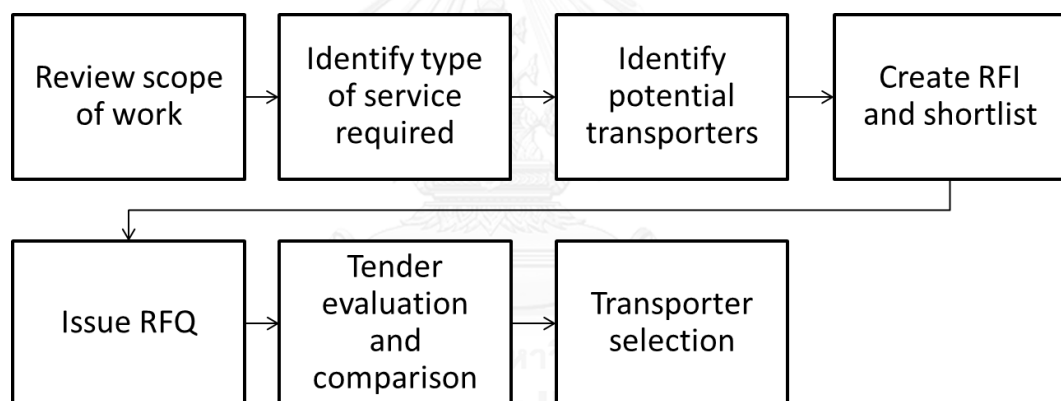


Figure 31: The proposed steps of Transporter bidding process

In **Transporter A** aspect, they are the current transporter of Bangkok route so they have the highest experience in Bangkok route. For transporter bidding, Transporter A has to think carefully to gain advantage over other competitors in order to keep revenue of their company. If they lose bidding, it will result in significant decreasing of revenue. Therefore, Transporter A has to propose most suitable price with better service based on their highest experience in Bangkok route compared with other companies.

One of the well-performed transporters is **Transporter C** who has responded in North-Eastern Region. Actually, Transporter C is the newest hired transporter which has started working for Company since 2014. Transporter C is the world class company which has well background in transportation in several countries. They also have many technologies for using in their operation processes. Transporter C started working with company by delivering spare parts to service centre in North-Eastern Region instead of Transporter B. With their world class experiences, Transporter C provides good services to company with the best on-time delivery, less damaging on transportation and fast responsiveness on special request. Transporter C also has the best internal operation management among 4 transporters hence Transporter C has good financial health. Transporter C also attended bidding for night time delivery as well.

For **Transporter B and D**, they did not attend bidding in order to not enough resources to serve company's night time delivery requirements. Night time delivery requires drivers to work overnight every night. Even though, they can request higher transportation cost from company because of working overnight, it is not attractive enough for these two transporters. The bidding was made and there are two transporters attended bidding of night time delivery.

In Table 10, the result of Transportation bidding is shown that Transporter C's price is cheaper than Transporter A about 30% less. Cost per trip of Transporter A is higher than Transporter C because Transporter A included staff's salary, welfare and annual bonus into transportation charge which are the new requirement of Transporter A. In addition, Transporter A requires one to two more staffs to manage and control transporter at night time. It resulted in additional cost which proposed in new quotation. On the other hand, Transporter C proposed much cheaper price compared with Transporter A with the same services as company's requirement.

For Transporter B and D, as author mentioned, they did not submit quotation to company in order to not enough resources.

Table 10: The quoted transportation price of four transporters for bidding of night time delivery

	Day trip Cost (THB/Trip)	Night trip Cost (THB/Trip)	Additional Cost (THB/Month)	Total Cost per month	Total Cost per year
Transporter A	1,400	3,244	100,000	922,120	11,065,440
Transporter C	1,200	2,500	-	668,200	8,018,400
Transporter B	-	Not attend Bidding			
Transporter D	-	Not attend Bidding			

As a result, if author decided based on quotation, Transporter C should be the new transporter which will service Night time delivery for company. However, in order to maintain relationship between company and Transporter A, author proposed two options to company managements for making final decision on transporter of night time delivery. A comparison of two option shows in Table 11.

The first option is selecting Transporter C to operate night time delivery in Bangkok area because of quoted price of Transporter C is cheaper than Transporter A. In order to serve Operation strategy and corporate policy, cost reduction is the main objective for company nowadays. However, day trip of Bangkok routes are still operated by Transporter A but author will explained to let them know that the demand of Day trip will be reduced soon because of night time delivery is better service which lead to faster parts availability. By this option, Transporter A will be forced by Transporter C which is a better company in term of performance and best practice. Therefore, Transporter A has to improve internal process to compete with Transporter C in order to keep company's revenue from Bangkok day trip. This option is a good option to keep relationship between company and Transporter A, in

addition performance competition between transporter companies still remains. It will result in improvement of transporters in the future and high quality of work which company receive from transporters.

The second option, Transporter C will operate both day and night trip for Bangkok route. This option leads to lower price immediately compared with current. Total annual transportation cost will reduce around 3 million baht per year. On the other hand, the second option will break relationship between company and Transporter A which have worked together for over ten years. Furthermore, the second option also reduces intensity of competition between transporters. Bangkok route will be dominated by Transporter C only without any competitors in same route.

Table 11: The comparison between two selection options of transportation bidding

Option	Merits	Demerits
1. Use 2 Transporters - Transporter A operates Day trip - Transporter C operates Night trip	- Keep relation with Transporter A - Increase competitive level	- a bit Expensive than second option - more complicated in managing transporter
2. Select Bid Winner - Transporter C operates both Day and Night trip	- Best in Cost of transportation - Easy to manage only one transporter	- Break relationship with Transporter A - No internal competition between transporters

All in all, according to supplier selection strategy which has been mentioned in Chapter 2, author decided to use the first option in order to maintain good relationship with Transporter A, meanwhile company is letting competition between transporter companies more intense. The benefit of having more than one transporter is quality of work which company gains from transporters. Therefore, Transporter C will operate night time delivery and Transporter A will operate only day trip when company make a decision to full operate night time delivery scheme.

For trial process, Transporter A performed night time delivery during trial period without any additional service fee.

Plan of delivery

After pilot service centres was confirmed, logistics team and transporter worked together for making plan of delivery. Plan of delivery consists of two tables; estimated arrival time and driver schedule. Transporter identified route which driver have to drive for night time delivery. Basically, the sequence of delivery was arrange as same as current route because there is no change on destinations. However, transporters checked the actual traffic situation again by delivery testing on same route but using night time. Delivery testing was executed to prove that plan of delivery is possible or not. Delivery testing was executed again before implementation for checking any other obstacles during delivery. Night time delivery starts on 19:00 of working day and driving to service centre follow the planned sequence. The sample of estimated arrival time table is showed in Table 12.

Table 12: Table of estimated arrival time of night time trial delivery

Service centre Code	Delivery Sequence	Estimated Arrival time
Parts Centre		19:00
40100101	A	19:30
40330311	B	20:10
40100103	C	20:40
40470524	D	21:05
40210201	E	21:35
40330210	F	22:00
40330208	G	22:25
40350207	H	22:45
Parts Centre		23:00

Furthermore, driver schedule was arranged by Transporter Company. It is a work schedule of driver who will deliver goods on each working day. It is very important information for drivers to plan themselves before trial. One driver drives only once a week. Lastly, driver schedule was also informed to pilot service centre as well. Therefore, guardsman of service centre knows who will arrive to service centre at night. It increases confidence of service centre on security issue which they have concerned.

Table 13: Driver schedule for night time trial delivery

Day	Truck Plate Number	Driver Name
Mon	1ฅง-6726	Driver A
Tue	1ฅง-6728	Driver B
Wed	1ฅง-6730	Driver C
Thu	1ฅง-6731	Driver D
Fri	1ฅง-6732	Driver E
Sat	1ฅฎ-8707	Driver F

Equipment

According to the designed method, author decided to modify existing equipment to be container or called Dropbox. Specification and size were indicated in designed method as well. In this step, company searched for ironsmith's workshop to work on modification process. Company has owned many movable storage racks which have the same size with expected. Therefore, author decided to modify movable storage rack rather than purchase new containers because of cost reason. The selected moveable storage rack is aluminium made so it is very durable and stable. The additional cost is modification cost which included purchasing metal sheet for wall and roof, making door structure and welding jobs. Furthermore, company purchased high grade door lock for using with containers. Company ordered container modification to ironsmith for eight units.

Ironsmith spent two weeks for modifying eight storage racks into containers then delivered to company. After inspection, containers were moved to pilot service centres by using company's truck. After that each container was located at service

centre area then delivered container's key to service centre staffs. The decision on location of container was made by each service centre staff. Some service centres decided to locate container under the roof of their facilities, but some of them decided to locate it outside facilities but near guardhouse for easy observation by guardsman.

In case of full implementation, the Case Study Company has to include initial cost of container in budget as well. Even though cost per unit is not too expensive but company has to prepare over 90 units for all service centres in Bangkok. Therefore, cost of modification will be relatively high. In addition, for some service centre which usually purchases big lots, company has to prepare more than one units for that service centre to support over containing case.



User training on Operation process during Trial

After operation process was approved by all concerned parties, author and Transporter Company explained drivers about the process which changed from current. User training mainly focused on operation process and also aimed to let all concerned staffs understand process of night time delivery. The explanation described process in detail from start to end. It also explained how to deal with unexpected matters to let them work smoother. In addition, in order to work over night, drivers were informed how to keep physical condition to be ready for working at night. They have to sleep immediately after work is done and rest over eight hours per night.

For the additional processes which author designed, smart phone and vehicle's camera has become an important device to keep evidence of delivery. Therefore, in user training, drivers were explained how to use video camera on smart phone and how to record video during delivery. Lastly, video keeping process was explained to transporter's staff that will be in charge of evidence keeping. They have to transfer video files from smart phone and vehicle's camera to computer and keep them as evidence for one month. The key reason is to protect transporter when service centres make opposition to company for claim on damage or shortage of goods.

User training was arranged in two sessions. The first session is the explanation of operation processes in detail and another session is on the job training.

Schedule of implementation

The schedule of implementation was announced officially to all concerned parties. It mainly shows the major tasks which concerned with implementation process. After the schedule of implementation was created, author informed all concerned parties then checked readiness of all concerned parties. For transporter, company confirmed schedule with transporter and assigned drivers who will delivered goods to service centres on each working day. Transporter's leader staffs planned manpower and schedule then informed the final schedule to driver. Truck number was also

included in plan. Transporter identified truck number in schedule then inform to company and customer relationship team.

On service centre side, customer relationship team visited and checked readiness of container and facilities. In addition, service centre staffs were informed estimated arrival time of each service centre. Truck plan was also informed to service centre staff for security issue. Guardsman acknowledged truck number which will arrive each night then checked the truck number when arrived service centre.

The second main task is delivery testing. Transporter tested run repeatedly during two weeks before implantation. Transporter checked actual transport route by driving from parts centre to each destination follow planned route and started delivery on the same time as plan. The reason of delivery testing is to check unexpected obstacles which will cause delivery problems. For example; road construction site, night market nearby service centre and traffic situation at delivery time. It is possible that traffic at night time is totally different from day time in some roads.

On the first of February, it was the first shipment of night time trial delivery. Meanwhile, logistics team and customer relationship team worked simultaneously on monitoring delivery process. Logistics team record important information such as delivered volume, arrival time and problem during implementation. In the meantime, customer relationship team got feedback and recommendation from service centre staffs on various points. For example; completeness of delivery, service time and end customer's feedbacks.

In the last step, the result conclusion was happened after trial delivery end. On March 2016, all parties discussed and shared information together to summarise result of trial delivery and made recommendation for further improvements. The schedule of implementation shows in Table 14.

Table 14: Implementation schedule of night time trial delivery

No	Task Description	2016											
		JAN				FEB				MAR			
		1	2	3	4	1	2	3	4	1	2	3	4
Implementation phase													
1	Readiness checking	■	■	■	■								
2	Transporter delivery testing			■	■								
3	Trial Delivery					■	■	■	■				
4	Operation monitoring					■	■	■	■				
5	Result conclusion									■	■	■	■



Implementation processes of Night Time Trial Delivery

The implementation of night time trial delivery was start on first of February 2016. It followed implementation schedule which shows in Table 14. The first two steps Readiness checking and Delivery testing was done before first of February. The implementation plan was announced to concerned parties before start around one month. Pre-implementation plan was done completely before start. In this part, there are four main processes were involved with trial delivery namely; Order receiving, Plan of Delivery, Delivery process and Feedback process.

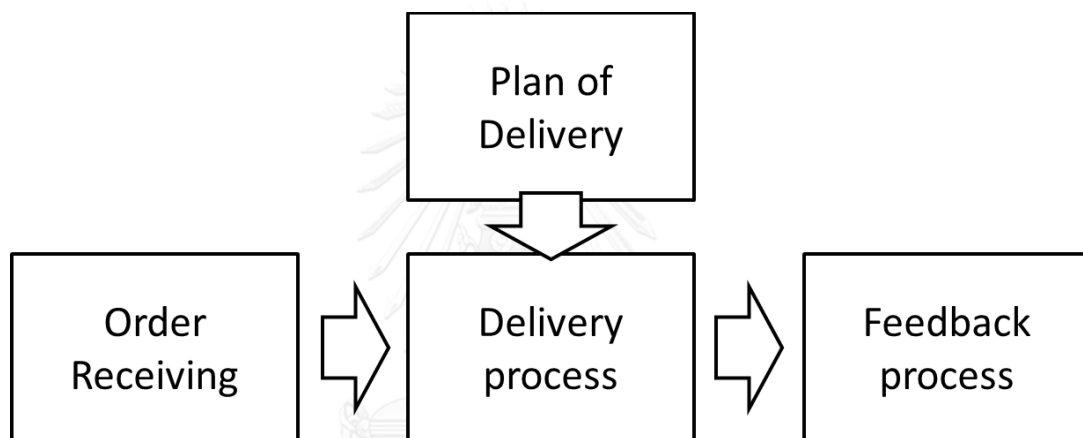


Figure 32: The four main processes of Night time trial delivery

Order Receiving

Order receiving process was operated as same as the normal operation. There is no change on receiving process. However, for successful of implementation, author identified sales orders which will be delivered at night time for monitoring. There are two cases which were delivered at night time namely; emergency orders during 11:01-15:00 and all normal orders. According to current process, warehouse operators still worked as the same but they concentrated on expected finish time that must be finish before 18:00 because transporter has to load goods to trucks and finish it before 19:00.

Order receiving is the first process of implementation because order was received at 1st of February. Emergency orders which were received during 11:00 -15:00 will be delivered at night as same as the normal order of 1st February.

For service centre side, service centre staffs also acknowledged that which sales orders will be delivered at night time by order acknowledgment. Order acknowledgement was automatically sent to service centre via e-mail after sales orders were allocated by Computer system. In consequence, service centre staffs acknowledged arrival orders before goods were delivered.

For non-selected service centres, all processes was remained as normal during trial period.

Execute Plan of Delivery

Plan of delivery was planned by logistics team and transporters. It was created and announced to drivers during pre-implementation period for planning themselves on their work schedule and estimated arrival time which driver should arrive at each service centre. Plan of delivery was explained in Table 12 and Table 13. During implementation period, Transporter followed plan of delivery and also checked readiness of driver before start working. If transporter would like to change driver schedule, they have to inform logistics team in advance then logistics team will inform service centre on adjustment via phone and e-mail.

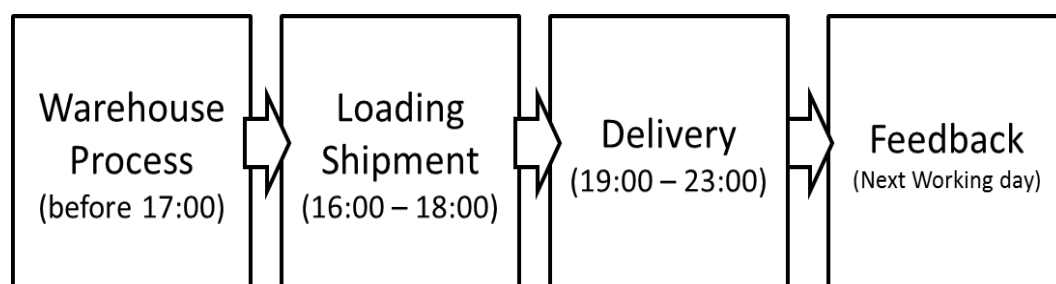


Figure 33: Delivery Process Flow and time schedule

Delivery Process

Delivery process is operated follow plan of delivery. The basic operations were operated as same as current. It starts with receiving goods from warehouse, sequencing, loading and creating document in computer system. Delivery process starts around 16:00 after transporters completely delivered afternoon shipments. Once trucks came back to warehouse, loading staffs loaded goods to truck separated by route and arranged sequence. Loading is normally finish around 18:00 or a bit late. Night shipment must be departed from warehouse at 19:00 then follow plan of delivery. Actual arrival time was recorded to computer system by transporter when they come back to warehouse. The estimated finish time is 23:00 as plan.

In case of no delivery to some destinations, Transporters also drove to service centres even though there is no good to deliver to that service centre. The reason is to check arrival time and obstacles during transportation. Driver drove to service centre then parked in front service centre for 5 minutes then drive to next destination. However, if night time delivery is fully implemented, transporter will skip service centres which do not have goods to delivery for reduce waste on no delivery and any abnormal matters were recorded by transporter and informed to logistics team to acknowledge problems. If the crucial problem such as road accident, drivers must inform head of transporter and logistics team immediately.

In addition, **smart phone** was used as supportive device for night time delivery as well. Transporter uses smart phone to record event since truck arrived at service centre. Transporter has to record situation until unloading is complete. The significant benefit of video recording is for proving that all shipments was handled and delivered with care. If service centre staffs complain company on damaged parts, transporter will use recorded video to check and proof mentioned shipment. Currently, there are many technology and gadgets which can support transporter on recording video namely car camera, action camera or phone camera. Therefore, this

option is alternative process for transporter which author highly recommended to transporter for protect arguments and complaints in the future.

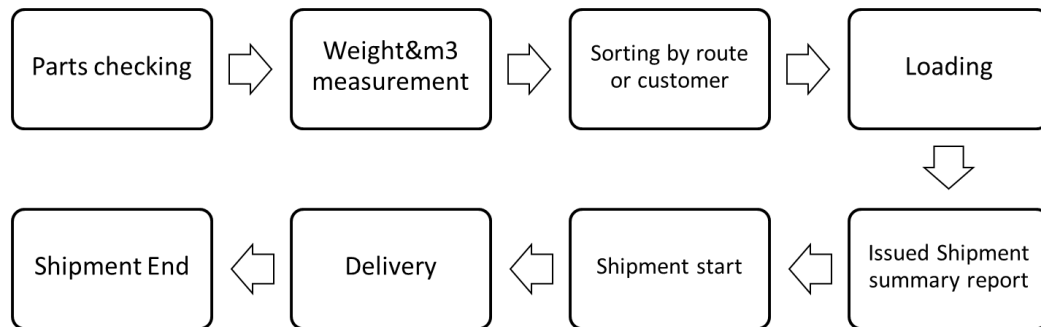


Figure 34: Delivery Process of Transporter

Feedback process

Feedback process was done every working day just for record problems during trial period. It was functionally separated in three groups namely; Logistics team and Transporter, Customer relationship team and pilot service centre staffs and Logistics team and customer relationship team. The first group logistics team and transporters arranged morning meeting for letting transporter inform result of last night shipment and problem which driver found during operation. The second group customer relationship team and pilot service centre staffs were discussed by phone and e-mail only. The content of discussion is same as first group. Service centre staffs recommend and gave feedback directly to customer relationship team about night time delivery. Lastly, customer relationship team and logistics team discussed together during 13:00-14:00 of every working day. They discussed to summarise result of delivery and shared gathered information for further improvement.

Chapter V

Results & Discussion

Night time delivery was implemented as suggested plan. In Chapter V, author has explained the result of night time trial delivery which implemented during February 2016. The result of implementation was separated into two parts; actual trial result and simulated result.

Actual trial result is result of delivery which explains directly on work result. It is raw data for simulating in case of full implementation. Actual trial result consists of **delivered volume, actual shipment time** and **parts waiting time**. Loading Efficiency of actual result is not important figures because trial was done with only pilot service centres which selected from current transportation route. Therefore, it did not make any clear differences between trial route and current route. It needs to be simulated in case of full implementation to realise difference.

Simulated result is analysed version of actual trial result which predicted transportation result in case of full implementation for all service centres in Bangkok and Suburbs. Simulated result is based on new transportation routes which are totally different from current routes and trial routes. It is also used for evaluate the research which author expected at the start. Simulated result is consisted of **Cost-Performance Index (CPI), Loading Efficiency and Estimated Transportation cost**.

Actual Trial Result

Delivered Volume

Delivered volume was recorded by computer system. Author generated report from computer system by selecting only 24 working days on February. Author focused on Bangkok route 3 which was selected as pilot transportation route for trial delivery.

The average delivery volume of route 3 remained at **0.96 M³/trip**. On the other hand, the six month average delivery volume of route 3 is **0.94 M³/Trip**. In consequence, delivered volume of route 3 was slightly increased on February and it was not a big difference.

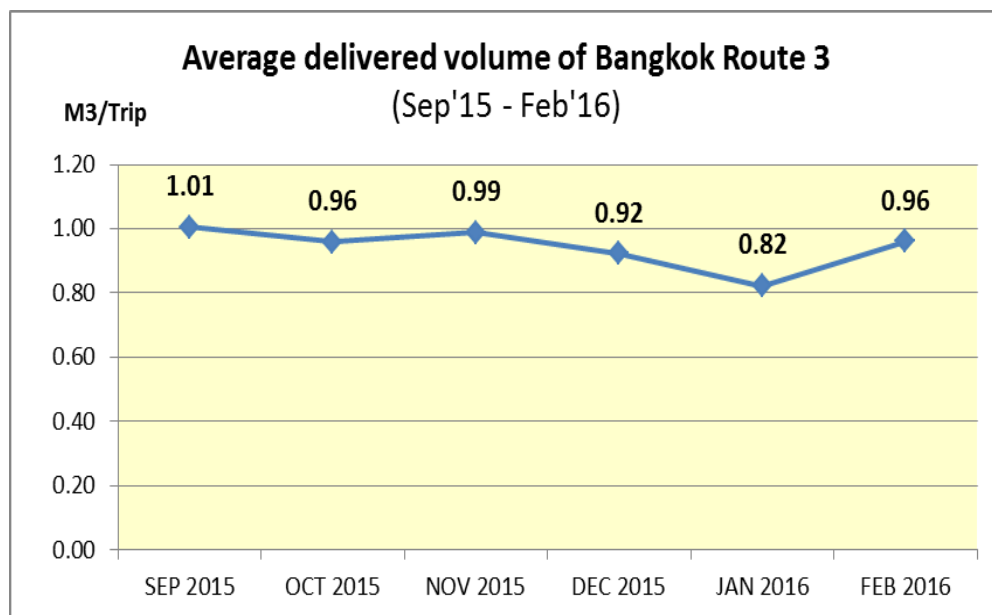


Figure 35: Average delivered volume of Bangkok Route 3

In detail, Figure 36 demonstrated that delivered volume was peak at early and mid of month because of credit term condition between company and service centres. At peak period, delivered volume stood at 3 M³/trip on 16th February. After peak period, delivered volume dramatically decreased and remained at average level then hit lowest volume at around 0.07 M³/Trip on late February.

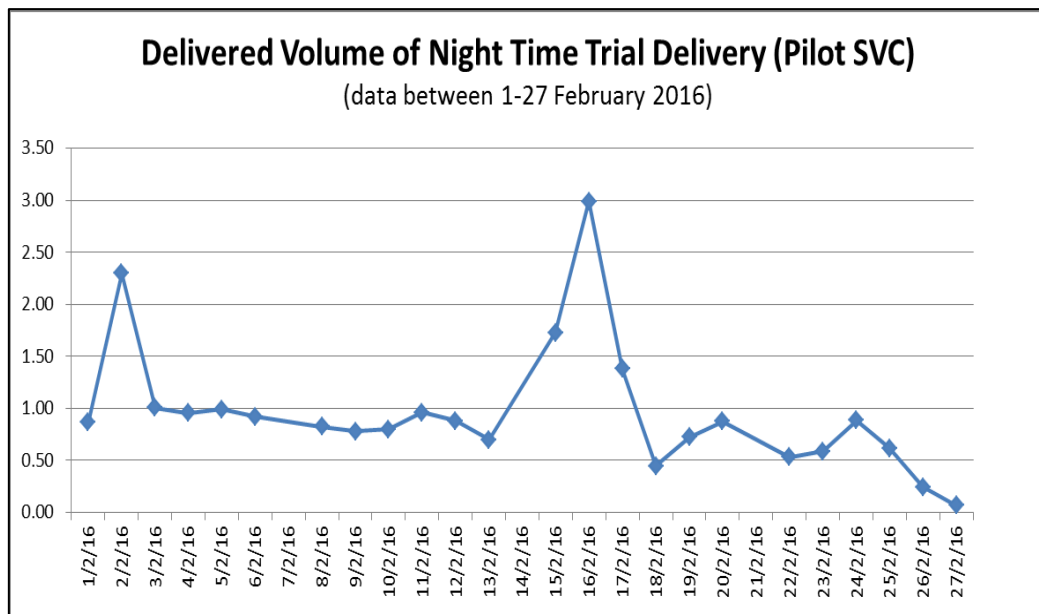


Figure 36: Delivered volume of Night time trial delivery (only pilot service centre)

For delivery efficiency, it was remained about 16% of maximum volume. Route 3 was the lowest in efficiency compared with other routes. Therefore, Route 3 was the worst route which made the highest cost per cubic metre.

According to delivered volume data, author also found that there is no delivery to service centres on some working days because there is no order submitted to company during that time. Therefore, transporter still drove to that service centre then rested for 5 minutes and continued driving to next service centre as plan.

As author mentioned, delivered volume did not result in any important impacts for the trial delivery because it used the same route as current. However, it is very important data for simulation in next sessions. Delivered volume of all Bangkok routes is showed in

Table 15.

Table 15: Delivered volume of Bangkok routes during Trial Delivery Period

Date	R1	R2	R3 (Night)	R4	R5	R6	R7	R8	R9	R10	R11	Total Volume (M3)
1/2/16	3.11	2.22	0.86	0.79	1.15	0.58	2.62	5.21	1.27	2.79	1.46	22.065
2/2/16	4.10	2.32	2.30	2.82	1.15	1.50	2.56	4.44	1.69	2.76	1.53	27.167
3/2/16	3.13	2.52	1.01	1.83	1.11	2.58	2.82	4.75	3.64	2.58	1.52	27.491
4/2/16	3.29	2.38	0.96	1.95	1.11	1.60	2.59	5.35	1.56	3.31	1.81	25.912
5/2/16	3.65	2.46	0.99	0.84	1.39	0.73	2.89	5.29	1.46	2.20	1.73	23.608
6/2/16	2.64	1.85	0.92	1.17	1.21	0.97	2.32	4.48	1.66	2.53	1.43	21.171
8/2/16	3.51	2.52	0.82	0.97	1.29	1.63	3.14	4.67	2.02	2.65	1.99	25.222
9/2/16	3.46	2.87	0.78	1.03	1.31	0.53	2.92	4.31	2.05	3.15	1.87	24.270
10/2/16	3.63	2.26	0.80	0.87	1.09	0.58	2.67	5.09	1.92	2.47	1.89	23.262
11/2/16	3.18	2.94	0.96	0.66	1.19	1.15	2.57	5.35	1.44	2.12	1.69	23.254
12/2/16	3.62	2.71	0.88	0.76	1.86	0.64	2.28	5.05	1.74	2.05	1.73	23.336
13/2/16	3.65	2.24	0.70	0.70	1.97	0.57	2.97	5.49	1.40	2.57	1.77	24.026
15/2/16	3.75	2.19	1.73	1.77	1.69	1.42	2.59	5.22	1.81	2.68	1.90	26.752
16/2/16	3.65	2.21	2.99	2.28	1.37	0.53	2.64	5.46	1.08	2.55	1.96	26.723
17/2/16	3.84	2.73	1.38	1.63	1.78	2.47	2.46	5.55	2.11	2.04	1.61	27.583
18/2/16	3.19	2.91	0.45	2.38	1.09	1.28	2.22	5.75	2.60	2.66	1.54	26.079
19/2/16	3.29	2.18	0.72	1.31	1.90	1.40	2.40	4.96	1.93	2.75	1.39	24.245
20/2/16	3.47	2.88	0.87	1.23	1.53	0.59	2.23	4.92	1.43	2.23	1.78	23.164
22/2/2016	3.93	2.13	0.53	0.73	1.23	0.73	2.13	4.95	1.57	2.56	1.71	22.208
23/2/2016	3.51	2.34	0.59	1.02	1.83	0.84	2.92	5.31	1.52	2.50	1.29	23.668
24/2/2016	3.23	2.69	0.89	0.60	1.99	0.93	2.71	5.58	1.94	2.29	1.60	24.437
25/2/2016	3.19	2.27	0.62	0.96	1.51	1.20	2.49	5.49	1.44	2.15	1.21	22.538
26/2/2016	3.06	3.00	0.24	0.81	1.98	0.95	2.65	5.01	1.30	3.00	1.92	23.919
27/2/2016	3.76	2.22	0.07	0.67	1.69	0.86	2.22	3.85	1.19	2.03	1.84	20.419
Avg M3/Trip	3.45	2.46	0.96	1.24	1.48	1.09	2.58	5.06	1.74	2.53	1.67	24.272
%Eff	58%	41%	16%	21%	25%	18%	43%	84%	29%	42%	28%	37%

Actual Shipment Time

Actual shipment time identifies the arrival time of transporter to deliver goods to each service centre. Normally, transporter always records arrival time every time truck arrives at service centre. Arrival time is recorded in transportation sheet as evidence. Once transporter comes back to office, arrival time is recorded to computer system.

Table 16: Arrival time and actual shipment time of Bangkok route 3 during Night Time trial delivery

Service centre	Parts Centre	40100101	40330311	40100103	40470524	40210201	40330210	40330208	40350207	Parts Centre	Total
sequence		A	B	C	D	E	F	G	H		
Estimated Arrival time	19:00	19:30	20:10	20:40	21:05	21:35	22:00	22:25	22:45	23:00	
1/2/2016	19:00	19:25	20:03	20:31	21:07	21:27	21:55	22:18	22:49	23:05	4:05
2/2/2016	19:00	19:39	20:12	20:33	21:00	21:29	22:04	22:32	22:44	23:04	4:04
3/2/2016	19:00	19:33	20:10	20:30	21:03	21:44	21:52	22:17	22:40	23:09	4:09
4/2/2016	19:00	19:20	20:11	20:39	21:05	21:35	21:54	22:28	22:46	23:04	4:04
5/2/2016	19:00	19:22	20:06	20:32	21:04	21:37	22:05	22:25	22:41	23:03	4:03
6/2/2016	19:00	19:30	20:15	20:41	21:04	21:31	22:01	22:33	22:41	23:06	4:06
8/2/2016	19:00	19:23	20:10	20:33	21:08	21:31	22:09	22:26	22:45	23:04	4:04
9/2/2016	19:00	19:30	20:05	20:40	21:07	21:37	22:06	22:21	22:46	23:02	4:02
10/2/2016	19:00	19:31	20:07	20:38	21:04	21:27	21:59	22:17	22:43	23:10	4:10
11/2/2016	19:00	19:29	20:04	20:26	21:06	21:36	21:57	22:21	22:41	23:06	4:06
12/2/2016	19:00	19:38	20:05	20:41	21:11	21:39	21:52	22:20	22:40	23:05	4:05
13/2/2016	19:00	19:28	20:07	20:42	21:10	21:40	21:57	22:17	22:40	23:04	4:04
15/2/2016	19:00	19:33	20:10	20:33	21:11	21:44	22:07	22:34	22:48	23:12	4:12
16/2/2016	19:00	19:27	20:12	20:32	21:09	21:32	21:56	22:25	22:49	23:12	4:12
17/2/2016	19:00	19:28	20:16	20:31	21:06	21:39	22:09	22:17	22:44	23:11	4:11
18/2/2016	19:00	19:30	20:18	20:41	21:04	21:29	22:02	22:18	22:40	23:11	4:11
19/2/2016	19:00	19:32	20:10	20:39	21:10	21:27	21:57	22:27	22:49	23:10	4:10
20/2/2016	19:00	19:21	20:11	20:36	21:06	21:30	22:00	22:27	22:41	23:02	4:02
22/2/2016	19:00	19:35	20:05	20:35	21:05	21:35	22:02	22:26	22:48	23:00	4:00
23/2/2016	19:00	19:31	20:09	20:32	21:01	21:37	22:01	22:19	22:42	23:06	4:06
24/2/2016	19:00	19:30	20:04	20:34	21:11	21:28	21:57	22:23	22:47	23:04	4:04
25/2/2016	19:00	19:29	20:01	20:30	21:07	21:33	22:07	22:31	22:49	23:11	4:11
26/2/2016	19:00	19:28	20:11	20:45	21:07	21:30	22:03	22:19	22:45	23:05	4:05
27/2/2016	19:00	19:25	20:12	20:43	21:02	21:34	22:08	22:22	22:48	23:10	4:10
Average	19:00	19:29	20:08	20:35	21:06	21:33	22:00	22:23	22:44	23:06	4:06

Author extracted data from computer system then put it in

Table 16. It shows time that transporter arrive service centre on each day. The average arrival time of each service centre is not too much different from estimated arrival time which set by transporter. It is not over 10 minute allowances which

transporter has committed with logistics team as shows in Figure 37. In Figure 37, there are control limit with 10 minute allowance from estimated time. There is only a case which arrived earlier than estimated for 14 minutes at Destination C but it was acceptable. Furthermore, there is no case which late than estimated arrival time for 10 minutes. Therefore, it has been proved that arrival time will be more accuracy if night time delivery fully implements.

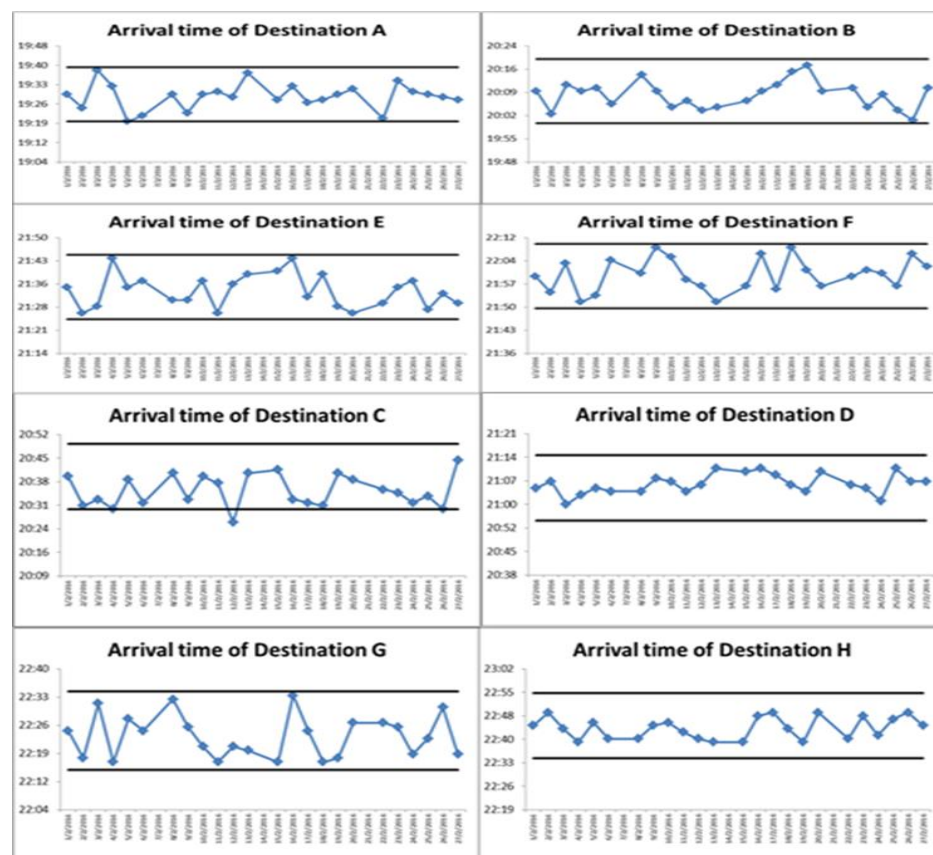


Figure 37: Arrival time of each destination of Bangkok route 3 during Night time trial

Parts Waiting Time

Lastly, Parts waiting time was totally changed from current because all service centres in Route 3 received goods before service centre officially open at 8:00. Therefore, all pilot service centres continued repairing job once staffs arrived at service centre in the morning. They did not need to wait for long time as same as current. According to

Table 17, Current receiving time is a time which service centre staffs receive parts from transporter. New receiving time is time which they normally open containers and check completeness of goods. It is clear difference between current receiving time and new receiving time except the first destination which currently is the first place to receive. The big difference is the last destination which normally receives ordered parts at 11:10 and they usually waits for over 3 hours. However, night time delivery reduces parts waiting time from 3 hours to zero so technician can start working earlier and it also results in shorter vehicle's downtime.

Table 17: Comparison between current receiving time and new receiving time

Service centre Code	Delivery Sequence	Current Receiving Time	New Receiving Time	Diff Time (Minutes)
40100101	A	8:00:00	8:00:00	0
40330311	B	8:20:00	8:00:00	20
40100103	C	8:45:00	8:00:00	45
40470524	D	9:20:00	8:00:00	80
40210201	E	9:40:00	8:00:00	100
40330210	F	10:10:00	8:00:00	130
40330208	G	10:50:00	8:00:00	170
40350207	H	11:10:00	8:00:00	190

Simulated Results

After author extracted and generated data from computer system. The next process is data simulation in case of fully implement night time delivery for all service centres in Bangkok. There are three key differences namely; number of involved service centres, number of transportation routes and working time. Firstly, number of involved service centres was changed from 8 service centres to 89 service centres. 89 service centres are located in Bangkok and Suburb area. The second is number of routes which changed from 11 afternoon routes to 5 night routes. It also changed from trial period which operated only 1 night route to 5 night routes. Lastly, operating time of transporter was changes from trial period. Transporter was working at 19:00-23:00 during night time trial delivery, but working time will be changed to 19:00 – 05:00.

During trial period, logistics team and transporter worked together to simulate transportation route in case of full implementation. Route planning was done by using service centre's location, available roads and transporter's opinion. In conclusion, author got 5 new routes for using in simulation. Even though, 5 new routes are not the most suitable routes for using in real operation but it is most possible route based on current information. In the future, transporter and logistics team have to make adjustment for the best transportation route.

Regarding to simulated routes, author used delivered volume data and applied with new transportation routes. Each route is a combination of current transport route therefore it was totally different from current routes. The result of simulation is showed in Table 18.

From Table 18, author realised that simulated route will cause of some extra shipments because of truck overloading. The maximum load of truck is 6 M^3 but there are some simulated data that over than maximum load. Logistic team have to

request more truck to support this case and it also cause of extra transportation cost as well.

Table 18: Delivered volume of simulated routes in case of full implementation

Date	Route A	Route B	Route C	Route D	Route E
1/2/16	5.04	2.97	2.41	3.47	5.74
2/2/16	5.14	3.13	3.28	2.76	4.42
3/2/16	5.03	2.94	3.05	3.51	5.12
4/2/16	5.47	3.02	3.31	3.93	5.44
5/2/16	6.00	2.68	3.02	3.75	4.85
6/2/16	4.53	2.43	3.20	4.32	4.21
8/2/16	5.93	2.65	3.37	3.63	6.25
9/2/16	5.12	3.89	3.83	3.76	5.08
10/2/16	5.01	3.49	2.94	5.14	4.87
11/2/16	5.92	2.47	2.42	4.46	5.51
12/2/16	5.88	2.47	2.91	3.77	4.14
13/2/16	5.57	3.00	3.38	4.22	5.51
15/2/16	5.98	4.43	3.85	3.86	4.90
16/2/16	6.00	2.86	2.38	3.98	4.77
17/2/16	5.95	2.68	2.55	3.61	3.84
18/2/16	5.70	2.11	2.09	3.60	5.39
19/2/16	5.05	3.54	3.05	4.65	4.23
20/2/16	5.49	3.46	4.04	3.46	4.58
21/2/16	6.00	2.45	3.15	4.24	4.56
22/2/16	5.26	3.06	2.74	5.26	4.57
23/2/16	5.91	2.98	2.35	5.77	5.69
24/2/16	5.98	1.40	2.22	3.74	5.57
25/2/16	6.00	2.07	2.76	5.18	6.03
26/2/16	5.68	2.43	2.69	3.05	3.94
Avg M3/Trip	5.57	2.86	2.96	4.05	4.97
%Eff	93%	48%	49%	67%	83%

Loading Efficiency

According to Table 18, delivered volume and efficiency are increased significantly from actual result. Route A has gained 93% of efficiency or 5.57 m³ per trip on average. It can be assumed that delivered volume is almost equal to maximum loading volume of truck every shipments. For Route B and C, they were only half of maximum loading in loading efficiency therefore they need more improvement in the future.

Loading efficiency is one of important factors of transportation cost. In order to use transportation service by using fix transportation cost per trip. For company's aspect, the higher loading efficiency is less wastes in shipment and also less cost of transportation per cubic metre. It also results in fewer trips because one truck can carry more goods compared with before improvement.

In conclusion, company will pay less transportation cost if night time delivery is applied in real situation. Concerned points such as overloading must be carefully solved and rearrange route for the most optimal transportation route.

Cost-Performance Index (CPI)

Another indicator to measure performance of transportation planning is Cost-Performance Index (CPI). CPI has been used in company for indicate how much money that company pays per cubic metre of goods. CPI is suitable for fixed transportation cost scheme. Basically, it is calculated by dividing total transportation cost by total delivered volume. The current average CPI of company is about 647 THB per M³.

According to simulated data, author calculated CPI by using transportation cost which charged by transporter company divided by total delivered volume. **The Calculated CPI is about 487 THB per M³**. It is less than current CPI of company 160 THB per M³ or reduced by 25%.

As author mentioned, CPI result in less transportation cost in case of fixed transportation cost only. For volume based transportation cost, CPI does not make huge impact to it.

Estimation of new transportation cost

For the management's point of view, cost reduction is one of management policies at this time. Therefore, transportation cost must be calculated and demonstrated to management on reduction of cost. This research studies to reach target on both customer satisfaction and company's profitability. It is an indicator to indicate how operation strategy works well with company.

Transporter proposed new quotation to company during trial period. The new transportation cost is based on full implementation scenario. There are 5 transport routes to be operated following new quotation. It decreased from current which operates with 11 transport routes. However, the cost of transportation is increased 43% from current transportation cost per trip. The main reasons are the longer operation hour and labour charge. It is reasonable to pay driver more than current because driver have to work overnight and driver may work against risk of restless condition. Therefore, driver will request for more income if driver have to work overnight.

Although new transportation cost is increased significantly but the number of trips are also reduced from 11 trips to 5 trips. In conclusion, the total transportation cost per month will be **reduced by 35%**. In management point of view, 35% cost reduction is a remarkable improvement in cost efficiency. Furthermore, it will also improve customer satisfaction level together with cost reduction.

For all benefit of night time delivery, it is showed in Table 19. There are two parts of indicators, key indicators which author has focused and other indicators which is not mainly focused but it also makes some benefits to company.

Table 19: Benefit comparison between current operation and night time delivery

Index	Current	Result	Diff
Key Indicator			
Spare parts waiting time (Hour)	124 (78 centres receive after 8:00)	0 (0 centres receive after 8:00)	-124 Hr
CPI (Baht/m3)	647	487	- 25%
Avg. Loading Efficiency	46%	68%	+12%
Total Transportation cost			-35%
Other Indicator			
% Delay	4.67%	0%	-100%
Number of Routes	11	5	-6 Routes

Feedback of customer

Lastly, feedbacks of customer were recorded by customer relationship team. Recording process was done by group interview with service centre's staffs. Owner, Service centre manager, Parts store staffs and technicians were invited to join group interview. It was happened weekly during trial period and summary meeting was arranged on early of March. Scoring and statistic practices were not involved in this research because of small sample size. Therefore, measureable indicators are not included but there are many valuable recommendations in customer's point of view. For advantage of night time delivery, there are 3 major points which they are satisfied.

Operation management of service centre

Service centre will be easier to manage operations in service centre. Currently, technicians cannot start working at opening time because they have to wait for spare parts delivery. In consequence, they waste working time until parts are received. However, night time delivery will result in better operation management because

they can exactly specify goods receiving time at the opening time of service centre. It will also result in shorter service time which leads to less vehicle downtime. Furthermore, better operation management also results in more service unit because of less wasted time in service operation. Finally, the more service unit results in increasing revenue of service centre.

Accuracy of customer appointment

Normally, service assistant makes appointment to customer. He tells estimated finish time to customer which depends on service time, spare parts availability and also order acknowledgment report. However, if delay of delivery occurs, estimated time will not be accurate then customer will not satisfy with services. Night time delivery guarantees that all ordered will be delivered before opening time so there is no chance of delay by using night time delivery. Accuracy of appointment is also increased by better of operation management because service jobs can be done within standard time.

Opportunity for extending order cut time

For the last advantage point, there is a potential to extend order cut time from 15:00 in the afternoon to be 16:00 or 17:00 because warehouse operators have more operation time to operate outbound process due to longer operation time of transporter. By this point, service centre will satisfy if company decides to extend order cut time from current period to for 1 or 2 hours. For author's opinion, it has high chance to do as customer's feedback because it is obvious that transporter has more time allowance. All in all, author has kept this feedback for further improvement.

By 3 major advantages which service centre made comments to author, night time delivery will support service centre to increase customer satisfaction and it will also result in increasing of revenue of service centre as well. The flow of benefit of night time delivery which recorded from service centres is showed in Figure 38

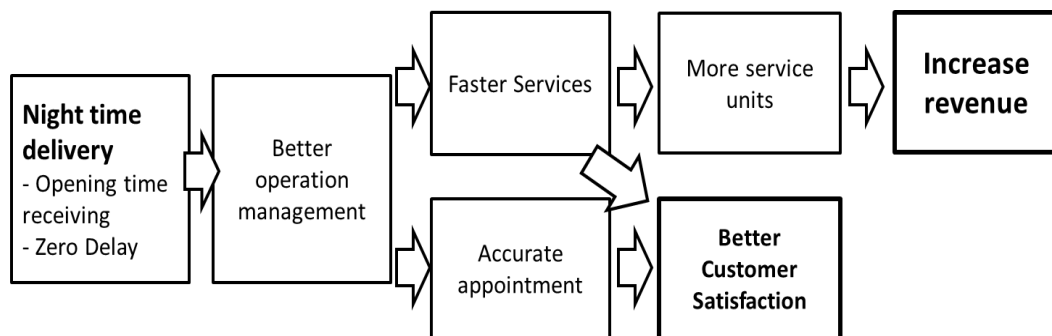


Figure 38: Benefit of night time delivery referred to customer's point of view

On the other hand, there are 2 major concerned points which all service centres also commonly realised.

Containers

Theft is still the most commonly concerned point for all service centres because the placement of containers which located outside service centre's facilities. Container's lock can be broken by metal cutting tools. In addition, thunderstorm is another concern because of weather in Thailand especially in rainy season. They said they were uncertain with provided container and it should be improved if company would like to apply night time delivery as permanent transportation scheme.

Incompleteness of shipment

Normally, parts store staff receives goods from transporter directly. They check appearance and quantity together. After goods receive is confirm, they have to sign on transportation sheets for confirm completeness of shipment. However, night time delivery does not have co-checking process therefore service centre's staffs are concerning about incompleteness shipment such as damage goods, deficit of delivery quantity and wrong goods received. They still need process to ensure completeness of shipment even though there is no incomplete occurred during trial period.

Chapter VI

Conclusion & Recommendation

Conclusion

In summary, according to company policy which aimed to reduce cost in company to retain profit level even though economic situation in Thailand was not quite well. In addition, management also aim to increase customer satisfaction especially on after-sales business as well. Therefore, author studied how to improve process in after-sales business which can reduce cost and also improve after-sales business in marketing aspect.

The modified Hill's framework was applied to point out the key factor to develop operation strategy which improves on both operation and marketing together. The operation strategy was a guideline for improvement in overall but author needed to improve operation in detail. Therefore, transportation process was selected for improvement. Transportation process is an operation which connects between company and customers through Parts delivery process. Furthermore, cost of transportation is one of the big portions in operating cost of logistics operations. Therefore, author found out solution to improve transportation process.

Night time delivery was proposed to improve operation and customer satisfaction. Even though, night time delivery is new scenario and it has not been operated in Thai automotive businesses before. It was expected to reduce transportation cost and increase customer satisfaction on the same time. The research has aimed to study how to apply night time delivery with automotive business. Implementation was required to study with real situation and measure result of new transportation scheme.

Implementation of night time delivery was happened on February 2016. It was a trial delivery with selected pilot service centre in Bangkok area. Before trial period, author cooperated with concerned parties to select the most suitable scenario for trial. Pilot service centre selection was done and there were eight service centres which involved in trial delivery. The implementation was stopped at the end of February 2016 then it turned back to normal situation. After trial period, author extracted raw data from computer system then simulated it based on full implementation of Night time delivery.

Compared work flow between current operation and operation with night time delivery is showed in Figure 39. The key difference is delivery time of transporter. Currently, transporter starts delivery on 6:00 in the morning until finish. For the night time delivery, delivery starts on 19:00 onward. Night time delivery does not require service centre staffs for goods receiving at night. Another difference is goods receiving time that delivered goods will be available at service centres at the same time. But the current operation service centre's staffs have to wait until truck arrives at service centre.

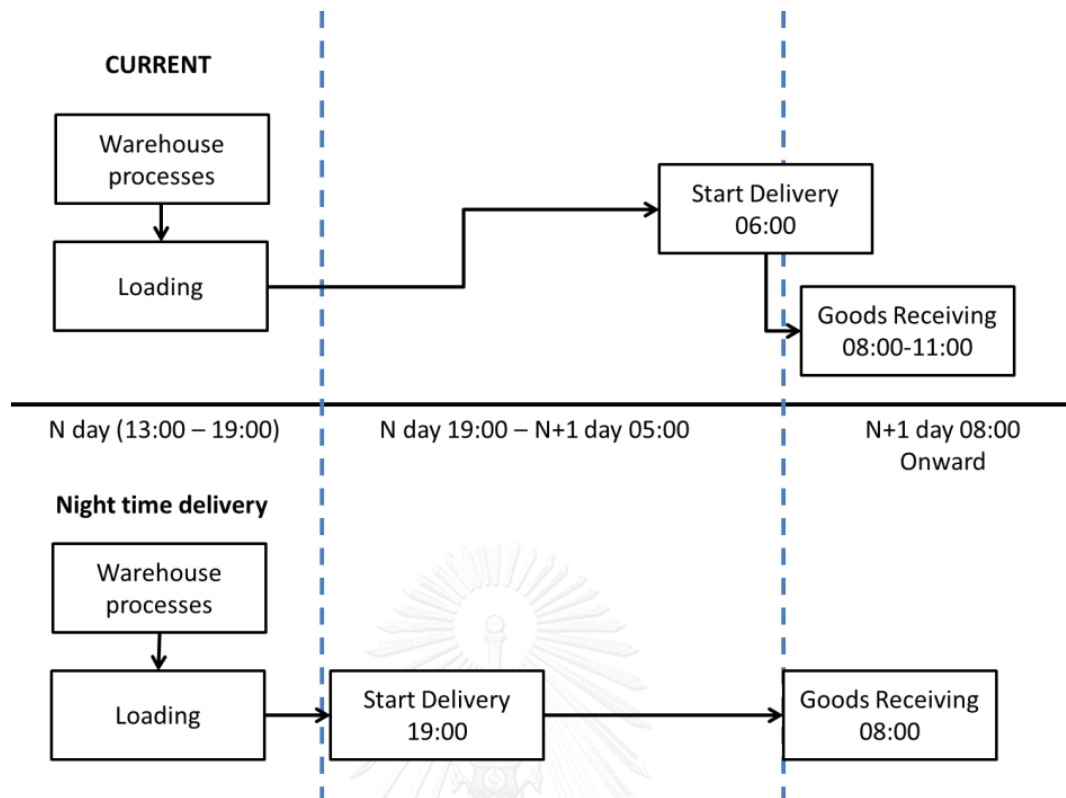


Figure 39: Compared work flow between current operation and night time delivery

In case of full implementation, night time delivery will result in 35% less transportation cost per year. The main reason was the higher loading efficiency which also resulted in less number of truck used in operation. Therefore, the total transportation cost will reduce significantly if night time delivery is fully implemented.

In addition, author got well feedback from service centre's staffs in several points. It was not only better service and customer satisfaction but it also improved internal processes of service centre as well. One of the most common feedbacks is faster service operation which result in increasing of service unit and revenue. However, they also made comments on some drawbacks. For example, theft, thunderstorm in rainy season and durability of containers. Completeness of shipment is needed to ensure and prove that all shipment will be perfectly complete.

All in all, night time delivery is basically proved that it can improve on both operation and marketing aspect. The operation strategy which generated based on the modified Hill's framework is a good guideline to create new transportation scheme. Company managements have also pleased with a result and good feedback from customer. In the future, night time delivery will need some improvement to solve all drawbacks.



Obstacles

During researching, author found some obstacles which caused difficulty. This research was done under organisation which is one of the most well-known companies in Thailand especially in automotive business. Organisation has many internal processes before approve to launch or do something news. In addition, the research was mainly operated with logistics department which has less experience in communication with customers and dealers. Therefore, there are some obstacles happened during researching and caused some difficulties such as supplier's issues, more complicated processes and cross functional communication. The mentioned obstacles were happened because of night time delivery is very new idea which had never happened before in company and they caused of schedule delay.

Cross functional communication has seemed to making the most impact to researching on schedule delay. Even though, the explanation of night time delivery was clear but it was very new scheme. Therefore, there were many questions from other associated teams. In addition, they spent a lot of time for internal approval on new idea. Author had to ensure that new idea is feasible and sensible to be operated.

For vendor side, suppliers included transporter and ironsmith. They also had some issues on new idea as same as internal parties. Hired transporter had never had experiences on night time delivery before. Therefore transporter had to recalculate transportation cost for support night time delivery. However, transportation cost which transporter proposed had to be compared with other transporters for checking suitability and correctness of proposed quotation.

Container modification also had some issues on vendor selection as well. It was very difficult to find ironsmith or any local workshop to modify movable rack to be container because of small lot size. Many vendors were not interest in modification job and author had to spend a lot of time to find vendor. However, in case of full implementation, this issue will be solved because of larger lot size than trial period.

Therefore, it will result in lower cost of modification per unit and it will be easier to find vendor to agree with modification job.



Recommendations

Night time delivery is still new concept of parts delivery in automotive business in Thailand. It has had oppositions from other associated parties both internal and external. As a result of trial, author found that there are some concerns about theft and incompleteness of shipment even though there is no case happened during trial. In consequence, author has to increase reliability by designing more secure process and more durable container. As author mention in container design, in the future company should put new design of parts store which included double gates entrance. It is better in security but it also needs a lot of money to invest on it. In addition, it may not suitable for current service centres because they may need to renovate parts store area and there are many limitations about renovation for example; limited space, municipal laws and financial issue.

Furthermore, to resolve opposition about new idea company has to apply Management of changes with this project. Management of changes was not participated in research too much. There were many meetings for explaining to concerned parties but it was not fully applied Management of changes in detail. Therefore, it will be a very good method to reduce resistances from other parties and it will support implementation to be smoother.

For one thing, measurement method can be improved to be more measureable in the future. This research did not focus on feedback measurement too much because of small group of selected pilot service centres. Interviewing was enough for feedback recording. However, measureable method should apply statistical methodology for more accuracy and unbiased.

For formulated operation strategy, there are many solutions to be applied under operation strategy which has aimed to increase customer satisfaction together with cost reduction. The main problems which author mentioned in the first chapter is long vehicle downtime which has been caused by long spare parts waiting time. In detail, availability problem is occurred because of two main reasons Parts Availability

and operation processes included transportation and warehousing. Even though night time delivery will improve operation problem and company can supply faster than current, but if ordered parts is not available in stock, it will not really solve downtime problem. Therefore availability problem still need to improve in inventory as well. All in all, company still needs more improvement actions to reach target and be the best of after sales automotive business. Formulated strategy should be fit with business situation for more realistic and it must be flexible to encounter with development of competitors as well.





Appendix

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

Appendix A

Raw test result data



Table A1: Total result of spare parts delivery on February 2016

Route	NEW ROUTE	Ship-to code	1/2/16	2/2/16	3/2/16	4/2/16	5/2/16	6/2/16	8/2/16	9/2/16	10/2/16	11/2/16	12/2/16	13/2/16	15/2/16	16/2/16	17/2/16	18/2/16	19/2/16	20/2/16	22/2/16	23/2/16	24/2/16	25/2/16	26/2/16	27/2/16
R1	A	2100005	0.39	1.10	0.93	0.21	0.20	0.28	1.65	1.10	1.62	0.70	0.73	1.46	0.91	1.39	0.85	2.00	1.07	0.88	1.30	2.23	1.00	0.85	1.63	
R1	A	4004310	0.21	0.02	0.53	0.67	0.98	0.92	0.33	0.37	0.66	0.97	0.99	0.24	0.45	0.96	0.98	0.22	0.84	0.95	0.46	0.05	0.79	0.23	0.28	0.85
R1	A	4028309	1.02	0.89	0.58	0.88	0.76	0.32	0.85	0.89	0.34	0.42	0.90	0.76	0.20	0.72	0.60	0.10	0.81	0.11	0.99	0.14	0.44	0.81	0.29	0.44
R1	A	2100007	0.82	0.67	0.23	0.55	0.85	0.15	0.15	0.79	0.35	0.07	0.25	0.12	0.96	0.06	0.11	0.11	0.28	0.61	0.39	0.54	0.85	0.07	0.80	0.40
R1	A	40059305	0.02	0.05	0.09	0.34	0.19	0.10	0.49	0.26	0.29	0.49	0.24	0.41	0.63	0.45	0.51	0.29	0.00	0.41	0.93	0.54	0.59	0.44	0.40	0.53
R1	A	40330102	0.65	0.45	0.77	0.64	0.68	0.87	0.09	0.04	0.18	0.52	0.64	0.61	0.08	0.79	0.47	0.29	0.52	0.27	0.02	0.40	0.65	0.43	0.26	
R2	A	4004311	0.18	0.43	0.07	0.32	0.81	0.38	0.48	0.18	0.10	0.13	0.04	0.36	0.55	1.05	0.77	1.07	0.46	0.23	0.67	0.26	0.47	0.56	0.83	0.34
R2	A	4058313	0.09	0.47	0.44	0.96	0.21	0.26	0.23	0.06	0.14	0.16	0.22	0.42	0.15	0.07	0.56	0.01	0.41	0.23	0.45	0.13	0.23	0.49	0.43	0.00
R2	A	40350210	0.76	0.38	0.49	0.42	0.35	0.15	0.66	0.64	0.45	0.68	0.11	0.21	0.25	0.48	0.79	0.98	0.22	0.51	0.06	0.22	0.16	0.12	0.23	0.12
R2	A	4028303	0.77	0.10	0.47	0.09	0.54	0.10	0.67	0.12	0.34	0.09	0.85	0.36	0.33	0.31	0.17	0.55	0.15	0.70	0.32	0.18	0.84	0.27	0.65	0.47
R2	A	40330412	0.04	0.44	0.38	0.12	0.16	0.55	0.08	0.45	0.07	0.95	0.59	0.22	0.42	0.19	0.14	0.12	0.45	0.07	0.19	0.45	0.43	0.54	0.10	0.33
R6	A	4004309	0.08	0.13	0.06	0.28	0.56	0.46	0.28	0.21	0.28	0.73	0.45	0.36	1.09	0.32	0.11	0.82	0.07	0.28	0.41	0.50	0.56	0.95	0.71	0.66
Total Route A			5.04	5.14	5.03	5.47	6.28	4.53	5.93	5.12	5.01	5.92	5.88	5.57	6.54	6.07	6.38	6.74	5.05	5.49	6.03	5.26	5.91	6.13	6.00	5.68
R10	B	40220101	0.89	0.07	0.06	0.48	0.31	0.11	0.66	0.44	0.21	0.29	0.10	0.36	0.12	0.30	0.62	0.44	0.56	0.33	0.56	0.29	0.53	0.25	0.09	0.05
R10	B	40100102	0.11	0.65	0.21	0.20	0.63	0.56	0.20	0.48	0.50	0.41	0.74	0.78	0.41	0.76	0.71	0.41	0.27	0.86	0.08	0.25	0.44	0.14	0.02	0.00
R10	B	40350203	0.19	0.71	0.50	0.21	0.16	0.25	0.14	0.18	0.38	0.32	0.15	0.25	0.81	0.05	0.01	0.00	0.38	0.05	0.13	0.12	0.18	0.29	0.86	0.91
R10	B	4004308	0.39	0.28	0.27	0.63	0.19	0.06	0.33	0.50	0.32	0.21	0.32	0.12	0.80	0.56	0.51	0.49	0.94	0.17	0.64	0.60	0.23	0.22	0.01	0.40
R2	B	40230106	0.16	0.20	0.18	0.30	0.22	0.16	0.38	0.64	0.49	0.57	0.08	0.32	0.00	0.03	0.20	0.17	0.06	0.32	0.03	0.56	0.27	0.27	0.18	0.68
R2	B	40120105	0.22	0.30	0.49	0.17	0.17	0.25	0.01	0.78	0.67	0.35	0.82	0.35	0.49	0.08	0.10	0.02	0.44	0.82	0.41	0.53	0.26	0.02	0.59	0.28
R3	B	40100101	0.02	0.01	0.48	0.30	0.04	0.07	0.46	0.17	0.42	0.06	0.02	0.06	0.90	0.13	0.11	0.13	0.28	0.01	0.06	0.25	0.26	0.00	0.07	0.03
R3	B	40330311	0.16	0.06	0.12	0.20	0.04	0.08	0.25	0.08	0.19	0.00	0.01	0.02	0.00	0.07	0.07	0.07	0.06	0.12	0.25	0.07	0.00	0.02	0.01	0.00
R3	B	40100103	0.09	0.16	0.03	0.02	0.06	0.03	0.05	0.06	0.01	0.00	0.02	0.00	0.13	0.17	0.01	0.06	0.00	0.03	0.06	0.03	0.08	0.01	0.00	0.01
R3	B	40470524	0.03	0.07	0.04	0.12	0.18	0.35	0.02	0.13	0.02	0.00	0.02	0.44	0.10	0.23	0.08	0.07	0.01	0.03	0.01	0.17	0.03	0.02	0.01	0.02
R3	B	40210201	0.12	0.12	0.06	0.09	0.08	0.33	0.03	0.03	0.07	0.02	0.10	0.10	0.34	0.14	0.05	0.05	0.01	0.12	0.09	0.02	0.02	0.01	0.02	0.00
R3	B	40330210	0.12	0.14	0.06	0.06	0.00	0.02	0.00	0.00	0.02	0.03	0.07	0.06	0.00	0.03	0.01	0.07	0.52	0.00	0.00	0.00	0.01	0.01	0.00	0.01
R3	B	40330208	0.26	0.17	0.12	0.03	0.07	0.01	0.00	0.00	0.03	0.04	0.00	0.00	0.00	0.24	0.00	0.02	0.05	0.02	0.02	0.03	0.00	0.05	0.03	0.00
R3	B	40350207	0.07	0.13	0.09	0.13	0.53	0.04	0.00	0.30	0.06	0.02	0.00	0.00	0.20	0.00	0.03	0.04	0.23	0.03	0.02	0.02	0.50	0.00	0.12	0.00
R6	B	4028302	0.08	0.03	0.10	0.00	0.01	0.10	0.02	0.07	0.04	0.10	0.00	0.04	0.02	0.02	0.10	0.09	0.09	0.01	0.05	0.04	0.09	0.02	0.04	0.00
R6	B	4028304	0.06	0.03	0.12	0.07	0.01	0.02	0.09	0.01	0.09	0.06	0.05	0.08	0.05	0.09	0.05	0.04	0.10	0.02	0.02	0.07	0.07	0.06	0.04	0.04
Total Route B			2.97	3.13	2.94	3.02	2.68	2.43	2.65	3.89	3.49	2.47	2.47	3.00	4.43	2.86	2.68	2.11	3.54	3.46	2.45	3.06	2.98	1.40	2.07	2.43
R11	C	402830305	0.40	0.15	0.04	0.05	0.05	0.22	0.34	0.03	0.12	0.38	0.10	0.16	0.97	0.12	0.17	0.15	0.03	0.35	0.18	0.09	0.10	0.04	0.41	0.49
R11	C	4028307	0.15	0.10	0.14	0.43	0.79	0.08	0.12	0.07	0.08	0.61	0.46	0.44	0.09	0.37	0.08	0.45	0.12	0.21	0.51	0.49	0.25	0.34	0.18	0.01
R11	C	40463002	0.14	0.60	0.59	0.04	0.12	0.60	0.43	0.08	0.05	0.00	0.49	0.00	0.17	0.41	0.34	0.03	0.11	0.18	0.03	0.15	0.22	0.02	0.74	0.48
R11	C	40463001	0.42	0.14	0.03	0.34	0.22	0.03	0.09	0.30	0.14	0.03	0.10	0.23	0.10	0.72	0.21	0.56	0.34	0.82	0.15	0.22	0.29	0.00	0.00	0.00
R11	C	40350206	0.00	0.41	0.07	0.11	0.14	0.36	0.38	0.34	0.26	0.16	0.23	0.72	0.48	0.06	0.33	0.06	0.26	0.13	0.39	0.18	0.14	0.59	0.22	0.22
R11	C	40470521	0.05	0.08	0.09	0.37	0.13	0.11	0.25	0.55	0.24	0.03	0.24	0.22	0.14	0.19	0.19	0.24	0.31	0.04	0.18	0.12	0.17	0.18	0.20	0.45
R11	C	4028313	0.30	0.04	0.60	0.47	0.28	0.03	0.38	0.50	1.00	0.49	0.22	0.00	0.02	0.09	0.28	0.05	0.22	0.04	0.27	0.04	0.44	0.04	0.16	0.19
R4	C	40350208	0.31	0.38	0.45	0.50	0.44	0.72	0.67	0.42	0.50	0.08	0.40	0.24	1.27	0.03	0.01	0.02	0.75	0.78	0.24	0.74	0.17	0.38	0.25	0.27
R4	C	40470522	0.03	0.08	0.01	0.08	0.06	0.03	0.01	0.09	0.11	0.12	0.01	0.00	0.06	0.03	0.08	0.01	0.06	0.05	0.08	0.06	0.02	0.04	0.12	0.03
R4	C	40470523	0.03	0.10	0.04	0.04	0.05	0.03	0.04	0.09	0.00	0.11	0.04	0.09	0.09	0.05	0.10	0.01	0.07	0.08	0.01	0.07	0.03	0.02	0.02	0.02
R4	C	4028311	0.12	0.12	0.12	0.09	0.07	0.10	0.05	0.11	0.03	0.09	0.03	0.08	0.05	0.05	0.10	0.02	0.11	0.07	0.06	0.00	0.09	0.12	0.05	0.09
R4	C	40230105	0.08	0.04	0.11	0.00	0.06	0.10	0.07	0.12	0.08	0.12	0.10	0.08	0.01	0.01	0.07	0.04	0.07	0.07	0.08	0.06	0.12	0.12	0.03	0.09
R4	C	4028312	0.04	0.01	0.02	0.06	0.04	0.02	0.07	0.06	0.05	0.03	0.04	0.08	0.11	0.02	0.12	0.05	0.06	0.07	0.12	0.04	0.11	0.10	0.10	0.07
R4	C	40570101	0.10	0.01	0.06	0.07	0.01	0.12	0.02	0.08	0.02	0.06	0.05	0.05	0.07	0.12	0.10	0.12	0.11	0.01	0.04	0.05	0.11	0.07	0.07	0.07
R4	C	40350205	0.07	0.09	0.02	0.10	0.11	0.04	0.05	0.05	0.07	0.06	0.09	0.08	0.12	0.02	0.04	0.12	0.07	0.00	0.12	0.00	0.11	0.10	0.09	0.06
R7	C	4004303	0.16	0.93	0.70	0.55	0.45	0.60	0.41	0.94	0.19	0.07	0.42	0.91	0.18	0.13	0.31	0.17	0.34	1.03	0.71	0.43	0.15	0.05	0.03	0.18
Total Route C			2.41	3.28	3.06	3.31	3.02	3.20	3.37	3.83	2.94	2.42	2.91	3.38	3.85	2.38	2.95	2.09	3.05	4.04	3.15	2.74	2.95	2.22	2.76	2.69
R5	D	4058312	0.81	0.66	0.38	0.33	1.10	0.88	1.00	1.09	0.67	0.75	1.56	1.82	1.17	0.31	1.04	0.60	1.55	1.13	0.87	1.47	1.63	1.18	1.68	0.44
R5	D	40230101	0.05	0.21	0.15	0.44	0.03	0.01	0.02	0.06	0.03	0.10	0.04	0.06	0.00	0.10	0.17	0.08	0.08	0.07	0.02	0.03	0			

Appendix B

Example of customer feedback survey form



Customer Feed back survey form

Project Night time delivery

Customer code 40100101

Interviewee Name Ms. Banyakorn **Position** Senior Parts Staff

Working year 7 **Parts Knowledge Level** Intermediate

Benefits of Night time delivery

- well operate in parts store and workshop
- reduce idle time of operation
- faster operation

Drawbacks of Night time delivery

- Container is locked unsafe

Recommendation

- please re modified container

Banyakorn Kositsmith
Interviewee

Figure B1: Customer feedback survey form (customer 40100101)

Customer Feed back survey form

Project Night time delivery

Customer code 40350207

Interviewee Name Ms. Wandee **Position** Service manager

Working year 16 **Parts Knowledge Level** Advance

Benefits of Night time delivery


- Faster service jobs. → lead to more service unit.
- Technicians work faster
- Clear job schedule of parts staff because parts deliver at exact time
- Appointment is more accurate.

Drawbacks of Night time delivery

- Container looked unsafe because it can be broken by a group of people (theft concerned)

Recommendation

Container should be re-design. → be bigger and safer



 Interviewee

Figure B2: Customer feedback survey form (customer 40350207)

Customer Feed back survey form

Project Night time delivery

Customer code 40350207

Interviewee Name Mr. Rachan **Position** Senior Parts Staff

Working year 7 **Parts Knowledge Level** Advance

Benefits of Night time delivery

- Better operation management because there are less customer at opening time. So, parts staff spend time for receive and counting carefully.
- Less problem with technicians because parts arrive faster.

Drawbacks of Night time delivery

- less communication with Transporter
- No co-checking process → May have chances of incompleter

Recommendation

- In case of very big size parts → container cannot contain. Please consider about size of container in the future.



 Interviewee

Figure B3: Customer feedback survey form (customer 40350207)

Customer Feed back survey form

Project Night time delivery

Customer code 40330210

Interviewee Name Ms. Sachada **Position** Parts Staff

Working year 5 **Parts Knowledge Level** Intermediate

Benefits of Night time delivery

Parts ready to use at opening time resulting in
faster service operation

Drawbacks of Night time delivery

-

Recommendation

Container should be modified for theft preventing
It should higher for preventing flood when heavy raining

Ms. Sachada
.....
Interviewee

Figure B4: Customer feedback survey from (customer 40330201)

Customer Feed back survey form

Project Night time delivery

Customer code 40330208

Interviewee Name Mr. Phongphan **Position.** Parts Staff

Working year 2 **Parts Knowledge Level** Basic

Benefits of Night time delivery

Don't need to wait for long time until spare parts arriving
at store , Normally I have to wait around 19:00.

Drawbacks of Night time delivery

Cannot reject damage and poor condition
parts during receiving

Recommendation

How to ensure that delivered parts are all complete



 Interviewee

Figure B5: Customer feedback survey form (customer 40330208)

Customer Feed back survey form

Project Night time delivery

Customer code 40330208

Interviewee Name Mr. Supawat **Position** Service manager

Working year 11 **Parts Knowledge Level** Advance

Benefits of Night time delivery

- better operation flow and time allocation
- Faster service operation because of faster parts delivery
- Increase accuracy of customer appointment
- Increase customer satisfaction

Drawbacks of Night time delivery

- Container looked unsafe for preventing theft
- CO-checking process was eliminated even though it is important for preventing receive damage parts to stock

Recommendation

Please design new container which look more safe
and prevent thunder storm in rainy season

Supawat K.
Interviewee

Figure B6: Customer feedback survey form (customer 40330208)

Customer Feed back survey form

Project Night time delivery

Customer code 40470524

Interviewee Name Mr. Man **Position** Service centre manager

Working year 15 **Parts Knowledge Level** Advance

Benefits of Night time delivery

- faster operation lead to better service operation and increasing of service unit
- There is no delay of delivery occured so parts staff can start receiving at opening time

Drawbacks of Night time delivery

- worry about theft and incompleteness shipment which my staffs have to spend time for tracking it with transporter and distributor

Recommendation

- Please consider for delivery parts of other orders namely Direct from supplier and Pre-order type for using night deliver
- Please improve container to be more durable

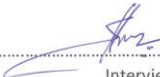

.....
Interviewee

Figure B7: Customer feedback survey from (customer 40470524)

Customer Feed back survey form

Project Night time delivery

Customer code 402 102 01

Interviewee Name Ms. Pathaporn **Position** parts staff

Working year 3 **Parts Knowledge Level** Basic

Benefits of Night time delivery

less complaints from technicians because parts are
available faster

Drawbacks of Night time delivery

-

Recommendation

Container looked unsafe however there is no theft happen

.....
 Interviewee

Figure B8: Customer feedback survey form (customer 40210201)

Customer Feed back survey form

Project Night time delivery

Customer code 40100103

Interviewee Name Mr. Prapat **Position** parts staff

Working year 1 **Parts Knowledge Level** Basic

Benefits of Night time delivery

- Increase accuracy of appointment time and service finish time
- Parts available faster and ready to sell faster
- Service operation finish faster

Drawbacks of Night time delivery

- No co-checking process
- Less over-time job.

Recommendation

Still need co-checking process



 Interviewee

Figure B9: Customer feedback survey form (customer 40100103)

Customer Feed back survey form

Project Night time delivery

Customer code 40330311

Interviewee Name Mr. Thamrong **Position** Service advisor

Working year 10 **Parts Knowledge Level** -

Benefits of Night time delivery

- Better customer appointment accuracy
- Faster stock available lead to better service mangement
- Increasing custor satisfactin

Drawbacks of Night time delivery

-

Recommendation

Please improve transporter performance and reliability for ensuring completeness of shipment



 Interviewee

Figure B8: Customer feedback survey form (customer 40330311)

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