Logistics improvement: A case study of automotive part distribution

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Abstract— Spare parts distribution is one of the key processes in after-sales services of the automotive business. Nowadays, many automotive manufacturing companies are focusing on improving their after-sales services to gain higher competitive advantages over their competitors. Therefore, the after-sales business needs to improve continuously to provide better customer services. The case study company targets at improving its after-sales business processes every year to retain a high position in the market. At its service centres, vehicle downtime (i.e. breakdown and wait until the repair is completed by the service centre) is used as a key indicator to measure customer satisfaction rate. Currently, the vehicle downtime of the service centres is reported quite unsatisfactory due to unavailability of the required spare parts. Hence, after analysing the root causes of the problem, the after-sales service department comes up with an innovative idea of using night-time delivery service instead of daytime to improve the parts supply service. The result shows that the spare parts waiting time of the service centres is reduced around 124 hours per day and also resulting in 35% reduction of the transportation cost. In addition, the number of transportation routes is reduced from 11 to 5 routes.

***Index Terms*— Automotive Parts, Logistics Management, After-Sales Services, Parts Distribution, Night-time Delivery**

I. Introduction

The logistics and customer service are closely linked together and they become one of the most important factors in business survival for the firms which have after-sales services as a core business [1]. High attention must be paid in the logistics processes since better logistics processes could bring about better customer services. The case study company is a main Japanese automotive distributor in Thailand which sells commercial vehicles to nationwide dealers. In addition, spare parts and technical service supports are also core business processes of the company. According to the current situation, the after-sales department needs an immediate attention since significant improvements are necessary for better competitive advantages over its market rivals, e.g. other distributors, non-authorised garages and one-stop service garages. In addition, the company has also sought after cost reduction opportunities along with better customer satisfaction. Therefore, the concerned departments of the company have to develop innovative improvement methods on their related processes.

After brainstorming with the working team, including vice president, head of the business unit, relevance engineers and main dealers, vehicle downtime and transportation cost are concluded as the top priority problems that need to solve instantly. The vehicle downtime is the outage duration of the vehicle under services. In order to create better customer satisfaction, the service centre has to provide better services, e.g. repair, maintenance, etc. with a shorter lead time. The causes of vehicle downtime can be categorised into many reasons, but the one which is responsible by the working team is the spare parts waiting time. In fact, delivery problems and parts availability are both root causes of long waiting time of spare parts.

For the transportation cost, currently, the company uses services from transportation service companies. Within Bangkok's areas, the door-to-door delivery method is used for distributing spare parts to service centres. All service centres will receive their ordered goods or spare parts within a specified committed time. However, the current method causes some problems to the company. The main problem is on loading efficiency of each truck which only uses at 40% average of the full capacity in each trip. According to the trip based transportation fee calculation method, the lower percentage volume of each truck is reflected with the higher cost of transportation per cubic metre. To mitigate the problem, in this research, the night-time delivery method is developed.

Although none of Thai automotive companies have implemented the night-time delivery concept in their current business operations, it is widely used in Europe. Yusen Logistics distributes automotive spare parts to BMW and MINI using night distribution scheme to eliminate spare part waiting time in the next morning [2]. TNT Innight offers night time

express services to various types of customers, e.g. agriculture, automotive, healthcare, etc. in European countries [3]. DANX provides logistics services in Scandinavia by starting its delivery operations in the early evening and finishing them all before 7 A.M. of the next day. The company also provides many options including dropbox as receiving points for customers [4]. Another example is NYK Logistics that integrates cross docking centre and milk-run delivery to distribute ordered parts to customers overnight [5]. From all mentioned cases, it is clear that night-time delivery is an effective concept that could be used to improve the delivery process of the case study company, and therefore it will be implemented in this study.

The outline of the paper is as follows. In Section 2, the new operations processes are created for using in the trial implementation period which is operated with the selected service centres. Section 3 demonstrates the simulated results in case of full implementation for comparing with the current implementation in various aspects. Results and conclusions are given in Sections 4 and 5, respectively.

II. Methodology

A. New transportation operations design

The new transportation method is initially developed by using the WHY-WHY and HOW-HOW techniques [6]. From Table 1, it is clear that traffic jam is the main root cause of all major problems. Table 2 illustrates the method for avoiding the traffic jam problem. Firstly, the driver has to avoid rush hour period which normally occurs between 07:00 A.M. – 10:00 A.M. Not only does this situation happens in city centre areas, but also it is occurred around business and industry areas. To avoid rush hour period, the driver has to work on another time period because it is impossible to solve traffic problems by the company.

TABLE 1
WHY-WHY method for finding root causes 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

TABLE II
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

Night-time delivery is a potential solution that the working team believes to solve the problem. According to the idea of night-time delivery, the driver has to start working at night-time after the warehouse operations is completed. The night-time traffic of Bangkok is totally different with daytime, especially during the rush hour. In fact, the available delivery operations time of the driver is longer than daytime; hence, it is possible to increase delivered volume leading to less transportation trips and higher loading efficiency. In addition, all service centres want to receive spare parts before or at latest at the business opening time so that they could begin the repairing process right after the service centres open in the morning. In fact, the part store staff do not necessary for the night-time delivery operations since the company will provide containers to keep delivered parts at the receiving points.

For the operations design, the ECRS (Eliminate, Combine, Reduction and Simplify) concept is applied to re-design and formulate new operations process flow [7] to follow the night-time delivery scheme. As a result, the operations process flows for the driver and concerned parties have to be revised. Currently, when the driver arrives at the service centre, if delivered goods pass the inspection checking in terms of quantity and quality, the store staff will sign in the transportation sheet. However, for the night-time delivery, there are normally no staffs available at night. Therefore, the goods receiving process has to be modified. The night-time delivery needs containers for storing and protecting delivered goods, and locking system which can only open by the driver and store staff. When the driver arrives at the service centre, the driver will open the container and then put goods into the container. After checking is completed, the driver signs in the transportation sheet and then put the copy of the transportation sheet in the container. At the service centre opening time, the store staff open the container and recheck the received goods and associated documents again, and then sign in the transportation sheet for confirmed receiving and moves the goods to the parts store area. The overall process is illustrated in Fig.I

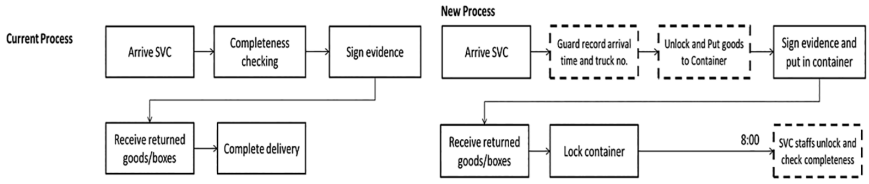

Fig. I. Comparison of the current and new operations work flows

To achieve the delivery deadline, the company needs to create a new work schedule for explaining to all concerned parties. The key change of the new schedule is that the customer orders received in the afternoon after the order cut-off time will be delivered by the night-time delivery. The new delivery schedule. From Figure 2, due to the night-time delivery, ordered parts will be shipped to service centres much earlier, i.e. within the night time of the same day (between 19.00 P.M. - 5.00 A.M.), than they used to be (between 13.00 P.M. - 16.00 P.M. of the next day).

Transportation route	Order (N day)	Current Delivery time	Expected new Delivery time
BKK	08:00 – 11:00	13:00 – 16:00	13:00 – 16:00
BKK	11:00 – 15:00	08:00 – 11:00 (N+1 day)	**19:00 –05:00**

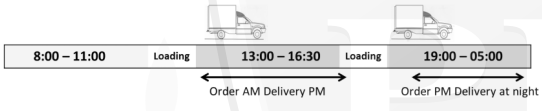

Fig. II. New delivery timetable of night-time delivery

B. Container design

The night-time delivery requires containers for storage received good at the receiving point of each service centre. The container is designed as a goods receiving point which is located in the customer's area, which is called "dropbox". A dropbox is used for two functions, i.e. drop off and pick up goods. The driver drops delivered goods into the dropbox and then closes it. After that, the staff of the service centre unlocks the dropbox and picks up goods inside. On the other hand, the staff at the service centre can also drops defective goods for returning them to the company into the dropbox and the driver picks them up to bring them back to the company's warehouse.

III. Implementation

A. Driver Management

The company decides to implement the night-time delivery at some selected service centres as a pilot experiment. The implementation is executed by trial delivery to the service centres with real ordered goods and transportation routes. The trial delivery is executed to prove whether the delivery operations plan is feasible or not. During the implementation period, the driver strictly follows the delivery plan and the company also checks the readiness of the driver before he starts working. In case of no delivery to some destinations, the driver is forced to drive to those service centres even though there is no good to deliver. The reason is to check the transportation time, arrival time and obstacles during actual transportation. Any abnormal matters are recorded by the driver and inform back to the logistics team to acknowledge the problems.

B. Transportation Supplier Selection

In addition, the appropriate transportation supplier is also selected in order to gain the most efficiency of the new transportation scheme. According to the current situation, the company employs four transportation suppliers to deliver spare parts to nationwide service centres, separated by regions. In order to launch the new transportation scheme, the company has to select a transportation supplier to be responsible for the night-time delivery in the Bangkok area. In fact, a proper supplier selection could increase competitiveness and lead to better purchasing performances, e.g. cost, quality, delivery, flexibility and innovation. The company needs to get good services with reasonable prices since more than 10 million THB is spent on each transportation supplier to deliver spare parts in the Bangkok area.

As a result of bidding, although the transportation supplier C proposes a lower price than the transportation supplier A, the company decides to use both of them for the Bangkok routes. The transportation supplier A is operated for day trips, whereas the transportation supplier C is operated for night trips. By this option, the company will keep benefits of maintaining good relationship with the transportation supplier A (transportation risk management). Meanwhile, the company poses a challenge to both transportation suppliers A and C since they have to compete with each other. The benefit of having more than one the transportation supplier is the quality of work. However, this option is a little bit more expensive and more complicate in the administration process.

C. Execution

After pilot service centres are confirmed, the logistics team and the drivers work together for developing a delivery plan. The delivery plan consists of two important timetables, i.e. estimated arrival time and driver schedule (Figure 3). The driver has to identify the route where he has to drive for the night-time delivery service. Basically, the sequence of the delivery is arranged in the same way as the current route because there is no change in the

transportation destinations. However, the driver has to recheck the actual traffic situation again during the night-time delivery testing on the same route. In addition, a smart phone is used as a supportive device in the night-time delivery service. The driver uses the smart phone to take a video on all events occurred after the truck arriving at the service centre until unloading is completed. The benefit of video recording is for proving that all shipments are handled and delivered with care. If the service centre staff complain the company on damaged parts and poor services, the driver will use the recorded video as a proof for the problematic shipment.

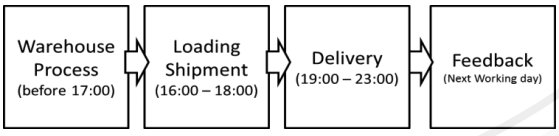

Fig. III. Delivery process flow and time schedule

A. RESULT

Actual trial result

The actual trial result is the result occurred during the delivery services which explains directly on the work result. This information could be used later as raw data for simulation in case of full implementation. Loading efficiency of the actual result is not an important measurement since the trials are done only with pilot service centres selected from the current transportation route. However, the result does not make a clear picture between the trial route and current route. Therefore, the new practice needs to be simulated in case of full implementation to prove if there exist any differences. The result is shown in Figure 3 where the driver has to drive according to the given delivery route (A-H).

The most obvious change is noticeable in the parts waiting time. In fact, the parts waiting time is totally changed from the current operations method because all service centres in the trail routes received goods before their official opening time, i.e. 8:00 A.M. Therefore, all pilot service centres could immediately start their repairing jobs once staff arrive at the service centres in the morning. They do not need to wait for a long time as it uses to be in the current operations method.

TABLE III
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

B. Simulated result

The simulated result is analysed based on the version of actual trial result to predict the transportation result in case of full implementation for all service centres in Bangkok. The simulated result employs new transportation routes which are totally different from the current routes and trial routes. In this case, the cost-performance index (CPI), loading efficiency and estimated transportation cost are used as performance measurements.

In fact, CPI has been used in the company to indicate how much money that the company has to pay per cubic metre (M^3) of goods. According to the simulated data (Table 4), the calculated CPI is about 487 THB per M^3. It is less than the current CPI of the company which is 647 THB per M^3 or reduced by 25%.

TABLE IV
BENEFITS COMPARISON BETWEEN CURRENT OPERATIONS 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**

For loading efficiency, the new loading efficiency obtained from the simulation is around 68% in average. It is found that the maximum loading efficiency is 93%. This means the night-time delivery could eliminate wastes and results in less number of delivery trips. In addition, even though the cost per trip is higher but the number of routes is reduced from 11 to only 5 routes.

It is found that the new transportation cost is reduced around 35% compared with the current scheme on the same situations (since the transportation cost is confidential information, it could not be disclosed to public). The main reason of the improvement comes from the higher loading efficiency which also results in less number of trucks used in operations. Therefore, the total transportation cost will be reduced significantly if the night-time delivery is fully implemented.

In addition, positive feedbacks from the service centre's staff are received in several aspects. Practically, it is not only better customer satisfaction but it also improve internal processes of the service centre as well. One of the most common feedbacks is faster service operations which result in increasing of service volume and revenue. However, some comments on drawbacks are also mentioned, e.g. theft, thunderstorm in the rainy season and durability of the containers.

V. Conclusion

In this paper, the problem on the vehicle downtime of the service centres causing by unavailable of the required spare parts is tackled. The current practice of the case study company is to use daytime delivery approach. Because of the traffic in Bangkok, this approach limits the number of delivery trips per day and also causes a delay in the starting repair time of the service centres. The night-time delivery scheme is investigate as a mean to mitigate the problem. The new delivery process flow which controls the shipment sequence, checks the quantity of delivery goods, and defines the interaction between the driver and the staff at the service centre is developed. This approach has never been used by any automotive firms in Thailand before. The results from implementing the night-time delivery method show that both operations and marketing aspects could be improved. Positive feedbacks from the service centres and customers are also reported.

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