Imbalance Problem in Inbound and Outbound Logistics Flows

Jirapat Wanitwattanakosol, Kobkarn Tapanyo and Nattaya Teepruksa

ABSTRACT--- This paper presents a SMEs logistics problem by using a real case. Inbound and outbound logistics should be synchronized to reduce cost. However, disturbance and the negative consequence of disturbance have appeared in logistics activities. The case study is located in the northern part of Thailand. It has eighteen delivery transport routes across Chiang Mai province. The research objectives are to 1) measure the delivery performance of the case study, 2) propose an approach for waste reduction in the existing distribution system. Focus groups, direct observations and interviews were chosen to gain insight into the logistics processes. Volumetric weight and on time delivery percentage were analysed and discussed to find out the solution. Eight main activities were drawn in IDEF0 diagram. Some lean tools could be applied to leverage the logistics performance in the future. The key performance indicator target should be also adjusted and revised to set at appropriate levels.

Keywords: Small and medium enterprises, logistics, lean,

INTRODUCTION

Inbound and outbound logistics integrates the planning and scheduling activities to managing the flow of physical goods, services or financial resources along the supply chain (Scheer, 1994). Incoming shipments carried by inbound vehicles are unloaded, sorted and loaded onto outbound vehicles at the distribution center in order to forward the shipments to the respective locations (Boysen *et.al*., 2010). Based on an ideal synchronization between inbound and outbound activities, logistics cost should be decreased comparing with the traditional concept.

Svensson (2002) proposed the inbound and outbound logistics flow vulnerability. Disturbance and the negative consequence of disturbance are combined in the vulnerability framework. Some Key Performance Indicators (KPI) are adopted to measure logistics processes in the supply chain. Cooper *et.al.* (2012) stated that specific KPIs under each category must be applied within the specific environment including historical and forward-looking measurements. A proportion of delivery completed processes within the time window promised to customers (On time delivery: OTD) is a popular KPI in the logistics evaluation (Dekker *et.al*., 2012: Meier *et.al*., 2013: Zhang *et.al*., 2016).

To achieve the KPI targets, inbound and outbound logistics require changes to cover all activities by applying lean concepts and tools (Farahani and Rezapour, 2011). However, Small and Medium Enterprise (SMEs) case studies of lean logistics implementations, especially in developing countries, are quite scare (Sumantri, 2017). Moreover, SMEs play a vital role elements of developing countries causing them to be an important foundation of the sustainable development (Wanitwattanakosol *et.al*., 2012). Hence, this paper investigated a Thai case study to bridge the academic gap.

PROBLEM STATEMENT

The case study is located in the northern part of Thailand. This enterprise is a medium-sized logistics company. It has eighteen delivery transport routes across Chiang Mai province. An OTD target is set to achieve 98% for all distribution routes. Almost incoming items are shipped from Bangkok to the case study for distributing to the destination locations with the specific due date. Nevertheless, this company confronts with the problem that there are not enough pallets available and yard operations. Thus, few routes could get instability results for the OTD target.

THE AIM OF RESEARCH

This paper conducted research to measure the delivery performance of the case study. A second objective is to propose an approach for waste reduction in the existing distribution system.

METHOD OF RESEARCH

The most common methods of listening to stakeholders include structured surveys, depth interviews, focus groups, and direct observation. It should combine at least two methods for diminishing risks "not hearing," what stakeholders mean (McKenna, 2004). This research selected focus groups, direct observations and interviews. A structured questionnaire was prepared and used as a guideline questions in the focus group and interview discussion. Organizational records were secondary data such as types of vehicle, distribution condition, freight transportation, and etc. A database contains data from January, 2017 to December, 2017. A stand-alone database was built with MS Access.

Volumetric Weight (VW) of a truckload was calculated by dividing vehicle volume with an empirical economic equivalence factor. The empirical economic equivalence factor was set as 2,500 (i.e. the financial cost of a volume of 2,500 cm^3 was made equivalent to the weight of 1 kg). The VW is calculated by

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$$VW = (\text{length} \times \text{width} \times \text{height})/2{,}500 \quad (1)$$

OTD is a measure of logistics efficiency which measures the amount of services delivered to customers on time. OTD is simply measured as a percentage of the number of units on time divided by the number of total units shipped on a monthly base as Equation 2,

$$OTD = \frac{\text{No. of delivered on time} \times 100}{\text{No. of orders}} \quad (2)$$

Logistics activities were drawn by employing a process modeling, IDEF0. The IDEF0 model consists of a hierarchy of related diagrams. Each diagram is based on a diagonal row of boxes connected by a network of arrows. This diagram consists of arrows, inputs (I), controls (C), outputs (0) and a mechanism (M). The case study IDEF0 As-Is diagram was the starting point to find rooms for improvement. Finally, a To-Be diagram was created in solving problems and designing processes by applying lean tools.

RESULTS AND DISCUSSION

Using a well-designed observation plan, main logistics data and activities were found to represent some important issues of the case study. A variety of vehicles types in term of inbound and outbound logistics are prompted to service customers like six-wheel truck, ten-wheel truck, trailer, pickup truck as depicted in Table 1. By observing routine works, incoming shipment bills are sorted by an officer. Classified bills are sent to assigned persons of each destination location. Fleet operators pick goods based on the specific bill at the conveyor to the pallet's destination. A bill sorting activity and goods selection from an unload conveyor unit was illustrated in Figure 1 and 2, respectively. The database was also built to support the logistics performance analysis as shown in Figure 3.

Table 1. Sample of Vehicles

Inbound	Outbound
Six-wheel truck	Pickup truck
Ten-wheel truck	Box truck
Trailer	Light truck

Figure 1. Sorting out bills

Figure 2. Unloading goods

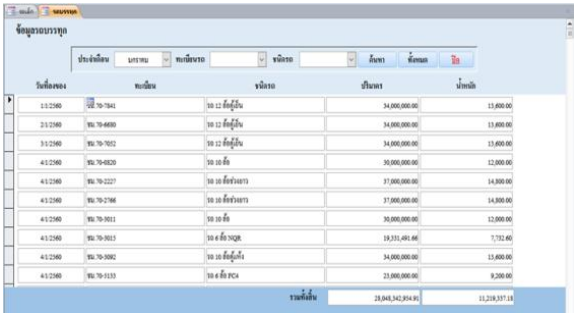

Figure 3. User interface of the database

Next, inbound and outbound truckload were compared in the form of VW (using Equation 1). It was found there was the imbalance between the incoming load and the outgoing load. In this case, the inbound truckload had always more than outbound truckload, especially in November. Table 2 exhibits inbound and outbound logistics information.

Table 2. Comparing between inbound and outbound truckload (Unit: Kilogram)

Month	Inbound	Outbound	Difference
January	11,219,337.18	10,113,635.12	1,105,702.06
February	11,751,470.56	10,136,055.67	1,615,414.89
March	13,041,166.55	11,314,149.88	1,727,016.67
April	10,261,521.37	8,829,131.10	1,432,390.27
May	11,444,619.55	10,743,393.15	701,226.40
June	11,611,321.15	10,797,184.86	814,136.29
July	10,977,858.74	10,428,533.04	549,325.70
August	12,373,373.16	11,526,583.62	846,789.54
September	12,360,106.37	10,524,815.26	1,835,291.11
October	11,814,057.06	10,868,152.58	945,904.48
November	13,765,306.96	11,436,601.72	2,328,705.24
December	13,696,678.16	11,409,537.27	2,287,140.89

It was important to measure actual monthly OTD in order compare the KPI target. The case study was missing its target to satisfy customer due date. In general, each demand has a given due date assigned by the customers. The best OTD result appeared in August as shown in Figure 3.

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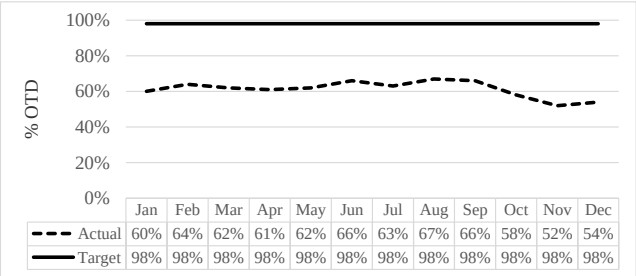

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Actual	60%	64%	62%	61%	62%	66%	63%	67%	66%	58%	52%	54%
Target	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%

Figure 4. An actual logistics performance in 2017

To explore logistics activities, this A0 level (Figure 4) was decomposed into eight main activities –unload goods from incoming shipment (A1), sort bills (A2), group goods in destination location (A3), move pallets (A4), estimate delivery price (A5), distribute goods (A6)), deliver goods (A7), return to the enterprise (A8).

The To-Be diagram was designed to banish wastes within the logistics process to better meet customer satisfaction. It was found that A3, A4, and A5 should be tailored for flow processes.

Total productive maintenance, root cause analysis, the principle of ECRS (Eliminate, Combine, Rearrange, and Simplify), and visual control could be implemented for A3. 5S (Sort, Set In order, Shine, Standardize and Sustain) could help to improve A4 operation. A5 was added with cross-trained workforce in the control unit.

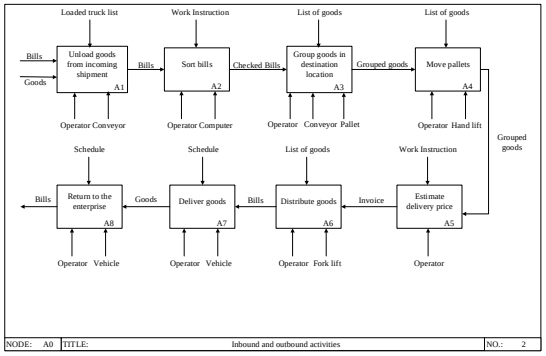

Figure 5. AS-IS activities

CONCLUSION

This research presented the logistics problem as the imbalance between inbound and outbound truckload. This research compared VW from vehicles instead of items. Delay waste and motion waste always occur in the process flow. Lean tools should be applied in the logistics operations. The OTD target should be adjusted and revised to set at appropriate levels.

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