Value and Non-value Added Analysis of Incoming Order Process

Kanyakorn Ketkamon and Jirarat Teeravaraprug

Abstract—This paper presents an application of lean concept in term of value and non-value added analysis for incoming order process of a printed circuit board assembly industry. The process involves both incoming forecast and purchase order. The prior process was observed and disaggregated into activities. The activities were classified into value and non-value added activities. By analyzing the activities, a new process is given. The new process shows that the process times of incoming forecast and purchase order are reduced by 56% and 42%, respectively.

Index Terms—Value added analysis, Value added activity, Lean concept, Incoming order process.

I. INTRODUCTION

Lean has been successfully implemented in manufacturing industries in eliminating wastes and increasing profits. Lean is one of the best tools for not only productions but also offices. By applying lean concept, wastes can be eliminated, quality can be improved, and a savings can be achieved. Therefore, many organizations including both productions and offices pay attentions in lean concept.

This paper shows the application of lean concept in term of value and non-value added analysis to the incoming order of a printed circuit board assembly industry. The incoming order process is an important process since it is a customer contacted process. The satisfaction of customers depends mainly on the process and the customer normally desires quick response or short processing time. Therefore, the incoming order process is observed and disaggregated into activities. Those activities are analyzed and classified into value and non-value added activities. A new incoming order process is given and applied. The processes of observation, activity disaggregation, activity analysis, and process generation are presented. The results of applying a new process are also given in the last section.

II. THE CONCEPT

Lean concept originally comes from the successful Toyota process, which is announced by Womack and two researchers

from Massachusetts Institute of Technology [1]. They wrote one of the best books in lean manufacturing concept called The Machine that Changed the World in 1990. In 1996, Womack and Jones [2] identified a similar gap in their own work of translating lean production into other industries and the results were published in a book named Lean Thinking and it was intended as a guide for lean organization. Lean is defined by several institutes and experts. Jeffrey Linker [3] stated that lean is a principle of production manufacturing by reducing process time and eliminating all wastes for adding more value added into the whole process. The Nation Institute of Standard and Technology (NIST) [4] give the definition of lean as "A systematic approach to identifying and eliminating waste through continuous improvement, flowing the product at the pull of customer in the pursuit of perfection". Juroff [5] stated that lean concept can be applied to administrative processes at all levels of company which are enterprise level, organizational level, department level and individual level. 7 categories of waste in administration, were presented by Keyte B. and Locher D. [6], are overproduction (excessive report), waiting (waiting for approval from management, waiting system proceeding), unnecessary transportation (sending document between department), Non-value added processing (duplicated job), excess inventory (backlog on hand, pending email), defect (reject work, rework), and unnecessary motion (searching, reaching, carrying or positioning documents)

III. ACTIVITY DISAGGREGATION AND ANALYSIS

The incoming order process of the case study can be divided into two parts: incoming forecast and incoming purchase order. The incoming forecast starts with sales representative obtaining customer forecast from customers. Then sales representative prepares "Request forecast form", which is the company form used to change the customer format to company format and gives it to a clerk. The clerk would upload the data from "Request forecast form" to the company system. The system proceeds for a while and once it's done completely, the clerk sends an email to confirm sales representative about the success of data uploading. Then sales representative sends an acknowledged email to customers to confirm the forecast receipt. Next sales representative prepares "Forecast notice Document", which is for a company record. It's required for internal auditing. The completed document must be signed by purchasing manager, operation planning manager and operation director. Then the clerk keeps the completed document into document file.

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Kanyakorn Ketkamon is a Master student of Industrial Engineering Department of Thammasat University, Pathumthani, 12121, Thailand (e-mail: jib435@yahoo.com).

Jirarat Teeravaraprug is with Industrial Engineering Department of Thammasat University, Pathumthani, 12121, Thailand (e-mail: tjirarat@engr.tu.ac.th).

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For the process of incoming purchase order process, it starts from sales representative getting customer purchase order from customers. Then sales representative sends an email to confirm PO receipt and prepares "Order Entry form" (the company form). Similar to as same as "Request forecast form", the main purpose is to change the customer data format to company format. This document should be signed by purchasing manager, operation planning manager and operation director before clerk loading the new order to the company system. Once the clerk loading the data and the system completely worked, the clerk would print out "Sale order sheet" and sign the document. After that the clerk scans the document and sends it to sales representative via email. Next, the clerk keeps the completed documents (sale order, customer's PO and order entry form) into document file. Then sales representative must forward the scanned sale order to customers via email to inform the sale order number and to re-confirm that PO is received and completely loaded into the system. Details of the desegregation of those two parts are shown in Figure 1 and 2, respectively.

Moreover, lead time of each activity is collected and analysis of each activity is given in the last column of the Figures. Based on the analysis, activities are classified into value and non-value added activities. Non-value added activities include overproduction, waiting, unnecessary transportation, non-value added processing, excess inventory, defects and unnecessary motion. The activities are classified as above as shown in the last column of the Figures. The time of the prior process was 102.7 and 55.6 minutes for incoming forecast and incoming order processes.

Department	Process Flow	Activity	Lead time/Analysis
Customer		Send forecast to sales rep.	-
Sales rep.	A-1	Prepare "Request forecast form" and send to clerk	LT = 23.7 mins VA
Clerk	A-2	Load data to system	LT = 10.6 mins VA
Clerk	A-3	Wait system proceeding	LT = 8.6 mins NVA = Waiting
Clerk	A-4	Send confirmation to sales rep. via email after system has loaded completely	LT = 1 min NVA = Transportation
Sales rep.	A-5	Confirm forecast receipt to customer via email	LT = 1 min VA
Sales rep.	A-6	Prepare "Forecast notice document"	LT = 25.9 mins NVA = Over Production
Sales rep.	A-7	Print out document and sign	LT = 4.2 mins NVA = Over Production
Sales rep.	A-8	Send document to clerk	LT = 2 mins NVA = Transportation
Clerk	A-9	Send document to purchasing for sign	LT = 2 mins NVA = Transportation
Clerk	A-10	Wait	LT = 4.8 mins NVA = Waiting
Purchasing	A-11	Sign and send back clerk	LT = 1 min NVA = Over Processing
Clerk	A-12	Send document to operation planning manager for sign	LT = 3 mins NVA = Transportation
Clerk	A-13	Wait	LT = 4.1 mins NVA = Waiting
Operation Planning Manager	A-14	Sign and send back clerk	LT = 1 min NVA = Over Processing
Clerk	A-15	Send document to operation director for sign	LT = 4.6 mins NVA = Transportation
Clerk	A-16	Wait	LT = 2.5 mins NVA = Waiting
Operation Director	A-17	Sign and send back clerk	LT = 1 min NVA = Over Processing
Clerk	A-18	Keep forecast notice document into document file	LT = 1.7 mins NVA = Over Production
Total Process Time			Total LT = 102.7 mins

Figure 1: Incoming Forecast (Prior Process)

Figure 2: Incoming Purchase Order (Prior Process)

Department	Process Flow	Activity	Lead time/Analysis
Customer		Send "Purchase Order (PO)" to sales rep.	-
Sales rep.	B-1	Confirm PO receipt to customer via email	LT = 1 min VA
Sales rep.	B-2	Prepare "Order Entry Form"	LT = 9.8 mins VA
Sales rep.	B-3	Print out order entry form and customer's PO then sign	LT = 3.5 mins NVA = Over Production
Sales rep.	B-4	Send documents to clerk	LT = 2 mins NVA = Transportation
Clerk	B-5	Send document to purchasing for sign	LT = 2 mins NVA = Transportation
Clerk	B-6	Wait	LT = 5.2 mins NVA = Waiting
Purchasing	B-7	Sign and send back clerk	LT = 1 min NVA = Over Processing
Clerk	B-8	Send document to operation planning manager for sign	LT = 3 mins NVA = Transportation
Clerk	B-9	Wait	LT = 3.9 mins NVA = Waiting
Operation Planning Manager	B-10	Sign and send back clerk	LT = 1 min NVA = Over Processing
Clerk	B-11	Send document to operation director for sign	LT = 4.7 mins NVA = Transportation
Clerk	B-12	Wait	LT = 1.6 mins NVA = Waiting
Operation Director	B-13	Sign and send back clerk	LT = 1 min NVA = Over Processing
Clerk	B-14	Load data to system	LT = 5.7 mins VA
Clerk	B-15	Wait system proceeding	LT = 2.3 mins NVA = Waiting
Clerk	B-16	Print out "Sale Order" and sign	LT = 2.5 mins NVA = Over Production
Clerk	B-17	Scan sale order	LT = 1.9 mins VA
Clerk	B-18	Send a scanned sale order to sales rep. via email	LT = 1 min NVA = Transportation
Clerk	B-19	File documents (sale order, customer's PO and order entry form)	LT = 1.5 mins NVA = Over Processing
Sales rep.	B-20	Send a scanned sale order to customer via email	LT = 1 min NVA = Transportation
	Total LT = 55.6 mins		

IV. A NEW PROCESS

Based on the analysis, some activities are value added activities and some are not. Non-value added activities should be taken into a consideration in order to reduce process time (or decrease wastes). Most non-value added activities seem to be redundant and worthless. Some activities are needed to be eliminated such as waiting for document approval, sending document from one department to other departments and excessive copied documents. To describe more obviously, new processes are then proposed as shown in Figure 3 and 4.

Figure 3: Incoming Forecast (After improvement)

Department	Process Flow	Activity	Lead time/Analysis
Customer		Send forecast to sales rep.	-
Sales rep.	A-1	Prepare "Request forecast form" and send to clerk	LT = 23.7 mins VA
Clerk	A-2	Load data to system	LT = 10.6 mins VA
Clerk	A-3	Wait system proceeding	LT = 8.6 mins NVA = Waiting
Clerk	A-4	Send confirmation to sales rep. via email after system has loaded completely	LT = 1 min NVA = Transportation
Sales rep.	A-5	Confirm forecast receipt to customer via email	LT = 1 min VA
	44.9 mins		

As shown in Figure 3 (incoming forecast process), some non-value added activities still remain (A-3 and A-4). A-3, which is waiting for the system processing the data, is unavoidable. The processing time (A-3 processing time) can be decreased by using an efficient high technology computer. A-4, which is sending the confirmation to the sales representative via e-mail, is an activity for internal control. The sales representative needs to know exactly how the forecast processes. The cut-off activities normally are intended to use for internal control but nobody is used as intended. So, when a clerk gives Request forecast form to purchasing manager, operation planning manager, an operation director to sign, nobody takes a look to the form. They believe that the data would load to the system and they can check the data when needed from the system. Therefore, those activities are eliminated.

Figure 4: Incoming Purchase Order (After improvement)

Department	Process Flow	Activity	Lead time/Analysis
Customer		Send "Purchase Order (PO)" to sales rep.	-
Sales rep.	B-1	Confirm PO receipt to customer via email	LT = 1 min VA
Sales rep.	B-2	Prepare "Order Entry Form"	LT = 9.8 mins VA
Sales rep.	B-3	Print out order entry form and customer's PO and sign	LT = 3.5 mins NVA = Over Production
Sales rep.	B-4	Send documents to clerk	LT = 2 mins NVA = Transportation
Clerk	B-5	Load data to system	LT = 5.7 mins VA
Clerk	B-6	Wait system proceeding	LT = 2.3 mins NVA = Waiting
Clerk	B-7	Print out "Sale Order" and sign	LT = 2.5 mins NVA = Over Production
Clerk	B-8	Scan sale order	LT = 1.9 mins VA
Clerk	B-9	Send a scanned sale order to sales rep. via email	LT = 1 min NVA = Transportation
Clerk	B-10	File documents (sale order, customer's PO and order entry form)	LT = 1.5 mins NVA = Over Processing
Sales rep.	B-11	Send a scanned sale order to customer via email	LT = 1 min NVA = Transportation
	Totol LT = 32.2 mins		

Figure 4 shows the improved process of incoming order. Most non-value added activities are eliminated. The remained non-value added activities include B-3 (over production), B-4 (transportation), B-6 (waiting), B-7 (overproduction), B-9 (transportation), B-10 (over processing), and B-11 (transportation). The over production and over processing activities are used as internal control. Waiting and transportation activities are unavoidable.

Similar to the incoming forecast process, the cut-off activities normally are intended to use for internal control but nobody is used as intended. So, when a clerk gives Order Entry form to purchasing manager, operation planning manager, an operation director to sign, nobody takes a look to the form. They believe that the data would load to the system and they can check the data when needed from the system. Therefore, those activities are eliminated.

V. CONCLUSIONS

After obtaining new processes, they are utilized. The observations of the processes are made. They show that the process times of the new processes are reduced. The process time of incoming forecast is reduced from 102.7 to 44.9 minutes (56%) and the process time of incoming order is

decreased from 55.6 to 32.2 minutes (42%). The new process can be satisfied by customer due to accelerative response process time and also for company which the new process can help saving administrative cost by reducing paperwork and improving workflow.

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