AN IMPROVEMENT OF DELIVERY LEAD TIME: A CASE STUDY OF A TRADING COMPANY

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Abstract

This case study is about a made-to-order product supply for projects of a trading company located in Thailand. The core products are regularly imported from around the globe. The lead time delivery, along with the supply chain process from upstream to downstream, is critical and has to be accurately and precisely planned. The company incurred significant amount of expenses, reaching over a million baht, due to delayed product delivery. The framework of this research is DMAIC methodology of Six Sigma concept to identify the root causes and find the appropriate solutions to solve the problem. The result indicates that DMAIC methodology supports the solution to the delayed delivery problem and ensures sustainability in the long term. ABC Company can reduce the Submit and Technical Approval process from 23 working days to 13 working days of delivery lead time based on the area that was focused on.

Keywords: Six Sigma; DMAIC; process improvement; lead time delivery; trading company

Introduction

In this case study, ABC Company focuses on Energy Management Infrastructure (EMI) Division combined with Totally Integrated Power for electricity, especially power transmission and distribution. ABC Company has comprehensive range of products, systems, and solutions for low and medium voltage, rounded out with full support throughout the entire lifecycle from planning with the company's own software tools to installation, operation, and services. EMI division classifies the characteristic of the business unit in two major types: 1) Product Business: any trading company conducts business by purchasing particular products from ABC affiliated vendors located overseas without providing any services, and 2) Project Business: selling the product and providing installation and commissioning service works at project site. The product supplier cooperates with ABC affiliated manufacturer overseas and ABC's third-party vendors overseas.

ABC Company orders two core products which are Gas Insulated Switchgear (GIS) and Air Insulated Switchgear (AIS) under ABC brand name, imported from ABC vendors around the globe. GIS products are regularly imported from four countries, such as Germany, Turkey, Mexico, and China. AIS products are imported only from ABC affiliated vendor in Indonesia. The inbound shipment reports of fiscal year 2015 reflected that these products had delayed deliveries. The majority of the delayed shipments were for Air Insulated Switchgear (AIS). The annual financial performance showed that ABC Company lost due to the penalties for delayed deliveries charged by the customers. These penalties were recorded in accounting records as NCC (non-conformance costs) in millions, year after year. The penalty for delayed deliveries of ABC Company from October 2014 to September 2015 was around 5.09 million baht. Air Insulated Switchgear (AIS) business unit had a delayed penalty of 4.05 million baht, equivalent to 80% of the total delayed delivery penalties. Gas Insulated Switchgear (GIS) business unit had a delayed delivery penalty of 1.04 million baht, equivalent to 20% of the total delayed delivery penalties. However, the other business units had good performance with zero penalties. This research study aimed to examine and answer the question "How can the Define-Measure-Analyze-Improve-Control (DMAIC) model improve

the delivery lead time?" This research presented a robust methodology to streamline the delivery lead time and reduce delayed shipment penalty charges for the company's assurance so that the problems can be eliminated permanently.

Literature Review

Six Sigma Concept

Knowles et al. (2005) applied Six Sigma concept to supply chain improvement by taking into account the individual activities of supply chain operational cycle among the complex organizational relationships in the existing chain. Six Sigma can be used to improve quality and efficiency, and it results in improving profitability of the company (Harry and Schroeder, 2000). In addition, many companies applied Six Sigma concept in order to reduce defects not only in manufacturing but also in services. The five phases of Six Sigma have been developed to enhance systematic thinking and attacking the problems.

Define-Measure-Analyze-Improve-Control (DMAIC) Methodology

The management tools initiate the process steps and key outputs described in the five driven forces of Six Sigma methodology called DMAIC model, which stands for Define, Measure, Analyze, Improve, and Control (Harry and Schroeder, 2000; Shaffie and Shahbazi, 2012). DMAIC is a systematic method in finding the root causes and help improve complicated processes.

A Project Stakeholders Management (PSM) Model

Cleland (1994) defined PSM (Project Stakeholder Management) model. This model considers both internal and external stakeholders in which it integrates the functions of planning, organizing, motivating, directing, and controlling of all resources. PSM model is able to identify the specific problems incurred among the project groups, and it helps to mitigate risk of project failure and sequential waste by reducing and eliminating the conflict workplace and integrated individual effort for team performance (Bourne and Walker, 2008).

Cause and Effect Diagram (Fishbone Analysis)

Chakrabortty (2013) explained that the Cause and Effect diagram also known as a Fishbone diagram is involved in identifying the input and output variables by team member that affect each critical process linkage to customer expectation. Fishbone diagram helps the team to focus on the problem and the list of elements that may be possible drivers of the problem (Aummontha and Smutkupt, 2017; Shaffie and Shahbazi, 2012). Overall, Fishbone can draw a big picture of all potential root causes that affect the problem statement.

Pareto Analysis

Cervone (2009) stated that Pareto chart is a very useful statistical tool recognized as "80-20 Rule". This gives the idea that a large majority impact is represented by 80 percent of the total value while the 20 percent of the total value has minority impact. Pareto chart supports decision making by creating the way of looking at the cause of the problem. Identifying the major portion of the root causes of the problem helps in solving high level problems (Summers, 2006). Then, the team can focus on fixing the key root causes rather than spending a lot of time to fix all causes.

Research Methodology

The research process has four stages which are Data Collection, Data Analysis, Proposed Model and Summary. In addition, this research has applied Six Sigma concept by going through DMAIC steps in order to find the root causes of delayed delivery problem and enhance the right and appropriate process.

Data Collection

The methods of data collection consisted of exporting financial data from the SAP system and interviewing concerned parties. The exported data were all customer purchase orders synchronized with revenue, cost of goods sold including penalty for delayed delivery charges and reflected to profitability of ABC Company. All data were recorded from October 2014 to September 2015.

The interviews were conducted with all key project stakeholders involved in work in process along project and delivery time planning before contracting with the customers. The stakeholders were six main key parties in the supply chain through internal ABC Company and one external ABC Company. For internal parties, the first person was the pre-sales manager from the Bidding team, the second person was the project engineer manager from the Project Management team, the third person was the supervisor leader from the Project Management team, the fourth person was the order management and logistics manager from the Order Management and Logistics team, the fifth person was the commercial project controller manager, the sixth person was the freight forwarder manager, and the last person was the customs broker and transporter company from external ABC Company. The interviews were conducted to acquire related problems of each function and to gather detailed process steps and problems that occurred in each step.

According to data collection, the baseline of the overall delivery lead time of this project was around 88 working days starting from the customer order until the product delivery as shown in Figure 1. The current baseline of each delivery process step has been identified.

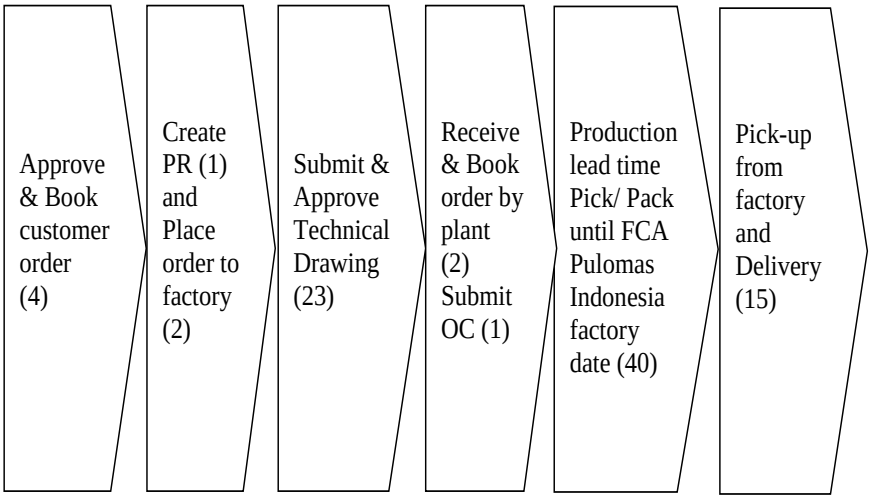


Figure 1: As-Is Delivery Process Times (days)

The researcher tried to identify the total standard delivery lead time in the current workflow. The purpose was to identify the critical areas that impact the total delivery time along the chain. The researcher asked each of the functional stakeholder managers for their specific KPIs based on their responsibility. It was found out that "Submit and Approve Technical Drawing" is one of the major functions of the project engineer. It is still in grey area of discussion about the lead time to submit the technical engineering drawing by ABC Indonesia vendor and to be approved by ABC Thailand Company and Thai customer respectively. Consequential lead time of technical engineering still has not been officially set up KPI in order to keep control of delivery times. Furthermore, non-disclosure of KPIs sharing across function was not clearly identified; therefore, it led to difficulty in managing delivery times.

However, the Project Management team had recorded the engineering submission and approval between ABC Thailand Company and ABC Indonesia vendor. The time consumed was an average of 23 working days from October 2014 to September 2015. In addition, unclear timeline and few communication flows occurred. However, the other steps were processed within the agreed KPIs with operations. Therefore, the scope of this project was focused on the Submit and Technical Approval process.

Data Analysis

This data analysis is based on the data collection during the fiscal year of 2015 from October 2014 to September 2015 and the interviews and discussion with the key stakeholders. The researcher found that 80% of penalty for delayed delivery came from the delayed delivery of 12 shipments (12 projects) of imported AIS and 20% came from the delayed delivery of 2 shipments (2 projects) of GIS.

The Cause and Effect analysis was established by interviewing the six key players as sources of information. The specific problem and possible causes were classified into five major categories: people, support tools, environment, material, and method. Then, the interview results were analyzed in order to harmonize into one fish bone as the core causes that affect the delayed delivery (see Figure 2).

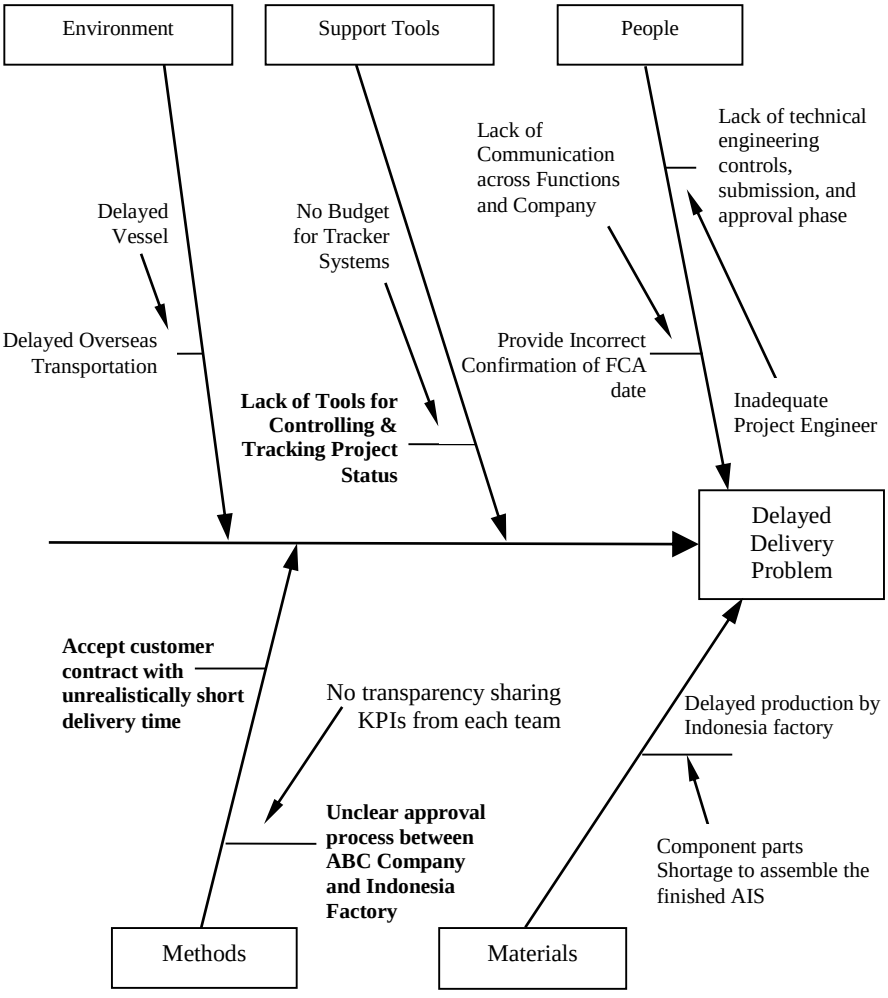


Figure 2: Cause and Effect Diagram of the Delayed Delivery Problem

The three major causes of the delayed delivery problems were identified by brainstorming and interviewing the team members. The causes were unclear technical approval process from ABC Thailand Company and Indonesia factory; lack of tools for controlling and tracking project status; and accepting customer contract with unrealistic shorter delivery time than the offer. By applying Pareto concept and measuring the root causes based on the value penalty charge, Table 1 shows the failures of the three potential causes, which turn into 85.9% of the total value of delayed penalty charges.

Table 1: Pareto Analysis by Causes of Delayed Delivery

Item No.	Causes of Delayed Delivery Problem [a]	Number of Delayed Shipments in Projects [b]	Penalty for Delay in Delivery Value (THB) [c]	Penalty for Delayed Delivery Value (%) [d]	Cumulative Delayed Delivery Value in (%) [e]
1	Unclear technical approval process of ABC Company and Indonesia factory	2	1,359,000.00	33.54%	33.54%
2	Lack of Control & Tracking project status	4	1,171,055.00	28.90%	62.44%
3	Accept customer contract with unrealistic short delivery time than offer	3	951,761.92	23.49%	85.93%
4	Incorrect order confirmation of FCA date	1	219,250.00	5.41%	91.34%
5	Delayed production by Indonesia's factory	1	200,250.00	4.94%	96.28%
6	Delayed overseas transportation	1	151,070.31	3.73%	100.01%
	Total	**12**	**4,052,387.23**	**100.00%**	

The first cause, unclear technical approval process by ABC Thailand Company and Indonesia factory, was analyzed first. The researcher studied the 12 delayed deliveries in details by interviewing the commercial project manager and engineering project manager. The researcher found that there were two projects charged for delayed delivery by the customer in the amount of 1.30 million baht. The reason recorded was delayed drawing submission.

This delayed submission of drawing consumed the longest lead time of delivery process excluding the fixed production lead time. This failed process created non-value-added efforts through back and forth e-mail clarifications between Thailand and Indonesia's parties.

The second cause is "Lack of Control and Tracking Project Status". There were two major problems causing the lack of control and tracking project: 1) No sharing project status to all stakeholders who may influence progress of the project, and 2) Missed sending notification of cargo date with shipping document by the factory.

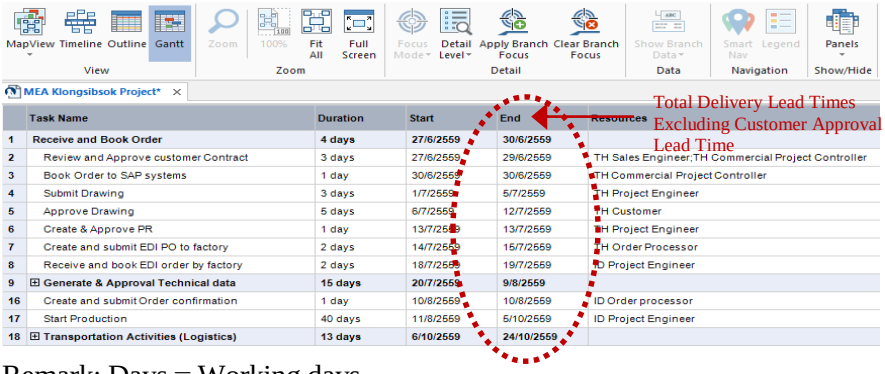
The third cause is "Accepting customer contract with unrealistic shorter delivery time than the offer". The researcher found that there were three cases that the commercial project manager and the sales manager accepted the customer's request date which was less than the company delivery time planning. The customer's requested date was in dispute with the original ABC quotation. All concerned parties realized that the action taken generated penalty charge.

Discussion of Results

The possible root causes were clearly identified with systematical and logical flow of thought, the Fishbone (Cause and Effect) diagram together with Pareto analysis. The researcher selected the three major causes of the problem in seeking for the appropriate solution. The improvement process has been agreed among all concerned parties. Improve phase was implemented with Gantt chart systems, explaining the result by reducing the lead time of Submission and Approval Technical and Engineering data process. There was an improvement from 23 working days to 13 working days after the group discussion and the new actions were taken. This empowers solution to solve all three major root causes. The ongoing to-be process for closing the gaps of delayed delivery can eliminate the non-value-added activities across functional process appropriately. Finally, the Control phase is to monitor and ensure that the improvement process is still maintained and the operations run on track in order to gain sustainable improvement.

Improvement Phase

The improvement process is recommended based on document review, interview, and discussion as well as consulting the experts in each particular area. The team has implemented the project milestone scheduling and tracking by Gantt chart. Gantt chart systems are facilitated to improve the delivery process graphical template representation of the duration of tasks against the progression of time. It provides the ability to see every step of the project from beginning to end as shown in Figure 3. It helps to track the progress of the project. All stakeholders have obligations to input the committed delivery date in each responsible area.



	Task Name	Duration	Start	End	Resources
1	**Receive and Book Order**	**4 days**	**27/6/2559**	**30/6/2559**	
2	Review and Approve customer Contract	3 days	27/6/2559	29/6/2559	TH Sales Engineer;TH Commercial Project Controller
3	Book Order to SAP systems	1 day	30/6/2559	30/6/2559	TH Commercial Project Controller
4	Submit Drawing	3 days	1/7/2559	5/7/2559	TH Project Engineer
5	Approve Drawing	5 days	6/7/2559	12/7/2559	TH Customer
6	Create & Approve PR	1 day	13/7/2559	13/7/2559	TH Project Engineer
7	Create and submit EDI PO to factory	2 days	14/7/2559	15/7/2559	TH Order Processor
8	Receive and book EDI order by factory	2 days	18/7/2559	19/7/2559	ID Project Engineer
9	⊞ **Generate & Approval Technical data**	**15 days**	**20/7/2559**	**9/8/2559**	
16	Create and submit Order confirmation	1 day	10/8/2559	10/8/2559	ID Order processor
17	Start Production	40 days	11/8/2559	5/10/2559	ID Project Engineer
18	⊞ **Transportation Activities (Logistics)**	**13 days**	**6/10/2559**	**24/10/2559**	

Remark: Days = Working days

Figure 3: Assigning Resources to the Project-Based Activities
Source: ABC Company

Control Phase

This phase is the last stage of DMAIC model. Control phase is the process of controlling the action improvement of the solution methodology. It is a vital step to control the new processes to make sure that changes made are reducing the lead time of delivery in the long-term. ABC Company Gantt chart systems and Lessons Learned tool were used in monitoring and maintaining the best practice and tracking the project delivery performance. As a result, the penalty for delayed delivery charge is reduced sequentially. The highest expectation of this Control phase is the comprehensible and manageable chronological situation in the company that will not happen again.

Conclusion

This study found that the delayed delivery problems incurred are from the project business category that comprises the highest value. The result showed that the three major root causes are unclear technical approval process upon ABC Company and Indonesia factory; lack of control and tracking project status; and accepting customer contract with unrealistic shorter delivery time than the offer. Hereinafter, the focal point of the study was the delayed delivery shipment of Air Insulated Switchgear as the product supply for project business. ABC Company Gantt chart systems and Lessons Learned tool were used in monitoring and maintaining the best practice and tracking the project delivery performance. Positive results showed that the overall delivery lead times were reduced from 88 working days to 78 working days, causing the reduction in the Submit and Technical Approval process from 23 working days to 13 working days or 43.48% reduction of delivery lead times based on the area that was focused on. This improvement and performance appraisal and evaluation should be established as robust and visible procedure professionally. Especially, any company can acquire it as mandatory and use it to turn the critical problem to become a standard routine. Using DMAIC concept does not only improve the current delayed delivery situation of ABC Company but also reduce the penalty for delayed delivery charges. It also creates an understanding among the project team members regarding on time delivery and achieving delivery targets. This method enables sustainable improvement and ensures the maintenance of the systems.

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