Reducing Lead Time and Improving On-Time Delivery Performance for an Oilfield Service Equipment Company

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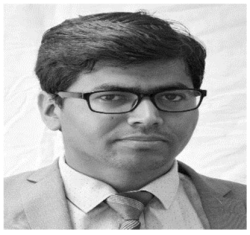
ABSTRACT

This thesis studies the Order-to-Delivery process practiced in an Oil Field Service Equipment Company (OFSE). The main objective is to reduce the lead time in the order-to-delivery (OTD) process. Value Stream Mapping (VSM) is conducted for the complete process to identify wastes. Data analysis is carried out on the lead time at various legs to identify variables affecting lead time. Some of the key findings are 57% of process variability in end to end lead time could be explained by four variables, 'Part No.', 'Supplier', 'Buying organization' (internal to the company which is buying) and 'Country of Destination'. This becomes the basis of creating a supply chain model to identify what orders should be prioritized and expedited along with the workflow for execution.

About the authors:



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KEY CONTRIBUTIONS: -

1. Conducted value stream mapping of OFSE company for Order-to-Delivery process.
2. Provided recommendations to reduce OTD lead time based on data analysis and VSM.
3. Developed a model to assign priority to orders based on historical data.
4. Designed workflows to carry out OTD process for Priority 1 & Priority 2 orders.
5. Studied OTD process of other industries and provided feasible recommendations.

INTRODUCTION

The company X is facing challenges in reducing Order-To-Delivery (OTD) lead time and prioritizing right orders for expediting. Over 50% orders are failing on OTIF (On time in full). Company's purchase decisions are driven by the lowest cost rather than supplier delivery reliability. The company X follows Shared Service Organisation (SSO) model to carry out

order-to-delivery process and expediting. The process is elaborate and has around nine steps from order-to-delivery. Each step has different stakeholders and departments responsible for carrying out different actions in the OTD process. The company has grown through mergers and acquisitions and has disintegrated IT systems. This also results in poor visibility of orders at each leg. Moreover, all products requested follow the same OTD process, irrespective of the criticality of the product to the requestor. This resulted in creating another team under SSO as a Supply Reliability and Efficiency (SRE) team dedicated to expediting the orders. Due to the high volume of requests and orders moving in the supply chain, the SRE team faces issues in understanding the criticality and priority of the orders to be expedited. Due to poor on-time delivery performance, the requestor flags most of the item under 'Urgent' and asks for items at an earlier date than required, which again makes the bulk of the orders look critical and to be expedited. This results in the bullwhip effect and dilutes the 'Urgent' flag.

EXTANT KNOWLEDGE

According to Hines et al.,1997 lean thinking can be defined as a managerial philosophy which enhances the value perceived by the customers, by adding product and/or service features and by continuously removing non-value-added activities (i.e. waste), which are concealed in any kind of process. By identifying and removing waste, the adoption of lean principles not only improves performance and reduces costs, but also enhances customer convenience and business profitability (Bonaccorsi & Carmignami, 2011). The core elements of lean construction are as below (Eriksson, 2010): a) Waste Reduction b) Process focus in production planning and control c) End customer focus d) Continuous improvements e) Cooperative relationships. These elements of lean construction and service supply chain were used in our research to conduct value stream mapping to identify wastes and provide recommendations for lead time reduction in OTD process of company X.

RESEARCH APPROACH

The research approach includes Order-to-Delivery (OTD) lead time data collection and analysis, conducting semi-structured interview on process & challenges faced by various stakeholder. The process is mapped on the principles of Value Stream Mapping (VSM) to identify process wastes and analyse data for one year for an end to end (E2E) OTD process. This helps to understand the Order-to-Delivery lead time for different legs of the shipments. Descriptive statistics of lead time for each leg on various variables such as country, suppliers, requestors, product line, buying organizations, mode of transport etc is conducted. The results from data analysis is further validated with discussions from different stakeholders and identified wastes in VSM. Linear regression is carried out on E2E lead time and other categorical variables to find their impact on On-Time delivery. This becomes the basis for creating prioritisation model for identifying 'urgent' orders to expedite.

RESULTS

The five key results were:1) Value stream mapping of OTD process, 2) Methodology for prioritizing orders, 3) Designing workflow for priority orders (Figure 1 on page 4 shows a Priority 1 workflow), 4) Recommendations for lead time reduction for each step of OTD, 5) Summary of OTD process information gathered from different industries through interview for Company

X reference.

Result 1: From the value stream mapping of OTD the Value Added and Non-Value Added (NVA) activities of each leg of the OTD was shared with the company. This will help the company to focus on reducing the NVA activities.

Result 2: Data analysis showed end to end lead time followed a Weibull distribution with skewness of 2.2 and Kurtosis of 11.1 as shown in figure 1. Linear regression showed, 'Buyer Part No', 'Supplier ID', 'Country of destination' and 'Buying Organization' explained 57.16% of variability in End to End Lead time.

Result 3: Figure 2 shows priority matrix logic to assign priority based on the difference of initial requested delivery date and average lead time (from historical data) on the y-axis and cost of the parts on the x-axis. Three different priority setting approaches were suggested based on 'Requestor' driven or 'System' driven and stage of OTD process. Different workflows were designed to treat Prirority 1 (P1) & Priority 2 (P2) orders. Refer figure 3 (as shown on page 4) for a proposed workflow for P1 orders. The parts with the assigned priority are flagged and each stakeholder in each leg of the OTD process has visibility to prioritize the order. Consolidation process and mode of transport is selected to fast track the order movement. System keeps track of all orders moved as priority along with reasons (for 'requestor' driven) for further root cause analysis and improvement.

Priority 1 (P1) Workflow helps material reach within 30 days , while material moving under priority 2 (P2) Workflow will reach the demand point within 60 days.

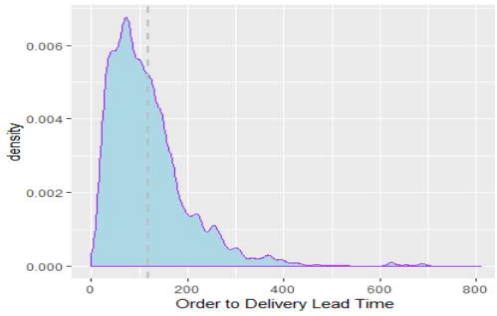

Figure 1: OTD Lead Time distribution

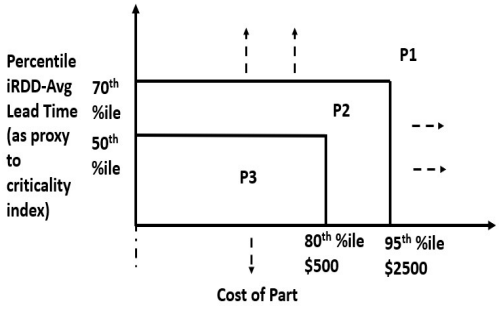

Figure 2: Priority Matrix Logic

Result 4: Based on the extensive data analysis, semi-structured interviews and value stream map (VSM), recommendations were provided for reducing OTD lead time. Key recommendations were divided into three categories: a). System-related recommendations such as Material Master database, Integrated ERP and tracking and tracing capabilities, b) Supplier-related such as Supplier consolidation for low value items, Supplier performance management and long term supplier contracts, c) Process-related such as mapping criticality of parts and factoring criticality in demand management, continuous replenishment for low cost high usage (Runner) items at RDC and automating PO approval for low cost orders.

The recommendations were mapped to show the impact it would have on reducing overall lead time through data analysis. Each recommendation was further assessed by recording company X response on their current state of adopting the recommendations and the priority assigned by the company to work on them.

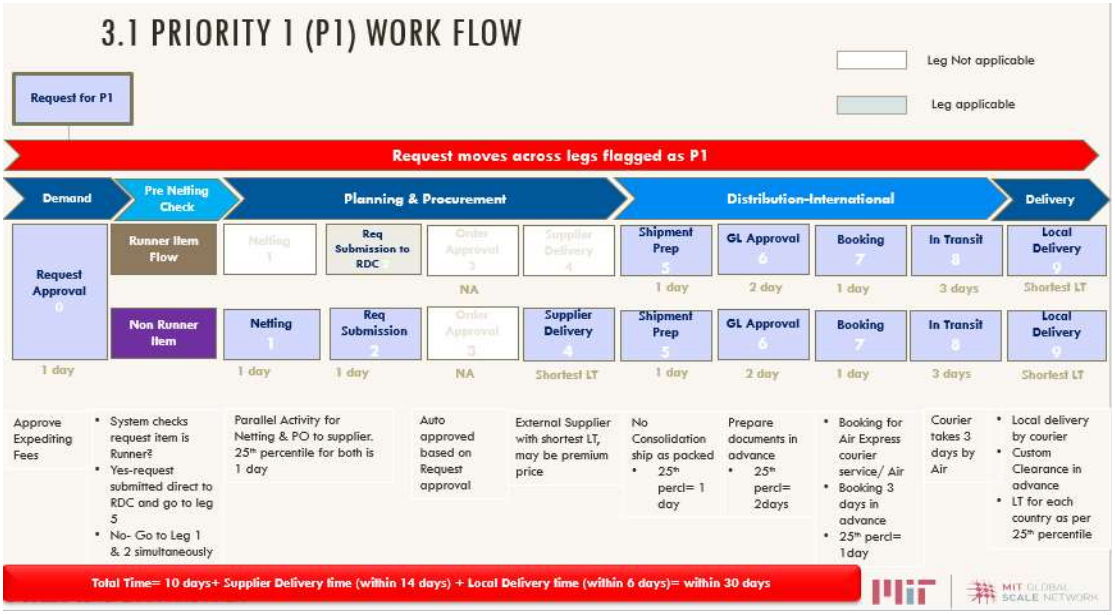

Figure 3: Priority 1 (P1) Workflow

Result 5: Some of the key recommendations from OTD process of the different companies were standardization of service offerings, shared resource of spares like in Airline Industries, supplier relationship management, defined set of Purchase order approval days target as per amount, supply chain segmentation with assigned service levels for different product category.

CONCLUSION

This research is however not exhaustive with a key limitation being that the data being used is of one year and of the eastern hemisphere to the entire geographical operations of the company. This may limit the scope of application of some of the recommendation.

Concluding the improvements proposed sometimes can be obvious. The topic is applicable to a service supply chain for construction company with both internal and external suppliers. The thesis further opens new avenues for further research on how to design a lean and agile order-to-delivery supply chain for this company to eliminate wastes shown in value stream map. Future study can be done by implementing the proposed priority setting approaches for the company, measuring the effectiveness of same and following a continuous improvement process by conducting root cause analysis.

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