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Cross-Functional Integration in an Engineer-To-Order Supply Chain

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CROSS-FUNCTIONAL INTEGRATION IN AN ENGINEER-TO-ORDER SUPPLY CHAIN

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Summary:

This thesis explores the impact of integration process for demand forecasting of project-oriented and Engineer-To-Order (ETO) supply chain which has not been explored much in the supply chain literature. In addition, Shared Service Center (SSC) of a leading global oil & gas field services company is a new context in terms of how integration process elements can be applied. The exploration takes place through the past researches, discussion with company officials and archival data from a company. The outcome of this thesis has resulted into a recommendation of forecasting technique for lumpy and intermittent demand and process framework which would ensure cross functional integration.



About the author:

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KEY INSIGHTS

1. The thesis developed a sufficient evidence to state that Informational Quality, Procedural Quality, Alignment Quality and Constructive Engagement are most important characteristics of demand forecasting in shared service and Engineer-to- Order environment.
2. The credible evidence resulted through research recognize that trust, proactive communication and transparency between entities play a critical role in developing demand forecast in SSC and ETO environment.
3. Croston method is capable of developing a forecast for both lumpy and intermittent demand.

Introduction:

ServeOil is a world's leading oil & gas field services company. This thesis focuses on the GW segment of ServeOil which provides seismic analysis to its customers. A particular seismic analysis project has multiple types of equipments and every equipment has multiple spare parts which experience lumpy and intermittent nature of demand which at times could be difficult to forecast.

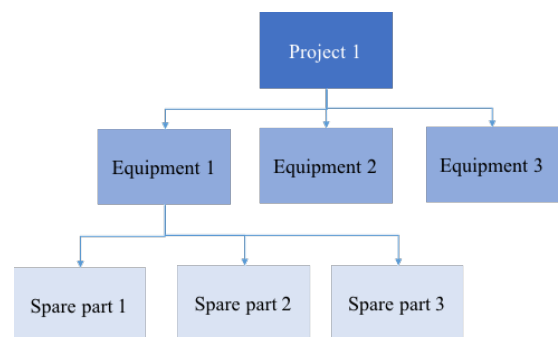


Fig 1: Demand Forecasting Hierarchy

Chief Mechanic(CM) works in field and is an in-charge of equipment maintenance. CM uses intuition and judgment based forecasting process to order spare parts from sourcing function which is based at Shared Service Center (SSC), physically located far away from field operations. The SSC has brought much-needed economies of scale but has resulted into imbalance of subject matter expertise and sometimes the distance leads to distortion of information. This thesis seeks to answer one primary question: How does a forecasting process work in a project and shared service environment? The question has one more dimension to it which is an integrated part of the primary question, i.e., what is the right forecasting method for lumpy or intermittent demand of spare parts?

Literature Review:

The literature review started with the objective of gaining insights into ETO supply chain. (Gosling & Naim, 2009) argued that, ETO is primarily associated with large, complex project environments in sectors such as construction and capital goods.

After this, the various researches in the field of demand forecasting of lumpy and intermittent demand were looked into. (Ghobbar & Friend, 2002) have recommended various cut-off values that distinguish the different categories of demand.

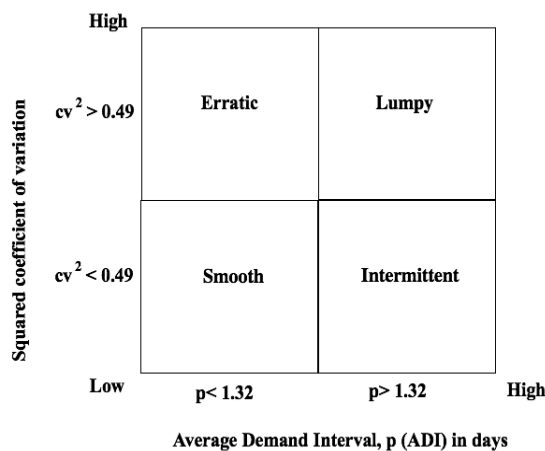


Figure 2: Data Categorization Matrix

(Regattieria, Gamberia, Gamberinib, & Manzini, 2005) in their paper of managing lumpy and intermittent demand for aircraft spare parts concluded that Weighted Moving Averages (WMA), the Croston Method, the Single Exponential Smoothing and Trend adjusted exponential smoothing perform better than the other known forecasting methods.

Finally, the focus of literature review was directed towards gaining the deep understanding of process perspective on spare parts supply chain. (Olivaa & Watson, 2011) in their research on cross-functional alignment in supply chain planning have strongly argued that process specifications play a mediating role between the incentive, structural choices and the firm’s performance. Further, they identified that the three key attributes of the planning process, Information, Procedural, and Alignment quality, can drive planning performance.

Methodology:

The overall research design is a single case study considering the nascent status of literature in integrating customer and supplier facing functions in engineer-to-order supply chain setting.

Primary Data: In order to cover the breadth and depth of main research question, it was decided to interview total eight people from field operations (3) and SSC (5). All the interviews were semi structured and lasted for 45-60 minutes each. A set of open ended and semi-structured questions were formed following background questions from the interviewees. Field notes and verified summary versions of interviews were used to identify patterns in the answers of all participants. The 4 constructs recommended by (Olivaa & Watson, 2011) were tested on primary data.

Secondary Data: Archival data for 2 representative projects were gathered from ServeOil in terms of spend history of all the resources that were acquired over the life cycle of the project. One project data got dropped due to insufficient data. Weighted

Moving Averages (WMA), the Croston Method, the Single Exponential Smoothing forecasting techniques were applied on secondary data. Finally, MAPE was applied on the outcome of all techniques.

Results:

The key findings of primary data analysis are that the characteristics like information quality, procedural quality and constructive engagement are applicable to ServeOil context. Below Collect-Develop-Validate-Consensus framework is developed for ServeOil to ensure cross functional integration.

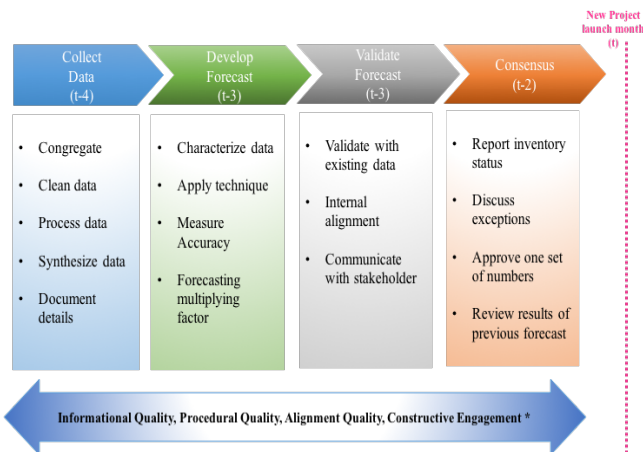


Figure 3: CDVC framework

Croston method performed better than Single Exponential Smoothing and WMA.

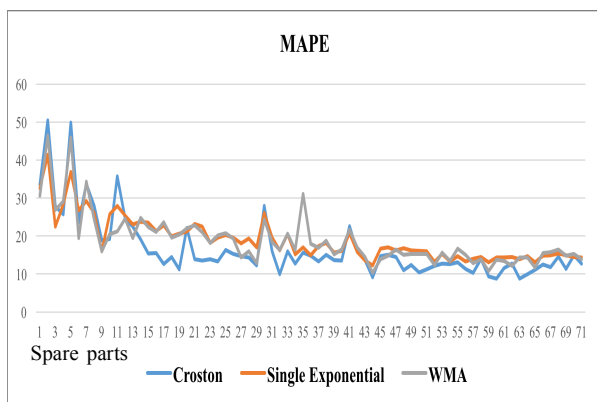


Figure 3: MAPE of all 3 forecasting technique

Conclusions:

One of the main conclusion of this thesis is that planning process plays a pivotal role in integrating customer and supplier facing functions. All 4 constructs Informational Quality, Procedural Quality, Alignment Quality and Constructive Engagement are equally important at every stage of customer and supplier facing function integration.

The credible evidence resulted through research recognized that trust, proactive communication and transparency between entities play a critical role in developing demand forecast in SSC and ETO environment.

Croston method clearly emerged as a winner and is capable of developing a forecast for both lumpy and intermittent demand. This thesis backed the results of past researches done in the area of forecasting of lumpy and intermittent demand and suggested that the extreme demand patterns can be forecasted to a good degree of accuracy.

The research findings also suggest that equal weightage need to be given to both scientific methods, experience and judgment of entities who play a key role in demand forecasting.

References

Ghobbar, A. A. & Friend, C. H (2002). Sources of intermittent demand for aircraft spare parts within airline operations. *Journal of Air Transport Management*, 8(4), 227.

Oliva, R., & Watson, N. (2011). Cross-functional alignment in supply chain planning: A case study of sales and operations planning. *Journal of Operations Management*, 29(5), 7-10.

Regattieria, A., Gamberia, M., Gamberinib, R., & Manzini, R. (2005). Managing lumpy demand for aircraft spare parts. *Journal of Air Transport Management*, 11(6), 5.

