

WECI Inventory Reduction and Just-In-Time Implementation

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Abstract — *The organization studied showed substantially high levels of inventory, thus a reduction was in need. Given the little information available to implement this in a service environment, a new approach was needed. A mix of common sales tools and a Lean Six Sigma approach allowed the study to take place. Measuring the Product Aging, Weeks on Hands, and Days-to-Sell, establishing a trend through a Product Histogram, developing a Pareto chart, and analyzing the process through a Value Stream Map verified that the levels of inventory are too high. A test was performed and the Just-in-Time approach allowed the organization to reduce the inventory levels while avoiding creating new inventory. Though the project is still being considered for implementation, the test proved to be successful in eliminating the need for inventory, reducing the issues related to inventory, and increasing the profit margin.*

Key Terms — *Inventory Reduction, Just-In-Time, Service Just-In-Time, Non-Manufacturing Just-In-Time*

INTRODUCTION

Inventory is one of the biggest expenses any organization will incur, but having too little affects the organization while having too much have the same effect. Inventory needs to be controlled, managed, and reduced to acceptable working levels.

WECI is a manufacturer representative specialized in the water and wastewater markets. The organization focuses on the transport and process of the aforementioned areas. The company provides sales and service in the Pacific Northwest.

Given the nature of the organization, currently, there is a substantial amount of inventory that seems to be growing without any signs of decreasing. Recent losses in inventory have caused concern about the size and items in their warehouse.

Although the losses were not significant to cause any disruption, there is still a high level of concern.

Given the organization's process and operations, the inventory levels can be reduced to the most essential products and implement a Just-In-Time approach to the rest of the inventory. There are enough delays in the system to allow the Just-in-Time approach to be highly successful. Furthermore, the organization can free up capital, liberate real estate, have a higher profit margin in those products, and eliminate the need for the amount of inventory that can hamper the organizational efforts.

The motivation of this study is to present the benefit of an inventory reduction and the implementation of a Just-In-Time approach to a service organization. The objectives of this project are to:

- Reduce inventory no less than 35%
- Decrease cycle time no less than 25%
- Decrease holding cost by at least 45%.
- Decrease Weeks on Hands by 6 weeks.
- Decrease Days-to-Sell by 30 days.

LITERATURE REVIEW

The Just-In-Time approach has always been associated with the manufacturing environment. This has caused the service environment to lack in the implementation because of this stigma. Nonetheless, the service environment can benefit substantially from the proper implementation of a Just-In-Time approach. This approach allows the organization to provide only what is needed when it's needed [1].

The Just-In-Time approach has five key benefits: it reduces inventory, improves quality, increases productivity, increases profit margins, and increases competitiveness [1]. The profit margin is a critical aspect of any business, but it is more critical

to small businesses, which may not have the same capital available as bigger businesses. This becomes even more critical to the service environment as the profits may rely on the quality of service provided and having a customer request the services again. Therefore, another five factors come into play, training, technology, processes, quality, and standardization [2]. However, how does a small business can properly measure and implement these key aspects?

They can implement a Just-In-Time by analyzing the processes with quality tools such as Value Stream Mapping, Process Flow Charts, Controls Charts, Pareto Diagram, Ishikawa Diagram, and among many other tools available [3]. The usage of quality tools must be applied properly as the incorrect usage or understanding may hamper the efforts of correct implementation; hence, training is needed. The training is not enough to implement these processes, as experience will be extremely beneficial. A great example is the training provided to Seattle's Virginia Mason Medical Center [4].

The Just-In-Time demonstrates the ability to reduce real estate, liberate capital, reduce cost, increase profit margins, and among all of these, allows the organization to grow further than their expectation [4].

The Just-In-Time derives from the Lean approach, which strives for waste elimination. The waste comes from non-value adding activities. Such activities might be the reduction of cost associated with inventory, improve quality, improve output, and among many other benefits. The key of the JIT is to analyze the process as a whole and implement the solutions step by step in small increments and the latter result will be an optimized output just at the right time.

A key limitation during the research is that there is very little information on how to apply a Just-In-Time approach to a service environment. The Just-In-Time approach is closely associated with manufacturing, therefore, most of the available information goes in hand with the manufacturing area. Though, a combination of common sales tools

and the Lean Six Sigma approach provided a great depth of the problem.

BACKGROUND

To establish the impact of the inventory levels the most important thing is to analyze the inventory. The inventory level can be analyzed by establishing the aging of the products, the Weeks on Hands, average Days-to-Sell, and trend.

A product aging is a key indicator in determining how long a product has been on the shelf. This reflects the levels of inventory an organization has through a year. The key is to have enough inventory to sustain surge but enough to cover the day-to-day operations. The two ways to reduce this are either increasing the Cost-of-Goods-Sold (COGS) or decreasing inventory levels. When you have priced-locked items the only way to decrease them is through inventory. The aging of the product is identified to understand how long a product has been sitting on the shelf. This is to be accomplished through the aging formula (1).

$$Aging = \frac{Average\ Inventory\ Cost}{Cost\ of\ Goods\ Sold} \times 365 \quad (1)$$

The Weeks on Hands or WOH (2) and Days to Sell (3) calculation work hand-to-hand. The Week on Hand is a good measurement of the average product cycle. The longer the cycle time, the higher the risk of a product becoming obsolete, lose value or have the quality lower due to the exposure of the elements. The Week on Hands is a powerful tool when combined with the aging, and Days to Sell (DSI). Days to Sell or DSI is another indicator of a product being slow to sell, long on the inventory, and to some extent provides the liquidity of the product. The longer the product takes to sell, the lower the margin of the product will be.

These are good indicators of how well a product is selling through a period. The difference between them is the approach used and the accounting period they considered. For the Weeks on Hands, you can establish the specific accounting period, while the Days-to-Sell considers the full year. This provides a full spectrum of how the products are moving. The

combination of these two tools provides a complete outlook into the product movement. However, the DSI equation shows that either decreasing the COGS (Cost of Good Sold) or decreasing the average inventory on hand can reduce the value.

$$WOH = \frac{\text{Accounting Period}}{\text{Inventory Turnover Rate}} \quad (2)$$

$$DSI = \frac{\text{Average Inventory}}{\text{Cost of Goods Sold}} \times 365 \quad (3)$$

The trend a critical part to understand as this will provide an insight into how a Just-In-Time approach can be implemented. The critically comes due to the expected variation within timeframes. The timeframe variation for this case is demonstrated through the analysis of the quarterly variation. This variation will be demonstrated with the use of a product histogram.

Moreover, the process needs to be considered and reviewed. This will present the opportunity on how and where to implement the Just-in-Time approach. The process will be reviewed through the use of a Value Stream Map.

METHODOLOGY

The data collection was performed during the annual inventory verification. This was through the counting of each product in inventory. Once the data collection was completed, the data integrity was verified for any errors and if any were found the information was closely reviewed and mitigated. This process was followed by the selection of five random products in the list. These items were reviewed through the aforementioned formulas.

The aging of the product was identified. Once the aging was completed, the Weeks on Hand and Days to Sell were calculated.

However, to understand the behavior the trend needed to be established. The trend was analyzed by reviewing the historical data of the past years in different quarters. The information was entered into a Product Histogram to identify a pattern.

The process was reviewed by following a project from start to end. This provided the feedback needed for the improvements of the process. The process was then changed for one project to test the

Just-In-Time approach by utilizing the same process, but changing the only the delivery of the product to the customer. The outcome of the test was verified against a control product. Both processes were subject to a thorough review.

Finally, a compilation of recent issues was reviewed and the information was entered into a Pareto diagram. This provided a different insight into recent issues. The results were then extrapolated to the other products.

A limitation encountered during the data collection was that the information of the product is closely guarded and protected. This meant that not all of the information was readily available, nor it cannot be shared outside the organization. Another issue was the cost variability. The cost variability played a significant role in establishing the impact of the inventory. However, the impact on the outcome was deemed minimal. The data and outcome suggested that even with the limited information, the organization will benefit from the implementation of the Just-In-Time and the reduction of the inventory.

RESULTS AND DISCUSSION

Most of the products are exceeding the expected 60 days of aging and a good average will be 45 days as this will provide some margin to have products sold within the 90 days window. However, four of the five items selected are exceeding the threshold and the reason is the sheer size of the inventory. By controlling the inventory, the aging can be reduced substantially.

All of the selected items exceed the expected 12 weeks. The 12 weeks should be the maximum product cycle time. Figure 1 shows the fluctuation within each item. Although each product has a differential in the data, once the data was normalized still the outcome was the same. To mitigate this, the inventory turnover rate needs to be increased and the best way to reduce this is through the reduction of inventory.

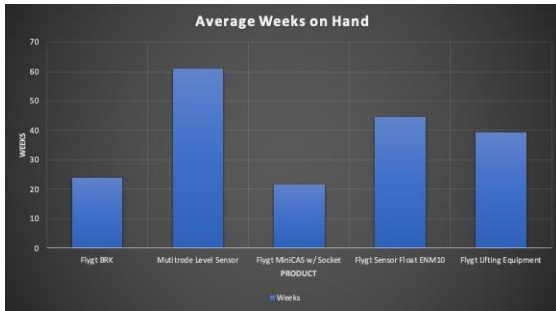


Figure 1
Average Weeks on Hand

Figure 2 shows the current DSI. The DSI demonstrates the high volume of inventory the organization has. The DSI should be contained within 90 days. While some items do comply, others do not. The five-item selected are the most frequent items sold by the organization and they are running close to the margin. The DSI for the selected items were close to the margins and when the output is extrapolated to the other slow-moving items it can be expected the items to be over the 90 DSI. The difference is that the Weeks on Hands and Aging were considered throughout a year while the DSI was considered in a specific accounting period. For this project was a quarter, specifically a Q2. The data is expected to follow the same pattern of exceeding the threshold of 90 days.

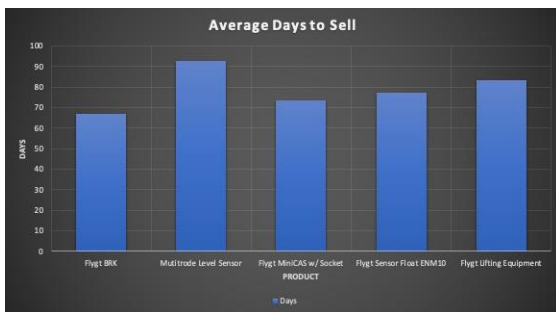


Figure 2
Average Days to Sell

To adapt the business for any fluctuation it is key to understand the trend throughout a year. Normally, the business sees the peaks during the last weeks in Q1 through the early weeks of Q3. This trend correlates with the seasons. The Fall and Winter times are the wettest months; therefore, the pumps need to be fully operational to accommodate

the change of flow due to the season's change. This is where the surge of parts, service, and new product orders comes in during the Q1 and Q2 and installation and maintenance occur typically during Q3. The insight the trend provides allows the organization to mitigate any unexpected surge, therefore ordering in advance rather than waiting, though, carefully not to build the inventory. The Just-In-Time approach is highly feasible throughout this period as the lead times are the smallest during Q2 and Q3. Moreover, it is possible to estimate when parts and maintenance can be expected as the service is standard through the product range. The organization can track the sold items to a customer and prepare in advance of when the maintenance for an item can be expected.

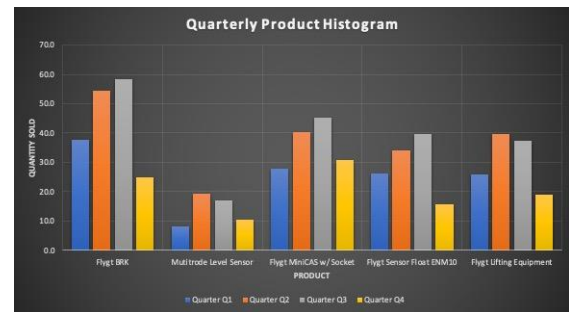


Figure 3
Quarterly Product Trend

The Pareto principles stipulate that 80% of the problem can be traced to 20% of the process. Figure 4 demonstrated wherein the process the most issues are arising. Usually, this can be traced to the first two, but in this case, it can be considered the first three causes. First, the low moving items constitute more than 41% of the issues presented. Secondly, the order issues follow up with 18% of the instances. Thirdly, the wrong part order constitutes 16%. Whenever there is an issue with an order or a wrong part is order it is uncommon for the part to be sent back to the manufacturers. There are some exceptions and reasons but is mostly related to the cost. The Just-In-Time approach will eliminate most of these issues.



Figure 4

Inventory Accumulation Issues

The current process the organization uses has a vast opportunity for improvement. First and foremost, the process is filled with too many delays. While most delays are inherent due to the business nature, others are not and can be mitigated by improving the process. Figure 5 demonstrates a better approach to the current one. The key impact of the proposed process is the inventory levels and the Just-in-Time approach.

Currently, the inventory must be mixed between in-house and drop-shipped from the manufacturers. This is where most of the issues come in. Therefore, by eliminating this step most of the issues related to the low moving items and order issues will be mitigated. Moreover, this will open additional time for each individual as the manufacturers will be responsible for the shipping process. The lead-time impact will be minimal, as the product's lead time gravitate around the bigger products such as the pumps. The cost of implementing such an approach will be minimal to the clients as the majority of the cost comes from the bigger products. This approach will be of great benefit as the inventory levels will be reduced and the organization is no longer in charge of the shipping process, rather than monitoring the product status.

The Just-In-Time approach fits perfectly around the new process and this in effect eliminates most of the inventory. This will allow for the clients to receive the items when needed and directly from the factory, rather than intervening or redirecting the products to the facility, thus decreasing the probability of order issues.

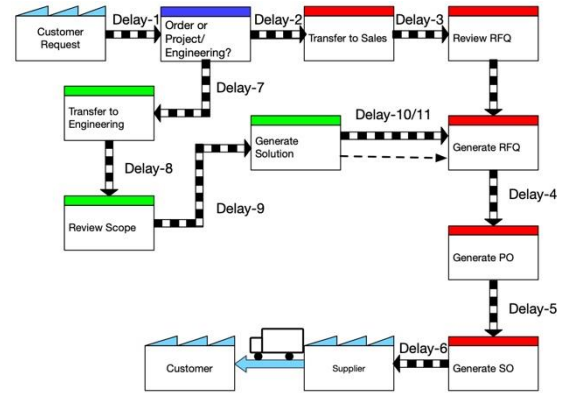


Figure 5
Proposed Process

CONCLUSION

The organization will benefit from implementing an inventory reduction and changing the model to a Just-In-Time. The data provides a bleak outlook of what the inventory is like. Reducing the inventory levels will allow the organization to free up capital, increase liquidity, liberate the real estate, and reduce its footprint. Though generally speaking, the Just-In-Time approach is associated with the manufacturing environment, this proves to be highly beneficial to the service environment. Based on the projected objectives, most of them are within reach.

Currently, the organization is considering implementing the approach, though the reduction of inventory levels will prove to be difficult. The reason is that these items cannot be return or rebated, therefore, the organization must look for a way to sell these. Given the organization will not start this implementation soon, we cannot provide a clear measurement of the goals. However, the extrapolation of the test proved that the project is successful given Just-In-Time approach eliminates the need for high levels of inventory.

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