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"Good Vibrations"

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Supply Chain Management

Introduction

VIBCO, a local manufacturing company, produces a large variety of products, such as industrial vibrators, vibratory equipment, and mounting brackets and hardware. The particular production area that we chose to focus on for our project, however, was the large turbine cell.

This project, through the DMAIC process (Define, Measure, Analyze, Improve, and Control) attempted to reduce certain inventory levels in the supermarket. In addition, we wanted to reduce and/or redirect other resources, such as labor. Putting the production of the large turbines onto a kanban system allows the company to continue to grow, as well as improve its on-time performance for its customers.

Define

The production for the large turbines at VIBCO is currently based on a schedule. When production staff, such as the machinists and assemblers, are finished with their assigned work for a specific day, they then start on the next day's production goals. This creates an excess amount of inventory for some products. Employees, such as production controllers, machinists, and assemblers are then not being used as efficiently as possible.

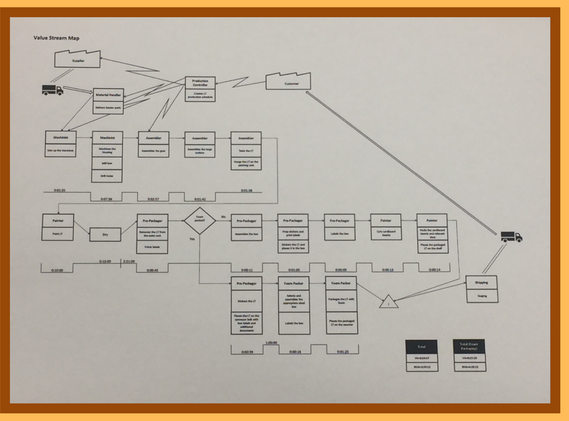
Measure

In order to track our success, we had to determine some Key Performance Indicators (KPIs), including inventory levels and stockout percentages. One of our more specific goals was to improve the company’s overall performance in each of these areas. First, however, we had to determine the company’s starting position in these areas.

To calculate the total cost of inventory on hand, we collected the “Product Cost Reports” for each of the products that we had planned to put on kanban. These reports gave us the total cost for each component that went into the production of each individual large turbine, including the direct cost of labor and materials. We counted the current inventory on hand, as well as determined the ideal supermarket values. Using all of this data, we were then able to compare the current and potential future costs of the inventory for VIBCO.

A stockout percentage represents the percentage of times that our kanban value does not meet the daily demand. Based on this data, we can decide whether or not to raise or lower the original kanban values that we had calculated. Additionally, we monitored the on-time delivery percentage as well, since one of VIBCO’s main goals is “same day, next day” delivery. In order to measure these values, we reviewed the daily open orders report, each day.

At the beginning of our project, we also conducted a time study on each section of the large turbine manufacturing process, including machining, assembly, painting, drying, and packaging.



Acknowledgements

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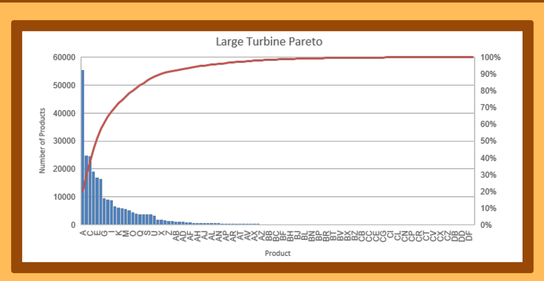
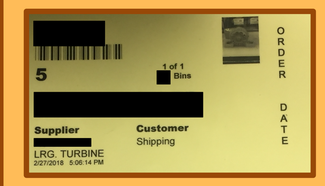


Large Turbines	Sum of Shipped Quantity	Cumulative Qty	Actual %	Cumulative %
A	55430	55430	20.09%	20.09%
B	24870	80300	9.01%	29.10%
C	24700	105000	8.95%	38.05%
D	19170	124170	6.95%	45.00%
E	16880	141050	6.12%	51.12%
F	16500	157550	5.98%	57.10%
G	9610	167160	3.48%	60.58%
H	9180	176340	3.33%	63.91%
I	8930	185270	3.24%	67.14%
J	6660	191930	2.41%	69.55%
K	6300	198230	2.28%	71.84%
L	5930	204160	2.15%	73.99%
M	5660	209820	2.05%	76.04%
N	5320	215140	1.93%	77.97%
O	4670	219810	1.69%	79.66%
P	3990	223800	1.45%	81.10%
Q	3960	227760	1.44%	82.54%
R	3840	231600	1.39%	83.93%
S	3810	235410	1.38%	85.31%
T	3810	239220	1.38%	86.69%
U	3300	242520	1.20%	87.89%



Analyze

We spent a lot of time analyzing the large turbine shipment data from 2017. From this information, we were able to determine which products should be put on kanban. The pareto graph above shows that 21 out of the 110 large turbines produced by VIBCO make up 88% of the total units shipped in 2017. We then used the ship data that is associated with those 21 products to calculate weighted averages and standard deviations for each. This, along with the product’s lead time and container quantity, were then inputted into an excel kanban calculator, to determine the ideal kanban values (shown in the graph to the right). We decided to have a container size of 5 products because the production and packaging teams prefer to work in batches. This also kept the number of kanban cards in our system to a minimum. In the end, these are still working values and can be changed as the business sees fit.

We also researched the feeder parts that go into each of the finished products. The feeder parts, and how they are made, affect the internal lead times of the finished good, which ultimately affects the kanban values. In addition, we created a spaghetti diagram (displayed on the right) for one of these feeder parts to show the movement of the part within the factory. This diagram follows the part from the point of delivery all the way to packing and shipping.

Lastly, we needed to make sure that our maximum quantity on hand values were greater than the average order size for each product. Again, we used the 2017 shipment data to check these values. Overall, all of these analyses and calculations were done with the help of excel spreadsheets, functions, and pivot tables.

In the end, we decided to do a trial for our proposed kanban system on two products, E and J. These two products were chosen based on their order volumes and standard deviations in shipment.

Improve

Implementing our kanban system, was the most complicated phase of this project. We began by creating the kanban cards for the two trial products (E and J). We then created a new Standard Operating Procedures (SOP) document to plan, in detail, each step of our kanban system. The SOP document will also allow others to understand how to continue to manage the new kanban system, in the future.

Before putting our kanban cards in place we had to create and install two mailboxes. We placed one mailbox in the shipping area, right near the supermarket, and the other mailbox at the machinist’s station, in the large turbine production cell. We then had to set up the supermarket with the correct amount of inventory - *x* units for E and *y* units for J. This process involved working with the production planner to schedule the units, so that the supermarket would be fully stocked on the day that we wanted to begin our trial. We also had to instruct everyone involved in the production process on how the new kanban system was going to work. This included the shipping supervisor and his associates, as well as the large turbine manufacturing team. In the beginning, we got some push back from the employees and heard many concerns about our newly implemented process.

Since we are beginning the a trial with only two large turbines and there are over 100 different types produced in the cell, we must use a hybrid of production methods. This means using a combination of both kanban cards and the production controller’s schedule.

The last step to the improvement phase was putting the kanban cards themselves in place with their associated finished goods. After putting the cards in place, we checked on where they had moved each day.

Kanban Quantities

	Product Name	Sum of Shipped Quantity in 2017	Actual%	Cumulative%	Order Lead Time	Transit lead time	Internal Lead Time	Container Qty	Daily Demand Weighted Average	Daily Demand Weighted Stdev	Reorder / lotsize	Total Lead Time	Daily Demand Variation (75% Service level	# Kanban Cards	Max Qty on Hand	# Days on Hand	Green Card	Yellow Card	Red Card
1	A	55430	20.09%	20.09%	1	0	1	5			1	2							
2	B	24870	9.01%	29.10%	1	0	1	5			1	2							
3	C	24700	8.95%	38.05%	1	0	1	5			1	2							
4	D	19170	6.95%	45.00%	1	0	1	5			1	2							
5	E	16880	6.12%	51.12%	1	0	1	5			1	2							
6	F	16500	5.98%	57.10%	1	0	1	5			1	2							
7	G	9610	3.48%	60.58%	1	0	1	5			1	2							
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9	I	8930	3.24%	67.14%	1	0	1	5			1	2							
10	J	6660	2.41%	69.55%	1	0	1	5			1	2							
11	K	6300	2.28%	71.84%	1	0	1	5			1	2							
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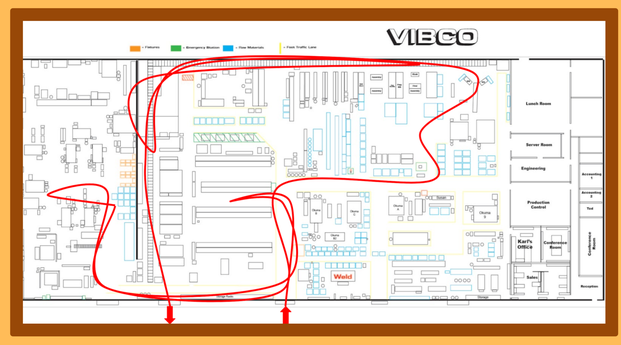
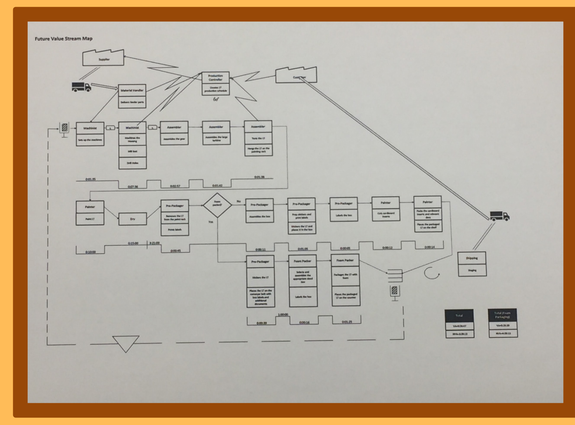
21	U	3300	1.20%	87.89%	1	0	1	5			1	2							
TOTAL		242520	87.90%																





Control

The control phase is the final part of the DMAIC process. In this section, we focused on monitoring our trial, and addressing any issues and/or concerns. As various issues did arise, we recorded and offered alternatives/solutions for each. We continued to track the daily movement of our kanban cards for the following three weeks.

We also created a future state value stream map (displayed above). This diagram shows how the new large turbine production process would look, if our kanban system was fully implemented. If VIBCO chooses to fully implement this kanban system, their supply chain would be better aligned, since the large turbine production would be moved from assemble-to-order to make-to-stock.

While our process did work, we have come to the conclusion that, at this point in time, VIBCO is not ready for a full implementation of the kanban system. The company is going to stop our trial to focus on a few other areas of improvement first.

Benefits Analysis

The purpose of this project was to implement a system, specifically a kanban system, that better manages the production of the large turbines. Some of the main goals of this kanban system is to achieve 100% on-time shipping, optimize labor, and eliminate and/or rearrange wasted resources. Implementing the kanban system has also helped to unearth other areas that need improvement.

Implementing a kanban system for VIBCO’s large turbines was not easy, but in the end, the benefits outweigh the costs. The largest benefit that this implementation has is improving the company’s on-time delivery. With better product availability in inventory, not only will VIBCO have higher on-time delivery rates, but it will also have the ability to gain a greater market share. In addition, maintaining customer satisfaction is much more probable, when the business can maintain same-day, next-day delivery. Although, overall inventory levels will rise in the beginning, the products will turn over faster, since they will go out the door faster.

With on-time delivery rates increasing, capacity also has the potential to increase as VIBCO’s demand trending upward. The kanban process helps VIBCO do more with less resources. For example, they can flex workers to other areas that are in need of help, instead of hiring additional employees.

The kanban system will better align VIBCO’s supply chain as well. Currently, VIBCO is operating at an assemble-to-order production level. After the kanban is fully implemented, however, it will shift to a make-to-stock production level. Products will be ready to ship when orders are received, rather than made afterwards. This will allow resources to be utilized more efficiently too.

In addition, the kanban system reduces the daily scheduler’s role. This creates a cultural change within the organization. It allows the product to be managed at the operator level, which will naturally instigate more commitment to meet the on-time delivery goal. This also allows the production controller to focus more on managing other areas, such as the raw materials.

Lastly, the new kanban system would reduce the amount of paperwork, as the scheduler would likely not have to print a production schedule every day. With a full implementation of the kanban cards, VIBCO would be able to operate with less people both in the office and on the factory floor. We cannot exactly calculate the monetary value of the potential market share growth, but we do know that it will positively affect VIBCO’s business overall.

Notes and Citations

Please note that the data above has been modified and the product names changed out of respect for VIBCO’s privacy.

*Marky Mark feat. the Funky Bunch. “Good Vibrations.” Good Vibrations, 1991.