Refrirest Case: Managing a Manufacturing Process

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Case Description

The primary subject matter of this case is managing a manufacturing process. Secondary issues include, but are not limited to, long lead time, excess inventory, customer service, human resources, and organizational culture. The case is broad and addresses issues across multiple business functions. The case has a difficulty level appropriate for senior students or first-year master students. The case is designed to be taught in one class of three hours and is expected to require two hours of outside preparation by students.

Case Synopsis

The case illustrates a situation encountered by a manufacturer of stainless steel bar and restaurant products. However, the problems described in this case are common to many manufacturing firms. The company is dealing with several issues including late deliveries, high inventory, and unhappy customers. In the case, the operations manager is looking for an effective way to manage the plant by reducing or eliminating late deliveries without having to invest large amounts of money. The case is intended to give examples and discuss some of the many challenges associated with successfully operating a business, especially in a manufacturing environment. Students typically have few problems listing the inherent problems of a manufacturer. However, joining the disparate problems into a management game plan that can effectively address the root cause can be challenging.

Keywords: Operations management, constraints management, Kanban, CONWIP, coordination theory, manufacturing flow, case study.

Introduction

The Refrirest[1] phones were ringing off the hook in the early morning hours. Most managers would relish the chance to field a heavy volume of phone calls to the sales department. After all, the more calls the more chances there are to increase sales! However, on this day the frequent phone calls were not necessarily customers looking to make a purchase. In fact, many of these calls were from angry customers. In most cases, they were simply wondering where their products were and more importantly when they would receive them. Some of these customers were threatening to change suppliers. In addition, employees were unhappy when they had customer interaction. Paperwork along with customer orders piled up in the backroom. Shipping companies were never sure if there would be multiple truckloads of orders to ship or nothing at all for the day. Delayed shipments led to angry customer phone calls that salespeople wished they could avoid.

[1] Not the real name of the company

Since sales personnel could not change the number of delays in the manufacturing process, they were forced to tell customers, "If you want quality, then you'll have to wait!"At first, it was simply a line used to answer customer inquiries; however, it soon began to sum up lead times for Refrirest. A manufacturer of stainless steel bar and restaurant products, Refrirest quoted customer orders at six to eight weeks when placed, when in reality customers could wait up to twelve weeks until their order was received. Marcos Morris (M-squared as he was known) came to Refrirest with a bachelor's degree and experience at other manufacturing plants with typical lead times of 4-5 weeks, a fraction of Refrirest's lead time. Unfortunately for the firm, customers in the restaurant equipment industry were requesting three-week lead times to accommodate their quick building times, difficult liquor license application process, and anticipation of some customers' grand openings.

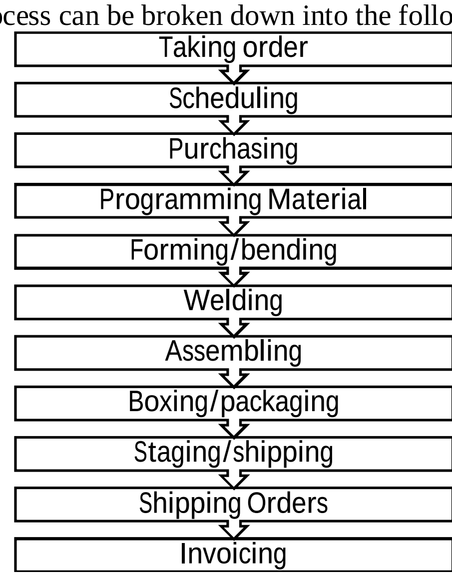
While customers noticed problems with Refrirest's long lead times, a step inside the manufacturing plant clearly showed a possible source of this problem: chaos. Material and products were scattered across the floor, workers were unsure what orders to work on, little communication between departments. Departments did not have individual leaders only certain workers who had more responsibility, including attendance at weekly meetings to discuss schedules. With ineffective or no communication among employees in the different stages of the manufacturing process, orders often waited unnecessarily in each phase for additional required parts. Every order was considered a priority resulting in confusion about which orders to work on. The shipping area was piled high with partially completed orders waiting for parts before full orders could leave the facility. Refrirest had no human resource department, so employees contributed further to the chaos through high absenteeism, no discipline for leaving early and efforts to organize a union. It was apparent that if Refrirest was to maintain its current customers and remain profitable as a company, the firm would have to make some drastic changes to its processes.

1.Company History:

Peter Coulton[2] founded Refrirest in 1975. By adding a variety of new SKUs to the product line, Refrirest soon carried a full line of equipment for commercial restaurants. Jacob Peterson, a financial backer, brought his business, sales, and financial expertise to Refrirest in 1979.The company prepared for its first expansion in 1988 by adding 7,000 square feet to its manufacturing facilities. In 1990 when a Colorado firm failed, Refrirest purchased the company's special fixtures and inventory to develop new technologies, which led to the company's expansion of its refrigeration line.As a result, the second expansion in 1995 doubled the plant area. The early 1990's became a critical point for Refrirest. The company saw its orders grow rapidly as its product line expanded to a one-stop-shop for bar equipment. Refrirest was regarded as the "benchmark" of the industry because its innovative, high-quality products served large restaurant chain accounts and independent bar and restaurant owners alike.

2. Manufacturing Process:

The Refrirest, Inc. manufacturing process can be broken down into the following functions/steps.



[2] Not his real name

Taking order:

The manufacturing process for an order began with the sales department recording the customer order via a phone call from various dealers of its products. Its customers included large restaurant chains expanding into new locations. Orders needed to be delivered quickly. The sales department listened to the customer's needs then developed a design and layout of the products required for efficiency in the restaurant area. After customer approval of the design and layout and after the order was placed, a paper copy of the order and a CAD drawing containing the various products was sent to the manufacturing plant.

Scheduling:

Refrirest took a proactive approach with its initial orders. As soon as an order was received, it was sent to the manufacturing plant. The vice president of the company developed a schedule driven by sales volume only. There were no target ship dates, only a list of customer orders to complete in a given week. A weekly schedule was placed in a large binder and handed to workers so that they knew which orders to work on. Part of the schedule included the "Top Ten Hot List" listing the most important customer orders to be completed. These customers were given priority because of the size of their accounts and the number of complaints received. Over time, a "Second Top Ten Hot List" also became part of each weekly schedule. Additional work hours were scheduled for employees. However, without plant supervisors, or a clear understanding of labor time required for certain products or the plant's capacity, an accurate scheduling of labor hours and machinery was not possible.

Purchasing:

When an order was received, a purchasing clerk would order the parts needed for the order. Additional parts were purchased in order to receive large-quantity discounts from suppliers. There were additional parts in inventory. Parts were ordered weeks in advance of the manufacturing process. However, no inventory was kept at Refrirest resulting in large amounts of excess and obsolete material. An order could spend four weeks in the manufacturing process once it was placed on the floor. Bottlenecks and waiting on orders of raw materials also accounted for the longer lead times.

Programming Material:

Once an order had all necessary parts the sheet metal fabrication process began. An order typically stayed in this process for sixteen days before it was completed and moved to the next stage. An hourly worker would determine what pieces to make using a given size of sheet metal stock. A book containing parts prints was available and constantly revised to determine pieces needed for each product. In order to maximize the use of each sheet of metal, parts would be batched and the excess parts would be stored for future use. This resulted in low scrap material costs but high levels of inventory. Product inventory was not organized or measured. Sheet material pieces were mixed with partly assembled pieces, finished products, and raw materials. Inventory was piled on shelves and across the plant floor. Over time, many pieces in inventory became obsolete.

Forming/Bending:

Once pieces were cut out of the sheet metal, they moved to the next stage where pieces were formed and bent into finished parts. This stage included manually debarring and sanding the sheet metal pieces by hand, rotating each side to smooth the edges and corners. When pieces reached the forming and bending stage, employees prioritized products by working on the easiest jobs first while saving the most difficult jobs for another day. This resulted in half-completed orders in the later stages of production. Extra pieces that were not assigned to an order were sent from the sheet metal phase to be formed, bent and stored on pallets in the plant.

Welding:

Once a piece reached the welding process, workers chose which piece to complete first based on its level of complexity. Several pieces were welded together to form the end product during the process. Orders waited in this stage for several days because not all the parts that needed to be welded together had been completed in the previous stages. Orders were scattered across pallets and between departments.

Assembling:

During assembly, the final product was assembled and prepared for shipment. Orders waited between eight and ten days in the assembly stage of the process. This also created a bottleneck in the manufacturing process as orders had to wait for products from the previous stages before they could be assembled. Workers did not have a schedule or priorities of orders waiting in the following stages either.

Boxing/Packaging:

Boxing and packaging was an important stage for Refrirest's manufacturing process. Several customer complaints concerned incorrect products being shipped to their location or missing products in an order. Packaging was important because it kept products intact while traveling across the country and to other continents while on route to customer locations. Products included warranties and the packages were designed to help reduce the amount of damage during shipping.

Staging/Shipping:

The shipping department had orders and products stacked over eighteen feet high with no extra room for additional finished items awaiting shipment. The numerous products in one single order were not completed at the same time, resulting in orders waiting for additional finished products before being shipped to the customer. Refrirest had to rent truck trailers for additional holding space to accommodate the unfinished orders in the shipping area.

Shipping Orders:

Refrirest always quoted customers a target ship date when the initial order was placed, however, orders rarely shipped on time. In order to please certain customers and contracts, Refrirest expedited a majority of their orders, resulting in expensive shipping costs each month. Customers were not the only ones frustrated with Refrirest's shipping methods. Employees and freight companies shared late nights in the parking lot trying to ship orders out to customers. Fridays were reserved as the days to ship out as many orders as possible. When the freight trucks arrived, employees placed small orders in each truck in order to keep the truck from leaving before the rest of the orders could be combined. Employees would keep freight companies at the plant as late as ten o'clock at night filling the trucks with as many completed orders they could find around the plant. This drove Refrirest's overtime labor costs and fees from the freight companies through the roof.

Order Invoiced:

Once the order was shipped and the invoice was received, Refrirest still felt the ramifications of their unorganized manufacturing process. Refrirest lost some sales, and compromised valuable relationships with customers and large account restaurant chains due to the long lead times and mixed up orders. Even the employees had a difficult time answering customer complaints and many did not feel like coming to work because of the negativity emanating from the plant's chaotic environment.

3. Questions

Marcos Morris finally decided to take action at Refrirest and positioned himself to make radical changes in the manufacturing process. Your work is to act as an outside consultant and to make suggestions for the transformation.

1. What are the problems with how the current manufacturing process was managed?
2. What are some of the generic challenges of managing a manufacturing process?
3. What are the important elements needed to manage a manufacturing process?

Instructor's Notes

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1.What were the problems with the management of the current manufacturing process?

The objective of this question is to make sure students read the case and understand the major problems of Refrirest's manufacturing process. The following is a list of the most important issues that students may identify:

a) High number of customers call complaining
b) Lack of visibility. They have problems informing customers the status of their orders
c) Lack of synchronization with shipping companies
d) Long lead times
e) Chaotic shop floor
f) No supervisors
g) Lack of priorities

h) Insufficient communication
i) Excess work in process
j) Inadequate scheduling
k) Obsolete raw material inventory
l) Excess raw material inventory
m) Excessive batching
n) No prioritization of work orders
o) Inaccurate inventory records
p) Selective order processing (not based on priorities)
q) High overtime costs
r) Lost sales

2. What are some of the generic challenges of managing a manufacturing process?

After discussing the specific problems related to Refrirest, the instructor could talk to the class about some of the general problems related to manufacturing. One strategy the instructor can use when discussing this case is to ask if these problems could arise in other industries and companies. Some potential answers may include:

a) Releasing too many orders to the manufacturing floor
b) Lack of clear priorities
c) Ordering unnecessary raw material
d) High holding costs
e) Making products in batches which creates excess inventory and holding costs
f) Workers are not cross-trained between departments
g) No communication between departments
h) No supervision in each department
i) No Human Resource department to regulate employees
j) Excess work in progress
k) Quality Problems
l) Excess Overtime
m) Long lead times
n) Excessive rework
o) Lost sales
p) Unhappy customer
q) Unmotivated workers

3. What are the important elements needed to manage a manufacturing process?

The objective of this question is to prompt students to think of elements important to a manufacturing process. Students will typically suggest a combination of technical (database, software, intranet access) and managerial (training, support, resources) actions. The instructor can suggest a potential framework with students to organize the suggestions provided by the students. In this case, the AIM approach (Sirias, et al., 2013) is used to manage the flow of a manufacturing process by (1) aligning resources, (2) identifying problem areas and (3) modifying the process.

AIM Framework for a Manufacturing Process		
Align	Identify	Modify
Is the order amount released to the manufacturing plant appropriate for available capacity? Are priorities clearly set and communicated to all departments?	Are there recurring bottlenecks in the process?	Is there a need to improve a step in the manufacturing process? Are there tasks that need to be reassigned? Is there a need to add, eliminate, or rearrange steps in the manufacturing process?

Align Resources:

The first part of the model is to make sure all available resources are working together to reach the production goals of the manufacturing process. At least two factors need to be considered in alignment: A) loading the appropriate amount of work in manufacturing floor and B) having a priority system that is followed by all human resources supporting the manufacturing process. Having too many orders released into the manufacturing plant can have serious negative effects. First of all, priorities become blurry due to the fact that there are many work orders to choose from. This can lead to workers picking work orders that are easiest to process or that can help optimize their own work centers without taking into account customer's needs. In addition, lead time becomes longer. The more inventories on the floor, the longer a new order has to wait for its turn. Also, multitasking becomes more prevalent which also increases lead time as workers could keep jumping from one order to another due to multiple demands and unclear priorities. A secondary effect of releasing too many orders is the creation of an artificial demand for raw materials which results in an increase of holding costs and the perceived need to "optimize" purchasing by buying in bulk. It is clear that implementing a mechanism to control work in process is crucial to improving manufacturing flow.

There are different strategies the instructor can explore to address the reduction of work in process and, as a result, to improve alignment. One strategy is Drum Buffer Rope (DBR) (Goldratt & Fox, 1986; Schragenheim, & Ronen, 1990) from the Theory of Constraints. One of the first actions taken by companies implementing DBR is to avoid releasing parts to the manufacturing floor immediately after receiving an order. Instead, it is recommended to wait until a predetermined time (referred to as time buffer) before parts are needed at a critical resource in the manufacturing process. This action can quickly reduce inventory and improve coordination. Another strategy is the use of Kanban (Sugimori, et al., 1977) where the amount of work in progress for specific components is controlled by the use of cards or some other visual device. The cards serve as a mechanism to prevent overproduction as parts cannot be processed until a card triggers a production signal. A similar approach to Kanban is CONWIP which stands for Constant Work in Progress (Spearman, et al., 1990).In this approach; there is a limit on the total amount of inventory within the system. It uses cards like Kanban but they are not created for specific parts but for the overall inventory. CONWIP still shares the same objective of controlling the amount of work within the system.

While reducing work in progress can go a long way toward improving alignment, clear priorities are necessary once work has been released to the floor. It is important, during execution, that personnel follow a work sequence that promotes flow and ensures that due dates are met. A weekly master schedule should be created listing specific orders to be completed. Since most plans are impacted by variation, such as quality problems, maintenance issues, absenteeism, etc., priorities must be dynamically changed to reflect any new realities within the plant. Visual systems, such a color scheme, or electronic board, can be designed to communicate priorities. During the improvement phase at Refrirest, orders were placed in colored folders to reflect priorities (e.g., work first on orders placed in red folders, then on yellow and last on green).It was a simple mechanism, but very effective.

Identify Problem Areas:

Another important element of this framework is to learn to identify problem areas that, if improved, can help increase output. The purpose is to have the company embark on a journey of continuous improvement by identifying critical resources in the process. While temporary bottlenecks can occur, the main concern is to find those areas that regularly are the reason for flow stoppage. Sirias (2013) recommends using work sampling "a technique from industrial engineering where random observations of an actual event are performed in order to estimate the percentage of time spent in different activities" (p. 7).Theory of Constraints uses a methodology called Buffer Management to identify problem areas (Umble & Umble, 2006).It is based on the idea that excessive wait time is the main symptom of problem areas. By randomly asking all resources the question "what are you waiting for?" data can be collected to build a Pareto diagram to rapidly identify critical resources. Lean, a strategy to reduce waste in processes, uses different tools to find the potential causes of disruptions including the fishbone diagram, Pareto charts and five whys (Alukal, 2007). Once the critical resources or steps in the process are identified, they can be improved. That leads us to the next and final element in managing a manufacturing process.

Modify Processes:

The final element in the AIM model is to continuously improve the manufacturing process. After identifying problem areas, improvement efforts can be targeted at the critical main steps or resources of the manufacturing process. The variety of improvement strategies ranging from the simple uses of Lean to more complicated ones including Six Sigma, experimental designs, Taguchi methods and Business Process Reengineering can be reviewed by the instructor.

Conclusion

The main gains in performance come from first aligning all resources. This can be accomplished relatively quickly by reducing the number of open work orders in the system plus incorporating a dynamic priority system. Then, a system to find the most critical resources should be designed. And finally, the company should adopt process improvement methodologies that allow for continuous gains in performance.

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