Cycle time reduction essay sample

The primary objectives of the study were to determine current cycle times, to identify obstacles that adversely affect cycle time performance across the supply chain, and to explore opportunities for cycle time reduction. Although several cycle time impediments were identified, the key obstacle identified was the lack of required information across the supply chain. It was noticed that Supply Chain Perspective have moving information internally, moving information up and down a supply chain that resulted to manage information more difficult. In response to this situation, the research team developed a prototype for inter – organizational information system (IOIS). The IOIS aims at meeting the information requirements of the supply chain members, and in so doing provides a critical resource required to improve performance across the entire supply chain. The cycle time project was originated in a meeting of researchers from the FedEx Center for Cycle Time Research (the Center) and representatives of a major semi – conductor manufacturer.

The purpose of this meeting was to explore potential cycle time reduction opportunities within the firm’s international logistics operations. During this meeting it was decided that, although the logistics issues were important, a potentially more fruitful (and challenging) project would examine opportunities for cycle time reduction across an entire supply chain where semiconductors were used. The semiconductor firm and the research team invited three additional organizations to participate in inter – organizational supply chain study. These organizations included a major supplier of semiconductor components, a world-wide producer of computers and related peripheral equipment, and a major US retailer of computer products. The research team’s role in the project was to:

•Assist the participating organizations in achieving cycle time reductions by sharing accumulated knowledge in the area; •Provide a forum for the participating organizations to explore mutually beneficial opportunities for inter – organizational cycle time reduction; and •Gain new knowledge regarding opportunities for cycle time reduction in inter – organizational supply chain environment. Each organization provided an overview of its key processes within the supply chain, discussed current cycle time performance, and presented areas viewed as major cycle time obstacles. In addition to the group presentations, several small group breakout sessions were also conducted which allowed participants to focus on specific topics of interest. At the close of the workshop, representatives of each organization committed to continuing with the project. To facilitate this process, each organization identified one to four people to participate in future project activities.

Issue Identification

1. Information flow not in close loop;
2. Longer lead – times from sales perspective;
3. Longer manufacturing lead time from the production perspective;
4. High WIP inventory;
5. Disruptive work flow;

Boeing’s alliance with its strategic partners was not, however, without its problems. Integration of their information systems was extremely complex and much of the data was not easily transferable. They were also concerned about the leakage of critically strategic information to one of their

competitors through the information shared with strategic alliance partners.
Viewing systems as functional instead of cross-functional

Interviewing managers individually instead of jointly
Asking the wrong questions during the interview
Not allowing for trial and error in the detail design process Viewing systems as functional instead of cross-functional is a very narrow and inappropriate perspective to take in the information requirements determination process. Much of the information needed to make decisions within a function will come from sources outside the function. Therefore, it is necessary to be aware of all of the functions involved in an information system in order to facilitate the development of systems that allow information to flow cross functionally. Joint Application Design: Interviewing managers individually, while the historical standard approach for conducting information requirements determination, has several problems. It places stress on managers because they cannot easily recall all of their needs in a comprehensive manner. They do not necessarily have a cross-functional perspective.

The most popular method for overcoming the problems associated with individual interviews is to undertake a group interview process known as joint application design (JAD). This allows the group to pool their memories concerning their information requirements by having all of the functions affected represented in the same room at the same time. This overall information requirement perspective is difficult to achieve if each manager is interviewed individually. Building an IOIS would be virtually impossible without taking a JAD approach to determining information requirements.

Environmental & Root Cause Analysis

Lack of required information across the supply chain is quite predominant. Further, the existing ERP is unable to have closed loop information. Procurement lead – time is 3 – 4 month whereas manufacturing lead – time (set – up, run – time, wait – time and move – time) is required to be one – week. From the perspective of sales, shorter lead times:

•Offer the ability to quote faster delivery to customers;
•Lessen the impact of cancelled orders; and
•Reduce the need to make forecasts about future demand.

From the production side, the goal is to achieve shorter flow times. This can be achieved by improving quality management as well as reducing the opportunity for work to be damaged and shortening the time between manufacturer and defect detection.

There are three key points involved in lead – time reduction. First, the major components of flow time (and hence lead time) are queuing time and waiting time. Practical strategies for reducing lead times must attack these components to achieve significant results. Second, WIP and flow time are proportional to each other for a given level of throughput. Consequently, causes of excessive lead time can be determined by identifying locations with large inventories. Finally, lead time is related not only to the average of flow time but also to the variance of flow time. Although most strategies that reduce the average flow time also reduce its variance, there are situations where this is not true and lead times may actually increase. We must therefore be aware of the impact of a proposed strategy on both performance measures. The extra inventory at a bottleneck should not be considered excessive if it is needed to protect throughput. To understand the relation between inventories and lead time, we must first note that flow times and inventories are not independent and that, for a given production rate, the two are directly related. For any given cause, the added inventory and added flow time due to that cause are related by Added Inventory = (Production Rate) x (Added Flow Time)

This expression is known as “ Little’s law” and is widely applicable to almost any queuing situation. For example, if assembly is often held up because not all parts are available, the inventory of parts waiting will be equal to the production rate multiplied by the average waiting time of the parts. Thus, a means of identifying the largest components of lead time is to find the largest inventories (both finished goods and work in process) and work to reduce them. By the same token, any action that reduces flow times will also reduce inventories. Schonberger describes how the JIT approach at IBM came to be known as “ Continuous Flow Manufacturing” or CFM. The basic idea is if the product is always moving toward completion, both flow times and inventories will decrease. This is particularly important since 90-95% of the time spent in a factory is spent waiting. Breaking the flow time down into its components reveals why: Flow Time = (Run Time) + (Setup Time) + (Move Time) + (Queue Time) + (Time of waiting for the parts) + (Time for waiting for the parts to move) Because a part assembly cannot be completed until all components are available, synchronization between fabrication and assembly is extremely important.

It is quite common for an assembly line to produce based on what is available rather than what is needed. In Kanban and CONWIP systems, synchronization occurs naturally, since work is pulled only as needed. MRP II systems would, in theory, also synchronize production if flow times were constant. However, because flow times are not constant, the lead times used to compute job release times from due dates are inflated to values much larger than average flow times to accommodate contingencies. Such practice builds inefficiency into MRP systems because inflated lead times cause jobs to finish early (on average), thereby increasing waiting inventory. The problem of deciding which jobs should be performed next takes place in the shop floor control module in the MRP II hierarchy and is associated with " dispatching." A commonly used technique involves a " dispatching rule" which allows an operator or foreman to choose the next job by considering those currently waiting in queue. Typical dispatching rules are " shortest processing time," " earliest due date," and " critical ratio," a rule that involves both job size and due date.

Smooth the Work Flow: To smooth the work flow, we must level the work releases, establish uniform work flow and rationalize line balance. Leveling Work Releases: The goal of leveling work releases is to maintain an even workload. Low workloads lead to small queues and quick turnaround, while high workloads cause long queues and long flow times. Overall, uneven workloads increase both flow time mean and variance. Gradual increases in release rates, accompanied by increases in capacity, can facilitate a chase production strategy. What is important is to release frequently and in small amounts. That way, there are smaller queues at release points and less likelihood for a “ bulge” of WIP that alternately overloads and starves production resources. Ultimately, releases should be tied to production at bottleneck work centers. In this way, a “ pipeline” to the bottleneck is established and is always full. More frequent releases only create WIP in front of the bottleneck with no increase in production.

Also, planning changes in the form of order cancellations and engineering change orders are less disruptive is the work is not yet released than if the work is already in process and somewhere on the floor. In pull systems such as Kanban and CONWIP, the release rates (pull rates) are naturally equal to downstream production rates. In push systems, such as MRP this is more difficult, although more frequent releases (such as twice daily rather than weekly) combined with some form of WIP control (e. g., input/ output control) can do a great deal to reduce flow time variance and congestion on the shop floor. The drum-buffer-rope system proposed by Goldratt is an example of a push system that directly ties work releases to bottleneck production. Establishing Uniform Work Flow: Change in the product mix; will always lead to setup changes as well as disruption in the factory rhythm. By establishing routings for families of parts so that setups between families are avoided and by reducing setup times for the instances where setups cannot be avoided many of these problems can be alleviated.

Also, since some changes are inevitable, cross-training of workers can minimize the disruption of these changes. Product standardization, involving the use of common lower levels, can reduce the number of different parts that must be produced, tracked, and inventoried. Also, by customizing the product late in production the system is less sensitive to changes in customer orders. Rationalizing Line Balancing: We have found that systems with all centers operating independently and at similar rates will tend to have longer average flow times than systems with a distinct bottleneck. Any time one work center works somewhat faster than the preceding work center (due to random variations), it will become starved unless WIP is excessive. Because of this dependency, the periods of high production do not make up for low periods. Although the usual reason given for balancing a production line is to " break bottlenecks" the practice has the opposite effect -all stations become bottlenecks and therefore must each be protected with additional WIP. Goldratt states this succinctly, " Balance the flow, not the capacity." During the inevitable slack periods at non-bottleneck stations, preventive maintenance and other housekeeping tasks can be performed.

Eliminate Variability: To eliminate the variability, we must reduce the reworks and improve the machine reliability. According to Suzaki, Schonberger, the root of all evil is variability. Variability in processing times caused by rework, downtime, and lack of consistency in production methods increase both mean and the variance of flow time. Unlike inventory, there are no instances where more variability is good. Some strategies for reducing variability include the following: – Reducing Rework: Rework operations can have a tremendous impact on flow time mean and variance; particularly if a job requires some rework. Tight quality control and SPC should be used to eliminate rework wherever possible. Where large lot sizes are used, quality checks should be made before completion of the lot. This will help avoid the situation where the entire lot is completed before it can be checked. Where possible, quality checks should be located in front of the bottleneck or other time-consuming operations.

Quality control in front of the bottleneck will avoid wasting its important capacity on defective parts. Quality checks in front of lengthy operations will help decrease the amount of rework. If rework is disruptive and means for eliminating it cannot be found, a dedicated line for rework may be required. This will help smooth the flow of work through the facility and speed the recombination of jobs requiring rework with the rest of the jobs. However, rework lines can also serve as " psychological crutches" and remove some of the stigma attached to quality problems. Elimination of the problems at the source should always be considered before resorting to rework lines. Improving Machine Reliability: An important source of flow time variance can be machine down time. Although many companies track machine availability (A), some do not track the mean time between failures (MTBF) and the mean time to repair (MTTR). The relation between these quantities is Availability (A) = (MTBF) / (MTBF + MTTR)

Although only availability is needed to determine the capacity of a machine, it is not sufficient to determine the overall congestion in the line. Long and infrequent outages are more disruptive than short and frequent ones even if the availabilities are equal. This is because short outages require relatively small buffer stocks between machines to prevent starvation whereas longer outages require correspondingly more. Of course, downtime at bottleneck resources is particularly important, not only because of its effect on system capacity, but also because it has a strong effect on flow time variance. Regularly scheduled preventive maintenance can be used to minimize machine downtimes. Replacing or overhauling unreliable machines, particularly if they are at the bottleneck, can also be used to reduce flow time variance. Planning for Yield Losses:

Although the best strategy to deal with yield loss is to eliminate it; this is not always possible in real world. A common procedure for deciding on the size of a job to start, given a desired finish quantity and some knowledge of yield loss, is to inflate the job size by dividing the desired quantity by the average yield (i. e., the proportion of good parts that are completed). If either the yields are low or the job sizes are large, it is unlikely that the resulting finish quantity will be equal to the desired quantity. However, by applying the above simple strategy, we imply that to end up with one piece short is just as bad as having one piece too many. This is seldom the case, since short pieces must be expedited through the factory to catch up with the rest of the job whereas additional pieces typically sit in finished goods inventory until the next order. Both outcomes are undesirable but the first usually has more severe consequences. The flow time clearly increases for the order involved and for other jobs as well if setups must be broken to facilitate the expediting. Rework also increases the variance of flow time because of the congestion it causes. Vendor Variability:

Variability is an important factor in purchased, as well as fabricated, parts. On the basis of realization, we set – up a system for establishing appropriate buffer lead times and tracking vendor performance that directly incorporated variance.

Recommendation (s) and Implementation

1. The research team developed a prototype for inter – organizational information system (IOIS). The IOIS aims at meeting the information requirements of the supply chain members, and in so doing provides a critical resource required to improve performance across the entire supply chain. Map out the information flow and eliminate the missing link. In addition, investigate the communication flow to find some possible information flow challenge due to broken communication link. 2. After describing the relationship between WIP (work in process), mean flow time, flow time variance, and Lead time, we can systematically review potential methods for reducing lead time by reducing mean flow time and/or flow time variance. 3. Improve quality management as well as reduce the opportunity for work to be damaged and shorten the time between manufacturer and defect detection. 4. Reduce in-process inventories.

5. Decrease disruption of the production process due to engineering change orders. 6. Enable shorter frozen zones in the Master Production Schedule, thereby reducing the dependence on distant forecasts. 7. Allow easier overall management of the facility because there will be fewer jobs to keep track of and fewer special cases (e. g., expedited jobs) to oversee. 8. The manufacturing lead – time reduction can be done by •Look for the WIP;

•Keep things moving;

•Synchronize production;

•Smoothen the work flow; and

•Eliminate variability by implementing Total Quality Management (TQM).

For each of these categories we relate the corresponding JIT philosophy and describe specific instances of implementation. Many of these can be achieved with simple low cost changes in the production system. 9. Product quality available at the input of the bottleneck work center must be appropriate to eliminate any time loss. 10. Provide sufficient inventory at bottleneck work center to ensure maximum throughput. 11. Develop Advance Demand Planning and Master Schedule based on Theory of Constraint (TOC). 12. Implement Lean Manufacturing and Total Quality Management (TQM) all over the company.

Monitor & Control

1. Set – up matrixes and Key Performance Indexes to monitor as well as control the implementation plan. 2. Prepare a project plan based on the implementation with milestones in order to track the progress.

Conclusion

We have argued that the key methods for reducing lead time are those that reduce mean flow time and flow time variance. As indicated in our discussion, there are many ways to accomplish these reductions with little or no cost. We have also seen the danger of implementing the JIT philosophy through the use of slogans. We have seen instances of “ good” inventory and valuable “ non-value-added” operations. However, we do believe in one slogan. Don’t look back; you never know who’s gaining on you.

Reference

Exhibits & Appendixes

Nichols, Ernest L., Mark Frolick and James C. Wetherbe (1995), “ Cycle Time

Reduction: An Inter – organizational Supply Chain Perspective,” Cycle Time Research, Vol. 1, No. 1, pp. 63-84.

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