The Wisdom of the Goal

by Drew Ungerman for an operations course at Stanford taught by Professor Kumar

The Goal outlines new global principals in manufacturing and illustrates how cash flow can be maximized by avoiding traditional myopic management and exercising more effective, systematic management of throughput, inventory, and customer response time.

1. Understanding the Goal
   - Focus on performance measures that are most important - increases in net profit, ROI, and cash flow; the goal is to make money
   - Develop operational rules to facilitate achievement of goal - increase the throughput (rate at which system generates money through sales) while simultaneously reducing both inventory (all the money the system has invested in purchasing things in which it intends to sell) and operational expense (all the money the system spends to turn inventory in throughput)
   - Avoid (1) striving for traditional manufacturing goals that promote optimizing performance of each station in isolation to run a balanced plant which ignores statistical fluctuations and dependent events, (2) expediting orders according to who screamed the loudest, and (3) focusing almost exclusively on achieving high utilization.

2. Throughput Management
   - Managers cannot measure capacity of resources in isolation; true productive capacity depends on where resources are in the plant; the whole system should be maximized
   - Since speed of the process is governed by the slowest part of the process, identifying bottlenecks (any resource whose capacity is less than or equal to the demand placed on it) is critical
   - Capacity of plants are equal to capacity of their bottlenecks; an hour lost at bottlenecks is an hour lost for the entire system
   - Once bottlenecks are identified, plant managers should make them more productive by redesigning the process to minimize the number of products that must pass through the bottleneck, increasing bottleneck resources (i.e. adding new machines), and/or maximizing capacity of bottleneck machines (i.e. eliminating idle time)
   - Plant managers should balance flow of product (as opposed to capacity) with demand; bottleneck flow should be equal to or slightly less than (on par) with market demand
   - Managers must not seek to optimize every resource in the system: Activating a resource is not the same as utilizing it (or making use of the resource in a way that moves the system toward the goal); the level of utilization of non-bottleneck resources (any resource whose capacity is greater the demand placed on it) is not determined by its own potential, but by other constraints (e.g. bottleneck capacity or market demand) in the system; non-bottleneck resources will be idle at times; an hours saved at a non-bottleneck is a mirage - it does not make the system more productive.

3. Inventory Management
   - Keep some supply of inventory in front of bottlenecks to prevent them from sitting idle
   - However, avoid conventional wisdom of building inventories to maximize efficiencies
   - As inventory increases, the carrying cost of inventory (operational expense) also increases
   - Only release materials into the production system as frequently as bottlenecks need them; avoid releasing materials faster than the system can process them; bottlenecks should pace the release of materials
• Reduce need for inventory by reducing variability in the system through consistent management of materials at the same rate as customer demand

• Avoid excess inventory by cutting unneeded inventory and thus reducing the amount of money tied up in the system at any one time, thereby increasing present cash flows

4. Management of Customer Response Time

• Reduce batch sizes at non-bottlenecks in order to reduce WIP inventory, processing time on each batch, queue times (which consume a large part of total elapsed time for parts going through bottlenecks), and wait times (which consume a large part of total elapsed time for parts going through non-bottlenecks)

• Reducing batch sizes at non-bottlenecks thus reduces total amount of time parts spend in the plant, resulting in lower lead times, faster turn-around on orders, and better overall responsiveness to customers

• Although smaller batch sizes increase setup time, this time typically represents only a small percentage of total elapsed time and the increase often only serves to reduce idle time on nonbottlenecks, thereby not affecting productivity of the entire system

• Develop a flexible scheduling process that takes entire manufacturing system into account to better manage product flows, and inventory, thus enhancing response time