Connecting S&OP to the Shop Floor: Here's How!

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Objective

The objective of this paper is to show an exciting approach for manufacturing planning that enables information to flow formally from the sales and operations planning activity though scheduling, and appear on the shop floor in a connected and fit-for-use condition.

Background

The following concepts are already established in many companies and are generally well covered in the "body of knowledge". A summary is offered here only to ensure the reader proceeds with roughly the same understanding as the author in the development of the problem and the solution.

Sales and Operations Planning

This is top management's handle on the business. It is the top management activity that is usually performed monthly at an aggregate level and includes a discussion of bookings, shipments, backlog, finished good inventory, production, and top level capacity. The objective of Sales and Operations Planning (S&OP) is to balance demand and supply to the best of the management team's ability knowing that an imbalance will result in higher costs. All other planning … detailed schedules, finished goods replenishment, order promising, material receipts, and capacity planning … derive from the decisions made in S&OP.

Functional vs. Cellular/Flow Factories

In a functional factory, all like processes are grouped together. For example, in a sheet metal fabrication factory, all the punches are together, all the press brakes are together, all the hardware insertion is together, and all final assembly is together. Characteristics of a functional factory include large lot sizes, long travel distances, functional supervision, high work-in-process, slow response to quality problems, and long throughput times (often days or weeks).

In a cellular or flow factory, all of the processes required to produce a product are co-located. For example, a cell to produce a computer chassis may include a turret punch, a surface finisher, two press brakes, a hardware insertion machine, and final assembly. Characteristics of a cellular or flow factory include small lots (one being the ideal), very short travel distances, one supervisor or lead person (and team) accountable for the entire product build, very low work-in-process, immediate quality feedback, and short throughput times (often hours or minutes).

The layout of cellular or flow factories quite often has eliminated the need for the traditional central stockroom and moved all of the raw material, purchased component parts, and manufactured component parts to the point-of-use. This reduces the need for multiple handling, kitting, redundant transactions, and dedicated material handlers.

Order Variation

Orders are typically received from customers in various quantities and frequencies. There are busy days and slow days, busy weeks and slow weeks, busy seasons and slow seasons. In most businesses, there is not much that can be done easily to alter customer buying patterns, even though several companies have had some success in the spirit of supply chain management. Here we assume that demand will vary, and the task is to effectively handle the variation.

It is important for every company to understand order variation. If you do not, statements like this one can be devastating: "We will only build today what the customer orders today". If you really intend to do this, then capacity must be positioned to handle the busiest day. Otherwise, orders will go past due. If you choose to set capacity at an "average" position, then delivery dates to the customer will flex in and out somewhat to allow for the order variation.

This is a critical concept to understand. The cost implications (driven by positioned capacity) and the customer service implications (driven by the delivery date promised or implied) are huge!

The Way Most MRP-Type Systems Work

Most MRP systems require a "forecast" at the end item level to be "blown through" an end item bill of material to create material plans. For order promising, most ATP (available-to-promise) methodology centers on promising inventory for end items. For controlling the shop floor, the common practice is to release work orders and then transact each operation on the routing as it is completed. Many companies set their system up to work this way.

This normal approach presents several reasons why they have trouble making their systems usable:

1. End item forecasts are wrong and next to impossible to get from sales.
2. Promising end item inventory is not the issue; promising cell/line capacity is the issue.
3. Transactions and paperwork restrict product flow in a work order operational transaction system.

The Problem

The basis of the problem is that top management planning (S&OP) is highly disconnected from the shop floor. This disconnection is evident in the following ways:

1. The S&OP production plan (if there is one) has no formal link to daily schedules released to the shop floor. Two plans appear … one top management and one for the shop.
2. The S&OP production plan is not formally linked to material plans. Materials are a function of the attempt to forecast end items.
3. The end item forecast (even if accurate) represents demand but the driver for materials must be supply!
4. Customer promises may be based on standard lead-times simply because there is not a better way.

Results can be devastating:
1. Production requirements that operational managers are trying to execute can be considerably more or less than resources positioned by top management. The result is high costs.
2. Inbound materials may be way out of sync with production's needs in terms of items and quantities. This results in higher cost.
3. Customer on-time delivery is typically many early, many late, and some on time to the original promise. This may cause lost business.
4. Because of the seemingly unusable formal system, post-processed spreadsheets become the normal way of doing business. This requires extra cost and time.

Assumptions

Before the solution is presented, a few assumptions are in order that basically deal with the physical facility and top management planning:
1. Cells or production lines with feeder lines have replaced the functional factory.
2. Point-of-use storage has replaced the central stockroom.
3. Routings have been updated to reflect the redesigned factory.
4. The factory is clean, well organized, and may even "look and feel" World Class.
5. There is a monthly top management S&OP process in place.
6. Employees have been educated in World Class Manufacturing practices.

How many of these have you done? If you haven't, don't worry. These can be accomplished partially in parallel with the solution steps that follow. In some cases, the solution can be implemented without doing these things, but may not be as effective or complete.

The Solution

The solution steps for effectively connecting the S&OP process to factory floor execution follow. Only the steps and a brief explanation are described here. During the presentation, several actual examples of formats, reports, and methodology will be offered.

Many of the steps seem to make good common sense and the reader may say, "why in the world would we do anything else"? That may be the case, but I strongly recommend that you check each and every step carefully to ensure it is being done without

compromise. Make sure your understanding and execution is precise. Good enough isn't!

Step 1 – Decide to use Rate-Based and Due-Date-Driven Production™

Each cell or production line needs a run rate. In can be in terms of units per day (highly repetitive), hours per day (job shop), equivalent units per day (mixed model lines), or dollars per day (unusual circumstances). There is some normal "no cost" tolerance put on the run rate. For example, 10% more per day can be achieved for a short period of time (a day or two). The run rate must be a function of production plan requirements … not a function of what is possible based on people and equipment available. This is very important! The run rate is a function what needs to be done … not what can be done.

Next, the cell or production line must be prioritized by due date. This due date is the date that has been promised to the customer (either external or finished goods replenishment). Within a given day, there is some flexibility for the specific sequence in which products are run … but they must be completed on the given date … due date driven.

Deciding to embrace these two principles enables the company to predictably run the right amount of the right product in the right sequence every day.

If the factory is still "functional", is much more difficult to become rate based simply because the resources are scattered. There is not a good basis for the rate. A "cellular" or "line" based factory is much better organized to become rate based. If yours is still functional, start planning your new layout today!

Step 2 – Organize the S&OP Process to Provide the Line/Cell Run Rates

The output of the S&OP process should require little if any interpretation to make it fit-for-use for the balance of the planning processes … scheduling, order promising, and material planning. The preferred information is run rates by cell or line stated in terms of either units or hours depending on the nature of the business.

To get this type of output, a translation is required from basic sales input data (normally in the form of a booking plan in customer/marketing terms) to manufacturing output data (normally in the form of a production plan in cell or line terms). This translation includes treatment of bookings, shipments, backlog, finished goods inventory, and production at an aggregate product family level. One of the keys to making this process work effectively is to properly define the product families … and they differ based on the function using the data. Sales works with customer and market families, manufacturing works with physical factory families, and materials works with common part groupings. It is crucial to have the ability to organize the data in these ways.

Step 3 – Split S&OP Monthly Buckets into Weekly/Daily Buckets

Output from S&OP is generally in monthly buckets. To make the process flow downward, there must be a precise way to divide the monthly buckets into daily buckets. Usually this is best accomplished by stating the number of production days on the S&OP document.

Step 4 – Recognize that the Line/Cell Run Rate is Consumed by Sales Orders and FGI Replenishment Orders

The line run rate is the basis for forward planning in the formal system. Specific SKU detail is only required through the manufacturing throughput time (unless specific SKU detail is known via a firm customer order). The demand on the cell or line is in two forms … replenishment for finished goods and orders shipping directly to customers. As SKU detail is added, aggregate run rates are reduced. In the short term, the total schedule for the line is stated in SKU terms … past the throughput horizon, only run rate aggregate planning is used.

Step 5 – Decide to Manage Open Orders "On the Desk", not "On the Floor"

In a factory where orders are released to the shop floor when the order is received will have a throughput time roughly equal to the size of the order backlog … both customer orders and finished goods replenishment orders. This method of operation is called "managing the open orders on the shop floor". Any reprioritization requires physically moving material on the factory floor. It also results in a huge "wait-to-work" ratio … the material is waiting much more that it is working.

The preferred approach is to organize the factory so the throughput time is minimal … a few hours! In this method of operation, work is released from the scheduler's desk only as needed by the factory and in sync with the run rate. For example, if the factory throughput time is typically one day, then Tuesday's work would be released on Monday. The remainder of the backlog would be kept "on the scheduler's desk". In this way, schedule changes only require dates to be moved … not material!

Intuitively it is better to manage the work "on the desk" rather than "on the floor".

Step 6 – Create Planning Items and Planning BOM's for Pre-positioning Material

To deal with aggregate planning information, planning items and planning bills of material are used. First, planning items are created to represent a collection of SKU's. The basis for the planning items is generally material commonality. All of the SKU's in this collection are run in the same cell or on the same line, and these SKU's are coded in the item master file. A planning item can represent several hundred SKU's if there is material commonality. These planning items are shown in the S&OP process as the production plan detail, and quantities are entered in the formal system as the "production forecast".

For each planning item there is a corresponding planning bill of material. This IS NOT the type of planning bill of material that translates family demand to SKU demand via planning percentages. This is a different type of planning bill. Make note of this now!

This planning bill IS a single level collection of dependent items that are MRP planned. The percentages represent the portion of occurrence that a given dependent MRP item is required for use in the planning item. Non MRP planned items (supplier surveillance items, two-bin items, one-bin items, and kanban items) are not included in this planning bill of material.

Step 7 – Get the Schedule Information Fit-For-Use

The correct presentation of the schedule has these characteristics:

1. It contains all open work orders for SKU's (through manufacturing throughput time).
2. It contains all work orders or MPS entries for planning items (through the material planning time horizon).
3. The first sort on this collection of data is by cell or line.
4. The second sort is by current due date.
5. The schedule is leveled by the daily run rate.
6. Subtotals are by date change.
7. The original commit date is captured and stored independently of the current date.
8. There are no past due current dates.

This report is updated at least daily and forms the basis for running the cell or line and forms the basis for the daily production meeting.

Step 8 – Decide to Operate with Valid Dates

All of the current dates must be current … that is … none are past due. If a date is missed, a new current date is assigned, and the original date is saved for performance measurement. This must happen at least daily. A date should also be updated whenever it is known or highly suspected that the date will be missed.

Keeping dates valid is a very powerful concept. The early teachings of MRP in the 1960's and 1970's insisted that dates be kept valid, however, most companies even today ignore this advice. There is still a school of thought that claims people will have a higher sense of urgency if dates are more past due. In actual practice in an effectively managed company, this is far from the truth!

To test this concept, prepare the schedule as described in Step 8 and see what portion of the dates are past due. The task then is to reprioritize the order dates to make all dates valid. This is best accomplished by having a "Schedule Kaizen Blitz" over one weekend and starting out with a fresh and valid schedule Monday morning.

Step 9 – Eliminate "Lead-Time" from the Order Promising Process

Any company using standard lead-time to make the customer delivery commitment (end customer or finished goods replenishment) will have many early deliveries and many late deliveries. The reason is that standard lead-time passes demand variation directly to the factory floor. Almost always, the demand pattern reflects busy days and slow

days, busy times of the month and slow times of the month. The result is that the factory floor sees the same variation offset by the quoted lead-time.

There are two choices in dealing with this problem:
1. Position capacity for the busiest days.
2. Flex the delivery commitment in or out depending on how sold out the cell or line is.

The first choice is not cost effective for most companies and is usually not used. The second strategy is often preferred. The trick is dealing with the flexible delivery commitment on a daily basis. Most "systems" do not do this well since available-to-promise is dealt with at the SKU level and is inventory based. The real issue is at the aggregate level and is capacity based. With data structured as described in Step 8, a very simple and effective method for determining the commit date is possible. The scheduler or order entry person simply looks to see where the next available slot of capacity is available as described by the position of the planning items vs. the position of the committed SKU's.

The important point, however, is to stop people from saying, "our lead-time on product XYZ is ____weeks (or days)" and start them saying, "our next available production date is _____". This is a powerful but very difficult change to internalize in the operation.

Step 10 – Position the Correct Measures, Accountability, and Reviews to Maintain High Performance and to Deal with Change

Very high performance companies have a daily production meeting that focuses on Rate-Based and Due-Date-Driven Production™ practices. Here is the agenda for this meeting:

1. Review performance from the previous day in terms of:
   A. Planned rate of output vs. actual rate of output
   B. Orders completed vs. orders scheduled
2. Review three other key performance measures:
   A. Safety
   B. Quality
   C. Cost
3. Reposition any missed orders. This is a critical step in maintaining valid dates!
4. Review the next few days' schedule to spot any potential problems and assign actions as needed.

The key performance measures and accountabilities are:
1. Actual rate achieved vs. plan – Shop supervision.
2. Orders completed vs. plan – Shop supervision.
3. Quality (defined in a variety of ways) – Shop supervision.
4. Safety (defined in a variety of ways) – Shop supervision.
5. Cost (defined in a variety of ways) – Shop management.
6. Units (or hours) scheduled vs. established run rate – Scheduler.

Each of these performance measures should be posted on a white board daily and summarized on performance graphs monthly. In the presentation, several examples will be shown.

Results

The direct results of the above process are:

1. An S&OP process that can be tracked formally to the shop floor. In this way, the operation is being run from one set of numbers and a one-plan process is in place.
2. System dates will be valid.
3. Forward visibility is simplified.
4. A valid commitment process is in place.
5. The forward-looking material plan is linked to the S&OP decisions.
6. Spreadsheet schedule post processing is eliminated.

The indirect operations results are:

1. Improved on-time delivery … 95+% to the original commit date.
2. Lower operating costs … typically 5% to 10%.

J. E. Boyer Company, Inc. integrates lean manufacturing with enterprise resource planning to create world-class manufacturing environments where these two improvement strategies work together. We work on-site at your company. We do classroom training, one-on-one coaching, and project work … individually or as part of a team. We work at all levels of the organization from the boardroom to the stockroom! Since 1984, clients from a wide variety of industries have improved their operations in terms of cost management, on-time shipments, inventory investment, people development, operational speed, and overall business performance.

More information is available at: www.jeboyer.com

Please direct your comments and questions to:

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