

number of calendar days in the period, the fiscal year to which the period belongs, etc. Normally the calendar links the S&OP process to the fiscal calendar (calendar months, 4-4-5, 13 fiscal periods, etc.) and also provides key sales and supply planning data like the number of sales days, number of supply days, production time in the period, etc.

As we'll see in the next chapter, the data in a planning calendar can be used to convert the sales plan to a rate of daily demand (sales), and to convert the supply plan to the rate of daily supply for each period. It can also be used to calculate takt time¹ – a key number for supporting lean manufacturing.

Basic Calculations in S&OP

Make-to-Stock and Make-to-Order S&OP Calculations

Two simple calculations help in managing the sales and operations planning process. In some cases, these calculations can be used to set the supply plan. More typically, they assist in comparing demand and supply so that people can decide whether to adjust the plans, and if so, by how much.

One formula, for products that are make-to-stock (MTS), relates supply to sales and the current and desired inventory. The other formula, for products that are make-to-order (MTO), relates supply to sales and the current and desired backlog. Both formulas are similar and are based on one basic relationship:

$$\text{Supply} = \text{sales} + \text{the adjustment in backlog or inventory}$$

For sales and operations planning purposes, the two essential calculations that are based on this relationship are:

$$\text{Ending inventory} = \text{starting inventory} - \text{the sales plan} + \text{the supply plan}$$

$$\text{Ending backlog} = \text{starting backlog} + \text{the sales plan} - \text{the supply plan.}$$

¹ Takt time, arguably the most important number needed for implementing lean manufacturing, is an expression of the rate of production or supply that is perfectly aligned with the needs of customers. In other words, takt time indicates what the marketplace would like for output – one unit every X seconds or minutes – regardless of whether the supply process is currently capable of supporting it. Another number – operational takt time – expresses the rate of production that can be supported considering overtime, additional shifts, use of inventory, etc.

These basic calculations are “time phased” - applied to each period of the planning horizon to project the consequences of the sales and operations plan for the period.

Because the calculations are time phased, they provide a standardized way to project the results of management decisions. For example, by specifying the sales and supply plans for a period it is possible to calculate the inventory consequence for that period. On the other hand, if a management decision is to support a particular sales plan with a specific amount of inventory, it is possible to calculate the required supply in the period. (It should be pointed out that in situations where the calculations are done this way the numbers still need to be evaluated before the existing plan is adjusted. Simply being able to calculate a new supply plan does not mean that it is a do-able supply plan.)

Because the calculations that are part of S&OP are so simple, there are several realistic options for doing them. At the time of the writing of this book, most companies still use software running on their PCs – spreadsheet software like Microsoft Excel. Some companies use computer programs that are part of a larger ERP system architecture. A few use S&OP software from software companies who specialize solely in this area.

While there are a few companies, with few products and low volumes of data, who are capable of doing these calculations manually, few actually do it this way any more. The simple fact is that spreadsheet software is cheap and widely available, and most companies would see the minor expense paid off almost immediately in time saved by people involved in the S&OP process. Instead of “feeding data to the system”, time can be spent in analysis and problem solving.

Mixed (MTS and MTO in the Same Family, and Finish-to-Order) S&OP Calculations

There are situations where both inventory and backlog exist for a family and where it is desirable to manage them simultaneously. For example, a company producing a range of electric motors might have a product family where some higher volume products are make-to-stock and others, sold to the same markets and produced on the same assembly lines but to a lower volume of demand, are

make-to-order. In this situation, there will be a finished goods inventory of the make-to-stock products and a backlog of orders for the made-to order.²

Another situation might be in a company using a “postponement” or finish-to-order (FTO) strategy for order fulfillment. This would include any company finishing, packaging, assembling or filling to order after the customer order is received. For these situations, there will be an inventory of semi-finished inventory (perhaps a key component, primary option or base module, or bulk product) as well as a backlog of customer orders promised for future shipment, each of which will need to be planned and managed appropriately.

For these cases, the same basic kind of calculations described above – one relating supply to shipments and the other relating sales to shipments – are needed to see the consequences of S&OP plans and decisions. The two essential calculations needed to manage a family carrying both inventory and a backlog of orders promised into the future are:

$$\text{Ending inventory} = \text{starting inventory} + \text{the shipping plan} + \text{the supply plan}$$
$$\text{Ending backlog} = \text{starting backlog} + \text{the sales plan} - \text{the shipping plan}$$

As in the pure make-to-stock and make-to-order cases, these calculations are “time phased” – applied to each period of the planning horizon to project the inventory and backlog consequences of the sales and operations plan for the period.

Notice some subtle differences in the basic S&OP information depending on whether the family is mixed make-to-stock/make-to-order or finish-to-order:

² In most situations, it’s simpler to separate the make-to-stock products from the make-to-order products and manage two separate families and aggregating to the totals. In this situation, the only “specialized” functionality required is the logic to summarize subfamilies into larger groupings and the ability to produce a display showing aggregated sales, shipments, supply, inventory and backlog.

However, some people prefer to manage a single “mixed” family where all the numbers are together and visible in a single display and where the basic calculations have been adjusted appropriately. This is the situation described here.

- For a mixed MTS/MTO family, all of the plans are related to activities for finished products in the family:

The sales plan represents order bookings for finished products,

The shipments plan represents planned shipments of finished products,

The supply plan represents the plan to produce or procure finished products,

The inventory plan represents finished goods inventory,

The backlog plan represents the customer orders for finished products promised for future delivery.

- For a finish-to-order family, some plans are related to finished products, others to semi-finished products, and one relates to both:

The sales plan represents order bookings for finished products,

The shipments plan represents the finishing plan (taking semi-finished inventory out of stock and transforming it to finished product based on the customer specification) and the subsequent shipment of the finished product,

The supply plan represents the plan to produce or procure semi-finished products,

The inventory plan represents semi-finished inventory (a key component, major option or base module, bulk product),

The backlog plan represents the customer orders for finished products promised for future delivery.

While the basic calculations for S&OP don't change much from the first situation to the second, there are some interesting implications with respect to rough-cut capacity planning. In the finish-to-order situation, supply for the semi-finished product has been separated from supply (synonymous with shipments) for the finished product. Since these supply plans may be running at different rates, some tools must exist in the rough-cut planning software to appropriately project capacity requirements for the finishing process based on the shipments plan, as well as for the primary manufacturing or supply processes