DURLINGER CONSULTANCY

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DURLINGER ESSENTIAL

Sales & Operation Plan

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Contents

1. Introduction

The Sales & Operations Plan (S&OP) is a balancing act for the top management of a company. The central question is how (and if) Production can realise the future demand for products, as forecast by Sales. Furthermore, can Production do this within the promised delivery time and with the customer service level desired or required by the MT?

As you can see from the above, production environments are the main subject of this Essential. That is not to say that wholesalers or distributors don't need a similar assessment process (Sales and Inventory Planning), but I first want to familiarise the reader with the original ideas behind S&OP. We will look at other environments at a later stage (Durlinger 2019, 1).

Much has been written about S&OP over the last decades (see reference list), but this literature mainly focuses on how to organise the process. Little or no attention is given to some awkward issues involved. In my opinion this may be the reason why there are few really successful implementations. So is S&OP really that difficult? The answer is no; certainly not the IT part. Many authors agree that it can easily be done in Excel.

Conceptually, however, it is somewhat more difficult. The MT will have to crack some tough nuts, but from then on it will

be a fairly straightforward process. These 'tough nuts' are:

1 The aggregation problem,

2 The unit of measure for the S&OP,

3 Assigning 'sufficient' slack.

First off though, the MT must consider several logistical preconditions, with consequences for the three 'tough nuts'.

2. Preconditions for a successful S&OP

In the introduction we mentioned 'delivery time' and 'customer service level'. This implies that the MT should have already chosen the logistics concept for the company. Will we deliver from stock (MTS, Make-to-Stock), or will we assemble to order (ATO, Assemble-to-Order) or produce to order (MTO, Make-to-Order)? For more on this see Durlinger [2019, 2]. This choice for the Push-Pull Point has immediate consequences for delivery times to the customer. The delivery time, in turn, has commercial impact: is the customer willing to wait for a product and, if so, for how long? The second MT decision concerns the desired customer service level. A high service level means high safety stocks (for MTS) or short and reliable delivery times (for ATO and MTO). Longer delivery times require larger safety stocks. We will go into this later, in paragraph 5.

3. Unit of measure for the S&OP?

What's the problem? The S&OP must provide information about the feasibility of a specific production plan, so surely things must be measured in hours. However, in practice this will rarely be the case. The language for Sales, certainly in the somewhat longer term, is money: "We are going to turnover 10 million euros in France in 2019", or "The large scrubber division will gross 15 million euros". This forecast is useless as far as Production is concerned. They want to know *which* machines exactly and *how many* machines. But that, in turn, is unworkable for Sales. They don't know how many type *X* machines will be sold in November, let alone in what week in November. Even though this is of crucial importance for Production. So there you have the fundamental problem when it comes to the S&OP. Operations need delivery dates and quantities, but when Sales are unable or unwilling to deliver, we are getting nowhere.

There are exceptions. For companies in the process industry (such as beer, plastic, steel) this is less of a problem. At Heineken's, Sales and Production both use 'hectolitre' as a unit. In their annual report they say that they want to start selling 50 million hectolitres in region *X*. The production capacity of the breweries is known in hectolitres. Something similar applies in Tata steel who work in tons of steel or at Smurfit Kappa who talk about tons of cardboard.

But when you are talking about 2000 different versions of a scrubbing machine, sold in several different divisions in many different countries, you are faced with a completely different problem. We have to define a measurement unit that is suitable and workable for both Sales and Production.

We also must aggregate. After all, senior MT level have limited time for discussing an SOP.

4. What does an S&OP look like?

We'll start with a very simple example. Suppose you produce and sell only one product, the so-called Squbble. Your production device can produce 100 Squbbles per month. We will set up an S&OP for this product. In addition to the production capacity, we also need the forecast. In the example given in Table 1, we see a total forecast for the next 8 months that is equal to the total capacity (800).

	M1	M2	M3	M4	M5	M6	M7	M8	Total
Forecast	100	80	120	80	120	100	120	80	800
Production	100	100	100	100	100	100	100	100	800

Table 1 Forecast and production planning data

At aggregate level, over the 8 months, there is no problem. We also see months in which the demand is less than 100, and months when the demand is greater. We can use the production capacity available when demand is less than 100 to build up stock. The S&OP might be as shown in Table 2.

	M1	M2	M3	M4	M5	M6	M7	M8	Total
Forecast	100	80	120	80	120	100	120	80	800
Production	100	100	100	100	100	100	100	100	800
Stock	0	20	0	20	0	0	-20	0	

Table 2. S&OP

We can see that there is no problem during the first 6 months, but when we come to period 7 there is a shortage. Now what? The first conceptual problem is that the first two rows are more or less prognoses. The forecast is what we think we will sell and production is what we plan to produce. But anything can happen. As far as the Sales forecast goes, it is fairly safe to assume that the actual sales will deviate. We can probably rely on our planned production capacity, but nevertheless something may go wrong. We must add at least two more rows, one to show the actual sales and the second to show the actual production. After the first two months, this might look like Table 3.

	M1	M2	M3	M4	M5	M6	M7	M8	Total
Forecast	100	80	120	80	120	100	120	80	800
Prod. plan	100	100	100	100	100	100	100	100	800
Sales	80	80							
Production	100	100							
Stock	20	40	20	40	20	20	0	20	

Table 3. S&OP after two months

You can see that the final 'stock' row has also been updated. The problem in month 7 has disappeared, because less was sold than forecast in the first 2 months. So what do we do now? Will the sales forecast for the remaining months be accurate, or will we sell less, or will we catch up in the coming months? In other words, should we take a fresh look at the forecast? Yes we should, according to theory at least: if reality deviates from the prognosis, we must intervene. But this is going to happen every month, because actual sales will never be identical to the forecast.

Solutions for this situation have been found at a lower level in our planning [Durlinger, 2019, 3]. Companies that use MRP / ERP will undoubtedly know the MPS concept. That is exactly the same thing, only with a shorter horizon. The ATP (Available-to-Promise) mechanism helps in that case [Durlinger 2019, 4]. Even so, you make the same assessment and encounter the same problems. One possible solution is to build in some slack and set control limits. As long as the deviations remain within specified limits, we take no action. This is one of the conceptual problems I mentioned in paragraph 1. The calculations themselves are easy enough, but the MT must make decisions about what measures to take. Build in slack? When to take action? Such decisions make the difference when it comes to the usefulness of an S&OP.

In this simplified example we were discussing the situation for just one product. Things appear to be manageable in this case, but what happens if you are dealing with 500 products? This brings us to the next paragraph.

5. Aggregation

We said earlier that Production wants to plan in hours, but that this is not the language that Sales speaks. A well-chosen aggregation may solve the problem.

5.1 Same routing, same capacity utilisation

Let's assume that we are going to aggregate products into families, in such a way that every product within a family runs on the same machine(s) (has the same routing) and has more or less the same capacity requirement on these machines. Basically this is what happens in process industry. In this case Sales can easily predict in 'quantities'. For each machine we can calculate the capacity utilisation for this family. Another possibility would be to only consider the 'bottleneck machines'. If all members within a family require the same capacity from the bottle-neck machine, that should be enough for the calculations – since all other machines have lower utilisation rates. At S&OP level we can then find the required number of hours per family. This can provide useful information at a later stage in the event of any problems.

5.2 Same routing, different time consumption

It can also be that all members of a family have the same routing, but a different capacity utilisation. In that case the mix will play a role within this family. Suppose a certain machine, M1, is available for 80 hours per week. If product A has a processing time of 4 hours on this machine and product B takes 1 hour, then we could make a total of 80 B's or 20 A's or, for example, 10 A's and 40 B's. But we can only know even this much when the actual orders start arriving. In a Make to Stock environment we can look at history to get some idea of the relationship. In a Make-to-Order environment, with many more variations, things will probably be quite different. This once again illustrates the importance of the Push-Pull Point mentioned in paragraph 2.

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6. Slack

In paragraph 2 we argued that fixed (or at least reliable) lead times are important. A large part of (internal) lead times are waiting times. Often the waiting time component is more than 90-95% of the total lead time. Lead time management is therefore actually 'waiting time management'. Waiting time theory is not the easiest of subjects, but fortunately the MT only needs to know two things.

In the first place, the relationship between the utilisation rate of a machine and the average waiting time for this machine is exponential, as shown in Figure 1.

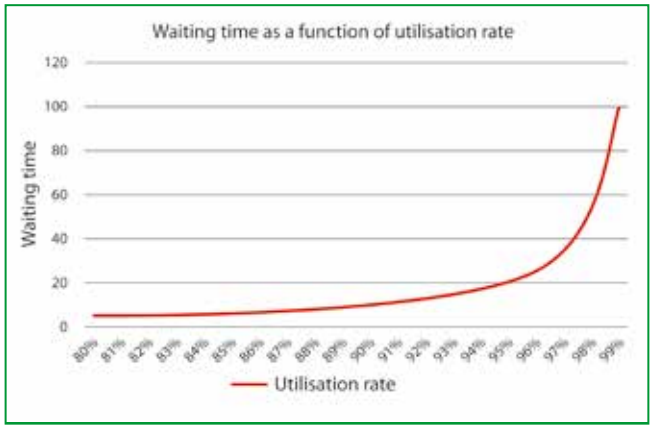

Figure 1 Relationship between utilisation rate and waiting time

But a second effect is that the variation in the waiting time also increases as the utilisation rate increases. Roughly speaking, lead times become unmanageable at utilisation rates over 85-90%. Does this mean that we have to leave the machines standing idle for 10-15% of the time? No, but for this problem I refer to Durlinger [2019, 5 and 6]. What we can infer from figure 1 is that things become particularly precarious at higher utilisation rates. An increase from 80 to 81% utilisation will have little effect on the lead time. But an increase from 95 to 96% certainly will. And at the time of drafting the S&OP little is known about actual orders in 3 months time. This means that the realisation rates are unclear, and therefore the same applies for the actually achievable throughput times.

So we will add some slack at S&OP level to avoid these problems. As mentioned, this can be slack in the utilisation rates required (by releasing fewer orders) or slack due to building in safety time. All this is aimed at providing sufficient slack at the lower planning levels (MPS, MRP, Shop floor control) to realise the quoted lead times.

7. Summary

So what are the responsibilities of the MT when drafting an effective S&OP?

1 Determining the Push-Pull point and the associated lead times to the customer

2 Determining the level of customer service

3 Determining the measurement unit for the S&OP

4 Determining utilisation rates and the associated slack

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8. Literature

Durlinger P.P.J. [2019,1]
Essential : SIOP for wholesalers

Durlinger P.P.J. [2019,2]
Essential : The Push-Pull point

Durlinger P.P.J. [2019,3]
Essential: Planning construct

Durlinger P.P.J. [2019,4]
Essential: MRP-II

Durlinger P.P.J. [2019,5]
Essential: Waiting time theory

Durlinger P.P.J. [2019,6}
Essential: Lead time management

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Paul lectured at several universities and has twenty years of experience as a senior consultant. He sees it as his mission to make difficult concepts readily understandable.

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