



December 9, 2009



## The Inventory Diet Managing Safety Stock at the Family Level

By Duncan McLeod

Wow! I sure stirred up a hornet's nest with the EOQ article. I would like to thank all the readers for your valuable feedback. My intent was not to suggest that the EOQ is the be all and end all of lot size rules but instead to show that lot-size inventory is a function of the lot size logic and you need to question the assumptions. This questioning requires that rare commodity – "Common Sense"

Here are a few examples forwarded to me to shake the EOQ world:

*"We base our purchase lot size on time-period-consumption. We have a set delivery schedule (daily, weekly) and quantity is based on the consumption for that time period. The lot-size inventory varies but the velocity stays fairly constant."*

*"We take the total capacity available for set up and apportion it across the items that have to be run. Using Pareto (ABC) logic we allocate this capacity to specific items."*

*"We run our products by family. The setup time between units in a product group is much lower than the setup time between groups. We top up all of the items in the group when we run it."*

So there you go, some creative and practical lot sizing rules all based on common sense and knowledge of the desired result. You are going to bump into the EOQ formula. If you are going to use it, then make sure you understand the assumptions and only use it to manage aggregate inventories (not individual items). If you already moved passed it and have rules that address your issues, then put the EOQ in the rear view mirror and press on. The bottom line is that you will have some lot-size inventory and your lot-size rules will determine what it should be.

Now let's see what I can stir up with safety stock.

Why have safety stock? To address supply and demand variation. In this article I will deal with safety stock supporting demand variation. More specifically I am going to write about a strategy for managing a portion of the safety stock at the family level.

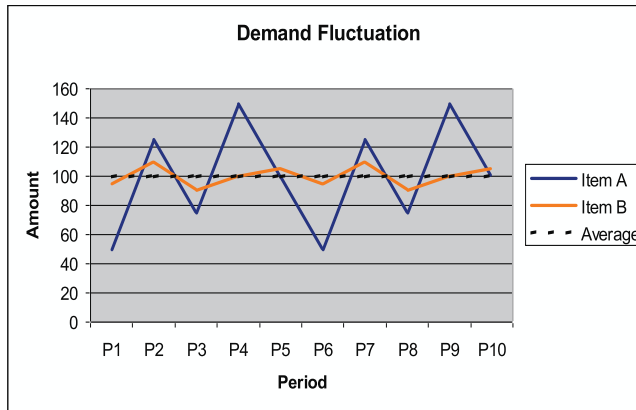
### Out With the Old

Most of the literature addresses safety stock at the item level. Demand variations or forecast errors for an item are plugged into a formula that gives the safety stock level for that item. This works for steady state demand, but the last two years have been anything but. I think the next two years will be just as volatile. We need to look beyond historical based forecasting models to calculate safety stock at the family level.

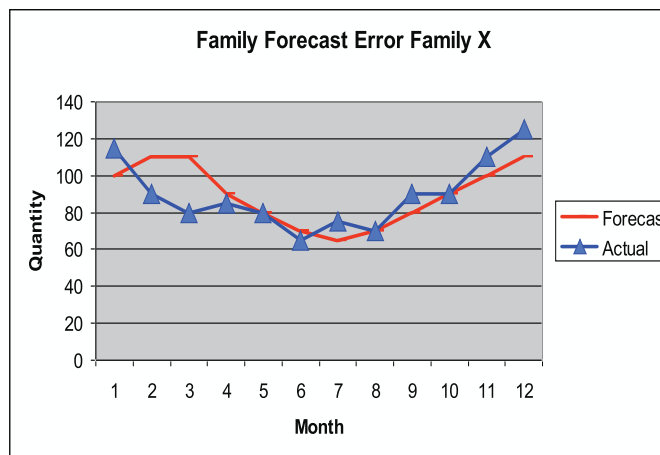
I suggest that you divide your forecast error, and safety stock, into two areas based on the driver for the error:

**1. Normal fluctuations at the item level** – this is the standard demand noise for individual items. The following graph shows the results for two items within a family. They both

have the same average demand but the noise is much higher for item A. Item A will need more safety stock.



**2. Errors at the family level** – this is the difference between the forecast and the actual demand for the family, or how well we are predicting the future. There will be soft inputs such as "gut feel", "common sense" and external indicators. The following graph shows the forecast and actual demand for an S&OP family.

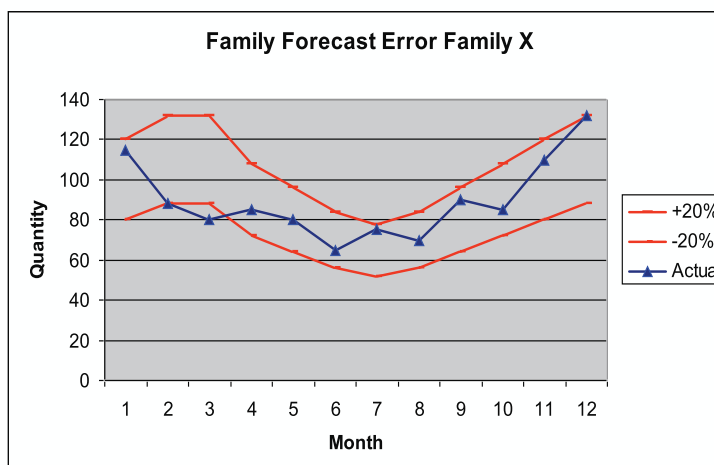


### How to Manage Family Level Safety Stock

Set the family level safety stock as part of your S&OP process. In S&OP, we track actual demand compared to forecast once per month. Tolerances are set and if we are within tolerance, there is no issue. The safety stocks should buffer the demand variation.

To start, set the demand tolerance at one failure per year for the family. This would mean that you are within tolerance 92% of the time, (11 of 12 periods). If you used 2 failures, the tolerance would be smaller but you would only be within it 10 out of 12 months or 83% of the time. Your call.

The following graph shows the last 12 months' S&OP data for family X. There was only one month where the error was greater than 20%, thus the demand tolerance was set at 20%. This is represented by the two red lines in the graph.



The demand for this family really fell off in month 2 and then stayed down until month 10. (There were signs of recovery starting to show in month 8). We can also see that management reacted to the downturn by bringing down the forecast in month 4.

The S&OP forecast is based on input from all sources and includes the key element of management "gut feel". Going through the recession and the recovery has and will involve a lot of "gut feel". The tolerances indicate how good this S&OP forecast is. Right or wrong, in the end, the S&OP demand plan is the final version of the forecast for the family and it should be the primary driver for family based safety stock levels.

If there were no mix issues, and the lead-time was equal to the forecast period of one month, then a safety stock equal to 20% of one month's future demand results in a 92% chance of not stocking out. Converting that to days, about 4 days of safety stock would cover the family level demand errors in the management S&OP call 11 times out of 12.

### The Advantages

- The future demand includes management overrides at the family level. It is difficult to apply these "gut feel" overrides at the item level.
- Safety stocks are based on time rather than quantity. The time based safety stock flexes the safety stock level with future demand. The tolerance level is based on past variances but the safety stock is based on the future demand.
- Safety stock can be overridden in times of uncertainty. When demand

tumbled through the beginning of the recession, some executives decided to tighten up their safety stock, risk service and preserve cash. This was a management decision based on their uncertainty about the depth of the drop.

- It is easy to understand. You math majors will argue that the results would be more accurate if the data was mapped to a normal distribution and we based safety stock coverage on "x" standard deviations of demand variation. You would be theoretically correct and probably wrong.

Family based safety stock is not the whole story but it should be the starting point. Beyond this you will need to consider a number of issues such as:

- Adding additional safety stock at the item level for standard fluctuations
- Allocating safety stock to items in the family
- Determining service levels for different items in the family
- Addressing the ratio between lead-time and the length of the forecast period
- Addressing mix shifts in the family
- Applying the approach to MTS and BTO items in the same family

Looks like there will be more safety stock articles coming up. In the meantime try calculating the family based safety stock for one of your S&OP families. If you have questions or comments bring them to our LinkedIn group called *Ask a Supply Chain Expert*.



Duncan McLeod, MBA, CFPI, CSCP, PMP, is the President and CEO of DBM Systems Inc., in Cambridge, Ontario, Canada, where his consulting and research focus on management strategy in fast-paced industries. Duncan can be reached at [dbmexecutive@dbmsys.com](mailto:dbmexecutive@dbmsys.com)



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## Project Matters: Part 2 S&OP in the Project Environment

By Doug Dedman

Last month, I wrote my first article about S&OP in the project environment. While S&OP is commonly used in product sales environments, I discussed how it can be useful in helping you plan your resources in a project based business.

I ended off my last article with a list of key items that are unique to making S&OP work in the project environment. This month, I will explain them in more detail.

### How to Get S&OP Working For you

**1. Get sales and delivery on the same presentation.** It will take time to come up with a common language for things such as bookings, sales, delivery and backlog. Forcing everyone to the “same version of the truth” is the first step. The goal of this is to tie the future sales or bookings to the future delivery AND account for the projects that are in process.

**2. Assign probability to discount future projects.** I often get a lot of argument on this point. People say “We either win the project or we lose the project.” If the project is in at a probability of 75% we aren’t going to get 75% of the project we will either get 100% or 0%. We need to look at the bigger picture.

The goal is to give the best picture of total future demand. The weighted probabilities across all projects should give the picture of total future demand. During the pre S&OP demand cycle the probabilities for individual projects should be reviewed and updated. Once the individual projects are rolled up to the total, management should review the top level number to determine if it gives an accurate picture of the expected future demand.

**3. Need to include both bookings and delivery for future projects.** This may sound obvious, but it may not be that simple. A project will be delivered as per the project plan. Times for design and production will vary based on the complexity of the project that is being delivered. In some cases the project will be delivered as milestones or cost complete. All of these factors need to be considered as part of the delivery.

The major point is that a typical project will take more than one period (month) to deliver and the future project delivery forecast needs to account for this.

The forecasted delivery needs to be added to the current backlog to give the “total project delivery”. The equation for this is presented below.



In the typical project environment, the first few months of delivery will be made up mostly of projects that are already in the backlog, while future months will be made up of forecasted projects. Monitoring the mix between backlog and forecasted delivery should be part of the S&OP process. Developing an understanding of the appropriate mix (100% of delivery in first month is backlog, 75% in month 2, 30% in month 3) should be an objective of S&OP. This understanding should help in the assessment of risk for future delivery.

**4. Review key future projects in the S&OP process.** The demand planning or Sales pre S&OP meetings should involve reviews of future projects. In order to do this you will require some sort of tool to keep track of these opportunities. I have worked with companies that are using everything from simple spreadsheets to more complex global CRM tools.

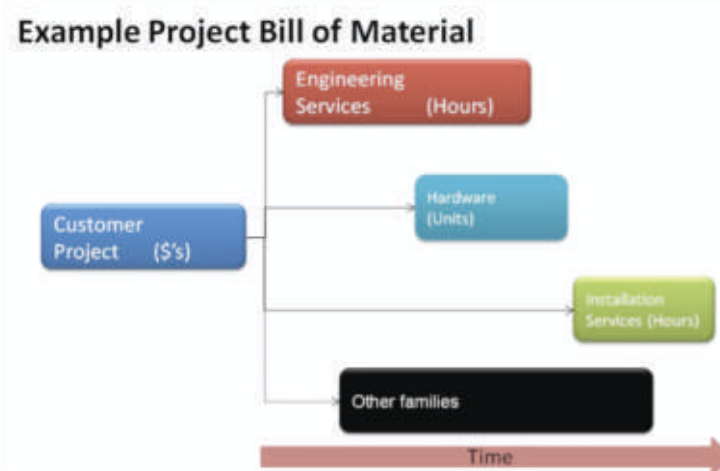
To track potential future projects, you will require expected booking date, expected shipping date, probability of winning the project, and preliminary project definition.

The key future projects should be reviewed and communicated in the Executive S&OP meeting. Projects that were expected to be booked for the previous month may also be reviewed as part of determining what is happening in the marketplace and reviewing the forecasting process.

**5. Use a project bill of material to break a single project into multiple families.** This may be the “secret sauce” that really allows you to link your project S&OP back to your financial plans.

Most companies in the project environment start their S&OP using dollars. They express both sales and delivery in dollars. This is a very good starting point. However when a company delivers a complex project it will be the result of several different functions of the company working together. For example it may include design engineering, production, purchased components and installation services.

The mix of these resources may impact the profitability of the project. The requirements for these different resources may also impact the ability of your organization to deliver the project on time.



In the example project bill of material above, Sales would forecast the top level project. They would need to provide some basic definition of what the project will look like as it moves from a prospect to the qualified prospect stage. This will allow the project to be broken down into the individual families. Once the project is in the pursuit phase, an initial project plan is developed. This can then be used to break the project into the delivery constraints. The timing of the delivery of the project sub families will be based on the expected project plan. You will also notice that the units identified for each family may not be dollars.

By taking this approach you will be able to get a more accurate prediction of your future requirements for critical resources. By establishing standard costs for each of the families, it will allow pro forma profitability

analysis across the projects. This will bring the S&OP directly back to helping manage the future business.

### Tracking Demand Flow

You may have both project and “regular” or “flow” demand for some products. What this means is that some of the demand comes from irregular or large orders, while the rest comes from smaller orders. In order to improve your overall delivery and reduce overall inventory you should view this demand separately.

Determine what constitutes a project. A single order over a certain dollar amount, or a single order for a large number of units. Treat these as projects. Show this demand separately. Track these through the project process. If you can manage these “spikes” in demand, it will make your regular business much easier to manage.

Track your overall planned backlog as part of the process. Once you have the process working you will want to monitor the level of backlog as an indicator of how healthy the business is.

If the backlog is too high, you run the risk of projects slipping because there is too much work in front of the resources. You become inefficient because you will tend to be changing priorities on work in order to get everything completed on time. If the backlog becomes too low, you run the risk of not having enough work to keep your resources busy. Monitor your backlog to find the “sweet spot” where it’s just right.

### So What’s the Big Deal?

After all of this, why should I bother doing S&OP in the project environment?

- **Improved resource planning.** By increasing the visibility of future projects we are able to do better resource planning. One executive I’ve worked with said “we made the decision to reduce our capacity two months sooner than we would have if we didn’t have the process, it’s saved us a lot in excess and obsolete inventory”.

- **Improved sales process management.** The measurement of sales performance compared to plan, and the review of the projects in the S&OP process helps to build “intelligence” on sales. Using the future project lists will help to focus the organization on the projects that should be closed in the near term.

- **Improved cross-functional communication and trust.** This is probably the biggest benefit that I’ve seen in project organizations that are working on the S&OP process. If the S&OP process is effective, it will help to identify the risks and forces the organization to address both sales and delivery concerns.

It’s a lot to take in in two articles. If you have any questions, send me an e-mail or find me in the LinkedIn group [Ask a Supply Chain Expert](#).



Doug Dedman, MBA, PMP, CPIM, is a senior Business Consultant with DBM Systems Inc., in Cambridge, Ontario, Canada. Doug consults with global, multi-divisional organizations with a focus on S&OP and supply chain execution. Doug can be reached at [dbmexecutive@dbmsys.com](mailto:dbmexecutive@dbmsys.com)