Maintaining Products with Sporadic Usage

Consider an item with following usage history (most recent history on left):

Dec	Nov	Oct	Sep	Aug	Jul	Jun	May	Apr	Mar	Feb	Jan
50	0	0	0	17	0	0	10	0	50	0	50

Fifty pieces of the item were sold in December, 17 pieces were sold in August, 10 pieces in May, another 50 pieces were sold in March and January. The history displayed suggests that when customers order the product, they most often order 50 pieces (50 pieces sold in December, March and January). Unfortunately many computer systems will forecast future demand of this product with a formula based on an average of usage recorded in the last several months. Consider the results when we apply a common demand forecast formula to the usage history to determine a prediction for January. The Six Month Rolling Average Method averages the usage recorded over the past six months[1]:

$$(50 + 0 + 0 + 0 + 17 + 0) \div 6 = 11.2 \text{ forecast of pieces for January.}$$

This is well below the typical sales quantity of 50 pieces. *This is even lower than total usage recorded in four of the five months that experienced usage!* We could apply other forecast demand methods but the resulting prediction will still be less than the typical sales quantity of 50 pieces and as a result there will probably not be enough inventory on-hand to meet our customers' needs.

An item experiences sporadic usage if the typical quantity sold or used in one transaction is greater than the average quantity sold or used in the applicable inventory period (e.g., day, week or month). In the example above, the typical usage quantity is 50 pieces while the average quantity sold per month is 11.2 pieces.

Replenishment parameters for an item with sporadic usage cannot be determined using a forecast based on the average of past usage recorded in previous weeks or months *because you do not sell or use the product on a consistent basis.* The weeks or months with zero usage cause the resulting forecast to be less than what is needed to fulfill a typical customer order.

Best practice is to maintain the stock of items with sporadic usage based on a multiple of the typical sales or usage quantity. That is, a specific number of typical requests for the product you would like to maintain in inventory.

The Typical Sales or Usage Quantity

The typical sales or usage quantity of an item can be determined by taking the greater of:

- The mean hit average
- The adjusted mean average

[1] Note that in many of our examples we will utilize monthly forecasting. The same principles apply to weekly or daily forecasts. We will discuss when it is best to use monthly, weekly or daily forecasts later in the chapter.

- The mode average
- The median average

Mean Hit Average

The mean hit average is calculated by dividing total usage of the product in the previous 12 months by the number of hits or requests for the product. Whenever a customer asks for the product, whether they want one piece, ten pieces or 1,000 pieces we consider it to be one hit. In this case our sales history record for the item lists six hits in the past 12 months. Consider our example again:

Total Usage Over the Past 12 Months	177 pieces
Number of Sales and Requisitions over the Past 12 Months (new information obtained from the sales history file)	6 Hits
Mean Hit Average	29.5 Pieces

Adjusted Mean Average

If your computer system does not accurately record hits, the adjusted mean average can be used in place of the mean hit average. While a mean average would divide total usage recorded over the previous 12 months by 12, the adjusted mean average divides total usage recorded over the previous 12 months by the number of months (or weeks or days, depending on your forecast timeframe or "horizon") with usage activity. Notice the difference between a mean average and an adjusted mean average:

Mean Average:

Total Usage of 177 Pieces ÷ 12 Months = 14.75 pieces

Adjusted Mean Average:

Total Usage Over the Past 12 Months	= 177 pieces
Number of Months with Usage Activity	= 5 months
Adjusted Mean Average	= 35.4 pieces

Mode Average

The mode average or most common quantity non-zero quantity. In our example 50 pieces are sold in two of the five months with usage activity. Therefore 50 is the mode average.

Median Average

The "median average" is the "middle" non-zero value. To determine the median average we first sort the monthly non-zero usage values lowest to highest:

May	10
Aug	17
Dec	50
Mar	50
Jan	50

The middle or median value is 50 pieces. If there were an even number of values to evaluate we would take the mean average of the middle two values to determine the median average.

Again, the typical usage quantity is the highest of the mean hit, adjusted mean, mode, or the median average.

Mean Hit	29.5
Adjusted Mean	35.4
Mode	50.0
Median	50.0

The typical sales/usage quantity will be 50 pieces. Note that in our example both the mode and median averages equal the same value. In most cases only one of these averages will represent the highest value and will be designated as the typical sales/usage quantity.

The Number of Typical Sales/Use Quantities to Maintain in Stock

After we determine the typical usage quantity, we must determine the multiple of this quantity we want to maintain in inventory. Do we want to be able to fill one sale, two sales or three sales from stock? If the sporadic usage item is stocked to be resold to customers, the multiple of the typical sales quantity is usually dependent on the number of times the product is sold during the year (i.e., hits), the lead time of the product, and the item's cost. On the other hand if the item with sporadic usage is a repair part utilized in an MRO (maintenance, repairs and operations) inventory we may base the multiple on the lead time, how critical the part is to maintaining normal operations, and the item's cost.

Sporadic Usage Items for Resale

If we normally sold an item only once a year, we might want to keep only one typical sales quantity in stock. When we sold that stock we would order another typical sales quantity from the vendor. In this case we would run the risk of being out of stock during the lead time. Here is how the minimum and maximum parameters for an item in this scenario would be set up if the typical sales quantity was five pieces:

Maximum – 5 pieces
Minimum – 0 pieces[2]

When we reach the minimum of zero we will order enough of the product to bring the stock level back up to five pieces. But if we sold the item six times a year, we might decide to keep two typical sales quantities in stock. When we sold one typical sales quantity we would issue a replenishment order for another typical sales quantity. Here is how the minimum and maximum parameters for the item would now be set:

Maximum – 10 pieces
Minimum – 5 pieces

By issuing a replenishment order when there is still one typical sales quantity on the shelf, we are reducing the chance of a stock out of this more popular product. We also might want to keep an additional typical sale quantity of an item with sporadic usage if the item has a lengthy lead time. Why? If we sell the one typical sales quantity on the shelf we will be out stock for a longer period of time.

It is a good idea to develop a matrix to determine the number of normal order quantities that will be stocked for a typical sporadic usage item. Here is a matrix based on hits and the lead time for the product:

Lead Time	***<=14 Days***	***<= 30 Days***	***<= 60 Days***	***>60 Days***
1- 2 Hits/Year	1	1	1	2
3-4 Hits/Year	1	2	2-3	3
> 4 Hits/Year	1	2	3	3

If hits are not available in your computer system you may substitute the number of months with usage activity in the past year. The values in this table are not cast in stone and may be modified to meet the investment and desired customer service goals of your organization.

Other companies prefer to utilize a matrix that combines hits and the cost of material for a typical sales or usage quantity. The theory is that you can provide a higher level of customer service (i.e., product availability) at a lower overall cost if the item has a relatively low cost of goods sold:

Material Cost→	***<=$50***	***<=$100***	***<=$250***	***>$250***
1- 2 Hits/Year	1	1	1	0
3-4 Hits/Year	2	1	1	1
> 4 Hits/Year	3	2	1	1

Note that the matrix is based on the cost of material for one typical order quantity, not an individual piece. You might have an item that costs ten cents per piece but you sell or use them

[2] Some computer systems reorder a product when the stock level reaches the minimum. Other systems reorder a product when the stock level drops below the minimum. In all of our examples we will reorder a product when the stock level reaches the minimum.

in quantities of 10,000. That results in the material cost for a typical sales or usage quantity of $1,000! We usually are willing to stock more typical sales or usage quantities for lower cost items but again the matrix entries are subjective and each organization must balance its inventory investment and customer service goals.

The maximum quantity is always based on a multiple of the number of typical sales quantities you want to maintain in stock. The minimum quantity is set to the maximum less one typical sale quantity (if your computer system orders products when the stock level equals the minimum quantity) or the maximum less one typical sales quantity *plus one piece* (if your computer system suggests you order products when the stock level drops below the minimum quantity).

Again note that the number of typical sales/usage quantities is subjective. It is hard to determine the "right" number as we have no idea when these products will be sold or used. If we did they wouldn't be sporadic usage items. They would be products with recurring usage whose future demand we could predict with a forecast formula.

Though items with sporadic usage usually do not (or should not) usually represent a large portion of your total inventory investment, they can comprise more than 50% of the items on your approved stock list. Maintaining these items correctly is crucial to providing a high level of customer service. We need to implement a simple system to maintain these products so that a majority of a buyer's time can be spent on those items with recurring usage. Those are the products that represent the best opportunity to maximize inventory turnover, customer service and corporate profitability.

Repair Parts with Sporadic Usage

In many organizations repair parts are critical to normal operations. Even though none of a particular item has been used in the past year, if it wasn't immediately available when needed a critical process might have to be shut down. For this reason the target stock level of a repair part is determined by a combination of its "critical nature" (instead of hits or number of months with usage activity) anticipated lead time, and cost. An item's critical nature can fall into one of three categories:

> **Very Critical Parts** - Lack of this part will cause a major, expensive problem for your company. It will shut down a critical process. For example, one of our customers is a food processor with one large (actually room size) mixer. If this machine breaks down, all production stops. Therefore any part that is necessary for this machine's operation is very critical.
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> **Somewhat Critical Parts** – Lack of this part will significantly reduce the output of a critical process. The same company has 14 wrapping machines. If one of these machines breaks down, it may delay the completion of a production run but it would not completely shut down operations. While processing delays over an extended period of time will cause major problems, the company can limp along for a day or two without one or two of the wrapping machines.

Non-Critical Parts – The loss of the machine or operation these parts support will have no or little effect on overall production. There are available workarounds that can be utilized for an extended period of time. Or the item is cosmetic and does not affect the normal operations of the machine.

The following matrix provides an example of the number of typical use quantities that should be maintained in stock for each repair part:

Lead Time →	***<=14 Days***	***<= 30 Days***	***<= 60 Days***	***>60 Days***
Very Critical	1	2	3	3
Somewhat Critical	0	1	1	1 - 2
Non-Critical	0	0	0 – 1	1

If you are forced to reduce the value of your spare parts inventory, remove all of your non-critical parts before touching any of your somewhat critical or very critical items. Also note that great insurance results from maintaining a couple more typical usage quantities of very inexpensive, but very critical, repair parts.

In chapter eight we will discuss evaluating your overall investment in sporadic usage items as well as your entire inventory.