



ABC ANALYSIS OF MRO INVENTORY

Background

Although there is not a direct correlation between the two, an ABC Analysis on MRO parts is somewhat similar to Criticality Rankings that are developed for plant equipment by Reliability Engineering. Criticality Rankings define the relative priority of assets in terms of their impact on plant safety, productivity, efficiency or other criteria. An ABC Analysis determines the relative priority of items in an MRO storeroom based on their criticality to the support of operations and their potential impact on plant inventory and investment.

There are three key activities involved in completing the analysis: prioritization, stratification, and optimization. The results of the analysis provide valuable information that can be used to determine how each part should be monitored and managed from the perspectives of procurement, warehousing, and strategic inventory management.

Prioritization

The first part of the analysis consists of rank ordering all MRO storeroom parts from 1 to n based on a set of predefined criteria. There are several different schools of thought on the best approach to take, and it is important to understand the advantages and disadvantages of each before deciding which method is best suited to your particular situation.

Unlike a dependent-demand manufacturing operation with a Master Schedule and complete BOM's, material requirements in an MRO environment are largely unpredictable. The inherent assumption in the ABC Analysis for MRO parts is that – at least to some degree – the past is a fairly reliable predictor of the future. Investment brokers are quick to remind us that is not the case, but in lieu of accurate material forecast data, there is little option. That brings up several key points to consider:

1. It is not advisable to prioritize items by on-hand inventory value, or any other parameter that can change significantly from day to day depending on issues, receipts, or other transactions that take place in the storeroom. Doing so would create dramatically different results depending on the day the snapshot of data is taken.
2. From a warehouse management perspective, there are definite benefits to analyzing inventory by activity level (number of issues or quantity of parts issued). However, using this method to prioritize inventory may negate some of the more important benefits of the ABC Analysis that are discussed below. If activity data is going to be used for such things as determining the most efficient stocking location for parts, the required data should be readily available outside of the ABC process.

3. For a newly established storeroom, or where no historical data is available, it may be useful to prioritize items initially based on unit cost until a sufficient base of historical data is developed.

Given these considerations, the recommended criterion for prioritization is annualized dollar value of usage. This method combines the impact of unit cost and activity level, and provides a more stable set of data that is obtained from a horizon of historical transaction information. For each part, average annual usage is calculated and extended at the unit cost, and the parts are listed in order from highest to lowest. When using this method, there are several *caveats*:

First, it is important to understand that “usage” is based on net quantity issued (total issues minus any returns to stock), and does not factor in inventory adjustments, scrap, or other transactions that affect the perpetual inventory balance. If proper practices are not in place to assure timely and accurate recording of transactions when parts are issued or returned, the quality of the usage data will be distorted, and the prioritization will be impacted negatively.

Second, in order to get a reasonable representation of past usage levels, it is necessary to capture an appropriate horizon of historical data. For example, in a leading-edge manufacturing environment where product life cycles are very short, a 6-month horizon may be sufficient to get a fairly accurate estimate of usage. In many MRO environments, however, parts may only turn over once every few years. Because of that, it is best to use the longest horizon possible, assuming the quality of the data remains intact. Typically, a minimum of 1 year’s history is required, but if available, 3 years’ worth of data is probably sufficient.

Regardless of the horizon chosen, the third thing to consider is where each part is with respect to its life cycle. Parts in the early stage of their life cycle may have little historical issue data available. In this case, the calculated annualized usage will likely be understated compared to actual future requirements. On the other hand, parts at the latter end of their life cycle are likely to have historical issue data that is more heavily weighted toward the earlier part of the horizon because of declining demand over that timeframe. In this case, the calculated annualized usage will likely be overstated compared to actual future requirements. Finally, as equipment and/or its associated spare parts come to the very end of their life cycle, there may be a sudden spike in demand as a result of a “last-time buy”. This can also skew the calculated annualized usage.

These considerations – although important to the ultimate quality of the completed analysis – can be factored in during the optimization step, and therefore do not have to be addressed during the prioritization part of the process.

Stratification

Once the items have been prioritized, a modified Pareto analysis (commonly referred to as the “80/20 rule”) is used to stratify the parts into categories. Typically three categories are used: “A”, “B”, and “C”, hence the name “ABC Analysis”.

“A” items are the most critical ones. These items require tight inventory controls; frequent review of demand forecasts and usage rates; highly accurate part data; and frequent cycle counts to verify perpetual inventory balance accuracy. Typically, these comprise 5 – 10% of the total item count, and represent the top 70 – 85% of the total annual dollar value of usage.

“B” items are of lesser criticality. These items require nominal inventory controls; occasional reviews of demand forecasts and usage rates; reasonably accurate part data; and less frequent but regular cycle counting. They typically comprise the next 15 – 25% of the total item count and represent the next 10 – 20% of the total annual dollar value of usage.

“C” items have the least impact in terms of warehouse activity and financials, and therefore require minimal inventory controls. In fact, depending on the nature of the items, these may be good candidates for free bin stores. Analysis of demand forecasts and usage rates on “C” items is sometimes waived in favor of placing infrequent orders – often in large quantities – to maintain plenty of stock on hand. “C” items typically comprise 65 – 80% of the total item count and represent the last 5 – 10% of the total annual dollar value of usage. Because of low usage, any dead or inactive inventory will normally fall into the “C” category.

There is no set rule for establishing the cutoffs between the categories. In fact, many CMMS/EAM systems will allow the user to define the cutoffs. Generally, a good starting point would be to define “A” items as those that represent the top 80% of total annual usage based on the prioritized list; “B” items as the next 15%; and “C” items as the last 5%.

Optimization

If the process were as simple as the mathematical exercise described above, it would have limited value. Like many other critical work processes, an effective ABC Analysis requires just that – analysis of the results.

Because of the impact of ABC classifications on other inventory management processes (described below), and the relative importance of “A” items, it is desirable to have the “A” category represent as much of the total annualized usage as possible, as long as the number of items is manageable. Achieving this balance requires an understanding beforehand as to what each classification represents in terms of required activity levels in other Material Management processes. If necessary and appropriate, the cutoff for the “A” category can be adjusted upward or downward and the stratification rerun to obtain a better distribution of items. However, it is generally a good idea to limit the “A” category to no more than 85% of total annual usage, nor less than 75%.

Before the analysis is considered complete, it may also be beneficial to review the results with other personnel. Maintenance/Operations Managers, Engineers, Technicians, *et al* may have further insight into future demand for particular items that would warrant modifying the ABC classification. This is not intended as an opportunity to “rethink” the entire analysis, or subvert the intent of it. Instead, it is an opportunity for subject matter experts to provide valuable input, and it should be done thoughtfully, but quickly.

There are also several ways that the process itself can be optimized:

1. **Eliminate the impact of dead inventory** – Transactions in the horizon for any inactive or obsolete items can result in overstating the true priority of “dead” inventory, and artificially force other active items to a lower priority and/or classification. In an environment where inactive and obsolete inventory is reviewed on a periodic basis, it is preferable to ensure that any items flagged as “dead” and awaiting disposition have no impact on the ABC classifications. To accomplish this, any such item should be excluded from the prioritization process, or at least have its usage forced to zero.
2. **Identify Critical Spares** – In many MRO operations, there are storeroom parts designated as “Critical Spares.” These often will be very expensive, sometimes one-of-a kind items, with long lead times. Because of the potential implications of an equipment failure requiring these parts, it is imperative to keep them in stock or readily available to minimize the impact on production should one be needed. From a criticality standpoint, they would generally be thought of as “A”-type items; and if there is any usage in the horizon, they will almost always end up as “A” items through the prioritization and stratification process. However, because they often have extremely low usage (if any), there is a distinct possibility that they would end up at or near the bottom of the prioritized list, and therefore would end up in the “C” category during the stratification process. This poses a potential problem where Critical Spares might not get the attention they require.

One solution to this is to establish a fourth category (“D”) to designate Critical Spares. In this case, the Critical Spares would be identified up front, and segregated from the rest of the inventory items before the prioritization process begins. Only the remaining (non-critical) items would be prioritized and stratified into “A,” “B,” and “C” classifications.

Procurement and Warehouse Applications

The results of an ABC Analysis extend into a number of other inventory control and management processes:

1. **Review of stocking levels** – As with investments, past results are no guarantee of future performance. However, “A” items will generally have greater impact on projected investment and purchasing spend, and therefore should be managed more aggressively in terms of minimum and maximum inventory levels. **Obsolescence review** – By definition, inactive items will fall to the bottom of the prioritized list. Therefore, the bottom of the “C” category is the best place to start when performing a periodic obsolescence review.
2. **Cycle counting** – The higher the usage, the more activity an item is likely to have, hence the greater likelihood that transaction issues will result in inventory errors. Therefore, to ensure accurate record balances, higher priority items are cycle counted more frequently. Generally “A” items are counted once every quarter; “B” items once every 6 months; and “C” items once every 12 months.
3. **Identifying items for potential consignment or vendor stocking** – Since “A” items

tend to have a greater impact on investment, these would be the best candidates to investigate the potential for alternative stocking arrangements that would reduce investment liability and associated carrying costs.

4. **Turnover ratios and associated inventory goals** – By definition, “A” items will have greater usage than “B” or “C” items, and as a result should have greater turnover ratios. When establishing investment and turnover metrics, inventory data can be segregated by ABC classification, with different targets for each category.

Periodic Review

To make the most effective use of ABC classifications, the analysis should be completed at least on an annual basis, and more often as necessary if there are significant changes in the MRO activity level.