



TCO WHITEPAPER

An overview of the impact of Total Cost of Ownership (TCO) on material sourcing decisions



Business Growth through Enterprise Strategic Sourcing and Quotation Management

Overview

Manufacturers of electronic products (OEMs & EMS providers) face unparalleled challenges in sourcing direct materials from component suppliers. Globalization has created rapid expansion of the number and type of component manufacturers and distributors that are available to manufacturers. Identifying the best source for any given component requires more than a comparison of raw unit cost. Other factors affect the overall true cost of purchasing components. The need to make purchasing decisions based on the true cost of a component creates demand for software solutions that assess and determine total cost. The total cost of a product is the sum of all the tangible and intangible costs a buyer incurs when buying a product. Total cost includes everything from payment to the vendor to shipping cost, inventory holding cost, indirect cost of quality and lead time, etc.

Total Cost of Ownership (“TCO”) solutions calculate the total cost of components based on any number of cost factors. Variability typically includes: country of origin, customs, warehousing, shipping, quality, and lead time, etc. Each of these variables contributes a markup on the raw component cost. The measurement of total cost facilitates buyers in making better purchasing decisions rather than solely based on the raw cost of a component.

In the typical materials sourcing process, a buyer receives quotes from suppliers and then applies different formulas to arrive at effective cost of procurement. Most buyers consider their formulas confidential and they are typically more complicated than simply applying direct markups. TCO markups enable buyers to make purchasing decisions based on the effective unit price and subjective parameters related to suppliers.

A comprehensive TCO solution allows manufacturers to calculate total cost based on a variety of variables including component manufacturer, components supplier and commodity type, as well as based on numerous variables at the component level.

Primary TCO Factors

Extensive research was conducted and interviews were held with numerous electronic manufacturers to determine the most important and frequently used total cost drivers (ie: TCO factors). These discussions produced a clear understanding of what drives the total cost of ownership directly and indirectly. Following is a

description of the primary TCO factors that are utilized by leading electronic manufacturers.

Direct Cost Factors

- **Lead time:** The time it takes for an order to arrive from the date an order is placed. When prices are the same, the product with less lead time is preferable.
- **Excess cost:** The cost a buyer incurs for buying units more than necessary. Excess cost not only includes the price a buyer pays to the vendor but also the overhead costs, e.g. shipping cost, warehousing cost, etc. A buyer will purchase extra units due to the following reasons. 1) A component supplier requires a Minimum Order Quantity (MOQ) and the MOQ is higher than the buyer's actual needs. 2) The available packaging sizes may require the buyer to purchase more than necessary.
- **NRE** ("Non-recurring engineering charges"): A one-time charge a buyer pays to a component supplier when placing initial order. The cost can be distributed over the initial order or over a number of orders within specific time period.
- **Rebates:** Refunds made to the buyer based on promotions, purchase volumes and other variables are often calculated as a percentage discount over the total monetary volume of an order.
- **Shipping cost:** An amount based on different cost components and suppliers' terms and conditions related to shipping. (ex: Free on Board (FOB), freight, Cost and Freight (C & F) landed, etc.)
- **Accounts Payable:** Effective price computed based on payment schedule and computed as percentage of the quoted price.
- **Inventory holding cost for excess units:** Inventory holding cost for excess inventory includes warehouse fees and other overhead charges. When lower package sizes cannot be ordered, inventory holding cost for the excess inventory should be taken into account for computing the effective price when making purchasing decisions. Markup is computed based on volume.

Indirect Cost Factors

- **Preferred suppliers:** Preferred suppliers have a stronger relationship with a buyer. All manufacturers on the Approved Manufacturers List (AML) are not necessarily preferred suppliers. It is implied a non-preferred supplier's price must be substantially low to win over a preferred supplier.
- **Supplier performance:** Suppliers' performance is monitored through score card/ratings, which is an internal measurement for evaluating suppliers. The ratings depend on quality, reliability, supply chain capability, etc. A supplier with higher ratings is eventually upgraded to preferred supplier based on performance. On the other hand, when a supplier fails to meet the performance requirements, the failure is analyzed to verify if it was an isolated event or a trend of degraded performance. If the failure is an isolated event, the buyer and the supplier may work together to improve the relationship. However, consistent poor performance usually results in a downgrade in status or removal from the AML in extreme cases.
- **Supply chain capability:** The effective cost depends on suppliers' capability and terms and conditions related to distribution (ex: auto replenishment, consignment, plant stores). These factors are collectively reflected in the effective price as percentage of the raw price.
- **Benchmarking against a best supplier:** Occasionally, effective price for different suppliers is computed as a markup on the raw prices. The markup is determined based on "flexibility" of corresponding supplier's terms and conditions with respect to the best supplier's price.

Primary TCO Solution Capabilities

A TCO solution should enable a buyer to capture tangible and intangible cost factors. All cost components or cost drivers cannot be quantified easily. Tangible cost is easier to quantify than intangible cost. Examples of tangible costs include shipping costs and engineering charges. Examples of intangible costs include lead time, supplier preferences and product quality. It is sufficient to capture only those costs that vary across vendors to make efficient vendor selection decisions. The costs that are same across all vendors do not play a role in the vendor selection process. For example, the inventory holding cost for the excess units would play a role in vendor selection decisions. However, inventory holding cost for the required quantities does not play a role in the decision of vendor selection. Following is a

description of the primary functional requirements that enable a TCO solution to facilitate the vendor selection process.

Requirements related to tangible costs

1. Tangible cost for an order as a sum of three components occurs from 1) fixed cost per contract 2) fixed cost per order 3) marginal cost based on the number of units to be ordered. Examples of fixed cost per contract include engineering charges and cost of vendor certification. Examples of fixed cost per order include cost of excess inventory associated with the order and fixed part of shipping cost.
2. "Buyers should be able to distinguish what percentage or which fixed costs should be applied to the current order. This determination allows the user to distribute some portion of a certain fixed cost to future orders." For example, engineering charges and cost of vendor certification are costs the buyers may want to distribute over several orders.
3. Buyers should be able to further specify different components of the fixed costs (ex: engineering charges, cost of excess units for the order, etc.) and different components of the marginal cost (ex: unit price, packaging cost, volume, etc.) as well as the factors that drive them. For example, the cost of excess units for the order depends on the number of excess units, price per unit, and the shipping and holding cost of excess units. Number of excess units further depends on the required quantity, MOQ and package sizes. The holding cost further depends on the number of excess units, warehouse cost, and utility-related overhead costs, etc. This cost relationship is best achieved by letting buyers define cost dependencies in a tree structure and specify an algebraic relationship between the dependent and depending nodes.
4. Some cost components can have fixed as well as variable components (ex: shipping cost). The buyer should be able to specify the algebraic relationship appropriately.
5. Buyers should be able to identify any savings ("negative cost") from the order in the form of a rebate, volume discount, etc.
6. Occasionally, buyers are not required to pay the entire payment to a vendor up front. The ability to pay in installments effectively creates some savings to the buyer. Buyers should be able to identify the savings ("negative cost") as the

interest earned on delayed payment which is essentially a percentage of the delayed payments.

7. Buyers should be able to typecast cost factors as binary, text, number, etc. and identify its relationship with the total cost and other cost components. For example, the buyer should be able to specify whether a vendor is regional, national or international as the buyer may need to designate a different formulation of shipping cost in each case. In this case, vendor-base is essentially of text type. An example of a binary type cost factor would be preferred supplier. An example of a number type cost factor would be shipping cost.

8. Buyers should be able to compute costs as precisely as possible based on different terms and conditions. For example, compute shipping cost based on sharing terms of shipping cost between buyer and supplier as specified in the contract.

Requirements related to intangible costs

9. When cost components are difficult to determine in monetary terms, buyers should be able to rank vendors based on their preference for the non-quantifiable factors such as lead time, vendor's supply chain capability, etc. Automated ranking can be achieved by allowing the user to assign weights for all the criteria for all the vendors and then order the vendors based on the total weighted score.

Final decision facilitation requirements

10. In order to facilitate comparison between vendors, buyers should be provided with total cost for the order and the cost per item. The cost per item is computed by dividing the total cost by the required quantity or the total order quantity. The total order quantity is the sum of the required quantity and the number of extra units to be ordered.

11. Buyers should be able to see the vendor ranking by both tangible and intangible costs.

12. The software should automatically eliminate vendors who are below a minimum threshold both in terms of rank and tangible cost compared to other vendors on the approved manufacturer list. Using the TCO factors, a buyer will have all the information required to choose the best supplier from the remaining vendors.

Requirements for handling cost components with uncertain values

13. Buyers should be able to specify cost components for which the exact value is not known and the value is probabilistic and drawn from prior experiences. For example, the cost of having defective items could be used in purchasing decisions. If 90% of the parts delivered come with 1% defective items and the other 10% of deliveries come with 3% defective items, the total cost should be based on the mean defective rate which is $(1\% \times 0.9 + 3\% \times 0.1)$ or 1.2%.

14. Buyers should be able to analyze the sensitivity of the total cost with respect to the value of a cost component when the value of a particular cost component cannot be known or predicted exactly. For example, a buyer might need to see how the total cost is impacted when the defect rate increases from 1% to 3% or labor cost for loading/unloading shipment increases from \$15/hour to \$16/hour.

Summary

Adjusting buying decisions based on TCO is a critical to the purchasing process for direct materials. Accounting for the “true cost” of a purchase yields significantly different results that can have a major financial impact on an electronic manufacturer. It can be a daunting process to calculate TCO with so many tangible and intangible factors to assess and account for. Calculating TCO for dozens or hundreds of assemblies with hundreds of components can become complicated and challenging. However, a comprehensive automated TCO solution can simplify and streamline the process to give manufacturers accurate and insightful decision making metrics.



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