SUPPLIER MANAGEMENT: A FRAMEWORK FOR SELECTION, EVALUATION AND PERFORMANCE

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ABSTRACT

Supplier performance management despite being a widely researched topic, companies are still struggling to set supplier strategies using key metrics. Most companies track too many metrics or fail to measure key variables and even if they do, they fail to execute the process consistently. If they get through these steps, they then fail to communicate their message to suppliers effectively. This leads to a strain in the supplier and company relationship. A simple multi-criteria driven holistic framework developed by industry input is critical to the success of supplier management. A supplier management framework using EIGHT main-criteria categories (convenience, customer service, financial, growth, innovation, inventory, quality, risk), 32 (between 2 and 7 in each category) metrics and 4 ranks (A, B, C, D) is presented in this paper to assist companies with their supplier management process. The framework that is presented has been developed through literature review, surveys, interviews and focus groups with several industry owners, supplier (vendor or manufacturer or brand) managers and business managers. The interaction with companies led to a set of FOUR critical questions:

1. Is there a comprehensive supplier management framework?
2. What supplier metrics should be tracked or monitored on a routine basis?
3. Would suppliers respond to scorecards and reports? How to build an effective supplier scorecard and communicate with suppliers using the results on the scorecard?

4. How to continually improve the supplier management process?

This paper is an attempt to answer these critical questions and provide a framework that is develop by bringing together existing literature available and input/findings from industry executives in the area of supplier management.

Key words: Supplier, supplier management, scorecard, performance management, selection, evaluation, relationship management, key performance metrics, framework.


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1. INTRODUCTION

Companies represent suppliers in a market and reach customers through products, services or a combination of both. Determining the right suppliers/partners is key to good customer service and business sustainability. Once the relationships are properly set and developed, suppliers provide companies with successful products and marketing efforts to help them grow and expand (Lawrence, Gunasekaran, Krishnadevarajan, 2009). As companies grow and expand into newer markets and geographies their ability to maintain or elevate supplier relationships is a big challenge that every company is witnessing. The priorities for both entities (company and supplier) could be different at any given time. In addition to the annual or once a year meeting that companies have with their suppliers for negotiation and business forecasting it is important to have frequent touch points at least every 3 months (each quarter) to communicate business priorities to their key suppliers. This cannot be just a meet and greet event every time. The meetings should be more objective and metrics driven. Companies should track key supplier metrics, create a report and set goals and objectives for the supplier. The metrics should drive meetings and should be monitored continuously. For instance, the company’s priority for 2014 could have been supplier deliveries (receiving products on time and in full) but for 2015 the priorities could be both deliveries and breadth of products (additional products needed to serve a new customer or a market segment). The priorities will often change but the key metrics should be kept consistent year over year for better execution.

2. MOTIVATION AND FRAMEWORK DEVELOPMENT

Companies typically try to measure performance of only their key suppliers that account for about 80% of their business (Pradip, Balasubramanian, Kannan, 2015). This is a good approach; however having a well-established framework for all suppliers would help the company in the long term. Starting with strategic suppliers (key suppliers) and expanding the process to other suppliers is an optimal approach. Companies often ponder if suppliers would respond well to scorecard and reports. If you talk to your key suppliers they should respond well. However, there are suppliers who may be too large (in size and scale) to even acknowledge the reports. In that case,
what metrics you communicate to the supplier, how often you communicate, nature of
text:metrics (should always be objective and data driven), and type of conversation (the
metrics should not be used as complaints during supplier meetings but rather as a
point of discussion for mutual benefit) is critical to the supplier performance
management process being effective. Suppliers may not respond immediately but a
constant reminder in an objective fashion will start producing results. The process of
supplier management actually begins by developing or choosing a supplier framework
that suits the company’s vision and goals. The development process of the proposed
supplier framework process took place in two stages. The first stage was to look at
existing literature to understand the different factors/criteria that are being used for
supplier selection, evaluation of performance management by various
industries/businesses. The second stage was interaction with companies to gather
input, understand metrics used and challenges faced in executing the supplier
management process.

2.1. Literature Review
A survey to over 100 manufacturing companies (AMR Research Survey, 2006) listed
the common indicators that were used to evaluate suppliers – statistical process
control, supplier on-time delivery, KPIs/performance of key production assets, scrap
and rework, average cycle times, inventory levels, variable manufacturing costs,
products/mix profitability, supplier quality (raw materials), finished goods quality,
demand variance, manufacturing line scheduling visibility, transportation schedules
and cost, manufacturing line capacity visibility (Gordon, 2008).

Lead time and lead time variability from suppliers requires companies to adjust
their safety stock and inventory levels in order to protect customer service levels
(Nahmias, 1997). (Araz, Ozkarahan, 2007) describe a supplier evaluation and
management methodology for strategic sourcing, in which suppliers are assessed
considering supplier’s co-design capabilities and categorized based on overall
performances, potential reasons for differences in performance of supplier groups are
identified, and performances of the suppliers are improved by applying supplier
development programs.

Determining a supplier's performance involves four key factors: lead time, lead
time variability, on-time delivery, and complete delivery. These four factors can be
combined using a multi-criteria decision model to determine a supplier performance
index – SPI (Lawrence, Gunasekaran, Krishnadevarajan, 2009).

Supplier evaluation considering environmental aspects included – general,
production, quality, logistics, production development, purchasing and environment.
The model is designed for evaluating strategic suppliers and not designed for
evaluation of suppliers of non-strategic importance since the criteria evaluated
concerns strategic aspects. The model consisted of seven criteria categories and 41
categorized criteria (Egeröd, Nordling, 2010).

(Aksoy, Öztürk, 2011) propose a methodology to select the most appropriate
suppliers in evaluating supplier performance to aid just-in-time (JIT). The
procurement of parts and materials is a very important issue in the successful and
effective implementation of JIT; thus, supplier selection and performance evaluation
in long-term relationships have become more critical in JIT production environments.
The key evaluation criteria are quality, JIT delivery performance, location for
transport and price.
(Chen, 2011) presents a supplier framework based on 5 business strategies – low cost strategy, differentiation strategy, growth strategy, innovation strategy and integration strategy, 2 sets of criteria for supplier performance (competition factor – quality, cost, delivery time and service, and organization factor – technical and production capability, relation combination and organizational management) and 17 metrics (return rate, discount rate, gross profit rate, quantity discount, lead time, on-time delivery, delivery flexibility, service standard, responsiveness, improvement capacity, R&D rate, process capability, technique co-operation, market co-operation, cooperative time, inventory turnover ratio and operating expense rate).

(Vanteddu, Chinnam, Gushikin, 2011) consider inventory costs and the supply chain ‘cycle time’ reduction costs, to help supply chain managers make informed decisions with regard to supplier selection problem at any stage, dependent upon the priorities attached to supply chain costs and cycle time. Inventory related costs and responsiveness related costs are the two primary cost elements that are considered in the model.

According to (Bilişik, Çağlara, Bilişik, 2012) supplier has an important role and in this situation supplier evaluation and selection has gained more significance for companies. For that reason, a form is designed to collect data from concerned company’s personnel and performance measuring model which includes scoring methodology and correlation analysis that is called as “Performance-Effect” analysis. They propose to divest supplier evaluation from its general evaluation concept by presenting alternative selection criteria, suppliers and methods for working with positioning of these in performance maps. The supplier evaluation criteria include – keeping up with critical situations, meeting the demand, meeting the cost requirements, process capability and quality, personnel capability, to match the lead times, to be solution-oriented, accessibility, to keep up with technological developments, communicating and general efficiency.

(Viswanadhma, Samvediahe, 2013) in their paper identify both performances-based and risk-based decision criteria, which are important and critical to the supply chain. (Singh, 2014) presents a hybrid algorithm that prioritizes the suppliers and then allocates the demand among the suppliers. The objective here is to maximize the total purchase value of the items taking into consideration budget constraint, demand condition, delivery lead-time and supplier capacity.

(Dey, Bhattacharya, Ho, 2015) say that supplier performance management can be performed by having metrics in two categories – performance, and capabilities & practices. Performance includes – quality performance (defined by six metrics), delivery performance (five metrics), and costing performance (five metrics). Capabilities & practices include organizational capability (eight metrics), environmental practices (three metrics), social practices (three metrics), and risk management practices (three metrics).

(Rezaei, Wang, Tavasszy, 2015) in their linking supplier development to supplier segmentation work evaluate suppliers based on two dimensions – capabilities and willingness. Capabilities include (8 main criteria – technical, product quality, delivery, intangible, service, financial/cost, sustainable, organizational) and 51 sub-criteria. Willingness includes (4 main criteria – willingness to improve performance, willingness to share information, willingness to rely on each other, willingness to get involved in long-term relationship) and 21 sub-criteria.

(Hosseininasab, Ahmad, 2015) introduce a two-phase supplier selection procedure. Unlike most supplier selection researches, which are decisive based on
supplier eligibility at the time of the decision making, their proposed method is based on the long term trend of value, stability, and relationship of potential suppliers. The model determines a supplier portfolio by maximizing the expected value and development of suppliers, and minimizing their correlated risk.

(Wu, Chang, 2015) use four dimensions (supplier management, product recycling, organization involvement, life cycle management) and twenty factors developed by (Hsu, Hu, 2008) suitable for electrical and electronic industries in Taiwan to identify the critical dimensions and factors in green supply chain management (GSCM). Pricing visibility (number of price points available) and pricing variability (deviation in price points) can be applied to measure the risk level of doing business with a supplier (Nepal, Naveenan, Krishnadevarajan, Lawrence, 2015).

2.2. Industry Feedback
Interaction with companies was performed through surveys, interviews and focus groups with several industry owners, supplier (vendor or manufacturer or brand) managers and business managers. The objective was to get an idea of the metrics being utilized for supplier management, challenges faced, supplier framework deployed and the effectiveness of their current supplier performance management processes. Key findings from the industry interaction were the following:

- **Lack of a supplier management framework.** Understanding where the process began and where it ended was the key challenge. Who should take ownership of this process in the company? Often, data was missing or currently not captured in the system in-order to create various metrics to help with supplier management. Internally, all companies did not have a goal or objective regarding what they would like to achieve with the supplier management process. They had annual meetings with their suppliers thanking them for being a partner and for the business relationship. No concrete data driven discussions or goal setting took place.

- **What to track?** Companies either tracked too many metrics or did not track anything. Even if they tracked too many metrics most of them were subjective and anecdotal. They lacked a significant number of quantitative metrics to act on something meaningful. Companies wanted a set of metrics they could choose from and then set a process in place to capture the relevant data to compute those metrics. If multiple metrics are used to track supplier performance, is there a methodology to combine various metrics to develop a single rank (ease of decision making) for each supplier?

- **Reporting and Scorecards**: The next challenge was that even if a few companies had the required data and were able to compute the metrics they did not have an effective way of reporting this information back to the supplier. They lacked reporting tools and templates for the performance metrics.

- **Continuous Improvement**: The steps that need to be established to continually improve the supplier management process at the company did not exist. Several companies had gone down the path of implementing a version of the supplier management process but could not sustain the same due to lack of accountability/ownership, failing to change the metrics when the industry dynamics changed, and execution challenges.

The focus of this paper is to propose a simple, yet holistic framework, list of metrics to track and a multi-criteria ranking method for supplier management.
3. **SUPPLIER MANAGEMENT FRAMEWORK**

The approach used to layout a supplier framework is bridging the gap between what was seen in the literature review and the feedback from industry. The key objectives in the framework development were the following:

- Metrics should be quantitative (objective and data driven). There will be only a few qualitative metrics.
- The framework should be holistic and comprehensive at the same time easy understand.
- Scalability and flexibility of the framework is important as companies adopt it into their supplier management process.
- Apply a multi-criteria approach but provide the ability to get one single final rank (A, B, C or D) for a given supplier so that business strategies can be established at a final rank level.
- Provide a starting point for ranking criteria – what determines an A, B, C or D supplier for each metric used in the framework.

Most companies measure suppliers based solely on performance (deliveries) because it is important to customer service and also it is relatively easy to measure. Supplier performance (customer service) is only one aspect of the supplier management. The proposed framework provides eight categories based on which suppliers should be addressed (shown in illustration 1). It varies from ‘customer service’ to the ‘level of risk’ of doing business with each supplier. These 8 categories have a set of metrics (32 metrics in total), formula to compute the metric and a ranking scale that places each supplier in one of 4 ranks – A, B, C or D. Companies can choose the categories that are most relevant to their current business priority and then choose a set of factors/metrics under each category to rank their suppliers.

**Illustration 1** Supplier Management Categories and Metrics

<table>
<thead>
<tr>
<th></th>
<th>Convenience</th>
<th>Customer Service</th>
<th>Financial (Profitability)</th>
<th>Growth</th>
<th>Innovation</th>
<th>Inventory</th>
<th>Quality</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Ordering</td>
<td>Online Ordering</td>
<td>On-Time Index</td>
<td>Spend</td>
<td>Product Penetration</td>
<td>New Product Contribution</td>
<td>Forecast Assistance</td>
<td>Inbound Accuracy</td>
<td>Number of Customers</td>
</tr>
<tr>
<td>Services and Technical Support</td>
<td>Order Completeness</td>
<td>Return Policy</td>
<td>Growth (Spend)</td>
<td>New Products</td>
<td>Inventory Turns</td>
<td>Inbound Quality</td>
<td>Warranties</td>
<td></td>
</tr>
<tr>
<td>Lead Time</td>
<td>Gross Profit %</td>
<td>Growth (Spend Trend)</td>
<td>Inventory Rank and Slow Move Items</td>
<td>Invoice Correctness</td>
<td>Price Visibility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipping Variability</td>
<td>Gross Profit Currency</td>
<td>Reverse Inventory Potential</td>
<td>Gross Margin Return On Inventory Investment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order Visibility and Tracking</td>
<td>Payment Terms and Discounts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Stock-outs</td>
<td>Quote Responsiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Stock-outs</td>
<td>On-Time Invoicing Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.1. Convenience
Ease of doing business with suppliers is the objective of this category. There are two metrics under this category – online ordering and services & technical support. The online ordering metric captures the ability of the supplier to receive orders online rather than phone or sometimes paper based (fax included). This functionality also reduces the cost of doing business with the supplier. The second metric is the level of support. It is important for the supplier to provide post-sales support, technical expertise and services to the company. This is usually a qualitative metric as various suppliers have different / multiple services to support their channel partners. This aspect of measurement is subjective in terms of ranking and varies from ‘High’ (good degree of support and services) to ‘Low’ (no support/services or lowest support/services). The factors, description and ranking for this category are shown in illustration 2. The framework is scalable and flexible. Additional factors can be added into this category as required by the company.

Illustration 2 Supplier Management– CONVENIENCE

<table>
<thead>
<tr>
<th>No</th>
<th>Factors / Metrics</th>
<th>Definition</th>
<th>Supplier Rank (A is better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Online Ordering</td>
<td>Percentage or orders that were placed online as opposed to other modes.</td>
<td>A: &gt;30%, B: 20-30%, C: 10-20%, D: Others</td>
</tr>
<tr>
<td>2</td>
<td>Services and Technical Support</td>
<td>Level of support (technical and other services) offered by the supplier.</td>
<td>A: High, B: Medium, C: Low, D: None</td>
</tr>
</tbody>
</table>

If the company places more that 30% of their orders to a supplier online then the supplier receives a rank of ‘A’ for online ordering using the ranking criteria from illustration 2. The criteria to determine the four ranks (A, B, C and D) should be changed to suit the company according to their needs. Services and technical support metrics can also include marketing funds or resources that the supplier provides to the company for business execution and growth.

3.2. Customer Service
This is the most common and only category used by a number of companies at present. There are 6 factors in this category. If 50 orders were received from a supplier and 40 of them were received on or before the requested date, then the on-time index is 40/50, 80%. The widely used factors are lead time and on-time index. If quantity ordered is 1000 units and the company received only 950, the order completeness is 950/1000, 95%. ASN (automatic shipping notification) from suppliers help the company plan better in terms of customer promised date as well as order receiving and inspection process. Stock-outs cause immediate customer service breakdown and should also be tracked at a supplier level. This may not indicate supplier planning but the company may not have forecasted better to account for the customer demand. Number of stock-outs is a difficult metric to track and very few companies track this metric. It is also important to focus on measuring the variability of lead times. The variability can be measured by the co-efficient of variation (COV), the ratio of the standard deviation to the average of lead times (Nahmias, 1997). This measure captures the relative magnitude of a variable with respect to its average. Another effective combination metric company is supplier performance index or SPI (Lawrence, Gunasekaran, Krishnadevarajan, 2009). SPI is a combination for the first four metrics from illustration 3.
If a company tracks their supplier using three metrics – lead time, shipping variability and on-time index, using illustration 3, they assign ranks to the supplier. If lead time is 3 days, shipping variability is 47% and on-time index is 96%, corresponding ranks for the supplier would be B, C and A respectively. The cut-off values that determine the four ranks (A, B, C and D) should be changed by the company according to their environment and needs.

### 3.3. Financial (Profitability)

This is a critical category for every company since it represents profitability. Spend indicates the total currency invested in each supplier. Spend for a given supplier is represented as a percentage of the company's entire spend. Returns are driven by economy, supplier errors, competitors in the market place, industry or business dynamics that are not caused by the supplier. Return policies are set at an annual level. Payment terms and discounts are represented in days. An early pay date may include a percentage discount from spend.

### Illustration 4 Supplier Management– FINANCIAL (Profitability)

<table>
<thead>
<tr>
<th>No</th>
<th>Factors / Metrics</th>
<th>Definition</th>
<th>Supplier Rank (A is better)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>Spend</td>
<td>Percentage of total annual amount of currency that is spent for procurement with each supplier.</td>
<td>&gt;15%</td>
</tr>
<tr>
<td>2</td>
<td>Return Policy</td>
<td>Number of returns allowed by the supplier.</td>
<td>12 Returns per Year</td>
</tr>
<tr>
<td>3</td>
<td>Gross Profit %</td>
<td>Profit percentage from the sale of products represented by the supplier.</td>
<td>&gt;25%</td>
</tr>
<tr>
<td>4</td>
<td>Gross Profit Currency</td>
<td>Total annual profit currency (percentage of the total company profit) provided by the supplier.</td>
<td>&gt;15%</td>
</tr>
<tr>
<td>5</td>
<td>Payment Terms and Discounts</td>
<td>The terms that the supplier offers after product is received by the company.</td>
<td>45 Days</td>
</tr>
<tr>
<td>6</td>
<td>Quote Responsiveness</td>
<td>When a price or quote is requested what is the response time (in hours) from the supplier.</td>
<td>&lt; 3 Hours</td>
</tr>
<tr>
<td>7</td>
<td>On-Time Invoicing Index</td>
<td>On-time invoices / Total number of invoices. Represented as a percentage.</td>
<td>&gt;95%</td>
</tr>
</tbody>
</table>
Illustration 4 provides a list of seven key metrics with their definition, and cut-off values to determine the financial ranks of the supplier.

3.4. Growth
The metrics listed in this category will help the company understand if their growth objectives can be met by working with a particular supplier. Also, if the company is looking to expand into new areas how should they go about setting the expectations for the supplier from a growth aspect of the business? The three metrics that help measure growth prospects with the supplier are listed in illustration 5. If the company is trying to market 9 different product lines to their customers but if a supplier can support only 5 of those lines then the penetration is 5/9 which is 56%. Growth of spend (in currency) resulting from the products provided by each supplier is compared over two consecutive years.

<table>
<thead>
<tr>
<th>No</th>
<th>Factors / Metrics</th>
<th>Definition</th>
<th>Supplier Rank (A is better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Product Penetration</td>
<td>It is defined as the breadth of supplier inventory or offerings.</td>
<td>&gt;80% 60-80% 40-60% Others</td>
</tr>
<tr>
<td>2</td>
<td>Growth (Spend)</td>
<td>Computed as the increase or decrease in revenue from the previous year / current year revenue.</td>
<td>&gt;15% 10-15% 5-10% Others</td>
</tr>
<tr>
<td>3</td>
<td>Growth (Spend Trend)</td>
<td>The growth trend over multiple years. 3-5 years. A weighted average trend can also be used.</td>
<td>&gt;15% 10-15% 5-10% Others</td>
</tr>
</tbody>
</table>

3.5. Innovation
Companies cannot survive selling existing products all the time to customers. As competition in the market place increases, customer needs and expectations change, suppliers should be able to cater to this change quickly if not the company would lose revenue and market share (also customers). This shifts the company products more towards a commodity status making it difficult to raise prices (pro-active or opportunistic) or sustain profitability in the long term. It is very important for companies to consider the innovation aspect of every supplier as they set long term growth goals. Two metrics that are easy to track are listed in illustration 6.

<table>
<thead>
<tr>
<th>No</th>
<th>Factors / Metrics</th>
<th>Definition</th>
<th>Supplier Rank (A is better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New Product Contribution</td>
<td>Revenue contribution (as percentage of total revenue for the company) from new products.</td>
<td>&gt;10% 6-10% 2-6% Others</td>
</tr>
<tr>
<td>2</td>
<td>New Products</td>
<td>Number of new products that are introduced by the supplier annually.</td>
<td>12 (approx 1 per month) 6 3 Others</td>
</tr>
</tbody>
</table>

3.6. Inventory
Inventory is one of the largest assets of the company in their balance sheet and it is important to track at the supplier level in-order to optimize inventory and supplier management. There are five critical metrics to achieve this objective as shown in illustration 7. Inventory turns and slow move items are the metrics that are popular. Suppliers often assist with forecast (usage or demand) for certain items. The level of increased forecast accuracy due to supplier input is tracked on a monthly basis. A
value of 10% indicates that by incorporating supplier input, forecast accuracy improved 10% or forecast error declined 10%. Turns are computed at the cost currency or value of inventory at cost. If number of turns is 4 then the inventory of the supplier is rotated every 3 months or 90 days. Slow move items can be computed at a currency level (average inventory currency) or just as number of items and represented as a percentage. If the forecast error is high on certain products or the demand is highly inconsistent, suppliers might provide an allowance for returning inventory when the company is stuck with excess inventory. This metric is called as reverse inventory potential and is done mainly to ease working capital.

**Illustration 7** Supplier Management– INVENTORY

<table>
<thead>
<tr>
<th>No</th>
<th>Factors / Metrics</th>
<th>Definition</th>
<th>Supplier Rank (A is better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Forecast Assistance</td>
<td>Level of increased forecast accuracy due to supplier input.</td>
<td>&gt;15%</td>
</tr>
<tr>
<td>2</td>
<td>Inventory Turns</td>
<td>Cost of goods sold / average inventory.</td>
<td>&gt;6</td>
</tr>
<tr>
<td>3</td>
<td>Inventory Rank and Slow Move Items</td>
<td>Number of C or D items of this supplier / Total items from this supplier.</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>4</td>
<td>Reverse Inventory Potential</td>
<td>Allowance for returning inventory to the supplier. This is represented as a % of total spend.</td>
<td>5%</td>
</tr>
<tr>
<td>5</td>
<td>Gross Margin Return On Inventory Investment</td>
<td>The ratio of profit currency and the average inventory currency over a specific period of time (6-12 months). Represented as a percentage.</td>
<td>&gt;200%</td>
</tr>
</tbody>
</table>

**3.7. Quality**

As companies adopted lean principles and quality techniques these metrics listed in illustration 8 became a routine process for companies. There are three metrics that are related to inbound shipments and invoice. Quality metrics are usually communicated immediately to suppliers as and when it happens. It is a reactive approach and often not a standard reporting performed for supplier quality on a proactive basis. Inbound accuracy is a check on the items requested and the items received. Just to ensure that only the requested items are shipped. Other quality metrics tracked by companies on a regular basis could also be added to this category shown in illustration 8.

**Illustration 8** Supplier Management– QUALITY

<table>
<thead>
<tr>
<th>No</th>
<th>Factors / Metrics</th>
<th>Definition</th>
<th>Supplier Rank (A is better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inbound Accuracy</td>
<td>Number of non-errors orders received / Total number of orders.</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>2</td>
<td>Inbound Quality</td>
<td>Number of orders without quality audits or inspections / Total orders received.</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>3</td>
<td>Invoice Correctness</td>
<td>Number of invoices with no errors / Total number of invoices. Represented as a percentage.</td>
<td>&gt;95%</td>
</tr>
</tbody>
</table>

**3.8. Risk**

These metrics provide an indication of the risk of doing business with the supplier. Some of the important metrics are number of customers for the supplier products – If it is a one customer item, the chance of liquidating inventory when the customer demand drops becomes very limited. Also if the customer goes out of business the
company is stuck with this customer-specific inventory. Warranties also constitute a significant portion of the company’s cost – If the company is wholly responsible for warranty, it becomes time consuming and an expensive process. Companies prefer to process fewer warranties. The other metrics include price visibility (assists with sales projections and inventory investments) and price variability (price consistency) as shown in illustration 9.

**Illustration 9 Supplier Management– RISK**

<table>
<thead>
<tr>
<th>No</th>
<th>Factors / Metrics</th>
<th>Definition</th>
<th>Supplier Rank (A is better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of Customers</td>
<td>Numbers of customers for the suppliers’ products indicates the risk associated with the supplier.</td>
<td>A: &gt;60 Customers; B: 40-60; C: 20-40; D: Others</td>
</tr>
<tr>
<td>2</td>
<td>Warranties</td>
<td>Number of warranties processed is in indicator of product quality and also the level of support.</td>
<td>A: &lt;10 per year; B: 6-10 per year; C: 2-6 per year; D: Others</td>
</tr>
<tr>
<td>3</td>
<td>Price Visibility</td>
<td>Number of different price data points available for price forecasting from a supplier.</td>
<td>A: &gt;12 points over 2 years; B: 8-12; C: 4-8; D: Others</td>
</tr>
<tr>
<td>4</td>
<td>Pricing Variability</td>
<td>Similar to shipping variability this is the ratio of standard deviation of supplier price points to the average of the price points.</td>
<td>A: &lt;25%; B: 25-35%; C: 35-50%; D: Others</td>
</tr>
</tbody>
</table>

### 3.9. Final Supplier Rank

Various metrics that could be applied to determine supplier ranks (across 8 categories) were addressed in the previous sections. Decision-making process becomes challenging when there are multiple ranks (while using multiple metrics across the 8 categories) pointing in different directions. In this situation, a weighted stratification matrix helps determine a final rank for each supplier (Lawrence, Krishnadevarajan, Gunasekaran, 2011). The final supplier rank depends on three factors:

- **Weights given for each factor:** This input captures the importance of each factor. Weights may vary depending on your environment, but an example when a company applies 5 metrics to rank their suppliers could be: Supply Variability = 25%; Price Variability = 20%; Growth (Spend) = 20%, New Products = 20%; and Gross Profit Percentage = 15%. If a company chooses to include additional factors, the weights may be distributed accordingly.

- **The relative importance of A, B, C, and D ranks:** Example: A=40; B=30; C=20; and D=10

- **Score the range for the final score:** The above weights are converted to a scale of 10 to 40, resulting in a best score of 40 (ranked A in all categories) and a least score of 10 (ranked D in all categories). The 30 points in the range of 10 to 40 is divided into four groups. Example: A=32.6 to 40; B=25.1 to 32.5; C=17.6 to 25; and D=10 to 17.5.

With these parameters, a final rank can be determined for a given supplier. If a supplier is ranked as B, C, A, B and D according to supply variability, price variability, growth in spend currency, new products and gross profit percentage respectively; this supplier’s final performance score is computed as follows:

Final supplier score = [(25% x 30) + (20% x 20) + (20% x 40) + (20% x 30) + (15% x 10)] = 27

This score falls between the ranges of 25.1 to 32.5, so this supplier gets a final rank of “B”.

http://www.iaeme.com/IJM/index.asp
3.10. Summary of Supplier Ranking

The various steps that are involved in the ranking of suppliers can be summarized as follows:

- Step 1: Customize the framework according to the company’s requirement. This includes both the categories as well as the metrics under each category.
- Step 2: Determine the cut-off values for each metric – the criteria that ranks the supplier as A, B, C or D. This is a very important step.
- Step 3: Choose key metrics that will determine supplier ranks.
- Step 4: Rank the suppliers for each metric using company-specific cut-off values.
- Step 5: Assign weights to each factor.
- Step 6: Compute final rank for each supplier.
- Step 7: Using a cross-functional team to determine strategies and reporting for each supplier based on the supplier rank (final rank and/or the individual metrics rank).

4. CONCLUSION

The proposed supplier framework provides a guideline for companies with their supplier management process. Determining the right suppliers/partners and managing them effectively is key to good customer service and business sustainability. Once the relationships are properly set and developed, suppliers provide companies with successful products and marketing efforts to help them grow and expand. Measuring suppliers on data driven objective criteria is critical to maintaining profitable-sustainable business relationships with suppliers.

REFERENCES


