Supplier management in a manufacturing environment

A strategically focussed performance scorecard

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Abstract

Purpose – Managing a supplier base can be both challenging and rewarding. Instances abound where the lack of attention to supplier management has caused once successful businesses great losses or even failures. Assessing a supply base using the combined approach of discrete choice analysis (DCA) and total cost of ownership (TCO) can help a company determine the necessary features required to alleviate the strain caused by doing business with poorly managed companies. The paper aims to discuss these issues.

Design/methodology/approach – By combining a company's DCA with their TCO, manufacturing companies can create a strategically focussed scorecard that aligns their supplier requirements with high-performing companies. During the analysis, the paper chose to analyze an appliance manufacturer.

Findings – As a result of the analysis, it was determined that a specific supplier that was labeled as strategic, should actually be considered for elimination. While this analysis can be extremely effective, three main limitations within the research do exist. First, the lack of alignment of DCA with the strategic business initiatives within each unit of a company can adversely affect its financial success. Second, implications for management which include all data used in the analysis through all three stages – identify and classify, consolidate, and maintain supplier base – must be up-to-date. Finally, trade-offs must be accepted as a means of doing business with a supplier.

Originality/value – After reading this study, sourcing managers should realize the potential for aligning and managing their supplier base with the strategy of the company to assure a profitable future.

Keywords Discrete choice analysis, Total cost of ownership, Supplier performance scorecard, Supplier classification, Supply base consolidation, Strategic sourcing

Paper type Case study

Introduction

During the 1980s and 1990s, companies realized that their productivity could be significantly increased by managing relationships, information, and material flow across enterprise borders (Cherry, 2006). As supply chains increase in complexity and continue to become more global, the management of these relationships can drastically affect the profitability and sustainability of manufacturing companies. It is also important to note that as manufacturing companies continue to become leaner, there is more emphasis on total costs associated with purchasing raw materials. These costs include, but are not limited to the price paid for the item, order placement, research and qualification of suppliers, transportation, receiving, inspection, rejection, replacement, rework, downtime caused by failure, and disposal costs (Ellram, 1996). Whereas, in the past, many manufacturing companies based their purchasing decisions primarily on price alone or price and vague qualitative data. The culmination of all of these factors has led many manufacturing companies to focus their efforts on creating long-term, more meaningful relationships with suppliers that benefit their firms' strategy.

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This close co-operation with suppliers has brought about lower unit costs and greater quality (Goffin *et al.*, 1997).

The first step in developing these long-term relationships starts with determining which suppliers will benefit a company's strategy and long-term goals. It is highly unlikely that any supplier will have the lowest unit cost items while also having the best value-added features. Consequently, firms have to trade-off between price, quality, and other value-added features when choosing suppliers for key components and raw materials (Rhee *et al.*, 2009). Because supplier choices can have such major effects on the future success of a company, cross-functional teamwork is essential in determining what attributes and qualitative factors need to be considered when determining the attributes deemed essential for suppliers to possess. One traditional, utility-based approach often used to conquer this problem is discrete choice analysis (DCA).

DCA

DCA can be used to assess the relative weights for price, quality, delivery, flexibility, as well as many other value-added features deemed important by departmental management (Rhee *et al.*, 2009). Intensive work must be completed to determine the important variables and their relative alignment within each business unit and also within the company. For example, a medical device manufacturer, like St Jude, might place more relative importance on purchasing goods of a higher quality than purchasing medium quality goods for better purchased prices. Conversely, a diversified manufacturer like 3M might pursue a more balanced purchasing approach on price, quality, and on-time delivery. Once the analysis is completed, the important variables must be weighted in relevance to importance, ultimately totaling up to 100 percent. A basic example can be seen in Table I.

In this mock example, total cost of ownership (TCO) is the most important variable and innovation/communication is least important to the overall study. If this was from a real manufacturing company this decision would have been made on a consensus basis after significant amount of time spent on it. Once the weights of these components are determined, firms have the ability to compare multiple suppliers against each other to determine which suppliers best fit the needs and wants essential to the firm's success. One of the most widely used tools in purchasing analysis, for supplier selection and supplier evaluation, is the TCO analysis model (Ellram, 1996; Bhutta and Huq, 2002).

TCO analysis

The TCO model uses the weighted analysis gained from the DCA model to assess both current and future suppliers. TCO model analysis is not an exact science, and many different companies throughout the world use different versions of the TCO model to evaluate, benchmark, and select suppliers. While many versions exist, Ellram (1996) supports developing a standardized company version of the model that can be applied

Variable	Weight (%)
TCO	30
Quality	25
Delivery	20
Financial security	15
Innovation/communication	10

Table I.
Discrete choice analysis template

and used readily across suppliers. When issues of concern are the same across buys, there is a desire for a relatively easy model, or there is a desire to computerize the system. In contrast, Ellram suggests using a unique TCO model when buys between suppliers and materials vary greatly, no one set of factors captures critical issues across buys, or there is a strong desire for flexibility in cost modeling.

Because the TCO model gives the firm a snapshot of the supplier at a specific point in time, many firms also use TCO to help them with benchmarking to identify and classify a supplier base, supplier maintenance, and even supplier reduction as part of consolidation. Suppliers, like employees, should be continually evaluated to ensure that proper performance measurements are met. It is also important that these suppliers should be given performance evaluations, so that they are made aware of any possible problems that may be arising.

Identifying and classifying a supplier base

In today's fast paced environment companies are dealing with more and more suppliers that are able to promise them the right product, at the right price, with the right quantity, at the right place at the right time. Various suppliers who promise all these things are not always able to carry out these promises due to a variety of factors such as: changes in demand, inadequate procurement of raw materials, and delivery issues. Being able to identify the right suppliers for the job means factoring in aspects such as cost, quality, and on-time delivery. These traditional aspects, although very important, ignore supplier capabilities to innovate and reduce costs, along with how well the supplier communicates with the manufacturer. Co-operation between buyers and sellers has moved from strictly transactional to a long-term basis that now puts emphasis on building relationships (Goffin *et al.*, 1997). Categorizing suppliers into tiers such as strategic, preferred, and approved can help the purchasing firm to ensure that the decisions they make when choosing external suppliers are in line with the firm's strategy.

Strategic suppliers. The top tier of supplier classification involves those suppliers termed strategic. These suppliers are long-term business partners that are committed to the utilization of strategic and operational capabilities of both firms. The more complex the supply market is, the fewer number of suppliers that will be deemed strategic. Evidence state that a product group consisting of <3 percent of total spend per year for the firm will not be categorized as strategic (Kamann, 2003). Strategic suppliers are in essence partners with the firm categorized by bringing high value to the firm while having a lack of clearly defined substitutes.

Preferred suppliers. The second tier of supplier classification is those of preferred suppliers. These suppliers can be identified as having the least amount of total costs associated with them. Products involved are usually routine, easily accessible, and available. Typically, these suppliers lack complexity in the market, and the value they bring to the firm can be categorized as being between low and high.

Approved suppliers. The final tier of supplier classification involves approved suppliers. These suppliers offer little to no customization of products and do not bring added value to the firm. Original equipment manufacturers and raw materials suppliers encompass most of this tier. Approved suppliers should be selected based upon their ability and willingness to reduce the costs of logistics to the firm (Kamann, 2003).

Classifying suppliers into one of the three tiers can help the firm identify where to consolidate their supply base. Data suggests that 85 percent of all suppliers are in the

approved supplier tier, but these suppliers only make up 10 percent of all firm inputs. Furthermore, 60 percent of all organizational costs can be found in the approved supplier tier (Kamann, 2003). Classifying a supply base makes it possible to identify suppliers for potential elimination.

Supplier consolidation

By the time most large manufacturing companies start their lean journey they may already be purchasing from thousands of suppliers. To ensure the proper coordination and effective supplier management, supplier consolidation is often a common route. Supplier consolidation, much like supplier selection, is integral to the future success of a manufacturing firm. However, it is important to know that firms should not reduce suppliers just for the sake of doing it; the process should be carried out component group by component group (Goffin *et al.*, 1997). While there are many benefits to supplier consolidation, some industry information exists supporting increasing the number of suppliers to mitigate supply risk and to increase competition (Levina and Su, 2008).

To capitalize on the benefits of supplier consolidation while mitigating the risks, many firms are utilizing a strategy called dual sourcing. The primary philosophy behind dual sourcing is having a prime supplier with a back-up supplier readily available. The main driver behind this philosophy is for disaster planning (Goffin *et al.*, 1997). If any unforeseen disruptions were to happen in the supply chain, the firm would have another supplier ready to meet the needed demand. While many different strategies abound, one strategy used by Packco is having more than one supplier approved for every part number, but only actively sourcing from the current supplier. The other back-up suppliers would be single sourcing another product to ensure continued communication between the two parties. Another strategy, this one used by Lubco, actively sources from two suppliers with the purchasing split 75 and 25 percent (Goffin *et al.*, 1997). At both of these companies single sourcing was seen as too risky, so a dual-sourcing technique was used. While Goffin *et al.* (1997) do believe that reducing the supplier base is generally a good practice, they caution about entering into long-term contracts where raw materials are considered commodities. Their rationale is primarily due to possible downward market fluctuations that could happen in the future. Although they do mention that contracts could be written to help companies protect themselves against originally agreed upon higher market price if commodity prices fell dramatically. Goffin *et al.* (1997) also caution that de-selected suppliers should be dropped in a professional and ethical manner at the appropriate time to ensure that the company maintains a professional image when dealing with suppliers.

Supplier maintenance

After consolidating, manufacturing companies must develop and nurture systems within their sourcing and purchasing departments that align themselves with the company's goals to ensure future success. One such practice is creating a scorecard system for all current suppliers. The name of this concept reflects an intent to keep score of a set of items that aim to maintain a balance between short-term and long-term objectives: between financial and non-financial measures, between lagging and leading indicators, and between internal and external performance perspectives (Bhagwat and Sharma, 2007). Scorecard systems typically contain both quantitative and qualitative data necessary to ensure beneficial long-term relationships for both the manufacturer and the supplier. The financial and non-financial measures that are chosen to be measured in the suppliers' scorecards should come from the information deemed

significant to the business gained largely from the DCA and TCO analysis. While using only a TCO system of managing suppliers would be useful, it would not likely be effective. The process to set up TCO models is typically labor intensive, whereas a standardized scorecard system can quickly be created and easily updated. It allows manufacturers an inexpensive, quick reference guide to ensure future company-supplier success.

While creating a scorecard for internal review is very helpful, sharing this information with the supplier can be more impactful. The sharing of this information with the suppliers allows them the opportunity to correct their mistakes and problems and to better the relationship between the manufacturer and the supplier. This interaction increases the future possibility of long-term beneficial relationships. A template of a standardized scorecard can be seen in Table II.

This basic scorecard lists the suppliers on the left-hand side, while it lists the important variables gained from the DCA analysis and their relative weighting just below them. Based on the number weighting given in the matrix above, the total supplier score will be outputted on the right of the scorecard. Based on the inputs (scoring 1-5), the output will be multiplied by the weighted variable, and all numbers in the row will be summed together. This final output will also be a numerical value out of 5. The higher the number, the more likely the supplier is aligned with the manufacturer's needs. The lower the number, the less likely the supplier is aligned with the company's needs. This particular scorecard will be further analyzed next using the aforementioned appliance manufacturer.

Strategy in action

Company overview

A company that will from here on be called Appliance Manufacturer X has allowed the team to analyze their purchasing activities. Appliance Manufacturer X is a two billion dollar manufacturing company with roughly 4,700 employees worldwide. Their products are sold in over 90 countries through both retail and distributor sales channels to companies and consumers alike. In recent years the company has recognized the need to grow, or risk being acquired by a major competitor. Their growth efforts are not only internal by increasing existing market share, but also external through acquisitions of other companies. It is through these acquisitions that the manufacturer has seen its supplier base continue to grow. The most recent acquisition has grown its supply base by almost 25 percent.

Appliance Manufacturer X recently implemented initiatives to reduce its supply base, and has found some initial success in doing so. Currently, tools are in place at the manufacturer to help identify suppliers for consolidation. Emphasis is placed on the traditional aspects of cost, quality, and delivery in order to classify their supplier base. The question persists whether or not these tools are enough to determine whether or not a specific supplier should be grown, maintained, or eliminated.

	TCO 30%	Quality 25%	Delivery 20%	Financial security 15%	Innovation communication 10%	100%
Supplier A						–
Supplier B						–
Supplier C						–

Table II. Standard scorecard template

Material group (MG) analysis

Appliance Manufacturer X divides up the particular commodities they purchase by MG. Within each MG exists a number of suppliers that the manufacturer purchases raw materials or products from, which are used in their manufacturing process. For example, a raw MG could be plastics and resins. Products used in their manufacturing process MG could be tires/wheels. Appliance Manufacturer X recently began an effort to closely examine their MGs in hopes of eliminating some of their suppliers.

A specific MG within this manufacturer was chosen for analysis. For confidentiality reasons the MG will herein be referred to as MG as injection molded plastics. Injection molded plastics makes up only 1.5 percent of Appliance Manufacturer X's total spend. A vast amount of suppliers (69 to be exact) exist within this MG. Spend varies with each supplier from a few hundred dollars to millions of dollars. Nearly 800 parts are purchased within this MG and are shipped to the manufacturer's locations throughout the USA and Mexico. Due to the limited overall Appliance Manufacturer X's spend and great number of specialized suppliers, injection molded plastics can be categorized as a bottleneck. Suppliers within this MG are rather unique, as they make products that are specific and specially made only for the manufacturer.

The strategic sourcing team at Appliance Manufacturer X has determined that it would like to eliminate 85 percent of the suppliers within this MG. Figure 1 shows Pareto distribution of the company's annual spending by suppliers. The company has categorized MG suppliers into one of three categories. They are grow, maintain, and eliminate; with the vast amount of suppliers falling into the eliminate category. The remaining, grow and maintain suppliers, will need to be closely scrutinized to help identify them as strategic, preferred, or approved suppliers. Variables such as cost, quality, delivery, location, and financial situation will need to be analyzed for

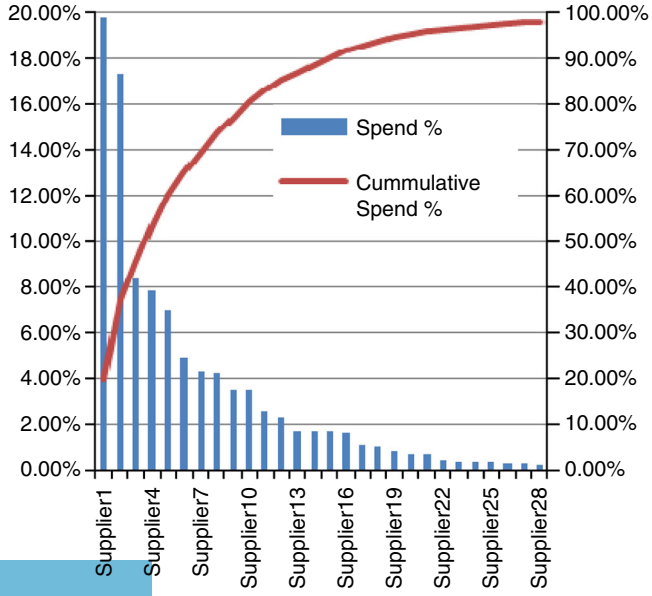

Figure 1.
Pareto distribution of spend by suppliers

each of the remaining suppliers. Three suppliers within the injection molded plastics MG that were deemed as grow and maintain by the manufacturer, were chosen for further analysis.

Suppliers

Due to time and space limitations, we choose to narrow down the list of 70 suppliers and more thoroughly analyze three suppliers. For all intents and purpose, and for the suppliers' anonymity, we will name these suppliers A, B, and C.

Supplier A. Supplier A is a medium-sized plastics supplier that was opened in the mid-1980s in upland Tecate, California. They currently operate in two countries with six operating plants and 52 molding machines containing the latest molding and process technology available. They employ roughly 60 employees and say that they are dedicated to achieving total customer satisfaction by meeting customer expectations through continuous improvement in all areas of operation. In 2011 they achieved sales of roughly $6 million.

Supplier B. Supplier B was opened in the early 1980s in southern California and currently sits on a 1.5-acre lot in Riverside and houses a 10,000 sq. ft. facility. They employ 11 employees and had 2011 sales of $1.2 million. They operate nine injection molding machines and specialize in custom injection molding, plastic mold making services, and plastic design mold engineering.

Supplier C. Supplier C is a full-service, custom injection molding company started in the late 1980s which specializes in injection molding, insert molding, and micro-molding. They employ over 150 employees and had 2011 sales of roughly $18 million. They believe that their key to success is their focus on the quality of their products, delivered at a fair and reasonable price. Table III provides location, number of employees, and 2011 sales information for suppliers A, B, and C.

Spend with suppliers

Appliance Manufacturer X has a respectable spend with each of the three suppliers being examined within MG 2,300 as shown in Table IV. Spend ranges between 4 and 8 percent of the entire MG spend. The number of parts shipped from each supplier varies considerably. The material price variance experienced by Appliance Manufacturer X for 2011 was favorable for Supplier A, yet unfavorable for Suppliers B and C.

	Location	No. of employees	2011 sales
Supplier A	Tecate, CA	50	$6,000,000
Supplier B	Riverside, CA	11	$1,200,000
Supplier C	Riverside, CA	150	$18,000,000

Table III. Supplier employee and sales information

	2011 spend	Spend % of MG	MPV $ (%)	Qty of parts
Supplier A	$1,097,497	8.4	−5.4	192,081,824
Supplier B	$548,501	4.2	7.1	2,550,821
Supplier C	$558,198	4.3	6.1	1,569,817

Table IV. Supplier spend and material price variance (MPV) information

Quality of suppliers

The overall supplier performance evaluation scorecard as determined by Appliance Manufacturer X, lists all three suppliers as having good quality, delivery, and business process compliance scores as shown in Table V. Supplier A ships smaller parts in very high volumes. Suppliers B and C ship medium-sized parts in average volumes. Despite having many more opportunities for defects and delivery issues, Supplier A has the lowest number of defects and one of the best on-time delivery rates.

Financial risk of suppliers

All three suppliers are privately owned companies. In order to get a better feel of each of their financial situations, a Dunn and Bradstreet small business credit report was pulled for each respective company as shown in Table VI. Variables such as commercial credit score, small business risk insight score, and Paydex score were all closely examined. Suppliers A and C both returned good scores with little concern for financial risk. However, Supplier B's scores were somewhat lower than expected, to the point that sending more business to Supplier B could be a concern.

Supplier company information

The overall size of each supplier, their number of employees, and their 2011 sales revenue were all analyzed to ensure that Appliance Manufacturer X was not currently making up too much of a current suppliers sales revenue. All three suppliers were located close to Appliance Manufacturer X's plant. Supplier B was once again a concern as the manufacturer's spend made up almost 50 percent of Supplier B's sales.

DCA analysis

As mentioned above, the DCA analysis is perhaps one of the most important building blocks of supplier management, because all of the future analysis is based on the weighted relative importance of factors affecting the future success of the company. Fortunately, due to the size and progressive nature of Appliance Manufacturer X, a thorough DCA style analysis had already been completed. After confirming the results with their upper management, the relative weighting scale can be seen in Table VII. The higher the weighted percentage, the more important the variable is to the company.

Table V.
Supplier parts per million (PPM), quality score (SPE), and SKU information

	PPM	SPE	SKU's
Supplier A	0	93.9	92
Supplier B	43	93.5	59
Supplier C	1154	91.5	33

Table VI.
Supplier commercial credit score (CCS), Dunn and Bradstreet (SBRI) and Paydex information

	CCS	SBRI	Paydex
Supplier A	469	858	78
Supplier B	372	906	60
Supplier C	477	864	73

TCO MG analysis

After taking the important weighting information gained from the DCA analysis above, we were able to combine both quantitative and qualitative information together to attain a better understanding of the total costs associated with each part and its associated supplier. Through the use of Appliance Manufacturer X's SAP system and our modified Microsoft Excel® TCO template, we were able to run each suppliers' pertinent information through our program for benchmarking and comparison.

Scorecard

After performing the DCA and TCO analysis, we then created a supplier scorecard (shown in Table VIII) aligning all of the aspects that the manufacturer deemed important in their suppliers. This scorecard was created for quick analysis and benchmarking for each supplier in the injection molding plastics group. Along the top are the important variables from the DCA analysis with their corresponding weights. Along the left side are the three suppliers that we analyzed earlier. Once all of the corresponding weights have been entered, a total supplier score out of 5 can be seen on the right.

As we can see the numbers on the right correspond to Suppliers A, B, and C. The scores are also color coordinated based on the needs and desires of what Appliance Manufacturer X deems necessary from its suppliers. The final rating scale and the corresponding alert level can be seen in Table IX.

Suppliers in the green are considered to be in good standing, suppliers in the yellow should be monitored and encouraged to increase their rating, while suppliers in the red or black should be evaluated for probation or possible elimination. These scorecards should be consistently evaluated together with Appliance Manufacturer X and each supplier with special emphasis given to transparency on the rating scale and cooperative long-term relationships.

Variable	Weight (%)
TCO	30
Quality	25
Delivery	20
Financial security	15
Innovation/communication	10

Table VII.
Discrete choice analysis weighting

	TCO 30%	Quality 25%	Delivery 20%	Financial security 15%	Innovation communication 10%	100%
Supplier A	5	4	5	5	3	4.55
Supplier B	3	4	5	2	3	3.50
Supplier C	3	4	5	5	4	4.05

Note: no concern; slight concern; cause for concern

Table VIII.
Standard supplier scorecard

Study limitations

Supplier management is an ongoing process that necessitates constant attention, not just when problems arise. Despite making a conscious effort to recognize the supplier base, various limitations do exist within supplier management. From a macro viewpoint, both DCA and TCO can be very difficult to assess, and therefore become quite subjective to manufacturer and supplier alike. It is for this reason that transparency among manufacturers and suppliers is so important. Without transparency, areas for improvement will go unnoticed and unrecognized.

The relative weights attributed to the features (cost, quality, etc.) that management looks for in a supplier (DCA) can vary across business units. Features that are important for one business unit and thus weighted heavily, may not be as important to another business unit. The result of this could become mixed messages to the supplier. On one hand, the supplier may be told they are doing a wonderful job with implementing cost savings to the manufacturer, but on the other hand they may be told that quality is suffering and the supplier is at risk for elimination. Communication across company business units will help to reduce mixed messages to suppliers, but this is easier in theory than it is in practice.

Implementing a TCO model within a business can be timely, costly, and if not maintained can have adverse impacts to the business. The TCO model gives the firm a snapshot of the supplier at a specific point in time. This snapshot goes beyond price to consider all costs over the supplier's history with the manufacturing firm. These costs may include administration, communication, and maintenance. If these inputs are not updated regularly, data will become outdated and unreliable when using TCO as a basis of supplier comparison.

Costs associated with the TCO model are often times hard to specify and attribute to a supplier. It is for this reason that they are considered subjective. Quality can be measured in defects, while delivery can be measured in number of orders received on time. Both have quantifiable data that can be attributed to the supplier. TCO combines subjective qualitative data with quantitative data in order to rate or rank a supplier. Qualitative data must be able to be justified across company business units in order to be effective. If it is not, then the company runs the risk of giving a supplier a TCO rating that is not deserved.

Managerial implications

When considering supplier management initiatives, there are various effects that management must be aware of. The first is that processes associated with supplier management must be both continual and up-to-date. Data must be specific and timely in order to be effective. If it is not, it loses credibility and relevance. Management must be willing to spend the time and money required to maintain supplier management systems so that they contain the best information available.

Rating	Level
> 4.5	No concern
4 < *X* > 4.5	Slight concern
3 < *X* > 4	Cause for concern
< 3	concerned

Table IX.
Supplier rating scale

Another issue that management must be willing to accept is the trade-offs associated with various features (cost, quality, etc.) of suppliers. It is a rare occurrence where a firm finds a supplier that does everything right and meets all of their needs. Instead management must be willing to accept the fact that sometimes cost or delivery must be sacrificed in order to meet the needs of innovation. Choosing an optimal supplier and eliminating inferior suppliers are necessary decisions for a manufacturing firm to grow and develop efficiently.

Recommendations for future work

Within the business issue of supplier management, whether being maintenance or consolidation, there exist the capability for further work and examination. The first recommendation for future work would be for estimating the possible ROI of implementing a supplier management system. Obviously, the costs and amount of time are extremely demanding, and a total analysis of the return and how long it might take would be extremely useful to a company of any size. Another recommendation for future work could be determining what internal capabilities and external capabilities a manufacturer needs to be able to carry out a massive and time-consuming supplier management system. This recommendation would be extremely helpful in deciding whether a firm needs to look into hiring an external consultant for support. Lastly, a final recommendation might include a final concluding analysis ten years after implementation. How effective was the supplier management system and what, if any, changes should have been made along the way?

Conclusions

Developing long-term relationships with suppliers starts with identifying the needs of the company through their strategy and long-term goals. A DCA is good tool to utilize to determine the required emphasis that the company needs to put on various features in their supplier relationship. The vast majority of a company's suppliers will not be able to meet all the needs of a company. For this reason it is important to consider trade-offs when choosing suppliers to determine the best value-added features.

As supply chains have become more global, and emphasis has been put on becoming leaner, companies have begun to consider the TCO associated with their products. Costs such as administration, transportation, and product failure can now be factored into the costs of working with a supplier. Together with a DCA, a scorecard can be developed to determine optimal suppliers for the company. This cannot only help a company to maintain their current supply base, but aid in eliminating suppliers that the company determines does not add value to their product or overall strategy.

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