Abstract Number: 007-0144
Abstract Title: Supplier Selection with Component Commonality

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POMS 18th Annual Conference
Dallas, Texas, U.S.A.
May 4 to May 7, 2007

SUPPLIER SELECTION WITH COMPONENT COMMONALITY

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ABSTRACT

Hayes and Wheelwright (1984,pp 208-227) introduce the Product-Process Matrix and theorize that a certain pattern of process decisions based on product characteristics will result in superior operating performance. Hill (2000, pp 145-157) presents a tool called product profiling which is used to help managers make process choice decisions according to the theory prescribed by Hayes and Wheelwright. While other authors have modified and used this tool to support a variety of decisions other than process choice, it has not been shown to be appropriate for use in supplier selection. Supplier selection is a more complex process that cannot be captured in a simple profile. Research shows that when managers are confronted by such complex decision problems they rely on intuition rather than any defensible methodology (Liberatore and Miller, 1998). This paper will highlight some of the inherent difficulty of ranking suppliers and introduce the use of the Analytic Hierarchy Process (Saaty 1994) as a mechanism for dealing with this highly complex scoring problem.

INTRODUCTION

Whether attempting to measure the performance of an individual, a process, a business unit, or a potential supplier, the complex interaction between potentially conflicting dimensions of performance make such measurements extremely complex. When supplier performance must be measured in relationship to multiple end items—items that compete based on different competitive priorities—the task becomes increasingly intractable.

Supplier selection decisions, like all other management decisions, should be aligned with the markets in which the firm is competing. Hill (2000, pp 35-42) presents the concepts of order winners and order qualifiers for use in describing the market in a way that is meaningful for making manufacturing decisions. Hill also presents product profiling as a visual tool for relating order winners and order qualifiers to the process selection decision. Product profiling is a simple and intuitive tool that has been used and modified by other authors for various uses since its creation. Unfortunately, it is not well suited to the supplier selection process for reasons that will be discussed below. The purpose of this article is to show why profiling in its traditional form is not an appropriate tool for supplier selection and present another more appropriate tool for this type of decision.

In this article we focus on the measurement of component supplier performance for the purpose of supplier selection in an environment where the component to be supplied is used in multiple product families competing in different markets. Simply put, we will provide a methodology for choosing the best supplier of a component for use in multiple products with differing component requirements and competitive environments.

PRODUCT PROFILING

Hill (2000, p. 35) defines order qualifiers as those product (or service) characteristics that must be present in order for the offering to be acceptable to the customer. Using order qualifiers allow a customer to reduce the set of potential purchases down to a reasonably sized subset for further consideration. For example, when buying a family car, a customer may decide to dismiss any vehicle that does not have room for five passengers and at least a six-cylinder engine. In this case, the ability to accommodate five passengers and engine size are two order qualifiers and any vehicle that does not meet both these criteria is removed from further consideration. A customer would have many order qualifiers that act as constraints on the set of potential purchases.

In order to be considered, a product or service has to satisfy all of these constraints. Order winners are the characteristics that are used to select which offering to purchase from within the remaining set after considering the order qualifiers. Continuing the example from above, if the customer has price as a sole order winner then the least expensive vehicle accommodating at least five passengers and having a six-cylinder or larger engine will be purchased. Note that this is not the same as purchasing the cheapest available vehicle. Many less expensive vehicles may be available but each would be thrown out of consideration for violating the customer's order qualifiers.

Hill suggests product profiling as a tool for making decisions that are aligned with the order winners and order qualifiers of the markets being served. In a typical product profile, products are categorized based on aspects of the product, the market and the manufacturing environment and manufacturing infrastructure. These aspects are then matched to the common characteristics of the processes that may be chosen to manufacture them, such as job shops, batch processes, or assembly lines. Typically, the profile will be arranged with each row of a product profile associated with a different aspect of the product, market, manufacturing environment, or infrastructure investment and each column will be associated with the process choices. For example, some of the manufacturing aspects are production volume and process technology. Each of these aspects has a "value" that is most often associated with job shops and with assembly lines. In the above example, a low volume for the production volume aspect is most often associated with job shops and a high volume for production volume is associated with assembly lines whereas the technology aspect value is normally general purpose for job shops and specialized for assembly lines. For batch processes, these aspects take on moderate values between the extremes represented by job shop and assembly line. On each row there is a place for the user to mark whether their current situation for the aspect on that line is most commonly associated with a job shop, batch process, or assembly line process. Ideally, these marks will result in a straight line under one of the process choices, clearly indicating the process choice for that product.

Relevant Aspects		Typical Characteristics of Process Choice				
		Job		Batch	Line	
Product	Range	Wide			X	Narrow
Market	Order Size	Small			X	Large
	Order Winners	Unique Capability			X	Price
Mfg	Technology	General Purpose	X			Specialized
	Flexibility	High	X			Low
	Volume	Low	X			High

Figure 1: EXAMPLE OF PRODUCT PROFILE

Figure 1 is a simple example of a product profile. The firm is attempting to use low price to sell a narrow range of products to customers that normally order in large quantities. In order to accomplish this, they are using highly flexible general-purpose machinery that produces in small batches. The table allows for easy identification of a major mismatch between products, markets and the processes used. The products and markets suggest that an assembly line is the most appropriate method of manufacture for the current product, whereas the current manufacturing environment is a job shop environment. If the firm intends to compete successfully in this market, it should invest in high volume, specialized equipment. If the firm decides to maintain their current manufacturing capabilities, they should seek to widen their product offering and seek customers more interested in unique capabilities, such as superior product quality, and who are less price sensitive. This is a very intuitive and adaptable tool. By changing some of the aspects considered, other authors have modified the basic tool resulting in service profiles as well (Schroeder, 2000; Johansson and Olhager, 2004).

DIFFICULTIES OF SUPPLIER PROFILING

Profiling is of limited use, however, for supplier selection. One reason for this is the relationship between the problem's complexity and the number of end items being considered. When only a single end item is being considered, the problem is rather trivial—select the supplier whose performance most closely matches the market requirements in terms of cost, quality, delivery speed, and service. For instance, if the product competes mainly on price, select the supplier with the lowest cost components, or if the product competes mainly on quality, select the supplier with the highest quality components.

To develop a supplier ranking system that effectively takes into account the complexities present in real-life supplier selection decisions, several issues must be addressed. First, there is the issue of component part commonality. Commonality occurs when multiple end items share components. When the markets in which these end items compete have different order winners and order qualifiers, it becomes less obvious what aspects of supplier performance are most important overall. If end item A competes mainly on price and end item B competes based on its high quality performance, but both contain component X, it is not clear whether component X should be sourced to the low cost supplier or the high quality supplier. Of course there is a chance that one supplier has the highest quality and the lowest price, but this is not always the case. To further complicate the supplier selection, the number of criteria important to the selection may be relatively high. Consider that a company may have several product families competing in different markets where the importance placed on quality, service, delivery and price varies from market to market. In addition, different measures of order-winning characteristics may be available that measure one or some combination of these four dimensions. In order to be effective, the supplier evaluation system must recommend component suppliers in accord with the needs of the customers as expressed by the order winners and qualifiers of the various end items that are made from the components being supplied. Further, the evaluation system must be consistent from one time period to the next as well as from one potential supplier to the next. A simple profile matrix cannot capture this level of complexity. Research shows that managers often have difficulty incorporating the results of subjective measures into the strategic decision-making process because they perceive such measures to be unreliable and resort to intuitive decision-making instead of any defensible methodology (Liberatore and Miller, 1998).

Fortunately, a mechanism for dealing with this type of highly complex scoring problem already exists in a decision science technique known as the Analytic Hierarchy Process or AHP (Saaty 1994). AHP is a widely acclaimed multi-criteria decision-making technique that allows the analyst to grasp a problem of this magnitude. In addition, by using a mathematically rigorous process it offers a measure of internal consistency (Saaty 1996). AHP has become one of the most popular aids to decision-making and is now widely accessible through commercially available software programs (Expert Choice, Inc., 2000; Forman et al., 1983). This paper presents a format for using AHP to produce an internally consistent, comprehensive measure of component supplier performance in the presence of multiple products with component commonality.

CHARACTERISTICS OF AHP

Use of a formal multi-attribute decision analysis process makes it possible to incorporate the myriad elements of a complex multi-level decision into a manageable evaluation system that captures the complexity of the interaction between the elements and provides the degree if internal validity required to assure that ratings are consistent from one instance to the next and from one subject to the next. One such multi-attribute decision analysis process is the Analytic Hierarchy Process, or AHP (Saaty, 1994; Saaty, 1996).

AHP is a widely used decision-making approach developed in the 1970s to aid in solving complex problems (Triantaphyllou & Mann, 1995). It provides the theory and methodology for the modeling of unstructured problems by using the judgment of individuals with a common understanding of the situation (Saaty, 1980). It breaks the decision problem down into small easily understandable parts, organizes these component parts into a hierarchy of levels, and provides a mechanism for evaluating the interrelationships among the components of the hierarchy (Saaty, 1994). Use of AHP requires only pair-wise comparisons allowing inclusion of criteria that are difficult or impossible to quantify in any way except by expressing that one is more important than the other as it relates to a particular application. AHP also allows comparison of factors that may change in time and space, or interact with other factors. AHP is a process designed to facilitate the formalization of multi-criteria decision-making. It allows the decision maker to incorporate both "hard data" and less quantifiable elements such as judgments, feelings, and experiences. AHP has been widely used in a variety of decision-making applications (Saaty 1996).

Using AHP, the decision problem is structured hierarchically from higher-level criteria to lower level sub-criteria. The resulting model is called a value tree or a hierarchy of criteria and objectives. Users of AHP make a series of pair-wise comparisons of these criteria. If the criteria being compared are objective, the numeric values for the criteria are compared. If, however, the criteria are wholly or partially subjective, then the comparisons are made on the basis of relative importance between the two on a scale of one to ten, where one indicates equal importance and ten indicates an overwhelming difference in importance.

APPLYING AHP TO SUPPLIER SELECTION

Using the AHP to structure the ranking of suppliers into a single measure requires the decision maker first structure the problem as a hierarchy. The elements of that hierarchy are then prioritized by responses to questions about the dominance, or importance, of one element over another (Liberatore and Miller 1998). The first, and perhaps most creative, step in the AHP process is structuring the problem as a hierarchy. A useful approach is to start with the goal and decompose it into the most general and easily controlled factors at the simplest or most basic level possible. The decision maker then works back up through the hierarchy starting with the simplest sub-criteria that must be met and combining the sub-criteria into generic higher level criteria until the various measurements are linked in such a way that comparisons between unlike elements are possible (Liberatore and Miller, 1998).

Many possible criteria can be measured or subjectively judged in association with any decision on supplier selection. Abernathy (2001) suggests the measurement design process start with ideal criteria and then compromise from this ideal to develop criteria that can be defined and rated. An example of the types of criteria that may be used in the ranking of potential suppliers is provided in Table 1.

Price Competitiveness	Overall Reputation
Favorable Financing Terms	Confidence in Sales Staff
% On-Time Delivery	Post Purchase Service
% In-Stock Availability	Vendor Flexibility
Delivery Speed	Engineering and Design Services
% Non-Partial Delivery	Technical and Training Offered
Ease of Ordering	Product Reliability
Past Experience with Supplier	Adherence to Specifications
% Error Free Delivery	

Table 1: CRITERIA

Although the number of measures that may be easily considered dramatically increases with use of an AHP software package, it is suggested that the number be limited for other reasons. When the number of measures expands beyond those essential to capture the most important criteria, the added complexity tends to cause the focus of the process to be misdirected from the importance of the criteria being measured to the measurement process itself.

Although every component could be measured for the same criteria, the weight assigned to these criteria will be different for different objectives. If it is determined that the weight of a particular criteria for a given objective is near zero, that criteria should not be considered for that objective. For example the appearance of a particular component might be a criteria. For one end use this criteria might be important and for another it might be irrelevant. A group of key stakeholders, including individuals at various levels in operations, engineering, marketing, finance and possibly, information technology and human resources should be involved in the design of the evaluation system. Their expertise is needed to refine the hierarchy to match the objectives for each component (Olveira, 2001).

At this point, several words of caution are in order. As the number of criteria to be compared increase, the number of pair-wise comparisons necessary to rank them rapidly becomes unwieldy. In addition, it is not only necessary that the comparisons rank one of each pair of choices as more important than the other, a determination must be made as to what degree one is more important. This may be accomplished a number of ways, including calculation with a hand-held calculator, spreadsheet software, or math software. However, special purpose AHP software is available to facilitate the comparison and ranking operations of the AHP as well as providing the numeric solution. These software packages make it possible to easily manipulate a large number of variables by keeping track of comparisons, rankings, and weights. They also provide measures of the consistency of the judgments and allow for sensitivity analyses to be performed.

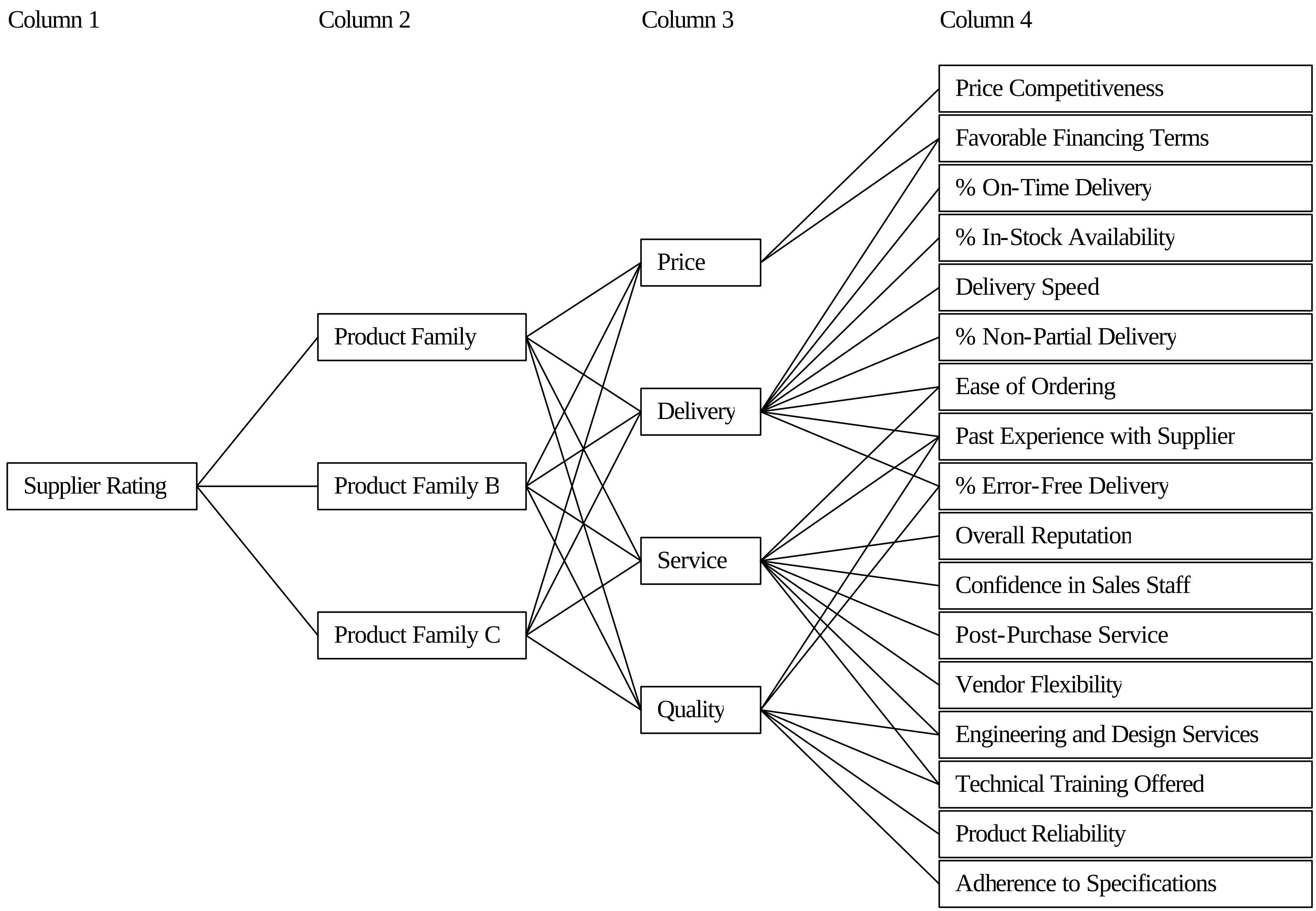
The balance of this paper provides an example of supplier selection for one hypothetical component that is used in three different end products. The selection is developed using AHP. What follows is a detailed example of use of AHP to link the characteristics of the component to the criteria developed by different functions within the company. A team brought together for this purpose and consisting of various key stakeholders in the organization would make almost all of the decisions made in this section. Throughout the example, these decisions are made concerning one specific hypothetical component and made by the authors for illustrative purposes only. Calculations for this example were done using Web-HIPRE, a publicly available Web based software package provided by the Systems Analysis Laboratory of Helsinki University of Technology (Web-HIPRE, 1998). The reader should keep in mind that although one particular software program was used in this example, the same process might be accomplished by hand or using other software, and that the illustration would be equally valid.

MECHANICS OF THE PROCESS

The first step of using AHP for a decision process is to construct a hierarchy for the process. In this example the first level of the hierarchy, the goal of the AHP, is developing a ranking or rating for the supplier of a component. This ranking is used for comparison to determine which supplier best fits the criteria necessary for various end uses. The second level follows and is simply a list of the product families that are end uses for which the component is chosen. Each of the product families depicted in this example competes in a different market environment. As previously stated, supplier selection should be aligned with the markets in which the firm is competing. Complications arise when different product families using the same component compete in different markets. For example one product family using a component might compete on high quality and another product family using the same component might compete on price. Obviously, the same competitive dimension might be important to different degrees for each product family. The third level of the hierarchy consists of the four primary dimensions upon which the end products compete. These dimensions are quality, service, delivery, and price. The forth and final level consists of all the criteria that are important to the decision. These criteria are measures of the order winning characteristics that make up the competitive dimensions for this company. Each criterion may be a component of either one or multiple dimensions. In this example, seventeen criteria are chosen as important to the decision process. They are the same criteria listed in Table 1 from the previous section.

Once the elements are identified and listed in the software program, they must be connected to depict their relationships. Each column in Figure 2 represents a level of the hierarchy. The second column represents the Product Families that use the component. All of the elements in the second column should be connected to the element in the first column which represents the Supplier Rating. Then the elements in the third column, competitive dimensions, are connected to the product families in the second column. In this example each dimension is important to some extent to all product families, however this need not be the case if some dimensions are completely unimportant to some product families. If a dimension is not important to a product family, simply do not connect the two. The individual criteria in column four are then connected to the competitive dimensions to which they relate.

Figure 2: HIERARCHICAL RELATIONSHIPS



Once these relationships are established, the weighting procedure is performed to compare the importance of each element in its relationship to the other parallel elements. Here parallel refers to two elements in the same column that are attached to the same higher-level element in the column to the left. The user can begin with any relationship in the hierarchy (represented by the lines), but all must be addressed. For example, beginning, in the column four, the user would answer a series of questions concerning which is more important to Quality, Mean Time Between Failure or Engineering and Design. The user would then be prompted to determine how much more important one Criterion is than the other. The user would then go to the next criterion and follow the same process. The user continues doing these simple pair-wise comparisons without regard for other relationships that exist. The user is prompted to complete this comparison process for each pair of elements in the each column of the hierarchy. In other words, working up to the next level of the hierarchy, the user answers the question, "How important is Quality as compared to Service in relationship to Product Family A" and on through each pair-wise comparison in the hierarchy. When this process is complete, the program automatically generates the matrices and eigenvectors needed to generate a supplier rating.

This supplier is being evaluated on the basis of a component that is used in three product families that compete in diverse markets which place different values on the four competitive dimensions. The software leads the user through the process of weighing the relative importance of each of the elements against the other to determine the relative importance that should be placed on each of the measurable Criteria.

The weighting factors for each of the Criteria as generated by the AHP software are displayed on the row with the Criterion under the heading “Weight” in Table 2 in the next section. In this example, Past Experience with this Supplier is associated with Quality, Service and Delivery, but it was not judged equally important to each. Quality was deemed tremendously more important to Product Family A than to Product Family C, but Price was of paramount importance to Product Family C.

There are multiple commercially available or even free software packages that can help with the calculations required to perform AHP (Expert Choice, Inc., 2000; Web-HIPRE, 1998; Forman et al., 1983). However, a small numerical example of how the numbers in Table 2 are generated may be instructive. First a series of matrices are created that capture the relative importance of each set of parallel elements. For example, one such matrix would be used to determine the relative importance of favorable financing terms and price competitiveness when considering how a product competes based on price.

All of the preference matrices generated will be square with a row and a column corresponding to each of the parallel elements being compared. Each matrix will also have a value of one in every element along the main diagonal representing the fact that each element is equal in importance to itself. The decision maker must generate the values for the elements above the diagonal. Every element below the diagonal is the reciprocal of the mirroring element above the diagonal. Mathematically this can be expressed as $x_{ij} = 1/ x_{ji}$. Consider the matrix containing favorable financing terms and price competitiveness. Only one element must be determined; $x_{1,2}$ where price competitiveness has been arbitrarily associated with the first row and column and favorable financing terms has been associated with the second row and column.

Suppose that the manager decides that price competitiveness is half again as important as favorable financing terms when determining how a product competes based on price. This is captured in the matrix by entering 1.5 at the intersection of the first row (price competitiveness) and second column (favorable financing terms). Because there are only two elements to be compared, this is the only decision required for this matrix. The preference matrix generated is $\begin{bmatrix} 1 & 1.5 \\ 2/3 & 1 \end{bmatrix}$.

The relative importance rating is then given by the eigenvector associated with the largest eigenvalue of the matrix. The eigenvalues of the previous matrix are the values of lambda for which the determinant of $\begin{bmatrix} 1-\lambda & 1.5 \\ 2/3 & 1-\lambda \end{bmatrix}$ is equal to zero. Setting the determinant of this matrix equal to zero yields $(1-\lambda)^2 - 1 = 0$ or $\lambda(\lambda - 2) = 0$ which means the eigenvalues are zero and 2. Fortunately, the eigenvalue calculations required in AHP are always somewhat easier and often much easier than the calculations that may be required in general to calculate eigenvalues due to the structure of the matrices involved.

Given the preference matrix and the principle eigenvalue, 2, the principle eigenvector is any vector for which $\begin{bmatrix} 1 & 1.5 \\ 2/3 & 1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = 2\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ is true. Without matrices, this can be expressed by the two equations $x_1 + 1.5x_2 = 2x_1$ and $\frac{2x_1}{3} + x_2 = 2x_2$. As is the case any time an eigenvector is calculated, there are an infinite number of equally valid solutions to the simultaneous equations. One solution is x_1 equals one and x_2 equals three halves. The individual values contained in the eigenvector are not important, only the ratio of the numbers. This is because multiplying or dividing every element of a vector by the same number will not change the ratio of the numbers and thus not change the "direction" of the vector. The principle eigenvector associated with each matrix must be determined.

Eigenvectors are often normalized so that the magnitude of the vector is equal to one. This is accomplished by dividing every element by the same constant where the constant is chosen so that the resulting sum of squared elements is equal to one. In AHP, it is more useful to normalize the eigenvectors in a different manner. Here, normalization occurs in two steps. In the first step each eigenvector is normalized individually so that the sum of elements, as opposed to the sum of squared elements, is equal to one. In the second step all of the eigenvectors in a single column are normalized together so that all of the elements in a column sum to one. In the first step, each element in an eigenvector must be divided by the sum of all of the elements in that vector. This is repeated for each eigenvector.In the second step of the normalization process a single composite vector is created in each column with the exception of the leftmost column, which contains only one element. The second column is already normalized because there is only one vector in the column. Suppose the eigenvector in this column is $\begin{bmatrix} 0.35 \\ 0.40 \\ 0.25 \end{bmatrix}$. There is one element in this vector for each of the vectors in the third column. Each vector in the third column should be multiplied by the appropriate value from this vector and the results added together. Thus, 0.35 should be multiplied by each value in the vector that compares the relative importance of price, delivery, service and quality as they relate to the first product family. A similar calculation is performed for each of the other product families and the results added together. The resulting vector corresponds to the relative importance of price, delivery, service and quality as they relate to supplier selection when all three product families are considered. This process is repeated for the last column and the result is the relative importance of each of the lowest level criteria as they relate to supplier selection when all product families are considered.

Generation of these values is the major purpose of the AHP method. The relative weights are based on a dependable, mathematically rigorous, quantitative approach that overcomes the complexities and difficulties inherent in measuring unlike elements and delivers a system that can be trusted and relied upon by managers (Saaty, 1996). For a more complete discussion of the mathematical process and theory underlying AHP see Saaty (1994). Harker and Vargas (1987) provide a discussion of the inherent theoretical strengths and weaknesses of AHP.

USING THE RESULTS

This process is, admittedly, time consuming. However, once this process is complete a supplier-ranking template can be constructed to evaluate each supplier and the process would not need to be repeated unless there were substantive changes in the Criteria upon which the process is based.

The weights as generated for each of the individual criteria have been incorporated into Table 2 as the weight column. In addition to the weight of each Criterion, this table includes a place for the score this supplier earned on each of the criteria and goal values representing a standard of excellence for the measure. For instance if the supplier is being scored on a criterion on a scale of 1 to 10 where 10 is the highest evaluation for the criterion, then the goal value would be 10. On the other hand, for another criterion that has a quantitatively observable outcome, such as a defect rate or Percent On-Time Delivery, the goal value might be 0 (number of defects) or 100% (percentage on time). This goal would be compared with the actual results for that criterion. In order to determine the index for each criterion, the difference between the achieved value and the goal value is determined. This is then divided by the goal value and one is added. This number times 100 is multiplied by the Criterion Weight to arrive at the Weighted Score. Mathematically, this is $\text{Index} = 100 * \left(\frac{(\text{actual} - \text{goal})}{\text{goal}} + 1 \right) *$ Criterion Weight. In situations where the object is a low goal number rather than a high goal number the following alterative equation is necessary:

$\text{Index} = 100 * \left(\frac{(\text{goal} - \text{actual})}{100 - \text{goal}} + 1 \right) *$ Criterion Weight. The Weighted Score for each criterion is then summed to provide the total score for the subject. If the subject accomplishes 100% of all set goals, the score is 100.

The labor-intensive task of constructing this goal template must be done only once. A spreadsheet program was used to construct the template reproduced in Table 2 and subsequent evaluations would require only that the subject's score on individual criterion be inserted to calculate the new weighted score.

Criterion	Measure	Goal	Actual	Raw Score	Weight	Weighted Score
Price Competitiveness	Evaluation Team Judgment	10	8	80	0.028	2.24
Favorable Financing Terms	Evaluation Team Judgment	10	6	60	0.037	2.22
% On-Time Delivery	Historical Percentage	100%	97%	97	0.057	5.53
% In-Stock Availability	Historical Percentage	100%	65%	65	0.052	3.38
Delivery Speed	Historical Average Days	3	5	33	0.035	1.17
% Non-Partial Delivery	Historical Percentage	100%	85%	85	0.053	4.51
Ease of Ordering	Evaluation Team Judgment	10	6	60	0.039	2.34
Past Experience with Supplier	Evaluation Team Judgment	10	7	70	0.110	7.70
% Error Free Delivery	Actual or Estimated Results	100%	95%	95	0.022	2.09
Overall Reputation	Evaluation Team Judgment	10	8	80	0.135	10.80
Confidence in Sales Staff	Evaluation Team Judgment	10	8	80	0.078	6.24
Post Purchase Service	Evaluation Team Judgment	10	9	90	0.027	2.43
Vendor Flexibility	Evaluation Team Judgment	10	8	80	0.035	2.80
Engineering and Design Services	Evaluation Team Judgment	10	7	70	0.030	2.10
Technical and Training Offered	Evaluation Team Judgment	10	4	40	0.037	1.48
Product Reliability	Historical MTBF (months)	36	22	61	0.201	12.28
Adherence to Specifications	Historical Cpk	2	1.7	85	0.024	2.04
Supplier Rating						**71.34**

Table 2: SUPPLIER RATING CALCULATION

INTERPRETING THE RESULTS

In this example, the supplier rating was around 72, which would indicate that the supplier failed to reach the ideal level on a significant number of criteria. However, remember the purpose of this process it to choose the best supplier for multi-product components. In this case, the individual score is of little significance. Its importance is in comparison with other suppliers, which have been subjected to the same evaluation process. Use of this process and a carefully chosen, impartial evaluation team provides a choice process that is free of undue prejudice and based on the actual complex interaction of criteria that is too complex for processing by human judgment without resorting to over-simplistic rules of thumb or ambiguous hunches.

DISCUSSION

Although this example illustrated the performance evaluation for single supplier the same process can easily provide ratings for a wide variety of uses. Use of AHP in the evaluation process provides the requisite level of theoretical rigor and internal consistency to assure reliability of the measure. In addition, even though the process is somewhat involved, it is doubtful that it would require more time or consideration than using a less meaningful calculation. This is particularly true when considering that the process need not be repeated each time a new ranking is required but only when there is a change to the importance of the competitive priorities or some other strategic shift.

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