Evaluating buyer-supplier relationships for international procurement

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Abstract

Three popular methods for supplier evaluation appear in the literature. However, these techniques have a number of disadvantages associated with them and an alternative approach is suggested which applies dimensional analysis to selecting prospective suppliers. An International Purchasing Office (IPO) is applying dimensional analysis to evaluating suppliers. The paper discusses the benefits of this approach over the traditional assessment methods and how it can be used to measure supplier and buyer performance.

Keywords

Supply chain management, performance measurement, global procurement.

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1 INTRODUCTION

Manufacturing firms in the 1990s are experiencing domestic and foreign competition at levels greater than ever before. Firms that excel must implement strategies to achieve cost reduction, continual quality improvement, increased customer service, delivery improvement, and reduced concept-to-market product cycle time. Global sourcing is seen as one of the key strategies crucial to achieving this aim Frear et al (1992). Consequently, many multinationals and other large companies have adopted this approach in an attempt to enhance their competitive position.

As product development lead times diminish and customers require closer collaboration with suppliers it is necessary to consider those factors which influence buyer/supplier relationships in an international context. As part of this process it is important to establish appropriate criteria for assessing vendor performance. At the same time customer attributes need to be considered as well, since either party, supplier or buyer, can have a positive or negative impact on the success of the relationship. This paper will examine an approach which has been developed in an IPO, based in Hong Kong, to monitoring and evaluating the relationship between suppliers located in China and a multinational electronics company. As a first step it is necessary to review the various techniques used to assess suppliers before going on to look at the approach adopted by the IPO.

2 SUPPLIER EVALUATION METHODOLOGIES

There are a number of methodologies which have been developed to assist in evaluating prospective suppliers. In the literature, three main methods are indicated: categorical, weighted point and cost ratio (Dobler et al, 1990).

The simplest method is the categorical method. With this approach, the customer assigns a preferred, satisfactory, or neutral rating for each of the attributes on which the supplier is being evaluated. The ratings are determined by agreement between the various purchasing representatives in the organisation and a total is obtained for each supplier. The supplier with the maximum score is then selected. For example, a rating score of two preferred, one unsatisfactory and two neutral would give a score of one positive. However, one of the problems with this approach is that the attributes are given equal weightings, which clearly is not the case in practice. In addition, the process is mainly intuitive and does not have the same precision as that provided by a more quantitative approach.

The most frequently used method of evaluation is the weighted point method. With this technique various factors that are important to customers are weighted according to their relative importance. Each weight is then multiplied by a

performance score determined by the customer. Finally, these products are totaled to determine a final rating for each supplier and the vendor with the highest score is chosen. The main disadvantage of this approach is that the performance measures used for the various criteria must apply standardised units.

The cost ratio approach is a more complicated technique to evaluating suppliers. Standard cost analysis is applied and cost ratios for quality, delivery and customer service factors are used to calculate a net adjusted cost for each vendor. If a supplier has a quality cost ratio of 2%, a delivery cost ratio of 4% and a service cost ratio of -2%, the total cost adjustment would be 4%. For a quoted price of \$600, the net adjusted cost is \$624 ($600 + (600 \times 0.04)$). The supplier with the lowest net adjusted cost would then be the preferred supplier. The cost ratio approach is not widely used in industry and is complex, requiring a comprehensive cost-accounting system, which is usually only found in larger companies. The approach, like the weighted-point method, also has the disadvantage that performance measures (cost ratios) are artificially expressed in the same units.

2.1 Dimensional analysis method

Willis et al (1993) have proposed an innovative technique to supplier evaluation which attempts to resolve some of the difficulties highlighted with the other methodologies described, namely, they do not provide a generally applicable methodology for combining multiple criteria or attributes into a single measure of supplier performance. They suggest that one way of resolving this problem is to apply the mathematical technique of dimensional analysis. Dimensional analysis combines several criteria of different dimensions and relative importance into a single dimensionless entity for each supplier. The criteria may be expressed in different dimensions, the only restriction is that they are assigned ratio scale values. The dimensional analysis model applied by Willis et al is:

$$VPI = \sqrt[n]{\prod_{i=1}^n \left(\frac{X_i}{Y_i} \right)^{w_i}} \quad (1)$$

Where: VPI = vendor performance index; X_i = performance criterion score for supplier X ; Y_i = "standard" performance criterion; $i = 1, 2, \dots, \text{nth criterion}$; w_i

= weight (relative importance) assigned to criterion i ; $w = \sum_{i=1}^n |w_i|$.

Both the weights (w_i) and the criteria measures must reflect ratio scale values. For example, weights of 6, 3, -1 for three criteria would indicate that the first criterion is twice as important as the second and six times as important as the third. Where a criterion has an adverse effect, a negative weight must be assigned. Table 1 illustrates the application of the dimensional analysis model to a purchasing evaluation process. The weights indicate, for example, that the company feels that quality is twice as important as delivery. It should be noted that the attributes for price and delivery have a negative weight. A higher price is less desirable, thus a negative sign is used. The model combines several different criteria into a single performance measure. Price is stated in dollars, quality as a percentage and delivery in days. Applying equation (1) the vendor performance index for the supplier is 0.89 and is found by:

$$VPI = 14 \sqrt[4]{\left(\frac{.98}{1.00}\right)^6 \cdot \left(\frac{\$29.00}{\$27.00}\right)^{-5} \cdot \left(\frac{3}{2}\right)^{-3}}$$

Using this approach other suppliers can be evaluated and the one with the highest vendor performance index is selected as the preferred supplier.

Table 1 Applying the dimensional analysis methodology

Criteria	Supplier	Standard	Weights
Quality (%)	98	100	6
Price (\$)	29	27	-5
Delivery (days)	3	2	-3

3 DIMENSIONAL ANALYSIS CASE STUDY

The case study examines the application of the dimensional analysis methodology within an IPO located in Hong Kong and represents the various business units of a multinational electronics company (for confidentiality purposes the company will be referred to as Electron). The methodology described by Willis et al (1993) offers a general approach to conducting vendor appraisal and provides a top level view of some of the key factors to be considered in the decision making process. The case study expands on the original model proposed by Willis et al to investigate its applicability in an international sourcing context and provide a means of evaluating the contribution of the buyer and supplier to the process.

The first stage in developing the dimensional analysis model was to determine the key factors which reflect the international nature of the procurement process

and the need to have a flexible, dynamic response to customer demands. The benefits of foreign sourcing (for example, superior quality and access to technology) often outweigh its disadvantages, even in a JIT environment. Frear et al (1992), Vickery (1989) and Carter et al (1988) identified a number of important criteria which enhanced the ability of an organisation to source internationally. These included the following:

- improved logistical planning and scheduling by the buyer to increase the feasibility of more frequent deliveries from foreign suppliers;
- enhancing the planning and scheduling controls which provide for stable production schedules;
- improved communication between buyers and suppliers;
- developing a sole source, partnership relationship with foreign suppliers.

As a result of discussions with senior purchasing managers and the literature review, key criteria were identified and are listed in Table 2 (column 1). In order to determine the relative importance of these factors, a postal survey was conducted of twenty two IPOs located in Hong Kong which are responsible for the procurement of manufacturing components (Yeung, 1995). The questionnaire was sent to a named senior manager in each of the organisations. The questionnaire asked each manager to consider a hypothetical scenario in which a buyer was sourcing on an international basis. Each attribute was assessed on a Likert scale with 1 - "not required" to 5 - "essential". Nine of the IPOs responded to the questionnaire giving an overall response rate of 45%. Table 2 (column 2) indicates the average importance weighting of each attribute in the purchasing decision from the survey responses.

In order to illustrate the application of the dimensional analysis approach, the technique was applied to evaluating two companies who manufacture printed circuit boards for Electron. Supplier A is based in the PRC and supplier B in Hong Kong. Table 2 provides a summary of the results for the two suppliers, the IPO and the customer. Each criteria was compared against the standard performance metrics established by the customer and the IPO and equation (1) applied to determining four performance indices: supplier, IPO, buyer and an overall group performance index.

The results indicate that Group B has a higher performance index (0.83) than Group A (0.54). However, what is more interesting is the detail behind these aggregate figures. For supplier A, the performance index was 0.56 and for supplier B a value of 0.86 was obtained. Clearly, the initial conclusion would be that the performance of supplier B in meeting the customer requirements is superior to A. In terms of the attributes on which supplier A is being measured, in nearly all cases, the performance is weaker than that of supplier B. For example, delivery performance (45%) and quality (65%) were particularly poor. However,

Table 2 Performance evaluation of two buyer-supplier groups

SUPPLIER	RIW	Performance Criteria	Group A - (Supplier A)		Group B - (Supplier B)	
			Requirement	Performance	Requirement	Performance
Accuracy of MRP	-4.4	% of time material shortages (scale 1 to 5)	10%	25%	10%	11%
Financial stability of supplier	3.8	dollar value (\$)	5	3	5	3
Price	-4	(scale 1 to 5)	70	75	70	85
Pro-active design/process improvement	4.1	(scale 1 to 5)	5	2	5	4
Prompt response to order changes	4.4	(scale 1 to 5)	5	2	5	4
Prompt response to engineering changes	4.4	(scale 1 to 5)	5	2	5	4
Staging buffer materials at supplier's plant	3.6	(No =1, Yes =2)	2	2	2	2
Supplier delivery performance	4.8	% on time	95%	45%	95%	90%
Supplier quality performance	4.7	% of acceptance	100%	65%	100%	98%
Use of EDI	3.2	(No =1, Yes =2)	2	2	2	2
				PI = 0.56		PI = 0.86
BUYER						
Appointment of international freight forwarder	4.3	(No =1, Yes =2)	2	2	2	2
Availability of order forecast/delivery plan	4.9	(scale 1 to 5)	5	2	5	3
Custom pre-clearance before arrival of goods	3.8	(No =1, Yes =2)	2	2	2	2
Early involvement of supplier	4.1	(scale 1 to 5)	5	1	5	4
Minimal number of engineering changes	-3.8	no. of times per quarter	2	3	2	2
Minimal number of purchase order changes	-3.8	no. of times per quarter	2	13	2	1
Prompt payment of purchase order	3.7	(No =1, Yes =2)	2	2	2	2
Stable production master schedule	4.4	(scale 1 to 5)	5	2	5	4
Strategy for partnership development	4.5	(scale 1 to 5)	5	2	5	4
Approval of first article samples	3.9	(No =1, Yes =2)	2	2	2	2
Visits to supplier's plant	3.8	no. of times per quarter	3	3	3	2
				PI = 0.53		PI = 0.81
				Overall PI = 0.54		Overall PI = 0.83

RIW = Relative Importance Weight

PI = Performance Index

closer investigation indicates that the buyer performance measurement was only 0.53 for supplier A, whilst a value of 0.81 was obtained for supplier B. This suggests that one of the major problems for supplier A is the lack of support from the customer when compared to that given to supplier B. In fact, it could be argued that the customer is adopting a collaborative relationship with supplier B, compared to the traditional adversarial relationship with supplier A.

4 DISCUSSION AND CONCLUSIONS

It is apparent that companies are having to manage in an era of global competition, which is forcing many firms to rethink their approach to supply chain management. International sourcing is becoming increasingly popular in order to take advantage of such factors as cost, quality, technology and delivery improvements which overseas suppliers can provide. Consequently, it is important to evaluate suppliers according to criteria which reflect the international aspect of the sourcing decision.

The dimensional analysis model provides a number of distinct advantages over the traditional methods to supplier evaluation. The most important advantage of the model is that it is not necessary to state the performance measures in the same units. Performance can be measured in any unit, such as monetary, percentages and days. Without having to force a standardised rating for the attribute, the dimensional analysis approach is less subjective than the previous methods proposed.

A successful purchasing programme cannot be carried out unless cooperative buyer/supplier relationships are maintained. Too often the supplier is blamed for not meeting the expectations of the buyer. However, in certain cases some of the responsibility for the poor performance of the supplier may be due to the inability or lack of motivation of the buyer in ensuring the success of the relationship. The dimensional analysis approach provides a tool for assessing the contribution of both buyer and supplier organisations. The performance index scores calculated can then be used as a means of enhancing and developing cooperation along the value chain by identifying relevant areas for improvement.

It is widely acknowledged that achieving global competitiveness requires effective management of the productive and material resources of the organisation and its suppliers. In their pursuit to achieve sustainable competitive advantage in the global marketplace, organisations are increasingly viewing purchasing not only as an infrastructural or support function, but as a strategic weapon. True global sourcing represents one method that can be used to obtain the world class performance levels that are needed to meet the challenges of the 1990s. The evaluation process described in this paper illustrates one methodology by which buyer and suppliers can develop closer cooperation and facilitate the achievement

of enhanced levels of performance.

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