EPRA INTERNATIONAL JOURNAL OF
ECONOMIC AND BUSINESS REVIEW

Online Journal ISSN : 2347 - 9671 www . epratrust.com

March 2014 Vol - 2 Issue- 3

COMPARISON OF SUPPLIERS AND SELECTING THE BEST SUPPLIER IN SUPPLY CHAIN MANAGEMENT-A CASE STUDY ON JUTE INDUSTRY

Md Asadullah Khan*& Syed Anwarul Islam**

**Sr. Executive in Production Planning, TNS Buttons (BD) Ltd, AEPZ Narayangonj, Dhaka, Bangladesh.*

***Asst. Manager in Planning, Hatil Complex Ltd. Muslimtek, Zirani Bazar, Savar, Dhaka, , Bangladesh.*

ABSTRACT

Supply chain consists of some identities that perform the selection of raw materials, convert this into finished goods and distribute these items by whole seller to customer. Supplier selection process for supply chain management (SCM) and ISO 9001 quality management system environments is considered. Determining suitable suppliers in the supply chain has become a key strategic consideration. However, the nature of these decisions is usually complex and unstructured. This paper reviews supplier selection by using weighted linear program. To get the raw materials in a lowest price is not the right supplier in every time. Such decisions entail the selection of individual suppliers to employ and the determination of order quantities to be placed with the selected suppliers. This is an innovation to resolve any ambiguity in choosing suppliers. This model has been tried in the suppliers selected in a competitive environment and according to all desired standards of quality and quantity. This paper mainly focused on the selection of supplier of a jute industry.

KEYWORDS: Supplier selection, supply chain management (SCM), weighted linear program.

1. INTRODUCTION

Now a day's companies are trying to get their raw materials of lower cost and on time with a good quality. So it is very important for all companies to have a good relationship with some reliable supplier. Supplier selection is one of the primary concerns on production planning and control (Khodadadzadeh & Sadjadi, 2013). A good supplier could reduce product interruption, increase the quality of the final product and provide better customer satisfaction (Mohammadshahi, 2013). According to Phil Crosby, quality specialist, a major portion of most firms' quality problems is due to weak selection of suppliers. During the old days, many production managers were looking for cheap contracts but during the past two decades, it is recommended to first make an assessment on different suppliers and choose only the ones with high quality characteristics.

Raw material cost is the major part of products final cost some times it is equal to the products 70% cost. So to run the business smoothly it is needed to identify the best supplier and to make the supply chain more strong. The objective of this paper is to select the best vendor and supplier, here specially focus on a jute industry where the raw materials should be jute which is supplied by the various suppliers from various regions.

2. LITERATURE REVIEW

The supplier selection problem has received considerable attention in academic research and literature. Early in 1960s, Dickson identified 23 criteria that ought to be considered by purchasing personnel in evaluating suppliers [6]. A latter review by Weber et al. [12] reported that well over half of 74 research papers reviewed addressedthe supplier selection problem with multiple criteria. Another comprehensive review by De Boer et al. [5] discussed a framework for supplier selection. The framework covers different phases of the supplier selection process, including pre-qualification, formulation of criteria, final evaluation, etc. In the final evaluation phase of suppliers, after pre-qualification, quantitative models incorporating multi-criteria were constructed. These models are based on multi-objective optimization (MOP) [4,13,14], data envelopment analysis (DEA) [8,10,11,13,14], analytic hierarchical process (AHP) [2,3,7] and simple multi-attribute rating technique (SMART) [10]. These models provide systematic approaches for purchasing managers to evaluate and score suppliers with multi-criteria. Nevertheless, these models are not easy to implement. Models based on multi-objective optimization require the decision makers to exogenously specify the exact values of weights of individual criteria. It is however difficult to obtain precise weight values. The weight determination is a challenging task for implementing the MOP approach. A similar problem is faced when decision makers choose the SMART approach.

On the other hand, to assist decision makers in determination of the weights, the AHP approach provides for interactive comparisons for users to obtain the weights. Decision makers are required to perform pair-wise comparisons between the criteria and the supplier alternatives under a particular criterion. However, the results are highly dependent on the subjective judgments of the decision makers. Decision makers have to specify not only the direction of relative importance (e.g., Criterion A is more important than Criterion B) but also the degree of the relativity (e.g., Criterion A is extremely/very strongly more important than CriterionB). The requirement of user preference is too demanding, when implementing these models.DEA appears to be the easiest for practical implementation. The DEA approach does not require the decision

maker to pre-define the weights. Weights are endogenously determined when solving a DEA model. DEA can automatically derive optimal weights of criteria with the performance scores of the suppliers. The solutionsof DEA models require a linear optimizer, which is available to a decision maker. An individual DEA model is required to be optimized for each supplier. In DEA models applied to supplier selection problems[8,10,11,13,14], decision makers cannot have any involvement or control for the importance of the criteria.To some extent, these DEA approaches are black-box models for decision makers in real situations.There are many real situations where the decision makers are able to tell the criteria importance ranking (although they cannot tell the exact values of weights). The decision makers may not have enough knowledgeto assign exact weight values but they can rank the importance by their expertise or experience. In this kind of decision-making environment, the two abovementioned streams of approaches (weights determined exogenously and weights determined endogenously) may not be applicable. We would like to propose an alternative mathematical model for the multi-criteria supplier selection problem. Our models retain the advantage of DEA, that requires no pre-defined weight values. At the same time, our model can incorporate some user control by ranking of relative importance of the criteria. Unlike AHP or MOP models, decision makers only rank the relative importance of criteria, rather than specifying the degree of relativity. This sort of subjective judgmentsis much less demanding.

3. MATHEMATICAL FORMULATION

Weighted linear model for the supplier selection problem with multiple criteria.

We consider a situation in which a set of I suppliers is available for a company. The purchasing manager would like to evaluate these suppliers based on J criteria. We evaluate a supplier i(i = 1, 2, 3, . . . , I) by converting multiple measures under all criteria into a single score Si.

The measure of supplier i under criteria j is denoted as xij (i = 1, 2, 3, . . . , I, j = 1, 2, 3, . . . , J).

We assume all measures are positively related to the score of a supplier. If there is a negatively related criterion, transformation of negativity or taking reciprocal can be applied for conversions. A common scale for all measures is also an important issue. A particular criterion measure, in a large scale, may always dominate the score. For this, we propose normalizing all measures xij into a 0–1 scale. All transformed measures as yij. Commonly used linear transformations used here.

$$yij = \frac{xij - \text{Min } i=1,2,3 \ldots\ldots\ldots I\{xij\}}{Max\ i=1,2,3 \ldots I - Min\ i=1,2,3 \ldots I I\{xij\}}$$

The score of a supplier is expressed as the weighted sum of transformed measures, Si = Σwijyij is the weight of criteria j of supplier i. decision makers to rank the criteria. In our model development, we assume the criteria are arranged in the descending order of importance (i.e. $w_{i1} \geq w_{i2} \geq w_{i3} \ldots \geq w_{ij}$).

We assume the weights wij□s are non-negative and are normalized so that $\Sigma w_{ij} = 1$. After normalization, all scores Si (i = 1, 2, 3,. . . , I) are always within a 0–1 scale. The value of the weight of a particular criterionis equal to the proportion of contribution of the criterion, in the total contribution of all criteria. We formulate our proposed multi-criteria supplier selection model as the following mathematical model:

$$\text{Max } S_i = \Sigma w_{ij} y_{ij} \text{ where } j=1, 2, 3\ldots J \quad \ldots(1)$$

$$w_{ij} - w_{i(j+1)} \geq 0, \quad \ldots(2)$$

$$\Sigma w_{ij} = 1, \quad \ldots(3)$$

$$w_{ij} \geq 0 \quad \ldots(4)$$

Constraint (2) ensures the weight values are in the same sequence as ranking. Constraint (3) is normalization. The weights are generated automatically when the maximization problem is solved and the corresponding score Si is the maximal score supplier i can achieve.

4. SOLUTION SCHEME

Optimal score Si can be obtained by comparing all partial averages of transformed measures. Procedure for supplier selection based on the proposed model is simple and efficient. We input all the measures of all suppliers and perform the following steps:

Step 1. List all measures in the same sequence as importance of criteria.

Step 2. Transform measures so that all measures are positively related to scores and normalized in a 0–1 scale.

Step 3. Calculate all partial averages,

Step 4. Compare and locate the maximum among these partial averages. The corresponding value is the score of Si of the ith supplier.

Step 5. Sorting the scores Si's in descending order and

Step 6. Identify important supplier(s).

Max, $S_i = w_{i1}$ (Supply Variety) + w_{i2} (Quality) + w_{i3} (Reciprocal of Distance) + w_{i4} (Delivery Time)

s.t

$$w_{i1} - w_{i2} \geq 0,$$
$$w_{i2} - w_{i3} \geq 0,$$
$$w_{i3} - w_{i4} \geq 0,$$
$$w_{i1} + w_{i2} + w_{i3} + w_{i4} = 1,$$
$$w_{i1}, w_{i2}, w_{i3}, w_{i4} \geq 0$$

The above linear model can be solved by comparing the partial averages rather than using the optimization procedure. Partial averages are calculated and the maximal scores are located by choosing the largest partial averages.

5. CASE STUDY

In this section, we present the implementation of the proposed study using a real-world case study in Jute Industry located in Dhaka Bangladesh. The firm is one of the largest industrial companies of the country producing major portion of jute fulfilling total annual demand. There are four suppliers of the company provides its necessary materials from various location of the country with different price & quality. The major concern of the company for selecting the best supplier depends on four key criteria for instances cost, quality, distances & delivery time. The supplier will be the best who can fulfill all the major criteria.

5.1. DATA ANALYSIS

Table 5.1.1-Measures of suppliers under criteria

Supplier Number	Supplier District	Supply Variety (taka per bale)	Quality %	Distance (Km) from Dhaka	Delivery time (hours)
01	Narayangonj	12800 taka per bale	95	17	0.425
02	Khulna	12500 Taka per bale	98	180	4.5
03	Jessore	11600 taka per bale	99	164	4.1
04	Panchagarh	10400 Taka per bale	97	443	11.075

Table 5.1.2-Transformed and normalized measures of suppliers under criteria

Supplier Number	Normalized measures				
	Supplier District	Supply Variety (taka per bale)	Quality %	Reciprocal of distance from Dhaka	Delivery time (hours)
1	Narayangonj	1	0	0.058823529	0
2	Khulna	0.875	0.75	0.005555556	0.38262911
3	Jessore	0.5	1	0.006097561	0.34507042
4	Panchagarh	0	0.5	0.002257336	1

Table 5.1.3-Partial averages and scores of suppliers

Supplier Number	Partial averages of transformed and normalized measures with the j criteria					Score
	Supplier District	j=1	j=2	j=3	j=4	
1	Narayangonj	0.4	0	0.011764706	0	0.411765
2	Khulna	0.35	0.225	0.001111111	0.038262911	0.614374
3	Jessore	0.2	0.3	0.001219512	0.034507042	0.535727
4	Panchagarh	0	0.15	0.000451467	0.1	0.250451

6. RESULT & DISCUSSION

From the above table 5.1.3 it is shown that Si is maximized for Khulna region supplier. So supplier number two is the best supplier for jute industry which is situated in Dhaka. This supplier provides raw material with cost of 12500 taka per bale, the quality of this supplier is around 95% & delivery times is about 4.5 hours.

7. CONCLUSION

Supply chain management plays an important role on producing better quality products. It can help to increase productivity of the firms by reducing male function parts, delays, product interruption, etc. Many companies are currently striving to reduce the number of their suppliers in order to promote better relations with the few chosen ones (e.g., exchanges of commercial, technical or planning information). Therefore, in a strategic, rather than tactical use of our models, it may be interesting to introduce constraints which limit the number of active suppliers. In the above paper weighted linear program is used for selecting the best supplier for a jute industry which is located in Dhaka region in Bangladesh. There is an involvement of the decision maker in ranking the weight under criteria. By considering this supply chain manager of jute industry can easily identify which supplier is more effective to serve his necessity and provide the raw materials at right time.

REFERENCES

1. *Ng Lung. Wan, An efficient and simple model for multiple criteria supplier selection problem European Journal of Operational Research 186(2008)1059-1067*

2. *K.S. Bhutta, F. Huq, Supplier selection problem: A comparison of the total cost of ownership and analytic hierarchy process approaches, Supply Chain Management 7 (3) (2002) 126–135.*

3. *C.T. Chen, C.T. Lin, S.F. Huang, A fuzzy approach for supplier evaluation and selection in supply chain management, International Journal of Production Economics (in press).*

4. *N.E. Dahel, Vendor selection and order quantity allocation in volume discount environments, Supply Chain Management 8 (4) (2003) 335–342.*

5. *L. De Boer, E. Labro, P. Morlacchi, A review of methods supporting supplier selection, European Journal of Purchasing & Supply Management 7 (2001) 75–89.*

6. *G.W. Dickson, An analysis of vendor selection systems and decisions, Journal of Purchasing 2 (1) (1966) 5–17.*

7. *E.Y. Lee, S. Ha, S.K. Kim, Supplier selection and management system considering relationships in supply chain management, IEEE Transactions on Engineering Management 48 (3) (2001) 307–318.*

8. *F. Liu, F.Y. Ding, V. Lall, Using data envelopment analysis to compare suppliers for supplier selection and performance improvement, Supply Chain Management 5 (3) (2000) 143–150.*

9. *A.D. Pearman, A weighted maximin and maximax approach to multiple criteria decision making, Operation Research Quarterly 28(3) (1977) 584–587.*

10. *Seydel, Supporting the paradigm shift in vendor selection: Multicriteria methods for sole sourcing, Managerial Finance 31 (3)(2005) 49–64.*

11. *C.A. Weber, A data envelopment analysis approach to measuring vendor performance, Supply Chain Management 1 (1) (1996) 28–39.*

12. *C.A. Weber, J.R. Current, W.C. Benton, Vendor selection criteria and methods, European Journal of Operational Research 50 (1991)2–18.*

13. *C.A. Weber, J.R. Current, A. Desai, Non-cooperative negotiation strategies for vendor selection, European Journal of Operational Research 108 (1998) 208–223.*

14. *C.A. Weber, J.R. Current, A. Desai, An optimization approach to determining the number of vendors to employ, Supply Chain Management 5 (2) (2000) 90–98.*

15. *Stevenson, J. William, "Operations Management"8th edition, ISBN 0-7-286905-4*