CASE STUDIES ON SUPPLIER SELECTION

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ABSTRACT

A case studies have been reported Multi-Criteria Decision Making (MCDM) approach for supplier selection.

In case study, usefulness of grey based MCDM approach method has been highlighted to solve multi-criteria decision making problem of supplier selection.

The method has been found efficient to aggregate multiple attribute values into an equivalent single quality index (overall grey relation grade) which facilitates ranking/benchmarking as well as selection of the appropriate alternative supplier.

1. A CASE STUDY ON SUPPLIER SELECTION

One of the critical challenges faced by purchasing managers is the selection of strategic partners that will furnish them with the necessary products, components, and materials in a timely and effective manner to help maintain a competitive advantage. Buyer-supplier relationships based solely on price are no longer acceptable for suppliers of critical materials or for organizations that wish to practice the latest innovations in supply chain management. Recent emphasis has also been on other important strategic and operational factors such as quality, delivery, and flexibility. Strategic relationships also play a vital role for the long-term well-being of a supply chain. Thus, to aid in the supplier selection process, a dynamic strategic decision model is introduced that allows inputs from a variety of managerial decision making levels (strategic to operational) while considering the dynamic competitive environment.

Strategic supplier selection processes require consideration of a number of factors beyond those used in operational decisions. With increased emphasis on manufacturing and organizational philosophies such as JIT and total quality management (TQM), and the growing importance of supply chain management concepts, the need for considering supplier relationships from a strategic perspective has become even more apparent.

While supplier selection is one of the most fundamental and important decisions that a buyer makes, it may also be one of the most difficult and critical. This is mainly due to the increased levels of complexity involved in considering various supplier performance and relationship factors. In order to perform a comprehensive evaluation of suppliers, a number of criteria can be utilized. For instance, a supplier could be evaluated and screened technically based on a number of factors that include:

_ Emphasis on quality at the source

_ Design competency

_ Process capability

_ Declining nonconformities

_ Declining work-in-process (WIP), lead time, space, flow distance

_ Operators cross-training, doing preventive maintenance

_ Operators' ability to present statistical process control (SPC) and quick setup

_ Operators able to chart problems and process issues

_ Hours of operator training in total quality control (TQC)/JIT

_ Concurrent design

_ Equipment/labor flexibility

_ Dedicated capacity

_ Production and process innovation

1.1 Prior State of Art

In the competitive global business environment of the 21st century, enterprises must respond effectively to customer demands. The selection of suppliers and the evaluation of their service performance are becoming major challenges that face manufacturing managers. Assessing a group of suppliers and selecting one or more of them is a very complex task because various criteria must be considered in this decision making process. Supplier selection problem in a supply chain system is a group decision according to multiple criteria [Chen et al.(2006)].

Literature depicts several supplier selection methods available. Some authors proposed linear weighting models in which suppliers were rated on several criteria and in which these ratings are combined into a single score such as the categorical model. The categorical model was a simple method, but it was also the quickest, easiest, and least costly to implement [Petrone (2000)]. The weighted point model was also easy to implement, flexible, and fairly efficient in the optimization of supplier selection decisions. It was more costly than the categorical method, but tends to be more objective, even though it relied on the buyer's assessment of the supplier performance. Total cost approaches attempted to quantify all costs related to the selection of a vendor in monetary units. This approach includes cost ratio [Timmernam (1986)] and Total Cost of Ownership (TCO) [Ellram (1990)]. According to Chen-Tung *et al.* (2006), the fuzzy logic approach measured for supplier performance evaluation. This approach could help Decision Making (DM) to find out the appropriate ordering from each supplier.

The Multiple Attribute Utility Theory (MAUT) method had the advantage that it enabled purchasing professionals to formulate viable sourcing strategies and was capable of handling multiple conflicting attributes. However, this method was only used for international supplier selection, where the environment was more complicated and risky [Bross and Zhao (2004)]. Another useful method is the Analytical Hierarchical Process (AHP), a decision-making method developed for prioritizing alternatives when multiple criteria must be considered and allows the decision maker to structure complex problems in the form of a hierarchy, or a set of integrated levels [Saaty (1980)]. It allows decision makers to rank suppliers based on the relative importance of the criteria and the suitability of the suppliers. Chan (2003) indicated the calculation of preference between attributes was still based on the subjective judgment from senior management level and use of AHP was quite cumbersome and clearly not straightforward for most users. Many supplier evaluation methods in the literature often involved the simultaneous consideration of various important supplier performance attributes and give weight to each attribute. Lamberson et al. (1976), Monczka and Trecha (1976) adopted the linear weighting techniques. Timmerman et al. (1976) and Gregory (1986) linked the linear weighting technique to the matrix representation of data.

Other methods include linear programming models [Pan (1989), Turner (1988)], clustering methods [Hinkle et al. (1969)] and dimensional analysis method [Wills (1993)]. Although each of these approaches has its own advantages in particular circumstances, some aspects of these techniques and models require more effort to be spent in deriving the attributes of the suppliers and the weights of these attributes. Almeida (2007) gave a multi-criteria decision model for outsourcing contracts selection based on a utility function. The utility function includes the impacts on cost, delivery time, and dependability.

In the present paper a Multi-Criteria Decision Making (MCDM) approach has been applied for quality evaluation and performance appraisal in vendor selection. Vendor selection is a Multi-Criteria Decision Making (MCDM) problem influenced by multiple performance attributes. These criteria attributes are both qualitative as well as quantitative. Quantitative criteria values are easy to handle where as qualitative criteria are based on expert opinion converted based on a suitable conversion scale. When both qualitative and quantitative simultaneously come into consideration; a common trend is to convert quantitative criteria values into qualitative performance indices. This conversion is based on humanjudgment; such result of vendor selection may not be accurate always because the method doesn't explore real data. To avoid this limitation, present study highlights application of grey relation theory for utilizing quantitative real performance estimates. Detail methodology of aforesaid MCDM technique has been illustrated in this paper through a case study.

1.2 Grey Relation Theory

The grey relational analysis consists of the following steps, [Wu (2007)].

(*a) Generation of reference data series* x_o. $x_o = d_{o1}, d_{o2}, \ldots\ldots\ldots, d0m$

Here m is the number of respondents. In general, the x_o reference data series consists of m values representing the most favoured responses.

(b) Generation of comparison data series x_i .

$x_i = d_{i1}, d_{i2}, d\ldots\ldots d_{im}$

Here$i$ =1,.........., k . k is the number of scale items. So, there will be k comparison data series and each comparison data series contains m values.

(c) Compute the difference data series D_i .

$D_i = (d_{01} - d_{i1}), (d_{02} - d_{i2}) \ldots\ldots (d_{0m} - d_{im})$

(d) Find the global maximum value D_{max} *and minimum value* D_{min} *in the difference data series.*

Max min

D_{max} = "*i (max*D_i and D_{min} = "(min D_i)

(e) Transformation of individual data point in each difference data series to grey relational coefficient.

Let $g_i(j)$ represents the grey relational coefficient of the *jth* data point in the *i th* difference data series, then

$$g_i(j) = \frac{\Delta\min + \zeta\Delta\max}{\Delta i(j) + \zeta\,\Delta\max}$$

Here $g_i(j)$ is the *j th* value in D_i difference data series. V is called distinguishing coefficient (= 0.5).

(f) Computation of grey relational grade for each difference data series.

Let G *i* represent the grey relational grade for the

$$_{ri} = 1/m\sum \gamma i(n)\ i\ th$$

The magnitude of \ G *i* reflects the overall degree of standardized deviance of the i_{th} original data series from the reference data series. In general, a scale item with a high value of G indicates that the respondents, as a whole, have a high degree of favoured

(g) Sorting of G *values into either descending or ascending order to facilitate the managerial interpretation of the results.*

CONCLUSION

In the present study, application feasibility of grey based MCDM approach method has been highlighted to solve multi-criteria decision making problems through a case study of supplier selection. The study demonstrates the effectiveness of the said MCDM techniques in solving such a supplier selection problem. The method has been found efficient to aggregate multiple attributes into an equivalent single quality index which facilitates ranking/benchmarking as well as selection of the appropriate alternative.

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