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Prioritization Of Preferred Suppliers For The Supply Of Gas Station Equipment: A Case Study Of N.S.M Firm

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A B S T R A C T

Since a company can only perform as well as it is allowed to by its suppliers, the importance of supplier selection in supply chain management has been increasingly recognized. Supplier selection can best be described as a highly complex process, due to the involvement of many, sometimes conflicting, qualitative and quantitative criteria. The objective is to select the most suitable supplier(s) that meet a company's specific needs. This article describes the typical step of supplier selection process: identifying suppliers, soliciting information from suppliers, setting contract terms and evaluating suppliers. By combining the decision-maker's preferences, using the developed methodology will eventually result in a ranking of Supplier that makes it possible to select the most suitable supplier(s). The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is a multi-criteria decision analysis method is used, in which suppliers are evaluated against the main criteria and sub-criteria The proposed methodology is applied to o N.S.M firm, and the results are discussed extensively in this paper. We have nine suppliers and nine indicators, therefore the results exhibit the HESA supplier was selected by experts. We conclude by proposing avenues for future research regarding the general applicability and further extensions.

1- Introduction

In the most industries the cost of raw material and component parts constitutes the main cost of a product, such that in some cases it can account for up to 70% (Ghodsypour and O'Brien, 1998). In such circumstance decision making of purchasing management can play a key role in cost reduction. In today's highly competitive environment, an effective supplier selection process is

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very important to the success of any organization. Selecting the suitable supplier is always a difficult task for buyers. Suppliers have varied strengths and weaknesses, which require careful assessment by the purchasers before ranking, can be given to them. The vendor selection process would be simple if only one criterion was used in the decision making process. However in many situations purchasers have to take account of arrange of criteria in making their decision .If several criteria are used then it is necessary to determine how far each criterion influences the decision making process, whether all are to be equally weighted or whether the influence varies accordingly to the type of criteria(Yahya& Kingsman,1999).

Supply chain management

Supply chain management (SCM) is denned as the set of warehouses , and stores, so that merchandize is produced in the right quantities, distributed to the right locations, and at the right time , in order to minimize system wide costs(or maximize profits) while satisfying service level requirements(Make, 2009). For this reason, the firms which provides supply chain support service processes is called as supplier, has an important role in the supply chain management in addition, selection and evaluation of suppliers are the critical decision problems for efficient supply chain management.

Supplier selection is sometimes highly complex, since it incorporates a great variety of uncontrollable and unpredictable factors that affect the decision involved. This should prompt careful attention to the way in which such decisions are reached and justified , and would consequently suggest (among other things) the use of decisional model to support procurement decision making, moreover , supplier assessments or ratings should be done routinely to ensure that incoming materials meet relevant quality standards(Bevilacqua, 2006).

Importance of new suppliers

Several factors make new suppliers important,First, there may exist new suppliers that are superior in some way to a firm's existing suppliers. For example, a new supplier may have developed a novel production technology or stream lined process which allows it to significantly reduce its production costs relative to predominate production technology or processes or , a new supplier may have a structural cost advantage over existing suppliers , for example , due to low labor costs or favorable import/export regulations in its home country. Second, existing suppliers may go out of business, or their costs maybe increasing. Third, the buyer may need additional suppliers simply to drive competition, reduce supply disruption risks, or meet other business objectives such as supplier diversity. In recognition of these reasons, buyers and their internal customers may be obliged by company policy to locate a minimum number of variable, potential suppliers for every product or service procured. (F.Hedderich, R.Giesecke&D.ohmsen , 2006)

2- Literature Review

One major aspect of the purchasing function is supplier selection criteria. The analysis of criteria for selection and measuring the performance of suppliers has been the focus of attention for many scientists and purchasing practitioners since 1960's. In the mind 1960's , researchers were developing performance criteria upon which potential suppliers could be evaluated(Dickson, 1966). Firstly performed an extensive study to determine, identify and analyze what criteria were used in the selection of a firm as a supplier .Dickson's (1966) study was based on a questionnaire sent to 273 purchasing agents and managers selected form the membership list of the national association of purchasing managers. The list included purchasing agents and managers form the United States and Canada, which was a total of 170(62.3 of Dickson's study) regarding the importance of 23 criteria for supplier (vendor) selection. Dickson asked the respondents to assess the importance of each criterion on a five point scale of: extreme, considerable, average , slight and of no importance. Based on respondents reply quality is the most important criterion followed by "delivery" and performance history. Weber current and (Benton , 1991) presented a classification of all the articles published since 1966 according to the treated criteria. Based on 74 papers the out puts observe that price , delivery , quality and production capacity and location were the criteria most often treated in the literature. According to Weber, current and Benton(1991), the review of the articles about supplier selection (SS) between 1966 and 1991 was investigated and Ng (2003)collected 49 articles between 1991 and 2003 , was a comprehensive classification of supplier selections published. The study of Zhangetal was done based on the Weber, current and Benton (1991) study and the 23 criteria of Dickson (1966) study. The study concluded that net price, quality and delivery were the most important supplier selection criteria as concluded from three different studies, price is the number one selection factor, replacing Dickson(1966) number one ranked quality criteria. In addition the well-noted research studies of Dickson (1966) , Weber, current and Benton(1991) and Zhang, Lei, Coal and Ng (2003), other researchers have also recently begun discussing the importance of additional supplier selection criteria , not mentioned in the above studies. Another study by Toulouse and Munson(1991) , which sampled eighty(80) technical service, delivery , reliability, and lead time were among the most importance selection factors. He definitions of Dickson (1966)23 criteria have been expanded and some new criteria were developed with the growth of new business needs. The review performed by Bross & Zhao(2004) study concluded that the most valuable supplier , relationship and organization.

David rajuh(2000)reviewed some studies which emphasize the important criteria and their invariability. While a number of supplier selection criteria studies have been conducted over the years, Dickson(1966), Weber , current and Brnton (1991) and Zhang , Lei ,Coa and Ng(2003) are

still recognized as the most common , and cited as the most comprehensive studies done on selection criteria.

As mentioned earlier, supplier selection is considered an extremely important task in purchasing and supply chain management.(Luo et al, 2009) identify three recent trends, which further emphasize the importance of the supplier selection. Firstly, due to theincreased desire for outsourcing, firms spend a larger share of their revenues on externally sourced goods and services, which directly increases the impact of the supplier's performance on buyers (Weber &Ellram, 1992). Secondly, since supply chain management nowadays advocates long-term partnerships with fewer but reliable suppliers (Ho, Xu, &Dey, 2010), a buyer's dependence on its supplier's performance has increased (Power, Sohal, &Rahman, 2001). Thirdly, the fact that, nowadays, buyers and suppliers look for a closer relationship, increases the role and contribution ofsuppliers in the performance of the purchaser. Furthermore, the supplier selection process is a process that is highly complex, for two main reasons. Firstly, as Weber et al(1991) have emphasized, the supplier selection process is highly criteria of a qualitative as well as a quantitative nature. To realize a satisfactory supplier selection, potential suppliers have to be assessed against these criteria, and as these criteria may be conflicting (e.g. cost vs. quality), trade-offs are typically required (Chen et al., 2006). Secondly, the increased sourcing and purchasing opportunities provided by the intensified globalization ofWorld trade, facilitated by enhanced communication methods, has also increased the complexity of the supplier selection process(Kahraman& Kaya, 2010; Luo et al., 2009)

Supplier selection methods

Although existing literature on supplier selection is dominated by one-phase methods, meaning that the most studies simply ignore the qualification phase, conceptual supplier selection methods, frequently define multiple subsequent phases (e.g. De Boer et al Luo2001;Luo et al,2009;Monczka et al 2011).

A general principleof these multiple-phase approaches is that the initial set of potential suppliers is screened, after which the ''qualified suppliers'' are subjected to further scrutiny.

Qualification methods

The first two methods that are suitable for the qualificationphase are the categorical method and cluster analysis. They seem like similar approaches, where suppliers are grouped into categories with the aim of maximizing the differences between suppliersin different groups, while at the same time minimizing the differencesbetween suppliers in the same group, according to a distinct set of criteria. However, the difference between the two methods isthat the categorical method is qualitative in nature (e.g. positiveneutral, negative)(Timmerman,1986)whereas the cluster analysis is based on numerical scores. Data envelopment analysis (DEA)is another possible method which was applied by (Weber Desai,1996 and Liu.Ding,and Lall,2000).in this case ,in order to evaluate

the supplier performance, an index of relative supplier efficiency is calculated for each supplier(Weber &Desai,1996),(Ng &Skimore,1995)developed a case-based reasoning (CBR) system, for the purpose of screening suppliers, that provides the buyer information from similar decision-making situations via a software-driven database. Finally, conjunctive, disjunctive and lexicographical screening methods are proposed as possibilities for qualification purposes (De Boer et al, 2001).

3-Methods

Decision making problem is the process of finding the best option from all of the feasible alternative in this paper , from among multi criteria models in making complex decisions and multiple attribute models for the most preferable choice, technique, for order preference by similarity to ideal solution (Topsis)approach has been dealt with .Topsis is a multi_cireria decision analysis method, which was originally developed by Hwang and Yoon in 1981 (Hwang,1981)with further developments by Yoon in 1987(Yoonk,1987)and Hwang, Lai and Lia in 1993(Hwang, Cl, Lai,Yj,Liu,Tr, 1993).Topsis is based on the concept that the chosen alternative should have the shortest geomantic distance from the positive idea solution and longest geometric distance from the negative ideal solution . It is a method of compensatory aggregation that compares a set of alternatives by identifying weights for each criterion, normalizing scores fore each criterion and calculating the geometric distance between each alternative and the ideal alternative, which is the best score in each criteria or monotonically increasing or decreasing. Normalization is usually required as the parameters or criteria are often of incongruous dimensions in multi criteria problems (Yoon, Kp,Hwang,1995) (Zavadska Ek, Zakarevicius, A, Antucheviciene, J,2006). , Compensatory methods where a poor result in one criterion can be negated by a good result in another criterion. This provides a more realistic from modeling than non_compensatory methods, which include or exclude alternative solutions based on hard cut_offs (Greene, R,Devillers, Rluther,J,,E,Eddy,B,G,2011).

The supplier’s evaluation criteria:

1. The ability of manager & contractor project team in strategy and project management.
2. Sending equipment according to the plan and agreement.
3. The number and quality of technical personnel for doing technical project.
4. The factory adequate facilities for manufacturing and testing equipment production line.
5. The quality and quantity of documentation and technical documentation and presentational equipment.
6. Use a third _party inspector The construction of all equipment
7. Using quality parts for vendors.
8. Quality installation of the equipment in gas station

9. Performing temporary delivery and punch timely

The above information &Indicators are generally about the appliers performance measurements in supply chain. The information and methodologies contain important knowledge about N.S.M firm (oil products Distribution Company) will work which suppliers. Therefore experts and engineers with the following traits helped us:

1. Bachelor's degree in mechanical with more 20 years executive experience.
2. Mechanical engineering, standard experts with more 10 years executive experience.
3. Master of science in mechanical, with more 8 years executive experience.
4. Mechanical engineering, expert an selecting and purchasing of equipment for the production process with more than 10 years executive experience.

Empirical study and discussion

The criterial will be evaluated by analyzing technique .In this technique, the Likert scale sores and the frequency of the Likert scale are multiple lied and the total score of maximum evaluation score (this occurs when all of the research participants give the highest points), a satisfaction rate is handled this rate can be called as service performance score or satisfaction / efficiency rate or meeting level. In the below the calculation details and an example are shown.

Tabale1:Likert Scale

increasing	Spectrum
xj	
9	Very good
7	Good
5	Not good, Not poor
3	Poor
1	Very poor

We checked prioritization of preferred suppliers for the purchase of equipment in N.S.M firm (oil products Distribution Company) with expert's opinion. We could distinguish appropriate supplier by Topsis method in the blew flow the calculation details and example are shown.

Table2.Decision Matrix

Indicator / option	The ability of manager &contractor project team is strategy and project management	Sending equipment according to the plan and agreement	The number and quality of technical personnel for doing technical project	The factory adequate facilities for manufacturing and testing equipment production line	The quality and quantity of documentation and technical documentation & presentational equipment
HESA	Not good, Not poor	Not good, Not poor	Not good, Not poor	Not good, Not poor	Not good, Not poor
SAFEPT	Good	Good	Not good, Not poor	Not good, Not poor	Not good, Not poor
HY	Good	Good	Good	Good	Good
CST	Not good, Not poor	Poor	Not good, Not poor	Not good, Not poor	Good
TGC	Not good, Not poor	Good	Not good, Not poor	Not good, Not poor	Not good, Not poor
LMF	Not good, Not poor	Not good, Not poor	Not good, Not poor	Not good, Not poor	Not good, Not poor
TAM	Not good, Not poor	Not good, Not poor	Not good, Not poor	Not good, Not poor	Not good, Not poor
PARS	Not good, Not poor	Not good, Not poor	Not good, Not poor	Not good, Not poor	Good
PMG	Not good, Not poor	Not good, Not poor	Poor	Not good, Not poor	Not good, Not poor

Table3.Decision Matrix

Indicator / option	Use a third_party inspector the construction of all equipment	Using quality parts for vendors	Quality installation of the equipment in gas station	Performing temporary delivery and punch timely
HESA	Poor	Not good, Not poor	Not good, Not poor	Not good, Not poor
SAFEPT	Not good, Not poor	Good	Good	Good
HY	Poor	Not good, Not poor	Good	Good
CST	Poor	Not good, Not poor	Not good, Not poor	Not good, Not poor
TGC	Not good, Not poor	Not good, Not poor	Not good, Not poor	Not good, Not poor
LMF	Poor	Not good, Not poor	Good	Good
TAM	Not good, Not poor	Not good, Not poor	Not good, Not poor	Not good, Not poor
PARS	Poor	Not good, Not poor	Not good, Not poor	Not good, Not poor
PMG	Poor	Not good, Not poor	Not good, Not poor	Not good, Not poor

$$D=\begin{pmatrix} 4 & 4 & 4 & 4 & 4 & 1 & 3 & 5 & 4 \\ 7 & 7 & 5 & 5 & 5 & 3 & 7 & 7 & 7 \\ 7 & 7 & 7 & 7 & 7 & 1 & 5 & 7 & 7 \\ 4 & 1 & 5 & 5 & 7 & 1 & 5 & 5 & 4 \\ 5 & 7 & 5 & 5 & 5 & 3 & 5 & 7 & 1 \\ 3 & 4 & 3 & 3 & 5 & 1 & 5 & 7 & 7 \\ 4 & 4 & 4 & 4 & 5 & 3 & 5 & 5 & 3 \\ 4 & 4 & 4 & 4 & 7 & 1 & 5 & 5 & 4 \\ 3 & 4 & 1 & 5 & 4 & 1 & 3 & 5 & 4 \end{pmatrix}$$

Gaining weight by Shannon entropy:

$Pj=\frac{aij}{\sum_{i=1}^{m} aij}$

Ej=-K$\sum$ (Pij.$\ln pj$)

$K=\frac{1}{\ln m}$

$K=\frac{1}{\ln 9}$

K=.455

D=1-Ej

$Wj=\frac{dj}{\sum dj}$

Table4:The weight of decision matrix

Ej	Wj
E1=.974	W1=.095
E2=.952	W2=.147
E3=.961	W3=.143
E4=.984	W4=.058
E5=.986	W5=.051
E6=.928	W6=.264
E7=.978	W7=.08
E8=.988	W8=.044
E9=.969	W9=.114

TOPSIS Approach

Normalization: nij = $\frac{aij}{\sqrt{\sum_{i=1}^{m} aij^2}}$

$$D = \begin{pmatrix} .026 & .039 & .043 & .016 & .012 & .045 & .016 & .012 & .027 \\ .046 & .068 & .054 & .020 & .015 & .137 & .038 & .017 & .048 \\ .046 & .068 & .076 & .028 & .021 & .045 & .027 & .017 & .048 \\ .026 & .009 & .054 & .020 & .021 & .008 & .089 & .012 & .027 \\ .033 & .068 & .043 & .020 & .015 & .137 & .027 & .017 & .048 \\ .019 & .038 & .032 & .012 & .015 & .045 & .027 & .017 & .048 \\ .026 & .039 & .043 & .016 & .015 & .137 & .027 & .012 & .01 \\ .026 & .039 & .043 & .016 & .021 & .045 & .027 & .012 & .01 \\ .019 & .039 & .010 & .020 & .012 & .045 & .016 & .012 & .027 \end{pmatrix}$$

$d^{\pm}$=√ (a1-v1)²+ (a2-v2)²+ (a3-v3)²……. (An-vn)²

v^{+}=[.046,.068,.076,.028,.021,.137,.089,.017,.048]

v^{-}= [.019,.009,010,.012,.012,.008,.016,.012,.01]

CL=$\frac{d^{-}}{d^{-} + d^{+}}$

Table 5

CLj
CL1=.473
CL2=.73
CL3=.438
CL4=.376
CL5=.207
CL6=.336
CL=7.153
CL8=.352
CL9=.139

Result:

HESA>HY>TGC>CST>PARS>LMF>TAM>RMG>SAFEPT

Conclusion

With this study, it's purposed to analyze the evaluation of supplier more detailed by comparing of meeting level for supply chain of company with performance of suppliers to see efficiency of supplier on supply chain of company and thus select supplier more effectively in terms of company's requirements on supply chain management. Also , designing model present alternatives with the situations that show to with times, which alternative are used and propose to activity that is made.

Table 6: Supplier's ranking

Supplier worked primarily	HESA
Supplier worked secondly	HY
Supplier worked in the third	TGC
Supplier worked in Fourth stage	CST
Supplier worked in Fifth stag	PARS
Supplier worked in Sixth stage	LMF
Supplier worked in Seventh stage	TAM
Supplier worked in Eighth stage	RMG
Supplier worked in Ninth stage	SAFEPT

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