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Critical appraisal of vendor selection mechanism: A review in power sector companies of West Bengal

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Abstract
Vendor selection is an organization's process of identifying, evaluating, and contracting with vendors. Now, to get quality material at a reasonable cost at the right time, considering sustainability and environmental effects in mind, the main concern for industrial operators is finding suitable vendors to operate. The vendor/supplier selection process deploys an enormous amount of a firm's financial resources and plays an important role in the success of any organization. The main objective of the supplier selection process is to reduce purchase risk, maximize overall value to the purchaser, and develop closeness and long-term business relationships with the vendors.
In this paper, we will be dealing with all the criteria that are required to be evaluated before selecting a vendor among the alternatives, based on a power sector company in West Bengal.

Keywords: Vendor selection process, vendor performance analysis, analytical hierarchy process (AHP)

Introductions
Vendor selection is defined as the process offending the vendor being able to provide the purchaser with the right quality of materials and/or services at the right cost and quantities and at the right time (A.E. Cengiza) [8].
In Supply Chain Management (SCM) vendor selection is an important task of the purchasing department. The main objective of the vendor selection process is to reduce purchasing risk, maximize overall value to the purchaser, and develop trust and long-term relationships between buyers and suppliers.
This selection process is critical for enhancing the company's competitiveness. In this process, the assessment of different alternative suppliers is carried out based on different criteria. Vendor selection is a multiple-criteria decision-making (MCDM) type problem that involves both qualitative and quantitative criteria. A suitable supplier selection should reduce purchasing costs & delivery lead time. Besides improving profit & customer satisfaction. Thus, strengthening competitiveness in the supply chain.

Literature Review
The vendor selection process depends on various things including multiple methods as there is no such fixed process. Based on the product, demands & criteria of the industry methods are varied. However, it is extremely important to the overall selection process and may have a remarkable influence on the results. So, it is important to review the existing literature to understand the methods that are suitable for different situations.
Many researchers have suggested to use the AHP method for the vendor selection process as it can handle both qualitative and quantitative criteria (T. L. Saaty [11]).
Tahriri [9] explained how preferences of evaluation for existing methods have changed for years and classified them as qualitative and quantitative. Before 2003, in most cases, quantitative methods were applied in the vendor selection process.
Quantitative methods are more structured than qualitative methods. Today, both methods are used in integrated model building for the vendor selection process.
The cluster analysis includes fuzzy logic as a pre-qualification method (Vasina [10]).
Some of the existing vendor selection processes are - Analytic Hierarchy Process (AHP), Analytic Network Process (ANP), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Multi-Attribute Utility Theory (MAUT method), etc.

L Saaty extended the AHP concept with the Analytic Network Process (ANP) which uses a grid/network structure instead of the numerical values of linguistic variables used for evaluation of criteria.

The AHP method has been developed by T.L. Saaty (1977). It allows users to assess the relative weight of multiple criteria. In case quantitative ratings are not available, policymakers or the assessors can still recognize whether one criterion is more important than another. Therefore, pair-wise comparisons are appealing to users.

Hill and Nydick [1] have shown how AHP can be used to structure the supplier selection process. This method of selection is described, and a detailed, hypothetical example of how AHP works.

AHP is designed based on a well-defined mathematical structure of consistent matrices and their associated eigen vector's ability to generate true or approximate weights [2].

Saaty established a consistent way of converting such pair-wise comparisons into a set of numbers representing the relative priority of each of the criteria [3].

The advantage is that it is simple and captures both qualitative and quantitative criteria but there is a chance for inconsistency of data in this method [4].

It converts individual preferences into ratio scale weights that can be combined into a linear additive weight for each alternative. The resultant can be used to compare and rank the alternatives and, hence, assist the decision maker in making a choice [5].

Nowadays, especially in complex economic conditions, many of the decisions are made in such an environment, fuzzy versions of AHP or similar methods are being used despite their complexity during the calculation. The advantages of FAHP are that it allows a more accurate description of the decision-making process and the disadvantage is that it requires data based on experience, knowledge, and judgment which are subjective for each decision-maker.

Objective of the study

The main objective of the study is to select the optimum vendor considering a technically sound vendor selection mechanism suitable for Engineering products. The study aims to identify the most suitable vendor considering the response given by the relevant officials of CESC Ltd. a reputed power generation & distribution company of West Bengal.

Methodology

This case study presents a structured model for selecting the most suitable vendor among the available alternatives using the Analytical Hierarchy Process (AHP) in a power sector company in West Bengal. The questionnaire was made for this purpose.

The AHP method is used for organizing & analyzing complex decisions using mathematics & psychology. It was developed by Thomas L. Saaty in 1970 & reframed since then. The beauty of AHP is that it uses paired comparisons to determine the relative weights of various criteria & then transfers them across each level of criteria to calculate overall weights for ranking.

AHP usually involves the following steps

Step 1: Establish the Hierarchy structure

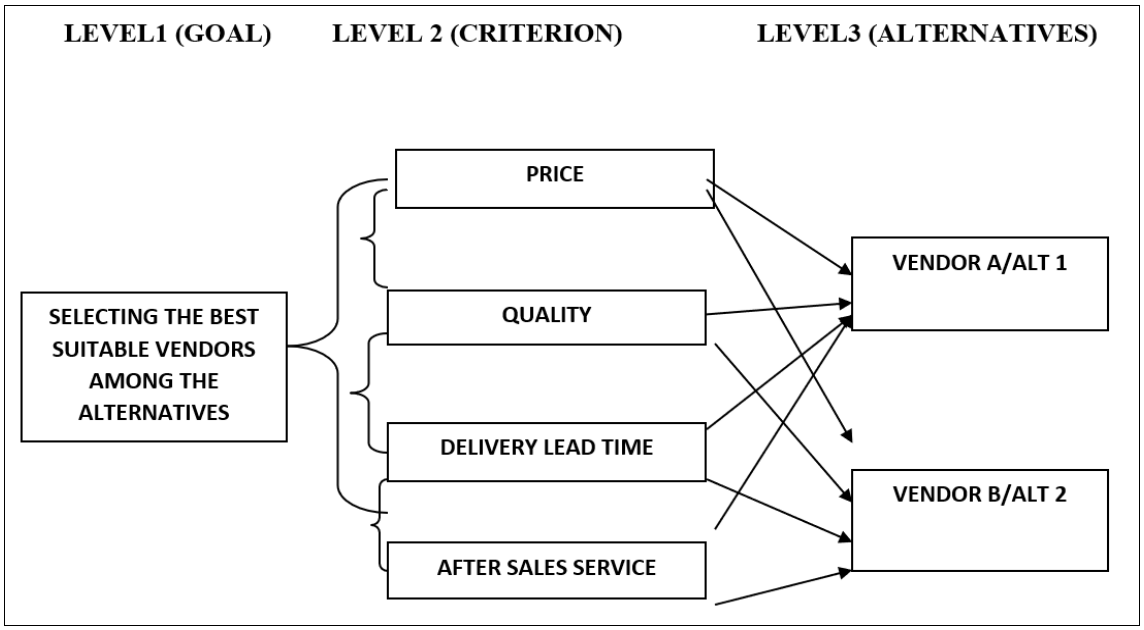

Fig 1: Establish the Hierarchy structure

Step 2: Pair-wise comparisons (Fig 3)

This is an Eigenvalue (λ) approach to pair-wise comparisons. It is a method to derive a ratio scale from paired comparisons for the measurement of quantitative as well as qualitative performance. The scale ranges from 1 to 9 based on the intensity of importance.

Scale of Relative Importance (Saaty, 1970) Fig 2.

Intensity of Importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extremely strong importance
2,4,6,8	Intermediate value

Fig 2: Scale of Relative Importance (Saaty, 1970)

Comparisons among criteria

Criteria 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Criteria 2
PRICE				*														QUALITY
PRICE							*											DLT
PRICE	*																	ASS
QUALITY	*																	DLT
QUALITY			*															ASS
DLT																*		ASS

3a

Comparisons among alternatives based on Criteria 1: "Price"

Alternative 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Alternative 2
							*											

3b

Comparisons among alternatives based on Criteria 2: "Quality"

Alternative 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Alternative 2
															*			

3c

Comparisons among alternatives based on Criteria 3: "Delivery Lead Time"

Alternative 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Alternative 2
													*					

3d

Comparisons among alternatives based on Criteria 4: "After Sale Service"

Alternative 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Alternative 2
	*																	

3e

Step 3: Construction of pair-wise matrix

Test the consistency of each comparison matrix by calculating the Eigenvector and maximizing the Eigenvalue (ƛ max).

The pair-wise matrix comparison is given in terms of how much vendor A (in our case HAVELLS) is more important than alternative vendor B (KEI INDUSTRIES).

It has been observed from the literature that price, quality, delivery lead time, and after-sales services are considered the most important criteria by most researchers. Hence, we have considered these four criteria for our study. Based on these criteria two major cable suppliers to CESC LTD. i.e., Havells & KEI industries have been given weightage.

As the AHP approach is a subjective methodology, information & priority weights of the criteria were obtained from the senior officers of CESC Ltd. using the questionnaire method.

Response received from thirty-five officials of the materials division (name kept undisclosed here, may produce if required with designations) of CESC Ltd. For the sake of uniformity, this response taken from officers belongs to the purchase, quality & supplies vertical of the materials division.

Step 4: consistency checking

After taking the responses it was tabulated in the Excel sheet for consistency checking to find out the aggregated value.

Steps for checking the consistency ratio-

- Calculate the relative weight and ƛ max for each matrix of order n.
- Compute the consistency index (CI) for each matrix of order n using the formula.

$$CI = (\lambda \text{ max} - n)/(n-1) \quad (1)$$

- Consistency ratio (CR) is then calculated using the formula

$$CR = CI/RI \quad (2)$$

Here, RI is known as the random consistency index obtained from many simulations & varies depending on the order of the matrix.

Fig 4 indicates the value of the Random Consistency Index (RI) for the matrices of order (1-10) obtained by approximating random indices using a sample size of 500 (Saaty 2000)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

Table 4

Thus, acceptable CR ranges vary as per the size of the matrices.

0.05 for 3x3 matrix

0.08 for 4x 4 matrix

0.1 for all larger matrices, n=5

If the value of CR is equal to or less than that value, it implies that the evaluation within the matrix is acceptable or indicates a good level of consistency in the comparative judgments represented in the matrix.

In contrast, if CR is more than the acceptable value, inconsistency of judgments has occurred and the evaluation process should be reviewed, reconsidered & to be improved. Hence, the problem to be restructured more carefully.

An acceptable consistency property ensures decision-maker reliability in determining the priorities of a set of criteria.

Step 5: Calculation of alternative weight or ranks of the vendor (table 5)
Data Analysis for Vendor Rating:

Aggregate Comparison Matrix (A)					
Criteria		Price	Quality	DLT	ASS
	Price	1	1/7	1/6	2/9
	Quality	6	1	2	2 2/7
	DLT	6	1/2	1	1/2
	ASS	4	1/3	2	1
		17.00	1.98	5.18	4.00

5a

Normalised Matrix					W					
	Price	**Quality**	**DLT**	**ASS**	**Weight**	**AW**	**Lambda (AW/W)**	**CI**	**RI**	**CR=CI/RI**
Price	0.06	0.08	0.03	0.05	0.06	0.22	3.965993521	0.0198894	0.9	0.0220993
Quality	0.35	0.50	0.39	0.57	0.45	1.84	4.064062436			
DLT	0.35	0.25	0.19	0.12	0.23	0.92	3.993531833			
ASS	0.24	0.17	0.39	0.25	0.26	1.10	4.215084958 4.059668187			

5b

Havells			**KEI**
Alternative (Price)	HAVELLS	1	4 1/6
	KEI	1/4	1
		1.25	5.16

5c

	Havells	**KEI**	**Weight**	**AW**	**lambda**	**CI**	**RI(AW/W)**	**CR**	**n=2**
Havells	0.80	0.81	1.61242	3.2571	2.02	0	0	0	
KEI	0.20	0.19	0.39534	0.7984	2.02 2				

5d

			Havells	KEI
Alternative (Quality)		Havells	1	3 5/8
		KEI	1/4	1
			1.25	4.63

5e

	Havells	**KEI**	**Weight**	**AW**	**Lambda**	**CI**	**RI (AW/W)**	**CR**	**n=2**
Havells	0.8	7/9	0.79211	1.5476	1.95	0	0	0	
KEI	0.2	2/9	0.20789	0.4059	1.95				
					1.953185				

5f

			Havells	**KEI**
Alternative (DLT)		Havells	1	1 3/5
		KEI	1/2	1
			1.50	2.59

5g

	Havells	KEI	Weight	AW	lambda	CI	RI(AW/W)	CR		n=2
Havells	0.6666667	3/5	0.64009	1.2114	1.89	0	0			
KEI	0.3333333	2/5	0.35991	0.68	1.89					
					1.8909					

5h

			Havells	KEI
Alternative (ASS)		Havells	1	1/5
		KEI	4	1
			5	1.21

5i

	Havells	KEI	WEIGHT	AW	lambda	CI	RI(AW/W)	CR		n=2
Havells	0.2	1/6	0.18677	0.3575	1.91	0	0	0		
KEI	0.8	5/6	0.81323	1.5603	1.92					
					1.916489					

5j

Priority Matrix					Criteria weight		
	PRICE	QUALITY	DLT	ASS	**Price**	0.06	
Havells	1.612416	0.792107	0.640089	0.186772	Quality	0.45	
KEI	0.395344	0.207893	0.359911	0.813228	DLT	0.23	
					ASS	0.26	

Alternative weight = PM x CW	
Havells	0.6454
KEI	0.41069

Conclusion: Havells is a better supplier than KEI.

Here in our case, we have found the aggregated value of the accepted three responses.
The calculated CR value is = (0.0220993 <0.08) i.e., consistent.
Next level we must find out the priority matrix of Havells & Kei industries based on weights of price, quality, delivery lead time & after-sales services.
We have already calculated the criteria weight for the selected criteria price, quality, delivery lead time & after-sales services.
Now alternative weight = priority matrix X criteria weight
After doing this matrix multiplication function, we have calculated the alternative weight which is as follows:

Havells: 0.6454
Kei: 0.41069
Finally, we can conclude with the remarks that Havells is a better vendor than Kei Industries in this study based on these four selected criteria for the supply of cables.

A vendor selection initiative provides a critical foundation for reducing vendors' risk, and costs and improving operational performance. Thus, increasing the organization's supply chain efficiency. It is not about completing a one-time review with the vendors, but the performance management initiative can significantly improve overall performance and the competitive advantage of the organization over others.

References

1. Hinkle CL, Robinson PJ, Green PE. Vendor evaluation using cluster analysis. J Purch. 1969;5(3):49-58.
2. Setak M, Sharifi S, Alimohammadian A. Supplier selection and order allocation models in supply chain management: A review. World Appl. Sci. J. 2012;18(1):55-72.
3. Merkin BG. Group Choice. John Wiley & Sons; 1979.
4. Mahmood Zadeh S, Shah Rabi J, Pari Azar M, Zaeri MS. Project selection by using fuzzy AHP and TOPSIS technique; c2007.
5. Apak S, Gogus GG, Karakadilar IS. An analytic hierarchy process approach with a novel for luxury car selection. ELSEVIER. 2012;58:1301-1308.
6. Chhabile SB, Dalu RS. Int. J Eng. Res Technol. (IJERT), 2014, 3(3).
7. Chhabile SB, Dalu RS. Int. J Eng. Res Technol. (IJERT), ISSN: 2278-0181, 2014, 3(3).
8. Cengiz AE, Ozdemirb OAI, Kusanb H, Cabuk A. A Multi-Criteria Decision Model for Construction Material Supplier Selection; c2017. p. 294-301.
9. Tahriri F, Osman MR, Ali A, Yusuff RM. Received: Sept 24, 2007; Revised: Jun 2, 2008; Accepted: Jul 29, 2008.
10. Vasina E. Analyzing the process of supplier selection: The application of the AHP Method, in Degree Programs in Industrial Management, Centria University of Applied Sciences; c2014.
11. Saaty TL. The Analytic Hierarchy Process. McGraw-Hill; c1980.
12. Raj S. ISSN (PRINT): 2393-8374, (ONLINE): 2394-0697, 2018, 1(1).
13. Procedia Manufacturing. 2019;32:1024-1034.
14. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1745-493X.1992.tb00561.x
15. https://www.researchgate.net/publication/332597034_Supplier_Selection_Criteria_and_Methods
16. https://www.sciencedirect.com/science/article/pii/S1877042812046423
17. https://www.tandfonline.com/doi/full/10.1080/23311916.2022.2146628.2146628