

## Courier partner selection for E-commerce business Using TOPSIS Method

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**Abstract:** In today's competitive business world, it is extremely important for decision makers to have access to decision support tools in order to make quick, right and accurate decisions. One of these decision making areas is courier service provider selection. Courier service provider selection is a multi – criteria decision making process that deals with the optimization of conflicting objectives such as quality, cost, and delivery time. If it is not supported by a system, this would be a complex and time consuming process. In spite of the fact that the term "Courier service provider selection" is commonly used in the literature, and many methods and models have been designed to help decision makers, few efforts have been dedicated to develop a system based on any of these methods. In this paper, Courier service provider selection decision support system based on the analytic hierarchy process (AHP) method which has been commonly used for multi –criteria decision making problems is proposed. To validate choice of the AHP model and also to validate the conceptual design of courier service provider selection decision support system, we conducted a case study as an example to determine best service Provider Company using TOPSIS model.

**Keywords—** Courier service provider selection, TOPSIS, AHP

### I. INTRODUCTION

Determining the most suitable logistic service provider is an important problem to deal with when managing supply chain of a company. It is vital in enhancing the competitiveness of the company and has a positive impact on expanding the life span of the company.

One of the most important functions of the logistic department is the selection of efficient courier service providers, because it brings significant savings for the organization. While choosing the best provider, a logistic manager might be uncertain whether the selection will satisfy completely the demands of their organizations. The overall objective of the provider evaluation process is to reduce risk and maximize overall value to the purchaser.

### II. TOPSIS METHOD

This study uses the TOPSIS method. A positive ideal solution maximizes the benefit criteria or attributes and minimizes the cost criteria or attributes, whereas a negative ideal solution maximizes the cost criteria or attributes and minimizes the benefit criteria or attributes. The TOPSIS method is expressed in a succession of six steps as follows:

Step 1: Calculate the normalized decision matrix. The normalized value  $r_{ij}$  is calculated as follows:

$$r_{ij} = x_{ij} \sqrt{\frac{1}{\sum_{i=1}^m x_{ij}^2}} \quad i=1, 2, \dots, m \text{ and } j=1, 2, \dots, n.$$

Step 2: Calculate the weighted normalized decision matrix. The weighted normalized value  $v_{ij}$  is calculated as follows:

$$v_{ij} = r_{ij} \times w_j \quad i=1, 2, \dots, m \text{ and } j=1, 2, \dots, n. \quad (1)$$

Where  $w_j$  is the weight of the  $j^{\text{th}}$  criterion or attribute and  $\sum_{j=1}^n w_j = 1$ .

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Step 3: Determine the ideal ( $A^*$ ) and negative ideal ( $A^-$ ) solutions.

$$A^* = \{(\max_i v_{ij} | j \in C_b), (\min_i v_{ij} | j \in C_c)\} = \{v_j^* | j = 1, 2, \dots, m\} \quad (2)$$

$$A^- = \{(\min_i v_{ij} | j \in C_b), (\max_i v_{ij} | j \in C_c)\} = \{v_j^- | j = 1, 2, \dots, m\} \quad (3)$$

Step 4: Calculate the separation measures using the m-dimensional Euclidean distance. The separation measures of each alternative from the positive ideal solution and the negative ideal solution, respectively, are as follows:

$$S_i^* = \sqrt{\sum_{j=1}^m (v_{ij} - v_j^*)^2}, j = 1, 2, \dots, m \quad (4)$$

$$S_i^- = \sqrt{\sum_{j=1}^m (v_{ij} - v_j^-)^2}, j = 1, 2, \dots, m \quad (5)$$

Step 5: Calculate the relative closeness to the ideal solution. The relative closeness of the alternative  $A_i$  with respect to  $A^*$  is defined as follows:

$$RC_i^* = \frac{S_i^-}{S_i^* + S_i^-}, i = 1, 2, \dots, m \quad (6)$$

Step 6: Rank the preference order.

### III. EMPIRICAL EXAMPLE

Supplier selection for logistic are based on cost per courier service, cash on delivery service cost, insurance cost etc. (Price), Quality of the service based on lead time, reverse logistic, real time update of order, communication process & pan India location serve. Reliability of logistic service based on management of the organization, capital & revenue, product loss insurance coverage policy etc. & Service of the logistic partner criteria based on product delivery, delivery time & customization capability. Decision Hierarchy level (Table I) for the AHP method is categories based on importance level criteria & weights are given based on the respective level of importance.

Table I  
DECISION HIERARCHY LEVEL

Level 0	Supplier Selection Of Logistic Partner 100%			
Level 1	Price 25%	Quality 25%	Reliability 25%	Service 25%
Level 2	COD Price 8.3%	Pan India Location Serve 8.3%	Management & Organization 8.3%	Communication 8.3%
	Insurance Price 8.3%	Reverse Logistic Features 8.3%	Capital & Revenue 8.3%	Delivery Lead Time 8.3%
	Reverse Logistic Price 8.3%	Product Delivery & COD Quality 8.3%	Product Loss Insurance Coverage Policy 8.3%	Customization Capability 8.3%

#### A. AHP Method

Table II shows the resulting weights for the criteria based on pair wise comparisons. The resulting weights are based on the principal Eigen vector of the decision matrix. Pair wise comparison matrix of the main criteria with respect to the Goal.

Table II  
DECISION MATRIX

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	FedEx	Gati	DTDC	Delhivery	Ecom	Aramex	Blue Dart	Procure
FedEx	1	6	5	5	2	2	5	2
Gati	0.17	1	3	2	1	0.5	4	0.25
DTDC	0.2	0.33	1	0.33	0.2	0.17	2	0.17
Delhivery	0.2	0.5	3	1	0.33	0.33	1	0.25
Ecom	0.5	1	5	3	1	0.5	4	0.2
Aramex	0.5	2	6	3	2	1	4	0.5
Blue Dart	0.2	0.25	0.5	1	0.25	0.25	1	0.25
Procure	0.5	4	6	4	5	2	4	1

Number of comparisons = 28  
 Consistency Ratio CR = 6.0%  
 Principal Eigen value = 8.584  
 Eigenvector solution: 6 iterations, delta = 8.6E-9

Table III shows the scale of AHP module, scale of AHP module decision based on testing the actual service of courier partner & noted down the analysis point based on weight scaling done.

Table III  
 SCALE OF AHP CALCULATION

Name Of Vendor	Price	Quality	Reliability	Service
FedEx	114	179	142	142
Gati	125.97	160	124	133
DTDC	118.56	148	119	136
Delhivery	107	139	116	129
Ecom Express	110.81	156	121	127
Aramex	116.85	167	126	139
Blue Dart	131.1	177	136	143
Procure	142.5	148	112	126

**B.AHP Rank Method**

We use only rank of each alternative under each criterion in AHP rank method.

Table IV.  
 RESULT OF RANK METHOD

Name Of Vendor	Price	Quality	Reliability	Service	weighted rank	conclusion
FedEx	3	1	1	2	1.75	1
Gati	6	4	4	5	4.75	4
DTDC	5	6	6	4	5.25	6
Delhivery	1	8	7	6	5.5	7
Ecom Express	2	5	5	7	4.75	4
Aramex	4	3	3	3	3.25	3
Blue Dart	7	2	2	1	3	2
Procure	8	6	8	8	7.5	8

From the above AHP method supplier selection for the logistic partner is FedEx based on the pair wise comparison of other logistic partner with respect to price, quality, reliability & service of the courier, thus validation of the above AHP result with TOPSIS module as follow.

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C.TOPSIS Method

Table V shows the collected data of courier service provider & converted to scale.

Table V  
THE COLLECTED SCALE

Name Of Vendor	Price	Quality	Reliability	Service
Fedex	113.6	179	142	142
Gati	125.97	160	124	133
DOTZOT (DTDC)	118.56	148	119	136
Delhivery	107	139	116	129
Ecom Express	110.808	156	121	127
Aramex	116.85	167	126	139
Blue Dart	131.1	177	136	143
Procure	142.5	148	112	126
	Min	Max	Max	Max
	25.00%	25.00%	25.00%	25.00%
Ideal	107	179	142	143
the worst	142.5	139	112	126

All criterions to maximize - it is a condition of TOPSIS method. So, the minimizing criterions had to be converted.

Table VI  
THE NORMALIZED MATRIX WITH SUPPLIER AND EVALUATION CRITERIA

Name Of Vendor	Price	Quality	Reliability	Service
FedEx	28.9	179	142	142
Gati	16.53	160	124	133
(DTDC)	23.94	148	119	136
Delhivery	35.5	139	116	129
Ecom Express	31.692	156	121	127
Aramex	25.65	167	126	139
Blue Dart	11.4	177	136	143
Procure	0	148	112	126
Normalized	68.80472	452.0221	353.1487	380.48

Table VII  
CRITERIA WEIGHTING

Weighted Normalized matrix	Price	Quality	Reliability	Service
FedEx	0.105007	0.099	0.100524	0.093303
Gati	0.060061	0.088491	0.087782	0.08739
DTDC	0.086985	0.081854	0.084242	0.089361
Delhivery	0.128988	0.076877	0.082118	0.084761
Ecom Express	0.115152	0.086279	0.085658	0.083447
Aramex	0.093199	0.092363	0.089198	0.091332
Blue Dart	0.041422	0.097893	0.096277	0.09396
Procure	0	0.081854	0.079287	0.08279
Ideal	0.128988	0.099	0.100524	0.09396
Worst	0	0.076877	0.079287	0.08279

The (positive ideal) ideal (A+) and (negative ideal) worst (A-) solutions are determined using Equations (V) and (VI). The results are shown in Table VII. The separation of each alternative solution is calculated using Table (VIII) and (IX). The final results are shown in Table X.

Table VIII  
POSITIVE IDEAL SOLUTIONS

From Ideal	Price	Quality	Reliability	Service
FedEx	0.023981	0	0	0.000657
Gati	0.068927	0.010508	0.012743	0.006571
DTDC	0.042003	0.017145	0.016282	0.004599
Delhivery	0	0.022123	0.018406	0.009199
Ecom Express	0.013836	0.012721	0.014866	0.010513
Aramex	0.03579	0.006637	0.011327	0.002628
Blue Dart	0.087567	0.001106	0.004248	0
Procure	0.128988	0.017145	0.021238	0.01117

Table IX  
NEGATIVE IDEA SOLUTIONS

From worst	Price	Quality	Reliability	Service
FedEx	0.105007	0.022123	0.021238	0.010513
Gati	0.060061	0.011614	0.008495	0.004599
DTDC	0.086985	0.004978	0.004955	0.006571
Delhivery	0.128988	0	0.002832	0.001971
Ecom Express	0.115152	0.009402	0.006371	0.000657
Aramex	0.093199	0.015486	0.009911	0.008542
Blue Dart	0.041422	0.021017	0.01699	0.01117
Procure	0	0.004978	0	0

The result of the ranking of approaches is derived using Equations (X) (Table X). The first alternative is considered as the best maximization of expected benefits for the courier partner to concentrate the business resources and strengthen logistic strategy.

Table X  
RESULTS OF CLOSENESS COEFFICIENT AND RANK

di+	di-	ci	Conclusion	Name Of Vendor
0.023989	0.1098977	0.820821	1	FedEx
0.071182	0.061932	0.465255	6	Gati
0.048419	0.0875154	0.643803	5	DTDC
0.030212	0.1290344	0.810277	3	Delhivery
0.026168	0.1157126	0.815561	2	Ecom Express
0.038211	0.095378	0.713961	4	Aramex
0.087676	0.0507038	0.366409	7	Blue Dart
0.132316	0.0049776	0.036255	8	Procure

#### IV. CONCLUSION

Logistics service provider selection process becomes increasingly important in today's complex environment. The selection process involves the determination of quantitative and qualitative factors to select the best possible provider. Decision-makers face up to the uncertainty and vagueness from subjective perceptions and experiences in the decision-making process. The decision criteria are cost of service, financial performance,

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operational performance, and long- term relationships. The analysis helped the company to structure the problem with its differing aspects rather than only financial considerations. As a result of this study alternative first (FedEx) is determined as the best logistics service provider which has the highest priority weight.

This study found that in ecommerce industry, the perception of the logistic partner for Pharmacy Supply Chain management for ecommerce. This paper considers the all factor for decision making of courier service provider. The ranking result by TOPSIS pointed out that the first alternative is strategically optimum supplier.

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