

AGILITY ASSESSMENT OF LOGISTICS SERVICES USING MCDM APPROACH

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Abstract - Agile concepts are applicable in the service sector as the logistics industry, even though the agility assessment is predominantly done for the manufacturing sector. This study thus contributes to the knowledge base by assessing and ranking the factors that affect the agile performance in logistics service using TOPSIS approach.

Keywords- Agility, Agile factors, TOPSIS SIMOS.

INTRODUCTION

Logistics is a very broad term. It is a process which involves planning, implementation, and control of efficient, cost-effective flow and the storage of materials which includes in-process inventory, finished goods and any related information from the point of origin to the point of consumption for the purpose of conforming to the customer requirements [1]. Agility is the ability of organizations to respond rapidly to the changes in demand in terms of both volume and varieties [2]. It can be related to the power to move quickly and have a quick resourceful and an adaptable character [3]. The agile practices can be adopted in logistics services and this will help in meeting the service demands that changes swiftly and unpredictably, thus gaining a competitive advantage within the industry [4] [5]. Agility is also related to the performance capability of an organization [6]. So the driving factors of agility have been assessed through various means like index, system approach [7], graph theory [8], fuzzy data envelopment analysis [9] and regression analysis [10]. Addressing the gap in existing literature relating to agility assessment in service industry becomes the motivation for this study [11].

LITERATURE REVIEW

The critical success factors affecting a logistics company are identified as geographical location, skilled logistics professional's, breadth of services [12], Order tracking technology [13], focus on

industries, industrial diversification, long-term relation [14], inter-functional integration and marketing integration [15]. The performance indicators are classified as efficiency, responsiveness, flexibility, and quality [16]. The factors that affect efficiency are transaction costs, distribution costs [17] and capacity utilization [18]. The flexibility can be volume flexibility, delivery flexibility, and exceptional orders [19] [20] [21]. Responsiveness factors are delay in order delivery, delivery lead time and complaints and shipping error [19] [21]. Packaging quality factor is the major the quality indicator. Customer perspectives factors are customized services, value-added services, losses and damage to products and alertness towards lapses [22]. The company internal factors are Order handling capacity, Scope for future expansion, facility operating costs, investments in infrastructure and decisiveness from available information [23] Other factors affecting the agility are government regulations and accessibility to market [24] and the agile swiftness factor.

Technique for Order Preference by Similarity to Ideal Solution [25], which is basically a Multi-Criteria Decision Making model (MCDM) is used. The principle involved is choosing a best alternative factor based on evaluating criteria having shortest distance from a positive ideal solution and that is farthest from a negative ideal solution [26]. Thus, the 33 factors identified from literature review were evaluated by five decision makers on a 5 point scale and the weights were assigned by an expert on 10 point scale from the logistics industry.

METHODOLOGY

The different steps in the approach are:

Step 1: Establishment of decision matrix and calculate the normalization values;

$$\text{Decision matrix} = \begin{bmatrix} X_{1,1} & \dots & X_{1,j} & \dots & X_{1,n} \\ \dots & \dots & \dots & \dots & \dots \\ X_{m,1} & \dots & X_{m,j} & \dots & X_{m,n} \end{bmatrix}$$

$$R_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}}$$

Where i is the score index, j is the factor index, n is the number of rating criteria used (here n=5), m is the number of factors (here m=33) and X_{ij} represents the number of response for score j w.r.t. factor i. R_{ij} is normalization value.

Step 2: A weighted decision matrix is constructed as:

$$V_{ij} = W_j \times R_{ij}$$

Step 3: Identification of A+ and A- ideal points as:

$$A+ = \{V_1^+, V_2^+ \dots V_j^+ \dots V_n^+\} \text{ (maximum value)}$$

$$A- = \{V_1^-, V_2^- \dots V_j^- \dots V_n^-\} \text{ (minimum value)}$$

Step 4: Calculation of distance of each element from positive ideal solution (S_i^+) and negative ideal solution (S_i^-) as

$$S_i^+ = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^+)^2}$$

$$S_i^- = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^-)^2}$$

Where I = 1, 2, 3 ..., m

Step 5: Calculation of relative closeness which is considered as ranking score for ranking the alternatives as:

$$S_i = \frac{S_i^-}{S_i^+ + S_i^-}$$

Where I = 1, 2, 3 ..., m

Step 6: Ranking the factors based on relative closeness with a preference for the highest value. Here the cutoff coefficient value for classifying the factors as essential or non-essential is 0.5.

Table 1. Vital agile factors of logistics industry

Sl No	Factor	Si+	Si-	Ci	Rank
1	accessibility to market	0.00 24	0.00 79	0.76777 045	1
2	delay in delivery	0.00 25	0.00 77	0.75208 4611	2
3	facility operating costs	0.00 25	0.00 77	0.75208 4611	2
4	government regulations	0.00 25	0.00 77	0.75208 4611	2

5	Geographical location	0.00 27	0.00 74	0.73675 2252	5
6	skilled logistics professionals	0.00 32	0.00 87	0.73074 0501	6
7	volume flexibility	0.00 30	0.00 77	0.72007 8496	7
8	customized service	0.00 33	0.00 71	0.68150 5592	8
9	Value-added service	0.00 37	0.00 74	0.66423 8742	9
10	Long-term relation	0.00 39	0.00 67	0.63070 0414	10
11	responsiveness	0.00 39	0.00 67	0.63070 0414	10
12	order processing time	0.00 40	0.00 65	0.62042 0057	12
13	alertness towards lapses	0.00 41	0.00 62	0.60145 932	13
14	delivery flexibility	0.00 50	0.00 72	0.59369 6072	14
15	delivery lead time	0.00 44	0.00 63	0.58914 9464	15
16	Order handling capacity	0.00 52	0.00 67	0.56166 2034	16
17	packaging quality	0.00 44	0.00 55	0.55634 6901	17
18	loss and damages to products	0.00 50	0.00 55	0.52343 7836	18

MANAGERIAL IMPLICATIONS

The agility assessment project has several parameters and measures. To work successfully, these parameters have to be understood better. The manager has to know how to make the firm agile to gain a competitive advantage which makes it necessary for the agile factors under consideration to be analyzed. The factors are ranked based on expert opinion. The threshold value gives the idea regarding which all factors to be taken as vital and these can be given due importance in the operation of a firm. Factors with C_i less than 0.5 can be removed during implementation and those having greater than 0.5 can be improved during operation.

RESULTS AND DISCUSSIONS

Out of the 33 agile factors, the vital factors to be focused on have been identified. Using cut off value as 0.5, 18 factors have been found to be vital. The main contribution of the study was the use of TOPSIS model in the logistics industry which is a first initiative in ranking the agile factors for the industry.

The vital factors are accessibility to market and delay in delivery. These factors have to be given prime importance so that the logistics service has a wider market reach and no delay in delivering the order occurs. The facility operating cost is the next vital factor that affects the agility and has to be minimized to improve the efficiency indicator of the logistics firm. Government regulations and geographical location play the next vital role which has to be adhered to and taken care of for the agile operation. Skilled logistics professionals in the firm ensure good competency which aids the agile performance. Volume flexibility helps manage the variation in volumes of services between maximum and minimum thresholds levels. Customized and Value-added services have the next priority which creates the trust in the minds of clients for having the next priority factor; long-term relations that allows some amount of negotiations from the part of either side involved in the business relation. Responsiveness, order processing times and alertness towards lapses are the internal factors that can be controlled by the firm and have a vital role in determining its agility.

Delivery parameters like delivery flexibility and delivery lead times play the next crucial role in defining the agility where the former has to be maximized while latter minimized. Order handling capacity, packaging quality and losses and damage to products are the ultimate agile factors that proved to be vital and also have a significant role in the agility of the firm.

CONCLUSION

TOPSIS SIMOS approach has been used to rank the agile factors in the logistics industry. The proposed TOPSIS approach for ranking can be incorporated for application in any logistics service provider. The proposed model reduces the complexity and uncertainty of decision maker scores required for providing weights for the factors in MCDM methods. The specific weights are obtained from experts without ambiguity. The model minimizes the mathematical complexity encountered in applying other approaches. The introduced SIMOS approach incorporates weights from experts in decision-making

scenarios. By focusing on the vital factors, organizations can improve their agility.

Appendix

A.1 Decision makers assessment of agile factors in logistics services

No.	factors	A	B	C	D	E	W
1	Geographical location	4	4	4	5	4	8
2	skilled logistics professionals	5	3	5	4	4	8
3	breadth of services	5	4	2	4	3	9
4	Order tracking technology	4	3	2	3	3	6
5	focus on industries	4	2	3	5	3	7
6	industrial diversification	2	2	2	4	2	7
7	Long-term relation	5	4	3	5	4	9
8	Investment in infrastructure	5	2	3	5	3	8
9	inter-functional integration	4	3	1	4	3	8
10	marketing integration	5	3	2	5	3	8
11	swiftness of service	5	4	2	4	3	9
12	responsiveness	5	4	3	5	4	9
13	volume flexibility	5	4	4	3	4	8
14	delivery flexibility	5	2	4	5	4	8
15	exceptional orders	4	3	3	4	3	8
16	transaction cost	4	4	2	5	3	5
17	distribution cost	4	4	2	5	3	7
18	delay in delivery	5	4	4	4	4	9
19	Order handling capacity	5	2	4	4	3	9
20	complaints and shipping error	5	2	3	5	3	9

21	Scope for future expansion	4	3	3	3	3	7
22	loss and damages to products	5	3	3	4	3	9
23	facility operating costs	5	4	4	4	4	8
24	order processing time	4	3	4	5	3	8
25	delivery lead time	4	3	4	3	3	9
26	customized service	3	4	4	5	4	9
27	packaging quality	4	4	3	4	3	7
28	capacity utilization	4	2	3	5	3	7
29	Value-added service	5	5	3	4	4	8
30	government regulations	5	4	4	4	4	9
31	alertness towards lapses	4	4	3	5	4	9
32	accessibility to market	5	4	4	5	4	9
33	decisiveness from available information	4	3	3	4	3	8

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