AUTOMATION OF 3PL SELECTION TO MATCH CLIENT REQUIREMENT USING ANALYTICAL PROCESSES

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ABSTRACT

This paper aspires to present an automation model for the third party logistics (3PL) selection process. The approach is to analyze the criteria based on applying the 10C supplier evaluation model and then evaluating their weightages using Analytical Hierarchical Process (AHP) and determining the ranking of 3PL service providers with the help of TOPSIS technique (Technique for Order Preference by Similarity to Ideal Solution). The model will automate the decision making process based on the client requirements and generate the ranking of 3PL service providers.

Keywords

Automation, 3PL, AHP, TOPSIS

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

1. Introduction

Logistics plays very crucial role in connecting the supply chain throughout. Now, with the market expanding, logistics becomes the key area where companies would want to improve their service quality for customers and at the same time it is the area where they can cut cost. Companies want their customer service to be top notch to provide to increase the perceived value of products and gain new market shares. Customers always look for tailored products/services and at the same time lower lead time for delivery. Customers can turn competition if their needs are not fulfilled. So it has become quite evident that logistics should be effective and efficient and it plays key strategic role in the market place.

Since logistics is not always a core competence for every company, so most of them are going for a third party logistics (3PL). The third party logistics is characterized as an outside coordination specialist organization which offers single or different coordination exercises to its clients. From the supplier's perspective, their business covers numerous connections which includes from basic calculated exercises to cutting edge strategic arrangements; from the client's perspective, it is the level of re-appropriating shifts. Companies can achieve competitive advantage by outsourcing their logistics activities to 3PL. Some activities that are frequently outsources are warehousing, domestic and international transportation, custom clearance, shipment consolidation, forwarding, etc.

The sole aim of this paper is to devise an automated model for the 3PL selection to match client requirements using analytical processes such as AHP and TOPSIS. Selection and evaluation are 2 key components in this model. A combined model of AHP & TOPSIS is used in this automated model along with the 10C supplier evaluation model.

2. LITERATURE REVIEW

A lot of journals/articles have discussed on the selection and evaluation of those who are providing 3PL services. There are two classes of papers that discusses selection of 3PL providers (Daim et al., 2013). The first category gives a deep understanding on what factors to look for. What factors will play crucial role and which factors can be neglected. The second category enlightens about the different mathematical techniques which will be an aid to the decision making. There are two main processes i.e. customer facing process and internal facing process which are discussed in detail by Lai et al., 2002. The customer facing process includes Flexibility, reliability & responsiveness which are also referred to as an effectiveness measures. The other process is an internal facing processes which includes assets and cost which are also referred as

an efficiency measures which helps in running a cost efficient operations.

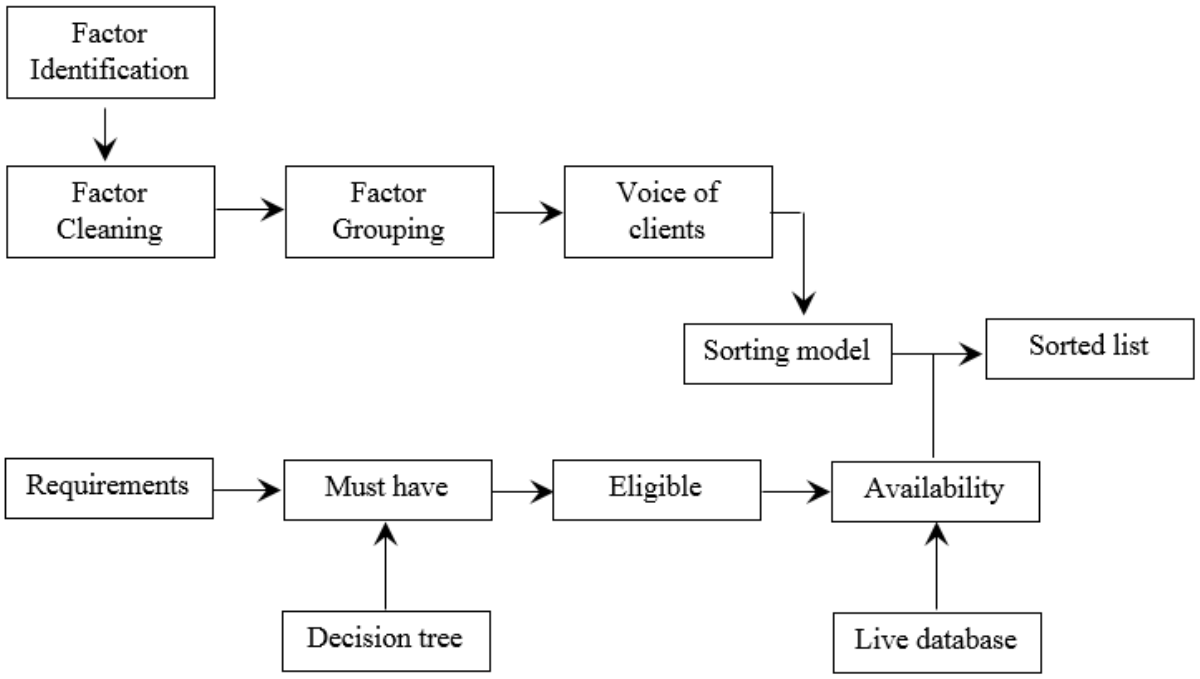
The ranking and selection for 3PL using the fuzzy TOPSIS has been discussed by Bottani and Rizzi (2006). The service quality of 3PL service providers addressed by So et al. (2006). They presented a very brief procedure of AHP in their paper. Five service quality dimensions were studied by them. A combined approach of ANP and interpretive structural model was applied by Thakkar et al. (2005). The paper discussed in detail about the various issues and the criticalities which persist in 3PL selection. They came up with a list of 26 criteria. Qureshi et al. (2007) contributed in determining the key 3PL using interval data with TOPSIS. For judging 3PLs, AHP was used to derive weights. The approach of ANP was selected by Jharkharia and Shankar (2007) for desirable selection of 3PL. The performance measurement of 3PL was given by Choy et al. (2008) which will also help in measuring their supply chain partners.

There were many articles published which discusses on various methods to be used for an optimal 3PL selection. This paper talks about how these processes can be automated and how it can be matched with client requirements to provide optimal selection.

3. METHODOLOGY

The overall process of information collection has been standardized by identifying the necessary parameters to be considered during evaluation.

3.1 Framework



Framework for Automation model

3.2 Client Survey

Clients are asked to fill the survey form where they have to rate the 10C model based on various sub categories as per their priority.

Category	Sub-Category	Point Scale
Competency	Active years No of operating sector No of core service offerings No of VAS offerings Previous clients	5 pt. scale 1 (L) -5 (H)
Capacity	No of operating cities No of payroll employee	5 pt. scale 1 (L) -5 (H)

	No of self-owned warehouses No of self-owned core services No of self-owned VAS	
Commitment to Quality	Certification Accregation No of recognized quality tools	5 pt. scale 1 (L) -5 (H)
Consistency of Performance	Response time Customer feedback Tenure of served customers	5 pt. scale 1 (L) -5 (H)
Cost	Cost of service Credit period Advance %	5 pt. scale 1 (L) -5 (H)
Cash and Finance	CIBIL Score Assets	5 pt. scale 1 (L) -5 (H)
Communication	Systems used Website available Customer care	2 Point Scale 0 (No) / 1 (Yes)
Control of Internal Processes	SOPs Contracts Policies	2 Point Scale 0 (No) / 1 (Yes)
CSR	Packaging material Social context Recycle mechanism	2 Point Scale 0 (No) / 1 (Yes)
Culture	Employee feedback Core values, mission	5 point scale 1 (Low) -5 (High)

Table 1 – 10C Parameters

3.3 Product Portfolio Matrix

The product portfolio matrix has 5 parameters – Warehouse type, Material Handling Equipment, Storage type, Packaging & Transportation. Various product categories are marked for each parameter.

Product Categories	**Warehouse Type**				
	Cold Storage	Godown	General Warehouse	Custom Bonded	Hazardous Material Warehouse
Vegetables & Fruits	X				
Agricultural Products		X			
Electronics			X		
Spare parts			X		
Machine parts			X		
Vehicle parts			X		
Printed materials			X		
Stationery			X		
Telecommunication equipment			X		
Bulk and packaged goods			X		

Glass products			X		
Pharmaceutical Products	X				
Packaged food and chocolate items	X				
Cosmetics and personal hygiene products	X				
Household and industrial appliances			X		
Textiles			X		
Controlled chemicals	X				
Radioactive substances					X
Fuels					X

Table 2 – Warehouse Type for Product Categories

Product Categories	**Material Handling Equipment**					
	Pallet trucks	Fork Lifts	Pallet Jack	Order Pickers	Piping System	More the better (AGV)
Vegetables & Fruits		X				X
Agricultural Products	X					
Electronics	X					
Spare parts			X			
Machine parts		X				
Vehicle parts		X				
Printed materials				X		
Stationery				X		
Telecommunication equipment		X				
Bulk and packaged goods		X				
Glass products	X					
Pharmaceutical Products	X					
Packaged food and chocolate items	X					
Cosmetics and personal hygiene products	X					
Household and industrial appliances		X				
Textiles		X				
Controlled chemicals		X				
Radioactive substances		X				
Fuels					X	

Table 3 – Material Handling Equipment for Product Categories

Product Categories	**Storage Type**							
	Pallet Racking	Open Space	Multi-tier Racking	Wire Partitions	Container	Shelves	Underground Storage system	Sliding racks
Vegetables & Fruits						X		
Agricultural Products							X	
Electronics	X							

Spare parts			X					
Machine parts		X						
Vehicle parts	X							
Printed materials			X					
Stationery	X							X
Telecommunication equipment	X							
Bulk and packaged goods	X							
Glass products	X							
Pharmaceutical Products	X							X
Packaged food and chocolate items						X		
Cosmetics and personal hygiene products			X					X
Household and industrial appliances	X							
Textiles	X							
Controlled chemicals				X				
Radioactive substances				X				
Fuels				X				

Table 4 – Storage type for Product Categories

Product Categories	**Packaging**						
	Carton Packaging	Chipboard Packaging	Flexible intermediate Bulk Container	Electrostatic Discharge (ESD) Packaging	Rigid box Packaging	Poly bags Packaging	Industrial Type A Packaging
Vegetables & Fruits	X						
Agricultural Products			X				
Electronics		X		X			
Spare parts	X						
Machine parts					X		
Vehicle parts					X		
Printed materials					X		
Stationery	X						
Telecommunication equipment					X		
Bulk and packaged goods					X		
Glass products					X		
Pharmaceutical Products		X					
Packaged food and chocolate items		X					

Cosmetics & personal hygiene products		X					
Household and industrial appliances					X		
Textiles					X		
Controlled chemicals						X	
Radioactive substances							X
Fuels							

Table 5 – Packaging for Product Categories

Product Categories	**Transportation**				
	Refrigerated Trucks	Semi-trailer Trucks	Jumbo trailer trucks	Flatbed trucks	Tank Trucks
Vegetables & Fruits	X				
Agricultural Products		X			
Electronics		X			
Spare parts		X			
Machine parts				X	
Vehicle parts			X		
Printed materials		X			
Stationery		X			
Telecommunication equipment			X		
Bulk and packaged goods			X		
Glass products			X		
Pharmaceutical Products	X				
Packaged food and chocolate items	X				
Cosmetics and personal hygiene products		X			
Household and industrial appliances			X		
Textiles			X		
Controlled chemicals					X
Radioactive substances			X		
Fuels					X

Table 6 – Transportation for Product Categories

4. ANALYSIS

The analysis consists of developing scoring model using AHP & TOPSIS. The process starts with forming the decision matrix by determining the relative importance of factors through pairwise comparison.

Pair-wise Comparison Matrix										
Criteria	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10
C-1	1	6	0.2	7	8	7	6	6	4	3
C-2	0.17	1	0.14	7	0.125	0.2	7	0.17	8	9
C-3	5	7	1	0.2	0.2	8	7	7	9	7
C-4	0.14	0.14	5	1	0.25	0.125	0.17	7	8	8
C-5	0.125	0.125	0.125	4	1	8	8	7	9	8
C-6	0.14	0.14	0.14	0.14	0.125	1	5	6	7	7
C-7	0.17	0.17	0.17	0.17	0.17	0.2	1	0.17	8	7
C-8	0.17	0.17	0.17	0.17	0.17	0.17	6	1	7	9
C-9	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.14	1	0.125
C-10	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	8	1
Total	7.494	15.327	7.5274	20.26	10.617	25.275	40.75	34.81	69	59.125

Table 7 – Pairwise Comparison Matrix

Using the decision matrix, a priority list was formed and assignment of priority percentage for each of the factor was done. With the help of pairwise comparison matrix, normalization matrix was formed to determine the weightage of each criterion.

Normalization												
Criteria	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	Total	**Weightage**
C-1	0.13	0.39	0.03	0.35	0.75	0.28	0.15	0.17	0.06	0.05	2.36	0.24
C-2	0.02	0.07	0.02	0.35	0.01	0.01	0.17	0.00	0.12	0.15	0.92	0.09
C-3	0.67	0.46	0.13	0.01	0.02	0.32	0.17	0.20	0.13	0.12	2.22	0.22
C-4	0.02	0.01	0.66	0.05	0.02	0.00	0.00	0.20	0.12	0.14	1.23	0.12
C-5	0.02	0.01	0.02	0.20	0.09	0.32	0.20	0.20	0.13	0.14	1.31	0.13
C-6	0.02	0.01	0.02	0.01	0.01	0.04	0.12	0.17	0.10	0.12	0.62	0.06
C-7	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.00	0.12	0.12	0.35	0.04
C-8	0.02	0.01	0.02	0.01	0.02	0.01	0.15	0.03	0.10	0.15	0.52	0.05
C-9	0.03	0.02	0.03	0.01	0.02	0.01	0.01	0.00	0.01	0.00	0.16	0.02
C-10	0.04	0.02	0.04	0.02	0.03	0.01	0.01	0.01	0.12	0.02	0.32	0.03

Table 8 – Normalization Matrix

Now the weightage for each criterion is determined. This completes the AHP model.

	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10
Weightage	0.24	0.09	0.22	0.12	0.13	0.06	0.04	0.05	0.02	0.03

Table 9 – Weightage for each Criteria

The TOPSIS model is now developed using the weightages given by AHP model. For the study purpose, 5 dummy 3PL service providers are taken and they will be analyzed in TOPSIS for all 10 criteria.

	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10
A	3.00	2.40	3.00	2.67	3.33	4.00	0.33	0.33	0.33	2.50
B	3.60	3.00	3.67	3.00	3.00	2.50	0.00	0.33	0.67	3.00
C	3.40	3.80	2.67	3.33	5.00	1.50	1.00	1.00	0.00	4.00
D	3.80	3.20	4.67	2.33	3.33	2.00	0.33	0.33	0.67	4.00
E	2.60	3.80	1.33	4.00	3.67	2.50	0.67	0.67	0.67	1.00

Table 10 – Sample 3PL Service Providers

Before ranking these 3PL service providers, a normalized matrix is developed.

	Normalized Matrix									
	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10
A	0.41	0.33	0.41	0.38	0.40	0.68	0.26	0.25	0.28	0.36
B	0.49	0.41	0.50	0.43	0.36	0.42	0.00	0.25	0.55	0.43
C	0.46	0.52	0.37	0.48	0.60	0.25	0.77	0.75	0.00	0.58
D	0.51	0.44	0.64	0.33	0.40	0.34	0.26	0.25	0.55	0.58
E	0.35	0.52	0.18	0.57	0.44	0.42	0.52	0.50	0.55	0.14

Table 11 – Normalized Matrix

Based on the normalized matrix, a weighted matrix is developed with the help of the weightages determined for each criterion with the help of AHP.

	Weighted Matrix													
	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	Si+	Si-	Pi	**Rank**
A	0.10	0.03	0.09	0.05	0.05	0.04	0.01	0.01	0.00	0.01	0.06	0.08	0.56	2
B	0.11	0.04	0.11	0.05	0.05	0.03	0.00	0.01	0.01	0.01	0.08	0.06	0.44	4
C	0.11	0.05	0.08	0.06	0.08	0.02	0.03	0.04	0.00	0.02	0.07	0.07	0.48	3
D	0.12	0.04	0.14	0.04	0.05	0.02	0.01	0.01	0.01	0.02	0.11	0.06	0.33	5
E	0.08	0.05	0.04	0.07	0.06	0.03	0.02	0.03	0.01	0.00	0.04	0.11	0.72	1

Table 12 – Weighted Matrix & Ranking

V+	0.08	0.03	0.04	0.04	0.05	0.02	0.00	0.01	0.00	0.00
V-	0.12	0.05	0.14	0.07	0.08	0.04	0.03	0.04	0.01	0.02

5. RESULTS & DISCUSSION

For the analysis purpose, 5 service providers are taken and random data is generated to test the model. With the help of 10-C criteria, the weightages of each service provider for respective criteria is calculated. This whole process is automated. The result of this automated model will directly give the ranking of the all the service providers as per the client requirements.

For example, if a client deals in dairy products then they only need to select dairy product as a product category and the list of service providers will get generated and their ranking will be done automatically with the help of this model and in the result the client will be able to see the final list of service providers based on the ranking.

6. CONCLUSION

This automated model will reduce the time drastically for clients who wants to search and list all service providers as per their requirements and rank them. This model will not only help the clients but it will be also helpful to service providers. Service providers will be able to identify their weak zones as per the client rating and they will get continuous feedback on the same which will help them to improve their services for clients.

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