

# An Extensive Study on Logistics Providers in FSCM using AHP Technique

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## Abstract

*The growth of the Logistics business has caused many firms from different industries to enter the field. A logistics provider is an external provider who manages, controls, and delivers logistics activities maintains warehouse and other necessities on behalf of a supplier. They collect outbound shipments from manufacturers & consolidates shipments in their distribution centres and delivers to the customers through an effective routing of transport. Lead time is the most repetitive risk faced by the logistics providers and hence bench marking the major focused variables is must. This results in lowering the uncertainty in Leadtime. Researchers have spoken about challenges faced in evaluating the process. This research intends to identify the variables which are considered for the evaluation process of the operations of logistics providers. A primary survey will be conducted using the identified variables and then subjected to Analytical Hierarchy Process to funnel down the major focused variables. These variables will be benchmarked and be considered as standard variables which will cause a direct impact on the daily operations and result in variation in profitability. This paper will give a clear perspective regarding the evaluation of Logistics providers and their various policies incorporated*

**Keywords:** Logistics providers, Leadtime, variables, AHP

## Introduction

Due to globalisation, organizations are moving towards optimizing their operations by involving 3PL providers. This will eventually help in reducing the lead time and delivery compliance. Evaluation of 3PL providers is a prime aspect because they play in the dynamics of supply chain. Companies who hire logistics providers must make strategic decisions while evaluating & selecting which services require outsourcing. It is necessary to identify the possible benefits and risks associated with the hiring of a logistics operator before

selecting one (citation to be added). There are various advantages regarding evaluation process for 3PL providers. As per recent survey done in U.S.A, around 37% companies have optioned for 3PL services. This has resulted in expansion of their operations and directly affected their profitability index. Hence there is a need for benchmarking variables which will be evaluated as standard aspects for the process. Companies have implemented strategic moves by have an alliance with third party logistics providers. Due to globalization and industrial revolution 4.0, companies are expanding their operations. With this move, the logistics distribution has become a prime aspect to deal with. Cost and time are the two most important factors for any supply chain. By the recent survey conducted in USA, around 42% of the companies use 3PL providers in their supply chain (Gürcana, 2016)

## Literature Review

The Food Industry is becoming an interconnected system with large variety of complex relationships with third party logistic providers. The importance of 3PL initiated way back in 1980, and as globalization occurred, in 2016 e-commerce giants are so dependent on 3PL that players like Amazon have launched their own 3PL networks (Sudipendra Nath Roy and Tuhin Sengupta, 2017). Customers basic expectation is on time delivery of product. To meet this requirement, companies have developed different strategies to meet this requirement. But many a times companies face lead times in deliveries which results in customer dissatisfaction and loss. There many techniques through which this problem can be addressed, but in this research AHP technique has be approached as it will state the major focus areas to be adhered to mitigate the problem. The AHP is a technique which involves theory of measurement through pairwise comparisons of various parameters involved. The comparisons are made using a scale of absolute judgements that represents, how much, one parameter dominates over other to a given attribute (Saaty, 2008). As the world is moving towards sustainability aspect, companies are trying to reduce their inputs in operations and optimize it to the next level. Government and customers are driving 3PL seeking opportunities which improve operational efficiencies and reduce carbon emissions in the supply chain, 3PL logistics firms have been striving to improve their truckload utilization and vehicle routing operations, especially in emission-regulated countries and volatile business environment (H. Taib Emma Zhoua, 2018)

Companies usually set a standard format to evaluate their 3PL and select the best of it. There are various aspects involved which help companies to evaluate the 3PL. The characteristics of logistics industry, the evaluation index (CIRation) system including logistics cost, the logistics operation efficiency, and the basic qualities of service suppliers and logistics technology level has more targeted and practicability context (Jianliang Peng, 2012). Within these characteristics' companies develop their strategies which help them optimize their business. But due to various product segments and expansion of business, companies face lead time in deliveries as of their 3PL. As this problem has been affecting the business on a larger scale, we are going to research the key parameters which the companies evaluate in delivering the products. Using AHP technique this problem can be mitigated to a limited extent. As mentioned by (Carman, 2012) the idea is to develop an integrated approach, combining quality function deployment (QFD), fuzzy set theory, and analytic hierarchy process (AHP) approach, to evaluate and select the optimal third-party logistics service providers (3PL). Evaluation criteria is prioritized w.r.t to the degree of achieving stakeholder requirements using Analytical Hierarchy Process. Based on the consistency index, alternative 3PL are evaluated and compared using fuzzy AHP to make the selection. AHP is a modified form of balance scorecard. In the paper mentioned green supply chain management (GSCM) has become an important strategy for companies to achieve profit and market advantages

by reducing the environmental risks and improving efficiency. An Effective balanced and dynamic performance measurements system is critical for monitoring, controlling and improving a Green SCM. AHP uses comparison matrix to note attributes in the Decision-making process. Pair wise comparison is used to determine the priorities of each pair criteria, indicating the strength with which one element dominates the other. Comparison matrix helps to quantify intangible and non-economic factors included in the decision making. The AHP helps to rank and make decision in a rational and systematic way. AHP also provides weightings to the performance measures (Qureshi2, 2012). Basically, many articles have mentioned about parameters which define the criteria on evaluating them. In this article which stated various aspects in selecting the 3PL and evaluating them for perishable products criteria such as transportation & warehousing cost, logistic infrastructure & warehousing facilities, customer service & reliability, network management, etc. these are the few criteria identified by various authors and clubbed up in this paper and finally a hybrid model of fuzzy AHP and fuzzy TOPSIS is proposed for the selection of and appropriate 3PL in order to outsource logistics activities of perishable products (Kumar3, 2017). Many authors have debated in various models to be used to analyse the best suitable to evaluate the 3PL so that the company can outsource their product delivery. Most of the FMCG companies outsource as they can't maintain their own logistics line which will be a huge investment for them. Decision support system helped decision makers process, analyse and define actions related to large amount of data. In this article the author has proposed a Fuzzy QFD (Quality Functional Deployment) for the prioritization of risks in terms of their impact on the performance indicators that are considered relevant by the actors in the supply chain (Gómez, 2016).

While evaluating the 3PL or selecting it on the basis of various parameters funnelled using AHP, there few operational risks faced. In this paper the author spoke about operational risks is a part of the criteria to be considered in the performance evaluation, taking into account the trend towards risk management that is being appreciated in the management of supply chain. Another part is Decision making process which involves different parts of an organization which contain a high level of uncertainty. The use of the tool such as Fuzzy AHP in these processes diminishes the subjectivity commonly found in expert judgements (Osorio-Gómez, 2017). As we discussed about the fuzzy topsis (ManLeecAliEmrouznejada, 2012) proposed that an integrated approach, combining quality function deployment (QFD). Also, another important aspect was discussed regarding evaluating criteria is prioritized with respect to the degree of achieving the stakeholder requirements using fuzzy AHP. Based on the ranked criteria alternatives and the assigned CI ratio, 3PL saree valuated and compared with each other to make an optimal selection of variables. The (3PL) provider selection problem was modelled by one of the most frequently used multi criteria decision making method (MCDM), AHP, which takes into account both tangible and intangible criteria. Considering this, AHP is determined as the best evaluating tool for logistic providers.

As companies have strategies for their operations, similarly they have strategies desiring to gain competitive advantage and 3PLs provider selection plays a critical role for the success of outsourcing. In order to select a proper logistic provider, integration of the Fuzzy AHP and Evaluation based on Distance Average Solution (EDAS) has offered a novel integrated model, in which Fuzzy AHP is used for calculating priority weights of each criteria and EDAS is employed to achieve the final ranking of 3PLs providers (ECER, 2017). Every organization needs a proper logistics for its supply chain which is defined as the process of strategically managing the procurement, movement materials, finished inventory and related information flow through the organization and its marketing channels. Due to pressures from increasing competition and high customer service-level expectation have created a need to optimize their supply chain by outsourcing the logistics to 3PL providers (Bolumole, 1999). Companies are aiming to gain a competitive advantage in

Today's world where global competition is intense by focusing on their core activities. Many factors and alternative need to be considered in the problem of selecting 3PL providers. The article published by (Pamučar, 2018) describes a new integrated Interval Rough Number (IRN) approach based on the Best Worst Method (BWM) and Weighted Aggregated Sum Product Assessment (WASPAS) method along Multi-Attributive Border Approximation Area Comparison (MABAC) to evaluate Logistic providers.

There are several issues faced by logistics provider. Few of them are discussed by that will help to understand the logistics of one big manufacturing firm in India engaged in fertilizers. Companies consider service provider by taking several issues such as truck availability, distance travelled and turnaround time w.r.t manufacturer. Recent studies determine 3 competent service providers to understand their logistic service model and their views. Finally, the study also surveys three component logistics service providers to understand their logistics model to select a service provider. Logistics are outsourced as a strategic move by companies so that the user focuses on their core activities. Experts focus on logistics functions, with benefits of increased flexibility, reduced costs and services. The study has identified several gaps the strategic core activities can be optimised and subjected for future research

There are many advantages in using AHP which can be useful in reaching a likely result which can satisfy the subjective opinion of the decision maker or the evaluation team. A four-step model based on both AHP and DEA is formulated, the use of the proposed model can give precise evaluation combining the subjective opinion from the decision makers with the objective data of the relevant factors (HeZhang, 2016). Organizations basically focus on cost reduction, service improvement and reducing of capital investment. Many methods have been identified such as MCDM, DEA, Fuzzy Topsis, Linear Programming. But the considering the fact and present scenario, AHP is the most suitable and flexible tool to be used for evaluation purpose. This tool helps in prioritizing the variables involved in the selection of the Logistics provider.

AHP technique there are measures to performance which help in identifying logistics performance measures with the perspective of supply chain and organize them in a time-phased format with post-production stage and continue through the delivery of goods to the distribution centre. To integrate the performance metrics (PM) into one model, we propose an analytical network process (ANP) to capture all PM and to understand the interrelated influences among them (Cooper, 2012). Hence considering various approaches to measure the performance parameters of 3PL and also evaluating them, AHP technique is considered as the best suitable technique which can be incorporated in the 3PL evaluation process, by reading several articles and understanding the need of 3PL in this global context, this research will ensure to mitigate the gaps which will be identified in terms of performance evaluation and overcome them by providing a solution. This research intends to list down various variables involved in the evaluation process of third-party logistic providers. These variables will be further subjected to analytical hierarchy process which will help to major focus the most important variables required. After reviewing various articles, around 27 articles have been identified and a pilot study has been conducted. These variables are funnelled down to 15 variables which is further subjected for primary survey

Impact Factors (Dependant Variables) Ys		Independent Variables Xs ---> effecting these Ys	
	Dependent Variables		Independent Variables
Y1	Factors affecting the knowledge & Information systems	X1	Control Management
		X2	Legal contracts
		X3	Documentation Management
		X4	EDI Capacity
		X5	No of years of experience in this field
			Delivery compliance
Y2	Factors affecting the performance of logistics providers	X1	Response Time
		X2	Defect/ Error Rate
		X3	Service Quality
		X4	Value added Services
		X5	Ontime Shipment
		X6	Frequency of Damages
		X7	Geographical coverage
			Organizational capability
Y3	Factors affecting Service	X1	Reliability on local transporters
		X2	Service innovation
		X3	Customer Service
		X4	Reliability of delivery
		X5	Pre and Post customer services
Y4	Performance metrices related to Infrastructure	X1	Warehouse
		X2	Logistics Equipment
		X3	Asset Ownership
		X4	Optimization Capability
		X5	Fleet conditions
Funnelled Variables after Pilot Study			

After conducting the Pilot Study, these the are variables which are funnelle dout for the primary survey and will be further subjected to AHP Technique foranalysis

### Research Methodology

#### Problem Statement

Today the major problem faced by FMCG companies is lead time in its delivery compliance which directly affects the profitability of the business. Hence bench marking the major focused variables for the 3PL providers is amust

## Objectives

### Primary Objectives

- To study and benchmark the major focused objectives which affect the compliance of the transporter and the 3PL logistics company with the existing policies

### Secondary Objectives

- To understand and evaluation process of 3PL providers by the companies

### Relevance and Importance of Research

This thesis will give a clear perspective regarding the evaluation of 3PL and their various policies incorporated. The parameters will be funnelled using AHP technique which will help in determining the major focus parameter and help in reducing the lead time. The variables funnelled will be benchmarked as per their eigen values and will be used as standard variables to be incorporated for any 3PL provider evaluation process and serve the purpose

### Hypothesis

#### Hypothesis 01:

“X” factors are major focused and are benchmarked for 3PL’s as they directly affect the profitability of the business

#### Null Hypothesis:

“X” factors are not major focused and cannot be benchmarked for 3PL’s as they don’t affect the profitability of the business

**(X factors involves Information System, Performance, Service, Infrastructure)**

### Experimental Design-Extensive Research

Companies are outsourcing logistics as it has various important dimensions involved such as Economies of scale, Process expertise, Access to expensive Technology. This helps organizations to reduce financial risks and maintain capital investment. A third-party logistics (3PL) is an external provider who manages, controls, and delivers logistics activities on behalf of a supplier. 3PL collects outbound shipments from manufacturers & consolidates shipments in their distribution centres and delivers to the customers through an effective routing of transport. Evaluating 3PL is a must factor and funneling down the major focus parameters is prime objective. This thesis involves primary mode of survey which is carried out for both the segments. The data collection phase is divided into two segments.

#### Stage 1:

This stage involves data collection from secondary sources such as journals, articles, government publications and company literature. This would help in understanding the current scenario of evaluation process and the variables involved in the process. Secondary sources help in analysing various works that are already carried out in evaluating the 3PL’s and analysing existing crucial factors affecting the profitability of the business

#### Stage 2:

- Pilot Study was conducted to funnel out major focus variables as the variables identified were 30+
- Online interview with a questionnaire which includes variables which are funnelled out after the pilot study conducted (15 variables), on a targeted audience of 80-100 individuals
- This questionnaire consists of 19 questions validated by domain experts (Work exp company)



&LinkedIn)

- The questionnaire largely consists of Likert-Scale based questions in order to quantitatively capture the respondent's data.
- The targeted audience includes Supply Chain executives, Purchase Department executives & Operation excellence executives
- The survey will be conducted through google forms (Online mode)
- AHP Technique will be used to funnel out the major focus variables and prioritize them
- The data collected will be subjected to further analysis and skeletal framework will be proposed for implementation

### Research Design

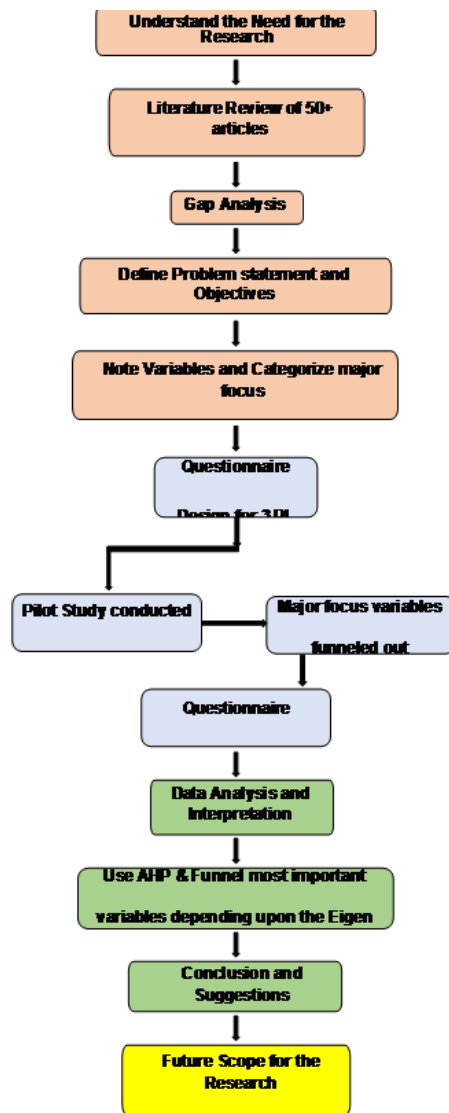


Figure: Research Flow

## Data Analysis and Interpretation

After collecting the data from various individuals and subjecting to Analytical Hierarchy Process, we have come up with the results for the 4 dependent variables, which includes comparison matrix, eigen vector and consistency index and ratio

### Information System

	Control Management	Legal Contracts	EDI Capacity	Delivery compliance
Control Management	1	1/3	3	8
Legal contracts	3	1	4	7
EDI Capacity	1/3	1/4	1	3
Delivery compliance	1/8	1/7	1/3	1

Eigen Vector	Eigen Vector (%)	Ranking
0.299613786	29.96%	2
0.525157148	52.51%	1
0.12437217	12.43%	3
0.050856896	5.08%	4

<b>Lambda Max</b>	4.245015163
Consistency Index (C.I)	0.081671721
Consistency Ratio (C.R)	0.090746357

- Hence the CR is less than 10%, so the evaluation is consistent
- Legal contracts and Control Management are benchmarked as they carry more weightages

### Service

	Service innovation	Reliability of delivery	Pre and Post customer services
Service innovation	1	1/3	1/7
Reliability of delivery	3	1	1/3
Pre and Post customer services	7	3	1

Eigen Vector	Eigen Vector (%)	Ranking
0.08820212	8.82	3
0.243100985	24.31	2
0.668696895	66.86	1

<b>Lambda Max</b>	3.010784914
Consistency Index (C.I)	0.005392457
Consistency Ratio (C.R)	0.00929734



- Hence the CR is less than 10%, so the evaluation is inconsistent
- Reliability of Delivery and Pre-post customer services are benchmarked as they carry more weightages

**Infrastructure**

	Warehouse	Logistics Equipment	Fleet conditions
Warehouse	1	1/5	3
Logistics Equipment	5	1	7
Fleet conditions	1/3	1/7	1

Eigen Vector	Eigen Vector (%)	Ranking
0.19318606	69.41	1
0.723506057	23.1	2
0.083307883	7.48	3

<b>Lambda Max</b>	3.111463701
<b>Consistency Index (C.I)</b>	0.055731851
<b>Consistency Ratio (C.R)</b>	0.096089398

- Hence the CR is less than 10%, so the evaluation is consistent
- Warehouse is benchmarked as it carries more weightages

**Performance**

	Response Time	Defect/ Error Rate	Service Quality	Ontime Shipment	Frequency of Damages
Response Time	1	7	5	6	5
Defect/ Error Rate	1/7	1	5	1/4	8
Service Quality	1/6	1/5	1	4	8
Ontime Shipment	1/6	1/8	1/4	1	7
Frequency of Damages	1/5	1/8	1/8	1/7	1

Eigen vector	Eigen vector (%)
0.512722655	47.91
0.18818731	26.02
0.167594359	13.77
0.093071269	8.56
0.038424407	3.72

<b>Lambda Max</b>	6.530644909
<b>Consistency Index (C.I)</b>	0.382661227
<b>Consistency Ratio (C.R)</b>	0.34166181

- Hence the CR is more than 10%, so the evaluation is inconsistent
- Hence the AHP in this segment is not meaningful

## Interpretation

After conducting data analysis, we can interpret that Information System, Infrastructure and Service have consistency, only performance has inconsistency and the AHP analysis is not meaningful

The major objective is to benchmark the variables, hence considering the top 2 variables with higher eigen vector percentage is taken

### 1) Information system

In this segment, legal contracts and control management are benchmarked as the eigen vector percentage is 52.51% and 29.96%

### 2) Service

In this segment, Pre and Post customer services and service reliability are benchmarked as the eigen vector percentage is 66.86 and 24.81

### 3) Infrastructure

In this segment, warehouse and logistics equipment are benchmarked as the eigen vector percentage is 69.41 and 23.1

### 4) Performance

As the Consistency Index value is more than 10%, AHP is not meaningful and hence the variables couldn't be benchmarked

But considering the current survey conducted, response time and defect rate have higher eigen vector percentage and to be benchmarked in the given scenario

## Conclusion

Evaluation of variables for 3PL providers is a prime aspect as lead time and delivery compliance has an adverse effect over the business and also the downstream of the supply chain. Subject matter expert interview for analyzing the various issues and validating the issues by primary survey was accomplished. Finally, we benchmarked the variables necessary for the evaluation purpose and can be subjected for standardizing these variables. Analytical Hierarchy Process is used for funneling down the variables and help in benchmarking by considering the higher eigen values for the variables

## Future Scope

As this paper is majorly focused on evaluating the variables and benchmarking them to standardise, an extensive study can be conducted for developing a performance measuring model for each dependent variable and also mitigate the inconsistency for the AHP which occurred for performance variable in this research

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**APPENDIX**  
**Instrument**  
**Questionnaire for Primary Survey Section-1**

1) FullName: \_\_\_\_\_

2) Age

- 18-25Years
- 26-36Years
- 37-45Years
- 46-55Years
- 56 and aboveYears

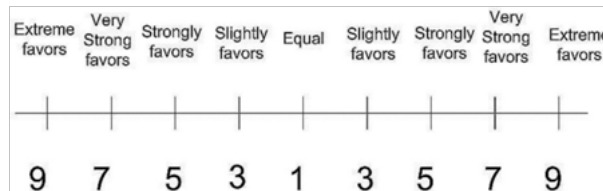
3) EducationalBackground

- Graduate
- Post-Graduate
- Doctorate
- Others

4) Industry:

5) CompanyName:

Section - 2



1. Do you think Control Management is an important pillar in information system for any 3PLprovider?

S/no.	Questions	1	3	5	7	9
1	How much do you rate Control management w.r.t legal contracts					
2	How much do you rate Control management w.r.t EDI Capacity					
3	How much do you rate Control management w.r.t Delivery compliance					
4	How much do you rate Legal contracts with EDI capacity					
5	How much do you rate Legal contracts with Delivery compliance					
6	How much do you rate EDI Capacity w.r.t Delivery compliance					

2. Do you think Performance is an important pillar in information system for any 3PL provider?

S/no.	Questions	1	3	5	7	9
1	How much do you rate response time w.r.t defect rate					
2	How much do you rate response time w.r.t service quality					
3	How much do you rate response time w.r.t on-time shipment					
4	How much do you rate response time w.r.t frequency of damages					

5	How much do you rate defect rate w.r.t service quality					
6	How much do you rate defect rate w.r.t ontime shipment					
7	How much do you rate defect rate w.r.t frequency of damages					
8	How much do you rate service quality w.r.t ontime shipment					
9	How much do you rate service quality w.r.t frequency of damages					
10	How much do you rate on-time shipment w.r.t frequency of damages					

3. Do you think Service is an important pillar in information system for any 3PL provider?

S/no.	Questions	1	3	5	7	9
1	How much do you rate service innovation w.r.t reliability of delivery					
2	Howmuchdoyourateserviceinnovationw.r.tpre&postservices					
3	How much do you rate reliability of delivery w.r.t pre & post customer services					

4) Do you think Infrastructure is an important pillar in information system for any 3PL provider?

S/No	Questions	1	2	3	4	5
1	How much do you rate warehouse w.r.t logistics equipment					
2	How much do you rate warehouse w.r.t fleet conditions					
3	How much do you rate logistics equipment w.r.t fleet conditions					

### Questionnaire Validation

1. Questionnaire shared with Previous company fellow mates working in Logistics Department, SME and MSMEcontacts
2. Questionnaire was also checked with LinkedIn Contacts through personalmails
3. Inputs taken and the questionnaire was framed for both pilot and primarysurvey