

AN ANALYTICAL STUDY OF ORGANIZATION MANAGEMENT BY EVALUATING EFFECTIVENESS OF DATA ANALYTICS (DA) IN CONTRACT LOGISTICS SERVICES OF THIRD PARTY LOGISTICS (3PL) COMPANIES IN MAHARASHTRA

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Abstract

A research entitled "An Analytical Study of Organization Management by Evaluating Effectiveness of DATA ANALYTICS (DA) in Contract Logistics Services of Third Party Logistics (3PL) Companies in Maharashtra" was undertaken to analyze the impact of DA on key O & M areas of the 3PL companies. The objectives of the study included assessment of the impact of DA on planning of 3PL companies, evaluating the effect of DA on operations of 3PL companies, ascertaining the impact of DA on cost management of 3PL companies, finding out the effect of DA on control of 3PL companies, evaluating the impact of DA on customer experience of 3PL companies, assessing the collective impact of DA on organizational performance of 3PL companies, and finding out the major challenges impeding use of DA in 3PL companies. 400 3PL companies from Maharashtra were surveyed using questionnaires. A pilot study took place before the main study began with a sample size of 100 companies. It aimed to identify issues in data collection. It tested the questionnaire usage and the hypotheses from the methodology. It also checked the validity and reliability of the primary data questionnaire. This paper presents the pilot study results.

Keywords: *Data analytics; 3PL Companies; Organizational Performance; Pilot study*

I. Introduction

A research entitled "An Analytical Study of Organization Management by Evaluating Effectiveness of DATA ANALYTICS (DA) in Contract Logistics Services of Third Party Logistics (3PL) Companies in Maharashtra" was undertaken to analyze the effectiveness of various O & M activities due to the impact of DA. The objectives of the study were:

- i) To assess the impact of DA on planning of 3PL companies,
- ii) To evaluate the effect of DA on operations of 3PL companies,
- iii) To ascertain the impact of DA on cost management of 3PL companies,
- iv) To find out the effect of DA on control of 3PL companies,
- v) To evaluate the impact of DA on customer experience of 3PL companies,
- vi) To assess the collective impact of DA on organizational performance of 3PL companies, and
- vii) To find out the major challenges impeding use of DA in 3PL companies.

A pilot study took place before the main study began. It aimed to identify issues in data collection. It tested the questionnaire usage and the hypotheses from the methodology. It also checked the validity and reliability of the primary data questionnaire. This paper presents the pilot study results.

II. Literature Review

1. Vassakis et al. (2017) discuss the major impact of big data on businesses during the fourth industrial revolution, or Industry 4.0. Changes in networks, platforms, people, and digital technology now drive firm innovation and competition. Academics and professionals show great interest in big data. Analytics create useful knowledge and promote innovation in enterprises and organizations. This transforms economies at local, national, and international levels. Data science includes the core principles for extracting knowledge from data. These techniques help organizations analyze critical information to understand their environment and make better, timely decisions. The Internet of Things has caused a massive rise in data through connected devices, sensors, and smartphones. This growth started a "data-driven" era. Every economy and sector uses big data analytics now, including agriculture, health, energy, infrastructure, economics, insurance, sports, food, and transportation. Data availability expands worldwide, and analysis processes turn this information into knowledge. Most organizations collect, store, and analyze data for strategic decisions that yield knowledge. Managing and acting on data through "data-driven decision systems" is a major asset. The potential of analytics is high,

- and the benefits for data-driven groups determine competitiveness and innovation. But obstacles prevent some from adopting these approaches and gaining knowledge from big data.
2. Ghofrani et al. (2018) observe that big data analytics, or BDA, attracts attention from analysts, researchers, and practitioners in railway engineering. This interest creates a need to review recent research in the field. The survey reviews recent big data applications in railway transportation using the taxonomy framework from Mayring (2003). The study covers three areas of BDA application: operations, maintenance, and safety. The authors summarized the levels of analytics, model types, and various techniques. The results identify gaps in the research and suggest directions for future work on BDA in railway systems.
 3. Ogrizović et al. (2024) note that machine learning models attract much attention in many applications, from computer vision to natural language processing. These models rely on big data. Many products now include built-in machine learning models. Software engineering, artificial intelligence, and data science meet in this space. Real-world operations present challenges. Designers must handle wrong predictions. They must maintain safety and security despite mistakes. Qualities beyond prediction accuracy matter. We must identify and measure requirements like learning and inference latency, scalability, explainability, fairness, privacy, robustness, and safety. Testing these models to assess capabilities and errors is necessary. Engineers have adapted existing software testing methods to find faults in machine learning and deep learning models. This paper presents a taxonomy. It provides a uniform presentation of answers to these issues. It also lists conclusions about future trends. The main contributions include a classification. This classification follows the ML-pipeline structure. The paper defines the role of each team member. It reviews trends and challenges in combining machine learning with big data analytics. The study covers uses in industry and education.
 4. Alani et al. (2018) review big data analytics. They focus on practical applications. Leading researchers analyze trends for storing and analyzing data. They discuss challenges in current systems. Real-world examples support these points. These examples come from healthcare, education, and disaster management. The text covers data science advances. It includes collection, searching, analysis, and discovery.
 5. Memon et al. (2017) define Big Data. This term refers to large datasets. Traditional methods cannot manage them. Big Data plays a key role in agriculture, banking, and data mining. It also serves education, chemistry, finance, and cloud computing. Marketing and healthcare stocks rely on it. Analytics reveal hidden patterns and relationships. This data leads to better decisions. Interest in big data grows quickly. It covers many application areas. The authors used Apache Hadoop. This technology runs on Linux. The study displays a free tool for distributed environments. It highlights the advantages and ease of use. New developments need analytical reviews. Healthcare is a major global concern. Big data here involves electronic health records. These records relate to patient health. The data volume exceeds the limits of current associations. It will increase in coming years.
 6. Al-Sai et al. (2022) state that big data analytics help with strategic decisions. Literature shows these tools help users during the COVID-19 pandemic. This paper reviews studies from before and during the crisis. It compares usage across two time periods. The comparison covers four fields. These are Healthcare, Education, Transportation, and Banking. The authors discuss the value of four analytics types. They highlight results in these industries. The paper describes the importance of big data during COVID-19. It aligns applications with relevant models. The authors conclude that proper models help organizations. They can overcome serious limitations faced during the pandemic. Future work will include a systematic literature review. It will compare existing systems. Future work will look into the main challenges of Big Data Analytics and applications during the COVID-19 pandemic.
 7. Roy et al. (2020) describe Big Data as a modern revolution. It aims to improve our work, lives, and thoughts by sharpening our decisions. Big data reaches every field of science and engineering. Data grows fast. We need modern methods and new learning techniques to use it well and fix related problems. The authors survey how machine learning links with big data analytics. They also focus on areas where big data plays a major role. These fields include health care, banking, finance, security, aviation, astronomy, agriculture, and natural disasters.

8. Iqbal et al. (2020) state that big data helps build smart cities and supports modern society. This paper investigates the value of Big Data in our economy and lives. The authors discuss the problems that come from using it. They view computational intelligence techniques as tools for analysis. They also explore the mix of Big Data and Computational Intelligence (CI). This combination can lead to new applications for smart city problems. The paper presents a case study on intelligent transportation. It uses a new data model called the Hierarchical Spatial-Temporal State Machine (HSTSM). The authors also discuss policy, protection, valuation, and sales related to Big Data.
9. Shabbir et al. (2020) use resource-based theory to test a model. This model links the application of big data analytics (ABDA) with organizational performance (OP) in small and medium enterprises (SMEs). The study also checks if knowledge management practices (KMP) connect ABDA and OP. The authors gathered data from SME workers in Pakistan-administered Kashmir. They used the Baron–Kenny approach to test the mediation. Results showed that ABDA improved OP. KMP partially bridged the gap between the two. The data came only from Kashmir, so the results might not apply to other regions. The findings offer tips for top management, mainly in developing countries. This study adds new findings to the literature. These results guide key decisions and help firms gain an edge through better performance.
10. Ali et al. (2016) note the boom in social media sites. Digital devices and Internet access produce huge amounts of public data every day. Fast algorithms analyze this data to provide real-time info. They give early warnings for emergencies, such as viral disease outbreaks. Mining this data reveals useful socioeconomic and political signs. These signs help form public policies. This study reviews how big data analytics helps humans. Big data techniques for development (BD4D) are new tools. They promise to change healthcare, education, and farming. They may also help reduce poverty and handle humanitarian crises or conflicts. These tools have benefits, but large-scale use faces problems. Big data is huge. It changes fast and varies widely. The

main worries involve collecting data well and sharing it. Users must verify context, such as location and time. They must check the truth of a dataset and protect privacy. This study reviews current BD4D work. We examine how big data impacts social growth. We review key works. We also point out major challenges and unsolved problems.

III. Methodology

Population- As per Easyleadz.com (2025), the number of 3PL organizations in Maharashtra was 2,287.

Sample- As per Krejcie and Morgan (1970), at 95% confidence level and 5% confidence interval, sample size for a population of 2,287 comes to 330, which was rounded off to 400 to take care of a much larger population as the sample size doesn't change much after the threshold of 20,000.

Inclusion criterion-

- i. Organization should be a private or public limited company,
- ii. Paid-up capital of minimum Rs.1 crore, and
- iii. Minimum standing of business of 5 years

Sampling unit and respondents: Sampling unit and respondents were either CEOs or General Managers from the 3PL companies.

Sampling Method: Convenience and Snowball sampling methods were extensively used considering the practical constraints.

For the pilot study, 100 respondents were selected as sample representing 25% of the main study sample.

Instrument for survey – A questionnaire was designed for the study. The questionnaire had seven sections. Each section had ten statements and responses were sought on a 5-point Likert scale – Strongly agree, Somewhat agree, Neither agree nor disagree, Somewhat disagree, Strongly disagree. The questionnaire was tested for validity and reliability as under:

Test of validity – The instrument's face and content validity were validated by the guide and experts known to the researcher.

Test of reliability – Cronbach's Alpha test was applied on the questionnaire using "Siegle Reliability Calculator" an excel program. The Cronbach's alpha scores are given in a table.

Table 1: Cronbach Alpha scores

Sr. No.	Section	Number of statements	Cronbach Alpha score
1	I. Planning	10	0.96
2	II. Operations	10	0.97
3	III. Cost Management	10	0.96
4	IV. Control	10	0.97
5	V. Customer Experience	10	0.95
6	VI. Organizational Performance	10	0.95
7	VII. Challenges	10	0.94
8	Entire questionnaire	60	0.98

As the Cronbach's alpha scores were more than 0.70, the questionnaire was considered as reliable.

Hypotheses formulation

The hypotheses formulation is presented below:

Ho1: There is no impact of DA on planning of 3PL companies

Ha1: There is positive impact of DA on planning of 3PL companies

Ho2: There is no impact of DA on operations of 3PL companies

Ha2: There is positive impact of DA on operations of 3PL companies

Ho3: There is no impact of DA on cost management of 3PL companies

Ha3: There is positive impact of DA on cost management of 3PL companies

Ho4: There is no impact of DA on control of 3PL companies

Ha4: There is positive impact of DA on control of 3PL companies

Ho5: There is no impact of DA on customer experience of 3PL companies

Ha5: There is positive impact of DA on customer experience of 3PL companies

Ho6: There is no collective impact of DA on organizational performance of 3PL companies

Ha6: There is positive collective impact of DA on organizational performance of 3PL companies

Ho7: There are no major challenges impeding use of DA in 3PL companies

Ha7: There are major challenges impeding use of DA in 3PL companies

Scheme formed for testing of hypotheses

- A survey questionnaire was designed to collect primary data in order to test the hypotheses as stated earlier.
- The questionnaire was administered to CEO/ General Managers of 3PL companies from Maharashtra.
- The questionnaire had VII sections in addition to the Profile section. Each section had ten statements.
- Responses to these statements were taken on 5-point Likert scale of agree/disagree.

- For the hypotheses from H1-H6, regression analysis was used.
- For the purpose of regression, the five DA applications levels were valued as 1 for very low, 2 for low, 3 for high, and 4 for very high.
- These five DA application values were averaged into a single value, which constituted the independent variable for H1-H5.
- Responses to Section I, to VI for the purpose of regression analysis were valued as 0 for Neither agree nor disagree, 1 for Somewhat agree, 2 for Strongly agree, -1 for Somewhat disagree, and -2 for Strongly disagree.
- Average value for each of the sections was calculated based on ratings of the ten statements.
- Application level of DA was taken as independent variable for H1-H5, and, planning, operations, cost management, control, and customer experience were taken as the dependent variables, respectively.
- In case of the 6th hypothesis, planning, operations, cost management, control, and customer experience were collectively taken as the independent variables, and organizational performance was taken as the dependent variable.
- R^2 , r , and p -values were calculated in case of each of the first six hypotheses.
- In case of H7, a t-test was used.
- Average agreement/disagreement scores for each of the sections were calculated for all the 10 sub-responses under each of them for the 100 respondents.
- Weights of 2 were used to value extreme (strongly agree and strongly disagree) responses and distinguish them from moderate (somewhat agree and somewhat disagree) responses which were valued at 1.
- Using these weights two summations were derived for each statement adding the

- strongly agree and somewhat agree responses and somewhat disagree and strongly disagree responses.
- Based on the summations, percentages of agreement and disagreement were worked out for each of the statement.
 - Using a t-test, the higher average agreement/disagreement scores (average of 10 sub-responses) were compared with a hypothesized population mean of 50%

agreement/disagreement, connoting an event by chance.

- A t-test was used since the standard deviation of the population was unknown (Had the standard deviation of the population been known a Z-test would have been used).
- P-values were calculated and the null hypotheses were tested for rejection or non-rejection at 95% confidence level.

IV. Data analysis

a. Descriptive analysis – Profile of the sample

Table 2: Profile of sample for pilot study (n=100)

Variable	Categories	Count	Percentage
City	Mumbai	46	46%
	Pune	31	31%
	Thane	10	10%
	Nagpur	7	7%
	Aurangabad	4	4%
	Others	2	2%
Designation of respondent	General Manager	34	34%
	CEO	66	66%
Business standing	5-10 years	13	13%
	11-20 years	32	32%
	>20 years	55	55%

Table 3: DA applications levels

Sr. No.	DA application	Application Levels				
		Very low	Low	High	Very high	Total
1	Shipment tracking	17	12	32	39	100
2	Inventory levels	12	13	36	39	100
3	Customer preferences	7	18	39	36	100
4	Delivery performance	16	19	39	26	100
5	Vehicle telematics	12	10	37	41	100

b. Inferential analysis (Testing of hypotheses)

Ho1: There is no impact of DA on planning of 3PL companies

Ha1: There is positive impact of DA on planning of 3PL companies

Results of the regression analysis are given below:

Table 3: Regression statistics – H1

Regression Statistics	
R Squared	0.681
Adjusted R Square	0.677
r (Pearson’s correlation)	0.825
Observations	100

Table 4: Hypothesis testing – H1

	df	SS	MS	F	p-value
Regression	1.000	94.428	94.428	208.834	<0.0001
Residual	98.000	44.312	0.452		
Total	99	138.740			

Going by the value of R^2 read along with the p-value, the null hypothesis, there is no impact of DA on planning of 3PL companies, was rejected. Further going by the value of r (Pearson’s correlation), it was found that there is positive impact of DA on planning of 3PL companies.

Ho2: There is no impact of DA on operations of 3PL companies

Ha2: There is positive impact of DA on operations of 3PL companies

Results of the regression analysis are given below:

Table 5: Regression statistics – H2

<i>Regression Statistics</i>	
R Squared	0.691
Adjusted R Square	0.688
r (Pearson’s correlation)	0.831
Observations	100

Table 6: Hypothesis testing – H2

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Regression	1.000	99.067	99.067	218.843	<0.0001
Residual	98.000	44.363	0.453		
Total	99	143.430			

Going by the value of R^2 read along with the p-value, the null hypothesis, there is no impact of DA on operations of 3PL companies, was rejected. Further going by the value of r (Pearson’s correlation), it was found that there is positive impact of DA on operations of 3PL companies.

Ho3: There is no impact of DA on cost management of 3PL companies

Ha3: There is positive impact of DA on cost management of 3PL companies

Results of the regression analysis are given below:

Table 7: Regression statistics – H3

<i>Regression Statistics</i>	
R Squared	0.674
Adjusted R Square	0.671
r (Pearson’s correlation)	0.821
Observations	100

Table 8: Hypothesis testing – H3

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Regression	1.000	88.481	88.481	202.842	<0.0001
Residual	98.000	42.748	0.436		
Total	99.000	131.230			

Going by the value of R^2 read along with the p-value, the null hypothesis, there is no impact of DA on cost management of 3PL companies, was rejected. Further going by the value of r (Pearson’s correlation), it was found that there is positive impact of DA on cost management of 3PL companies.

Ho4: There is no impact of DA on control of 3PL companies

Ha4: There is positive impact of DA on control of 3PL companies

Results of the regression analysis are given below:

Table 9: Regression statistics – H4

<i>Regression Statistics</i>	
R Squared	0.386
Adjusted R Square	0.380
r (Pearson’s correlation)	0.621
Observations	100

Table 10: Hypothesis testing – H4

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Regression	1.000	36.177	36.177	61.626	<0.0001
Residual	98.000	57.530	0.587		
Total	99.000	93.708			

Going by the value of R^2 read along with the p-value, the null hypothesis, there is no impact of DA on control of 3PL companies, was rejected. Further going by the value of r (Pearson’s correlation), it was found that there is positive impact of DA on control of 3PL companies.

Ho5: There is no impact of DA on customer experience of 3PL companies

Ha5: There is positive impact of DA on customer experience of 3PL companies

Results of the regression analysis are given below:

Table 11: Regression statistics – H5

<i>Regression Statistics</i>	
R Squared	0.331
Adjusted R Square	0.324
r (Pearson’s correlation)	0.575
Observations	100

Table 12: Hypothesis testing – H5

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Regression	1.000	21.902	21.902	48.512	<0.0001
Residual	98.000	44.245	0.451		
Total	99.000	66.148			

Going by the value of R^2 read along with the p-value, the null hypothesis, there is no impact of DA on customer experience of 3PL companies, was rejected. Further going by the value of r (Pearson’s correlation), it was found that there is positive impact of DA on customer experience of 3PL companies.

Ho6: There is no collective impact of DA on organizational performance of 3PL companies

Ha6: There is positive collective impact of DA on organizational performance of 3PL companies

Results of the regression analysis are given below:

Table 13: Regression statistics – H6

<i>Regression Statistics</i>	
R Squared	0.958
Adjusted R Square	0.956
r (Pearson’s correlation)	>0.80
Observations	100

Table 14: Hypothesis testing – H6

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p-value</i>
Regression	5.000	107.687	21.537	426.243	<0.0001
Residual	94.000	4.750	0.051		
Total	99.000	112.436			

Going by the value of R^2 read along with the p-value, the null hypothesis, there is no collective impact of DA on organizational performance of 3PL companies, was rejected. Further going by the value of r (Pearson’s correlation), it was found that there is positive collective impact of DA on organizational performance of 3PL companies.

Ho7: There are no major challenges impeding use of DA in 3PL companies

Ha7: There are major challenges impeding use of DA in 3PL companies

Average agreement percentages for Section VII were as under:

Table 15: Agreement percentages for Section VII

Stat.	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	7.10	Average
Agree %	77%	82%	76%	69%	79%	80%	80%	73%	86%	84%	79%

The hypotheses was tested using a t-test, by comparing the average agreement scores (average of 10 sub-responses) of Section VII with a hypothesized population mean of 50% agreement, connoting an event by chance.

Table 16: Testing of H7

Parameter	Value
Average = Ho (Sample mean)	79%
SD (Standard Deviation of sample)	1.29
H1 (Hypothesized mean of population)	50%
n (Sample Size)	100
t-value (Ho-H1) / ((SD) / √n)	2.22
p-value	0.014

Since, the p-value of 0.014 is <0.05, the null hypothesis, there are no major challenges impeding use of DA in 3PL companies, was rejected.

V. Conclusion

Due to high levels of adoption of DA practices in the areas of Shipment tracking, Inventory levels, Customer preferences, Delivery performance, and Vehicle telematics, there is a positive impact on planning, operations, cost management, control, and customer experience, of the 3PL companies in Maharashtra. Further, these key five O & M areas have a collective positive impact on the organizational performance of the 3PL companies in Maharashtra.

Overall it can be concluded that adoption of DA has a positive impact on organizational performance of the 3PL companies. However, there are challenges that need to be addressed for improving the levels of DA adoption.

From the pilot study, we got these results:

- a) Collecting data is doable with some ease.
- b) It is possible to change the data into variables needed for analysis.
- c) We can test the hypotheses using the research methods.

The questionnaire made for gathering primary data shows good validity and reliability. But, the respondents wanted their information to be kept confidential.

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