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SUPPLY CHAIN ANALYTICS FOR REDUCING LEAD TIME IN MANUFACTURING

R. Anitha

Student, Department of Management studies
Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology (Deemed to be University) Chennai, India

Abstract

The importance of supply chain operations in the competitiveness of manufacturing organizations has been realized. This study, "A Study on Supply Chain Analytics for Reducing Lead Time in Manufacturing" has been conducted with an aim to analyze how supply chain analytics could be used to minimize lead time. This research has been conducted on supply chain operations like procurement, inventory management, production, and transportation to identify the major factors that cause delay in supply chain operations.

The research design that was followed while conducting the research was descriptive and analytical research. To conduct the research, structured questionnaires were sent and filled out by the employees of the supply chain, procurement, production, and quality departments. To analyze the impact of analytics on the reduction of lead time, statistical tools like percentage analysis, correlation analysis, regression analysis, and chi-square tests were conducted. From the study, it was identified that demand forecasting and transportation are the major factors that cause delay in supply chain operations. Digital technology is moderately being implemented in supply chain operations.

The study has recommended that AI-based forecast tools and ERP systems could be used to improve responses from the company and customer satisfaction, which could be applicable to .

Key Words:

Focused heavily on all aspects of supply chain efficiency: Supply Chain Analytics, Reduction of Lead Times, Demand Forecasting, Optimization of Logistics, and Maximizing Manufacturing Efficiencies

Introduction

Today, with an increasingly global marketplace, supply chain efficiency has become a critical component to the success of companies who compete against each other. Companies manufacture products to meet customer needs/desires for fast delivery and quality; therefore, those companies are always striving to improve efficiencies. Lead times, including all

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activities from raw materials to finished products, have a direct impact on costs, quality, and customer satisfaction. Therefore, minimizing lead times has emerged as a major priority for modern-day manufacturing supply chains.

One of the most important success stories of effectively using analytics in the supply chain to meet this challenge is the application of Supply Chain Analytics where data-driven insights and advanced analytical techniques are used to solve some of the biggest challenges that businesses face. Businesses employ advanced analytical techniques including predictive modeling, real-time tracking of supply chain data, and optimization techniques to help them identify those areas where inefficiencies exist and improve their decision-making capability at every step in the supply chain. Supply chain analytics has helped businesses transform static supply chains into dynamic supply chains, responding to the changing factors in the business environment.which is a leading Indian organization specializing in the manufacturing of automobile components, SC effectiveness in the organization would mean its very survival as a market leader. With an ever-increasing demand for efficient braking systems both in India and abroad. would have a pressing need to eliminate production lag as well as logistics wastage. The longer lead times are not only a cost of operation but also a measure of its inability to remain competitive in a highly competitive automobile industry. Supply chain analytics would give . a chance to monitor its key performance indicators, automate its operations, as well as collaborate with its distribution partners.

In addition, the reduction in lead time by using analytics has greater implications beyond mere cost reduction. This would allow for effective demand management, reduced inventory holding costs, improved resource efficiency, and customer satisfaction. From the analysis of trends in information related to the supply chain, the firm would be able to predict demand, avoid the risk of stock-out and overproduction, and deliver products in a reduced lead time. This would help create a supply chain that is less susceptible to disruptions and is agile, a crucial factor in developing a continuous path to growth and profitability in the industrial manufacturing industry.

The research thus attempts to examine the application of supply chain analytics in minimizing lead times.

Objectives Of The Study

Primary Objectives:

A research project on supply chain analytics for minimizing lead time in manufacturing.

Secondary Objectives:

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➢ The research is intended to examine the existing supply chain system. and identify key manufacturing activities that influence lead time.

➢ The major research objective is to identify and examine the major factors that cause lead time during procurement activities as well as production and distribution operations.

➢ The research project examines the operation of supply chain analytics tools/techniques.

Review Of Literature

Jitesh Thakkar 2022 The research work carried out by Deepika Joshi et al. (2013) and Jitesh Thakkar et al. (2012) is useful in understanding supply chain management challenges in the Indian industry. The research work highlights the importance of understanding supply chain management and developing strategies to improve industry competitiveness. Some of the major takeaways from these research works are the importance of business environmental factors and the challenges faced by small and medium-sized enterprises (SMEs) in managing supply chains in the Indian industry

A Pradeep 2022 The research work carried out by Jitesh Thakkar et al. (2012) and A Pradeep and K Balaji (2022) is useful in understanding the importance of using lean manufacturing techniques and supply chain management principles in the Indian industry. By understanding and addressing supply chain management complexities, organizations can improve overall industry competitiveness by using Value Stream Mapping (VSM) techniques

Janat Shah The book on supply chain management titled "Supply Chain Management: Text and Cases" by Janat Shah (2009) is useful in understanding supply chain management principles and its application in industry. The book has been quoted 224 times and is useful for students and practitioners in emerging markets such as India.

John Humphrey 2023 Effective supply chain management is vital for the success of the automotive industry, and this has been depicted in the studies and book discussed. Supply chain management is vital for the success and achievement of organizational goals. This has been depicted in the use of tools such as Value Stream Mapping and balanced scorecards. These tools help in the achievement of organizational success in the automotive industry.

D Mukhopadhyay 2021 The success and growth of the Indian automotive industry depend on the ability to adapt and innovate in supply chain management. This is by incorporating digital transformation, green supply chain management, and supply chain partnerships. This has been depicted in the use of technologies such as IoT, AI, and blockchain in supply chain management. This has been depicted in the use of green supply chain management, and the success and growth of the industry depend on these two factors.

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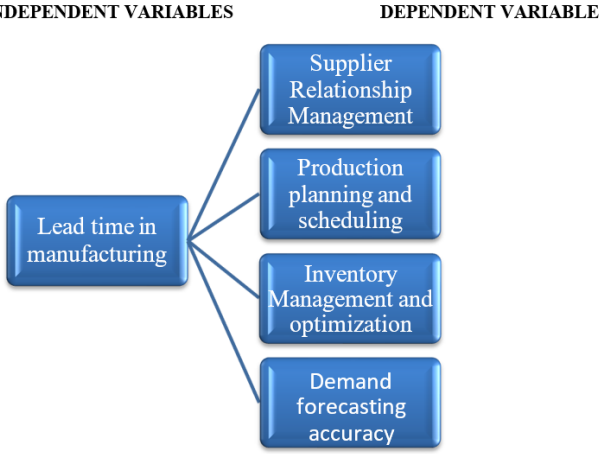
David Steven Jacoby 2024 Globalization and technological advancements have led to a significant shift in supply chain management. This has helped companies in sourcing products and delivering finished products in a more effective and efficient manner. Companies such as Dell, Wal-Mart.

Samir K Srivastava 2020 The paper discusses the current scenario of logistics and supply chain practices prevailing in India. The gap between logistics and supply chain practices has also been emphasized. The research has been conducted by focusing on various aspects of supply chain collaboration, structure, facilities network design, transportation, and ICT.

RESEARCH BY John Wiley & Sons, 2021 Supply Chain Management Best Practices" by David Blanchard is a complete resource that discusses traditional core processes, new technologies, and strategies employed by best companies. The book provides an opportunity for readers to become familiar with the top-performing practices in the supply chain; the best measurements used to measure performance, as well as the various current trends in different industries. The book is a must have for supply chain practitioners or organizations wishing to achieve an edge by having their supply chain create value through increased efficiency, effectiveness, and innovation.

Conceptual Framework:



Statistical Analysis:

Regression:

Null Hypothesis (H_0):

There is no significant relationship between independent variables (accuracy of current data supplied by the supply chain and delays in raw materials procurement) and dependent variables.

Alternative Hypothesis (H_1):

There is a significant relationship between independent variables (accuracy of current data supplied by the supply chain and delays in raw materials procurement) and dependent variables

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.127[a]	.016	.000	1.037

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a. Predictor variables (Constant), Time since Supply Chain Data Accuracy, and Delayed Response for Raw Material Acquisitions to your Business

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.103	2	1.051	.977	.379[b]
	Residual	127.996	119	1.076		
	Total	130.098	123			

Dependent Variable: How do you feel about how long it takes for raw materials to arrive based on the time it takes to get them usually?

Predictors: (Constant), How do you feel about the overall accuracy of your current supply chain data and how do you deal with delays in raw materials?

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.023	.315		6.428	.000
	How 2 do you face delays in raw material procurement?	.072	.083	.079	.861	.391
	How 2 are you in the accuracy of current supply chain data?	.088	.092	.088	.961	.339
a. Dependent Variable: How deal with material procurement delays?						

Interpretation:

R = 0.127, meaning there exists a weak positive correlation among all three predictors and the dependent variable. R-squared = 0.016; therefore, the model explains only 1.6% of the variations to that dependent variable. Consequently, the independent variables (accuracy of supply chain data and delays of procurement) do not provide any usable information to help estimate any movement in the dependent variable. Finally, adjusted R-squared = 0.000; thus, the explanatory power of the regression after adjusting for the number of independent variables is nearly zero.

Chi-Square Test:

Null Hypothesis (H_0):

There is no significant association between the department of employees and the usage of analytics or digital tools in supply chain management.

Alternative Hypothesis (H_1):

There is a significant association between the department of employees and the usage of analytics or digital tools in supply chain management.

Your Department Does your company currently use analytics or digital tools in supply chain management? Crosstabulation.

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			Does your company currently use analytics or digital tools in supply chain management?				Total
				1, extensively	1, to some extent	2.	
Your Department	Logistics	Count	0	5	8	2	15
		Expected Count	.1	6.0	7.0	2.0	15.0
	Others	Count	0	2	0	2	4
		Expected Count	.0	1.6	1.9	.5	4.0
	Procurement	Count	0	15	16	2	33
		Expected Count	.3	13.1	15.3	4.3	33.0
	Production	Count	0	1	4	3	8
		Expected Count	.1	3.2	3.7	1.0	8.0
	Quality	Count	1	9	12	3	25
		Expected Count	.2	10.0	11.6	3.3	25.0
	Supply Chain	Count	0	17	17	4	38
		Expected Count	.3	15.1	17.6	4.9	38.0
Total		Count	1	49	57	16	123
		Expected Count	1.0	49.0	57.0	16.0	123.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.692[a]	15	.279
Likelihood Ratio	16.626	15	.342
N of Valid Cases	123		

a. 16 cells (66.7%) have expected count less than 5. The minimum expected count is .03.

Interpretation:

This indicates that there is no significant relationship between the department in which an employee works and their company's usage of analytics or digital tools in supply chain management. In other words, the level or extent of analytics usage is fairly uniform across departments such as Supply Chain, Procurement, Quality, Logistics, Production, and Others.

Conclusion

The study concludes that Limited has achieved significant milestones in the implementation of supply chain analytics as a strategic tool in the reduction of lead time and increasing the efficiency of the manufacturing process. The study findings reveal that the organization is using digital technology in the form of forecasting software and dashboards. Most significantly, leads times have increased because there still remain shortfalls in the areas of demand forecasting and transportation methods. These are the main reasons for the delays in the manufacturing process. The study findings reveal that the employees are moderately confident about the data accuracy and the importance of using analytics. However, the correlation and regression study reveal that the relationship between procurement delays and production delays is poor.

A major finding from the investigation was that Limited will need to continue focusing on predictive analytics (also known as forecasting), Automation, and Digital Integration throughout their Supply Chains. Implementation of these initiatives could yield greater efficiencies in Supply Chain responsiveness through Automation and Digital Integration with the support of Advanced Technologies (i.e. Artificial Intelligence, Internet

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of Things or Data Analytics). Continued use to develop complementary capabilities will allow Limited to continue to maintain their competitive edge as a Manufacturer in the Automotive Industry with regard to lower lead times, decreased costs and increased levels of customer satisfaction.

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