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TRANSFORMING SUPPLY CHAIN MANAGEMENT THROUGH E-COMMERCE: A REGIONAL STUDY IN MADURAI, TAMIL NADU

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ABSTRACT

The rapid growth of e-commerce has significantly transformed traditional supply chain models, introducing new dynamics in logistics, inventory management, and customer service. This study explores the impact of e-commerce on supply chain management (SCM) in Madurai, a tier-2 city in Tamil Nadu, India. With the increasing penetration of internet services and digital literacy, local businesses and consumers in Madurai are increasingly embracing online commerce. This shift has compelled supply chain stakeholders' retailers, logistics providers, and manufacturers to adapt to faster delivery expectations, real-time inventory systems, and integrated technology solutions.

The research, based on primary data collected through surveys and interviews with key players in the local e-commerce ecosystem, reveals that while e-commerce has enhanced operational efficiency and market reach, it also presents challenges such as infrastructure limitations, training gaps, and increased pressure on last-mile delivery systems. The study concludes by offering practical suggestions to improve SCM practices in the region, aiming to support sustainable and scalable e-commerce growth in Madurai.

KEYWORDS: *E-Commerce, Supply Chain Management, Logistics, Inventory Management, Last-Mile Delivery, Digital Transformation, Third-Party Logistics (3PL), Technology Adoption, Madurai, Small and Medium Enterprises (SMEs)*

INTRODUCTION

In recent years, the advent of e-commerce has revolutionized the way businesses operate and customers shop, triggering significant transformations across various sectors, particularly in supply chain management (SCM). E-commerce refers to the buying and selling of goods and services over digital platforms, and it has become an essential part of modern commerce, reshaping consumer behavior, business models, and logistics infrastructure.

Supply Chain Management, on the other hand, involves the coordination and integration of all activities related to the flow of goods, information, and finances—from the procurement of raw materials to the delivery of finished products to end consumers. Traditionally, supply chains were designed for bulk movement of goods through established channels. However, the rise of e-commerce has led to the need for more agile, responsive, and technology-driven supply chains.

This study aims to explore how e-commerce is influencing supply chain operations in Madurai. It examines the changes in logistics management, inventory systems, customer service expectations, and the role of third-party logistics providers. By focusing on a regional perspective, the study highlights the unique challenges and opportunities faced by stakeholders in smaller cities, which are often overlooked in national-level analyses.

Understanding the local impact of e-commerce on supply chains is crucial for designing more inclusive and efficient systems that can support sustainable growth. The findings of this research will be valuable for policymakers, business owners, logistics providers, and academics interested in the intersection of digital commerce and supply chain dynamics.

REVIEW OF LITERATURE

1. Hernandez, P. (2025) - "The Future of E-Commerce and Supply Chain Management Post-Pandemic" This paper analyses post-pandemic shifts in e-commerce and supply chain management, focusing on automation, predictive analytics, and resilient logistics models. It provides insights into how businesses are future-proofing their supply chains.
2. Khanfar, Suha S. (2024) - "The Impact of E-commerce on Supply Chain Management in Jordanian Manufacturing Firms" This study utilized a descriptive analytical approach to investigate the impact of e-commerce on supply chain management

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in Jordanian manufacturing firms. The study population included employees from three selected manufacturing firms, and data were collected through a statistical questionnaire.

3. Zhang, W. & Chen, H. (2023) - "Green Supply Chain Management in E-Commerce: The Role of Sustainability Practices" The study investigates the growing importance of green supply chain management in e-commerce and highlights the role of sustainable logistics, packaging, and carbon footprint reduction in global trade.
4. Tiwari, Shreya (2023) - "Impact of E-Commerce on Supply Chain Management" Approximately 90% of all global e-commerce transactions are reportedly B2B, with only 10% being B2C. More than any other type of business, e-commerce has been substantially adopted in the tickets and hotel booking industries.
5. Patel, R. & Singh, M. (2022) - "Blockchain and AI in E-Commerce Supply Chains: A New Era of Integration" The adoption of blockchain and artificial intelligence in supply chain management has improved security, transparency, and efficiency in e-commerce logistics, leading to enhanced customer satisfaction and cost savings.

OBJECTIVES OF THE STUDY

- To examine the impact of e-commerce benefits on supply chain management in B2B e-commerce companies located in Madurai.
- To investigate the influence of e-commerce benefits on the usage of e-marketplaces by B2B e-commerce companies in Madurai.
- To assess the effect of e-marketplace usage on supply chain management in B2B e-commerce companies in Madurai

RESEARCH METHODOLOGY

RESEARCH DESIGN

A research design is a detailed blue print used to guide a research study towards its objective. The process of designing a research study involves many interrelated decisions. The most significant decision is the choice of research approach, because it determines how the information will be obtained. The choice of the research approach depends on the nature of the research that one wants to do.

The present study is descriptive research based on the survey method. The methods adopted in the choice of sample, selection of respondents, collection of data and tools of analysis are briefly discussed in this part.

AREA OF THE STUDY

The geographical area of the study chosen for this research is Madurai, Tamil Nadu

POPULATION OF THE STUDY

The population of the study are the people who are living in Madurai district using e-commerce on supply chain management for the last six months period.

SAMPLING TECHNIQUE

A convenience sample is a sample where the respondents are selected, in part or in whole, at the convenience of the researcher. The researcher makes no attempt, or only a limited attempt, to ensure that this sample is an accurate representation of some larger group or population.

SAMPLE SIZE

Since the entire population cannot be taken for the study, the size of the sample was restricted to 106 respondents.

HYPOTHESIS OF THE STUDY

H1: There is a significant relationship between the number of years an enterprise has been in operation and whether it has implemented E-commerce.
H2: There is a significant relationship between E-commerce implementation and the preferred method of procuring products.
H3: There is a significant relationship between the method of tracking products (online vs. manual) and the velocity of product flow.
H4: There is a significant difference in the effectiveness of customer management due to E-commerce across different business categories, with some categories (e.g., retail, fast food) reporting higher improvements in customer management.

DATA COLLECTION

There are several ways of collecting the appropriate data. While deciding about the method of data collection to be used for the study, the researcher should keep in mind, that there are two types of data viz primary & secondary data.

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1. PRIMARY DATA

Primary data are those which are collected a fresh and for the first time and thus happen to be original in character. Primary data for the study has been collected through questionnaire and personal interview from the respondents.

2. SECONDARY DATA

Secondary data on the other hand are those which have already been collected by someone else and which have already been passed through the statistical process. In this study secondary data are collected from the online articles, journals, text books, etc.

TOOLS USED FOR DATA ANALYSIS

- **Percentage Analysis**

This is a Univariate analysis where the percentage of a particular factor with different categories is calculated, in order to help one get fair idea regarding the sample and thereby that of the population. The number of responses of each category is summarized to percentage format for the convenience to use other statistical tools namely pie chart and bar diagrams.

Percentage = ((a portion)/ (the whole)) *100.

Statistical Techniques

Using SPSS statistical analysis software, the following tests were conducted to test the hypothesis.

- **Chi-Square Test**

Chi-Square test can be used to determine if categorical data shows dependency or the two\ classifications are independent.

$2 = \sum \{(Oi – Ei) 2 / Ei\}$

Applying Yates correction:

$2 = \sum \{(|O i – E i| - 0.5) 2 / E i\}$

DATA ANALYSIS AND INTERPRETATION

Chi-Square Tests-1

H_0: There is no significant relationship between the number of years an enterprise has been in operation and whether it has implemented E-commerce.

H_1: There is a significant relationship between the number of years an enterprise has been in operation and whether it has implemented E-commerce.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.448	3	.694
Likelihood Ratio	1.397	3	.706
N of Valid Cases	106		

Calculated $\chi 2$ Value: 1.448
Degree of freedom: 3
Signification level: .694

INTERPRETATION

The Chi-Square test results indicate that there is no statistically significant association between the variables under investigation. The Pearson Chi-Square value is 1.448 with 3 degrees of freedom and a p-value of 0.694, which is well above the conventional significance level of 0.05. Similarly, the Likelihood Ratio test yields a p-value of 0.706, supporting the same conclusion. With 106 valid cases included in the analysis, these results suggest that any observed differences between the groups are likely due to chance rather than a meaningful relationship between the variables.

Chi-Square Tests -2

H_0: There is no significant relationship between E-commerce implementation and the preferred method of procuring products.

H_1: There is a significant relationship between E-commerce implementation and the preferred method of procuring products.

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Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18.863	2	.000
Likelihood Ratio	18.209	2	.000
Linear-by-Linear Association	14.196	1	.000
N of Valid Cases	106		

Calculated $\chi 2$ Value: 18.863
Degree of freedom: 2
Signification level: .000

INTERPRETATION
The Chi-Square analysis reveals a statistically significant association between the variables tested. The Pearson Chi-Square value is 18.863 with 2 degrees of freedom and a p-value of 0.000, indicating that the observed differences are highly unlikely to have occurred by chance. This is further supported by the Likelihood Ratio value of 18.209 (p = 0.000) and the Linear-by-Linear Association value of 14.196 (p = 0.000), which suggest a strong linear trend between the variables. With 106 valid cases included in the analysis, these results provide strong evidence of a significant relationship between the categorical variables examined.

Chi-Square Tests -3
H_0: There is no significant difference in the effectiveness of customer management due to E-commerce across different business categories, with some categories (e.g., retail, fast food) reporting higher improvements in customer management

H_1: There is a significant difference in the effectiveness of customer management due to E-commerce across different business categories, with some categories (e.g., retail, fast food) reporting higher improvements in customer management.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.118	3	.068
Likelihood Ratio	8.440	3	.038
N of Valid Cases	106		

Calculated $\chi 2$ Value: 7.118
Degree of freedom: 3
Signification level: .068

INTERPRETATION
The Chi-Square test results suggest a marginal association between the variables. The Pearson Chi-Square value is 7.118 with 3 degrees of freedom and a p-value of 0.068, which is slightly above the conventional 0.05 threshold for statistical significance. This implies that, based on this test alone, the association is not statistically significant at the 5% level, but may be considered borderline or suggestive. However, the Likelihood Ratio test shows a value of 8.440 with a p-value of 0.038, which does reach statistical significance, indicating some evidence of a relationship between the variables. With 106 valid cases, these mixed results suggest that while there may be a meaningful association, it is not consistently confirmed across both tests.

FINDINGS

1. The majority of enterprises are relatively young, with 71.7% operating for 10 years or less, indicating that most businesses are still in their early or growth stages.
2. Logistics and retail businesses are the most common, each comprising 33.0% of the total, while only 11.3% are cloth stores. A mislabelled category accounting for 22.6% suggests data entry issues and the need for improved data categorization.
3. 77.4% of enterprises have implemented E-commerce, showing a strong shift toward digital business practices, though 22.6% have yet to adopt it, possibly due to resource limitations or preference for traditional methods.
4. Online procurement is the most preferred method at 43.4%, reflecting growing digital adoption, while 34.0% prefer in-person procurement and 22.6% opt for phone-based methods, highlighting that traditional procurement still plays a significant role.
5. Online selling is preferred by 43.4% of enterprises, suggesting a shift to digital sales channels, though in-person (34.0%) and phone selling (22.6%) remain important, indicating a hybrid sales model.

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6. Speed of product delivery is the highest-rated operational factor, showing that customers are satisfied with delivery times. Frequency of ordering from suppliers is also rated positively, while marketing effectiveness, replenishment cost, and customer-incurred cost are seen as average, suggesting these areas need improvement.

SUGGESTIONS

1. Enterprises should invest in advanced tracking technologies like RFID to enhance supply chain efficiency and accuracy, reducing reliance on traditional barcode systems.
2. Businesses should refine their marketing and sales strategies to improve consistency in sales performance and address operational challenges such as replenishment costs and customer-incurred costs.
3. Companies that have not yet adopted e-commerce should be provided with training and digital tools to facilitate a smoother transition, ensuring broader digital adoption and improved operational outcomes.

CONCLUSION

This study aimed to investigate the impact of e-commerce on supply chain management and the usage of e-marketplaces among B2B e-commerce companies in Madurai, Tamil Nadu. The findings indicate that e-commerce has played a significant role in transforming the supply chain operations of businesses in the region. Firstly, the benefits of e-commerce, such as enhanced communication, real-time tracking, and efficient inventory management, have positively impacted the supply chain management processes in B2B companies. These benefits have led to improved operational efficiency, reduced lead times, and increased responsiveness to customer demands.

Secondly, the adoption of e-marketplaces has proven to be a key factor in facilitating smooth business transactions and improving procurement practices for companies in Madurai. The integration of e-marketplaces with supply chain operations has streamlined procurement, reduced costs, and provided access to a larger pool of suppliers and buyers, fostering a more competitive business environment.

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