Data-Driven In Supply Chain Management With Qlik Insights

1. Introduction

1.1 Overview:

This project aims to transform supply chain management for DataCo Global by leveraging Qlik's advanced data insights. By using structured and unstructured data, cutting-edge analytics, and Qlik's visualization capabilities, the project targets logistics, forecasting, and inventory management optimization.
The primary focus is on improving operational efficiency and responsiveness to uphold customer satisfaction, productivity, and competitiveness. The project integrates advanced analytics and machine learning algorithms to offer actionable insights, aiding in informed decision-making, process streamlining, and proactive supply chain issue resolution.

1.2 Purpose of Project:

The key objectives of this project are to:

1. Enhance Customer Satisfaction: Ensure timely delivery of customer orders by analyzing delivery performance for improvements.

2. Optimize Operational Productivity: Identify and eliminate supply chain inefficiencies to enhance productivity.

 3. Improve Market Competitiveness: Provide strategic insights to help DataCo Global stay ahead of competitors and adapt to market changes effectively.

1.3 Technical Overview:

The project's technical architecture involves several components working together to analyze and enhance delivery performance:

1. Data Sources:

- Structured Data:

 - DataCoSupplyChainDataset.csv: Detailed records of supply chain operations.

 - DescriptionDataCoSupplyChain.csv: Descriptions for variables in the primary dataset.

 - Unstructured Data: - tokenized_access_logs.csv: Clickstream data representing customer interactions

on digital platforms.

2. Data Processing and Integration: - Data Cleaning: Handling missing values, outliers, and inconsistencies. - Data Transformation: Normalizing and tokenizing data for analysis. - Data Integration: Combining structured and unstructured data for a comprehensive view of supply chain operations.

3. Analytical Tools and Techniques: - Qlik Software: Utilized for data visualization, analysis, and dashboard creation. - Machine Learning Algorithms: Applied to predict delivery performance and identify bottlenecks.

4. Dashboard Development: - Visualization Tools: Used to create an interactive dashboard displaying key metrics in real-time.

Social Impact Analysis: 1. Demographic Distribution Visualization: Visualize the demographic distribution in supply chain management.

2. Impact on Social Welfare Programs: Analyze the impact of data-driven innovations on social welfare programs.

3. Financial Inclusion: Explore the correlation between supply chain analytics and financial inclusion.

4. Correlation Analysis: Examine correlations between data-driven innovations and social welfare improvements.

Business Impact Analysis: 1. Sectoral Analysis: Analyze how innovations in supply chain management impact key business sectors.

2. Impact on Sales and Customer Onboarding: Evaluate the effect of innovations on sales growth and customer experience.

3. Operational Efficiency: Assess improvements in efficiency and cost reduction.

4. Real-Time Decision Making: Implement real-time analytics for quick decision-making.

By integrating these components, the project aims to provide a comprehensive view of supply chain operations, enabling DataCo Global to make data-driven decisions and improve delivery performance. The goal is to empower stakeholders with tools and insights for operational efficiency, timely deliveries, and market competitiveness.

2. Problem Statement

2.1 Business Problem:

The main issue facing DataCo Global is the inefficient performance of their supply chain, specifically in terms of delivery effectiveness. The current On-Time Rate (OTR) is notably lower than industry benchmarks, with only 41% of orders being delivered punctually in 2018.

This poor performance adversely affects customer satisfaction, operational efficiency, and the company's market competitiveness. Key concerns include:

- High Variance in Shipping Lead Time: A significant disparity exists between actual and scheduled

shipping days, resulting in delays and unpredictability.

 - Underperformance in Specific Shipping Modes: In particular, the Second Class shipping mode exhibits a very low OTR of 19%.

- Geographical Obstacles: Certain regions like Western Europe and Central America pose challenges with delivery delays despite contributing to higher order volumes.

2.2 Business Objectives:

 To tackle the aforementioned business issue, the following objectives have been outlined:

1. Develop an Extensive Delivery Performance Dashboard:

 - Utilize Qlik's advanced visualization features to create an intuitive and dynamic dashboard.

- Provide real-time insights on crucial metrics such as Shipping Lead Time Variance, On-Time Rate, and Average Shipping Lead Time.

 2. Implement Advanced Data Analytics:

 - Employ machine learning algorithms to forecast delivery performance and pinpoint bottlenecks.

- Analyze historical logistics data to enhance transportation routes and minimize lead times.

3. Enhance Real-Time Monitoring:

- Deploy real-time tracking solutions to enhance visibility into goods movement.

 - Enable swift decision-making in response to unexpected events or shifts in demand.

4. Optimize Logistics Strategies:

 - Identify and rectify inefficiencies within the supply chain to streamline operations.

 - Improve resource utilization to enhance productivity.

5. Evaluate Social and Business Impacts:

 - Evaluate the effects of data-driven innovations on social welfare programs, financial inclusion, and business sectors such as banking, telecommunications, and e-commerce.

2.3 Literature Review

The literature review focuses on examining existing research and case studies related to supply chain optimization, data-driven decision-making, and the use of advanced analytics in logistics.

1. Supply Chain Optimization:

- Key Principles and Methods:

 Examination of methodologies like Lean Management, Six Sigma, and the Theory of Constraints

commonly utilized to improve supply chain performance.

- Case Studies: Analysis of successful supply chain optimization projects across various industries, showcasing best practices and lessons learned.

 2. Data-Driven Decision-Making:

- Significance of Big Data and Analytics:

 Exploration of how big data and advanced analytics can revolutionize supply chain management by offering deeper insights and enabling predictive capabilities.

 - Applications of Machine Learning: Review of specific machine learning techniques such as regression analysis, classification models, and clustering used to analyze and enhance supply chain operations.

 3. Logistics and Transportation:

- Route Optimization: Study of algorithms and models employed to optimize transportation routes, reduce lead times, and cut costs.

 - Real-Time Tracking and Monitoring: Evaluation of technologies and systems for real-time tracking and monitoring of goods including RFID, GPS, and IoT devices.

 4. Social Welfare and Business Impacts:

- Social Impact Assessment:

Review of research on how enhancements in supply chain management can improve social welfare programs, enhance financial inclusion, and contribute to economic development.

 - Business Impact Assessment:

 Analysis of the repercussions of supply chain innovations on various business sectors, focusing on metrics like sales growth, customer satisfaction, and operational efficiency. By addressing these areas, the project aims to create a strong framework for enhancing delivery performance, optimizing supply chain operations, and evaluating the broader social and business impacts of data-driven innovations.

3. Data Collection

3.1 Collecting the Dataset

The success of the supply chain analytics initiative relies on the thorough gathering and fusion of pertinent data from diverse origins.

The datasets employed in this undertaking encompass both structured and unstructured data, offering a

holistic perspective of supply chain activities.

1.Structured Data:

-DataCoSupplyChainDataset.csv: This principal dataset comprises detailed records of supply chain activities spanning from 2015 to 2018. It encompasses various facets such as customers, orders, distribution, shipping, and products.

- DescriptionDataCoSupplyChain.csv:This supplementary file furnishes descriptions for each variable within the principal dataset, ensuring lucidity and uniformity in data interpretation.

2. Unstructured Data:

- tokenized_access_logs.csv:This dataset incorporates clickstream data delineating customer interactions and behaviors on DataCo Global's digital platforms. This unstructured data is pivotal for comprehending customer engagement and its influence on supply chain efficiency.

3. Data Cleansing and Preparation:

 - Handling Missing Values:Missing data is managed through imputation methods or by eliminating incomplete records, based on the scope and relevance of the absent information.

 - Outlier Identification and Treatment:Outliers are detected and addressed to prevent them from distorting the analysis outcomes.

- Normalization and Tokenization: Data normalization ensures uniformity, while tokenization is employed on the clickstream data to render it suitable for analysis.

3.2 Connecting Data with Qlik Sense

 Qlik Sense is harnessed for its sophisticated data amalgamation, visualization, and analytical functionalities. The process of associating the gathered datasets with Qlik Sense entails multiple steps to guarantee a smooth data flow and real-time analytics.

1. Data Integration:

 - Connecting to Data Sources:Qlik Sense facilitates seamless connection to diverse data sources, encompassing CSV files and databases. The structured and unstructured datasets are imported into Qlik Sense.

 - Data Load Scripts: Tailored data load scripts are devised to automate the import and transformation processes. These scripts handle data cleansing, normalization, and fusion, ensuring the datasets are primed for analysis.

 - Data Schemas: Qlik Sense allows for the creation of associative data schemas, which enable efficient data linkage and querying.

The structured and unstructured data are amalgamated into a unified data schema, streamlining comprehensive analysis.

 2. Data Visualization:

- Dashboard Development: Leveraging Qlik Sense's robust visualization tools, dynamic and user-friendly

dashboards are crafted. These dashboards furnish stakeholders with clear insights into pivotal metrics such as Shipping Lead Time Variance, On-Time Rate, and Average Shipping Lead Time.

- Interactive Visualizations: Qlik Sense presents interactive visualizations that empower users to delve deeper into the data, explore trends, and unearth insights. These functionalities allow stakeholders to engage with the data in real-time, enhancing decision-making capabilities.

3. Advanced Analytics:

- Machine Learning Integration: Qlik Sense integrates with advanced analytics tools and languages like R and Python. Machine learning models are formulated and implemented within Qlik Sense to forecast delivery performance, pinpoint bottlenecks, and optimize transportation routes.

- Real-Time Monitoring: Real-time data tracking and monitoring solutions are deployed within Qlik Sense, delivering up-to-the-minute visibility into the flow of goods and supply chain efficiency.

By meticulously gathering and merging data, and leveraging Qlik Sense's advanced functionalities, the initiative aims to equip DataCo Global with actionable insights that steer efficient operations and strategic decision-making in their supply chain management.

4. Data Preparation

Data preparation plays a critical role in supply chain analytics projects by ensuring that collected data is cleaned, transformed, and organized for efficient analysis. This phase encompasses various essential processes to make data suitable for modeling and visualization. ####

4.1 Data Cleaning

- Handling Missing Values: Identify and resolve missing values in the dataset using techniques like imputation or removal of incomplete records based on the significance and extent of missing data.

- Outlier Detection and Treatment: Detect outliers that could impact analysis results and address them through methods like trimming, winsorization, or substitution with mean/median values.

- Data Validation: Validate data integrity and consistency to guarantee accuracy by checking for duplicates, incorrect data types, and inconsistencies in data values.

4.2 Data Transformation

- Normalization: Standardize numerical data to ensure consistency and comparability across variables using techniques like min-max scaling or z-score normalization.

- Tokenization: For unstructured data such as clickstream logs, tokenize text data into individual words or phrases to simplify analysis by splitting the text into tokens or words based on specific delimiters.

- Feature Engineering: Generate new features or variables from existing ones to capture additional insights by aggregating, combining, or transforming variables to extract meaningful information.

4.3 Data Integration

- Merge Datasets: Combine multiple datasets to create a unified view of supply chain operations by

integrating structured and unstructured data sources for enriched analysis.

 - Data Joins: Link related data tables through joins or merges based on common key attributes to enable seamless querying and analysis across different datasets.

 - Data Aggregation: Summarize data at various levels (e.g., daily, weekly, monthly) to reduce granularity and identify patterns and trends over time.

4.4 Data Modeling

- Define Data Model: Establish a data model representing relationships between different entities in the supply chain by defining dimensions, hierarchies, and measures to facilitate analysis.

- Dimension Reduction: Reduce data dimensionality while preserving important information through techniques like principal component analysis (PCA) or feature selection to enhance computational efficiency and reduce noise.

4.5 Data Validation and Testing

- Cross-Validation: Validate predictive models using methods such as k-fold cross-validation to assess performance on unseen data.

- Model Evaluation: Evaluate predictive model performance using metrics like accuracy, precision, recall, and F1-score to select the best-performing model for deployment.

4.6. Data Splitting

- Training-Testing Split: Divide data into training and testing sets to train predictive models on one subset and evaluate their performance on another to assess model generalization ability.

 - Validation Set: Optionally, create a validation set to fine-tune hyperparameters and optimize model performance before final evaluation on the test set. By diligently following these data preparation steps, the project aims to ensure that data is clean, structured, and primed for analysis, laying the groundwork for deriving actionable insights and making informed decisions to optimize supply chain performance.

5. The Social Implications of Supply Chain Management Advancements

The progress in supply chain management (SCM) extends beyond business functions, impacting various facets of society. Here are some key social consequences of these advancements:

5.1 Employment Opportunities and Economic Expansion

Effective supply chains boost economic growth by easing trade, fostering job creation, and generating wealth. As companies enhance their supply chain operations, they open up job prospects in manufacturing, transportation, logistics, and related fields, thereby enhancing livelihoods and living standards.

5.2 Enhanced Access to Goods and Services

 Well-coordinated supply chains ensure the smooth movement of goods and services from producers to

consumers, enhancing access and affordability. Through cost and lead time reductions, SCM progress enables businesses to reach underserved markets, remote regions, and marginalized communities, promoting inclusivity and reducing disparities.

5.3 Aid in Times of Crisis and Humanitarian Relief

Supply chains play a vital role in providing essential goods and services to affected populations during crises like natural disasters or humanitarian emergencies. Advanced SCM practices, such as real-time tracking, demand prediction, and stakeholder coordination, enhance the efficiency and effectiveness of disaster relief efforts, saving lives and easing suffering.

5.4. Promotion of Environmental Sustainability

Sustainable supply chain practices, like eco-friendly sourcing, energy-efficient transportation, and waste minimization, contribute to environmental preservation and climate change mitigation. By reducing carbon emissions, cutting resource consumption, and advocating circular economy principles, SCM progress helps mitigate environmental harm and safeguard ecosystems for future generations.

5.5 Ethical Sourcing and Equitable Trade

Transparent and ethical supply chains advocate for fair labor practices, responsible sourcing, and ethical production standards. Consumers increasingly demand ethically sourced, environmentally conscious, and socially responsible products. SCM advancements empower businesses to trace raw material origins, ensure compliance with labor laws, and uphold ethical standards across the supply chain, fostering trust and accountability.

5.6. Healthcare Services and Medical Supply Chains

Efficient supply chains are crucial in the healthcare sector to ensure the availability of life-saving drugs, medical devices, and vaccines. SCM progress enables healthcare organizations to optimize inventory management, reduce stock shortages, and enhance healthcare service delivery to communities, particularly in remote and underserved areas. In conclusion, advancements in supply chain management have substantial social implications, spanning from job creation and economic growth to disaster relief, environmental sustainability, and ethical sourcing. By utilizing technology, innovation, and collaboration, businesses can harness the potential of supply chains to drive positive social change and enhance the well-being of individuals and communities globally.

6. Data Visualization

6.1 Dashboards

This project utilizes Qlik to create dynamic and intuitive dashboards for visualizing supply chain data. The dashboards are designed to provide stakeholders with clear, actionable insights into various aspects of supply chain management, including logistics, forecasting, and inventory management. Key components of the dashboards include:

1. **Overview Dashboard:** Displays key performance indicators (KPIs), trends over time, and summary statistics.
2. **Logistics Dashboard:** Features route optimization maps, regional delivery performance heatmaps, and transportation cost comparisons.
3. **Inventory Management Dashboard:** Visualizes stock levels, demand forecasting, and inventory turnover rates.
4. **Order Management Dashboard:** Shows order status, lead time analysis, and customer satisfaction metrics.
5. **Supplier Performance Dashboard:** Highlights supplier ratings, lead times, and compliance metrics.
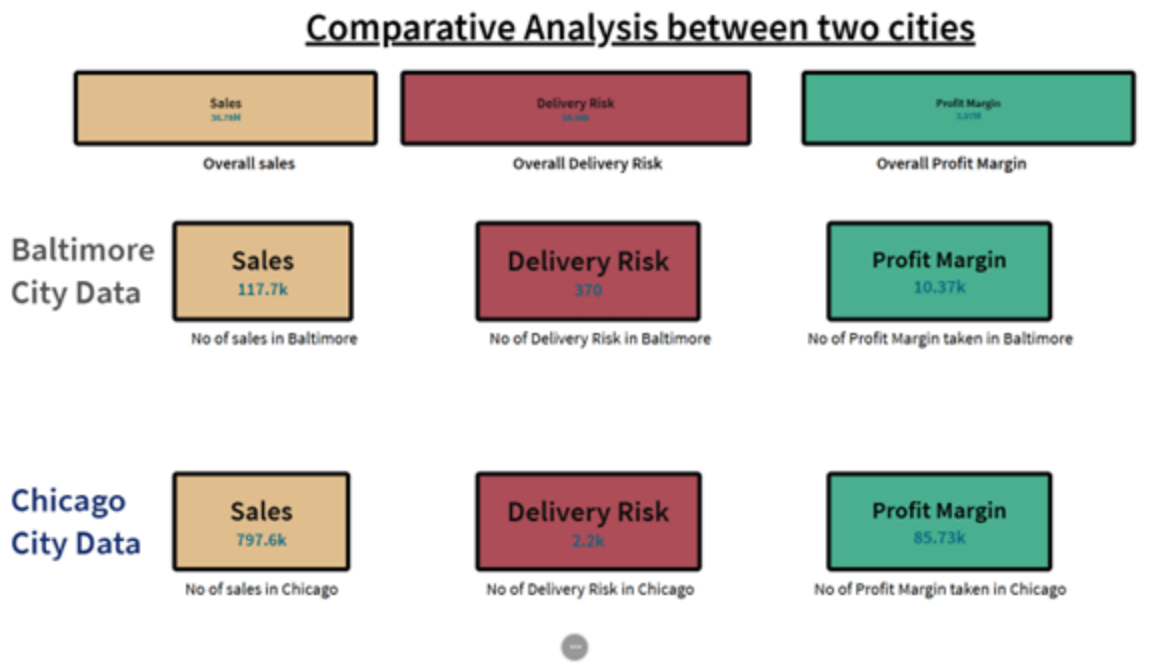
6.2 Stories

This project utilizes Qlik to create interactive dashboards that transform supply chain data into compelling stories. By focusing on narrative-driven data visualization, stakeholders can better understand key insights and trends, facilitating informed decision-making.

Key Components of the Storytelling Dashboard

1. **Introduction and Context:**
   - **Overview Slide:** Presents the current state of the supply chain, including key performance indicators and benchmarks.

- **Contextual Data:** Provides background information to set the stage for the narrative.
2. **Identifying Key Issues:**
   - **Problem Highlights:** Uses visualizations to pinpoint critical issues such as delays, inefficiencies, and high costs.
3. **Analyzing the Data:**
   - **Detailed Insights:** Interactive charts and graphs that delve into the specifics of logistics, inventory, and order management.
   - **Trend Analysis:** Visual representations of trends over time to identify patterns and anomalies.
4. **Proposed Solutions:**
   - **Actionable Insights:** Recommendations based on data analysis, supported by visual evidence.
   - **Impact Projections:** Charts showing the potential impact of proposed changes on overall supply chain performance.

Comparative Analysis between two cities

Sales	Delivery Risk	Profit Margin
Overall sales	Overall Delivery Risk	Overall Profit Margin

Baltimore City Data

Sales 117.7k	Delivery Risk 370	Profit Margin 10.37k
No of sales in Baltimore	No of Delivery Risk in Baltimore	No of Profit Margin taken in Baltimore

Chicago City Data

Sales 797.6k	Delivery Risk 2.2k	Profit Margin 85.73k
No of sales in Chicago	No of Delivery Risk in Chicago	No of Profit Margin taken in Chicago

Top 10 Countries with highest profits

Analyzing Market Trend with Top 5 countries contributing in profit
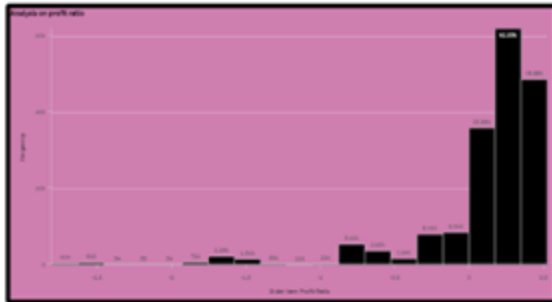
Representing Profit Ratio

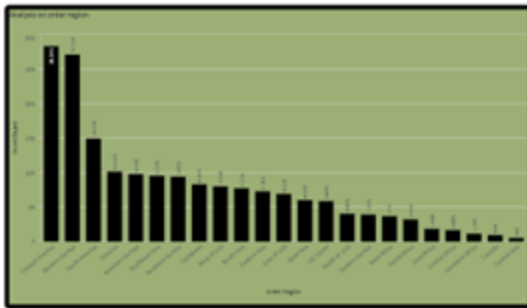# Customer Purchase Insights

Bar Chart Representation

Pie chart representation

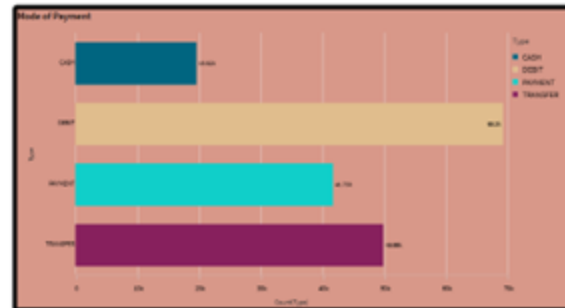**Comparision of Purchases made by two different cities**

Analyzing items placed by a state
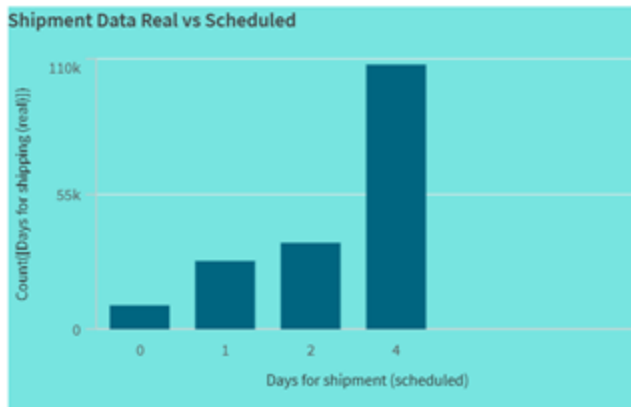
Understanding the Order region

Examining sales data by geographic areas to optimize logistics, forecasting, and inventory management for improved efficiency.
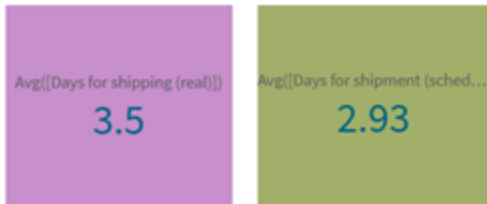
<u>Preferred Mode of Payment</u>

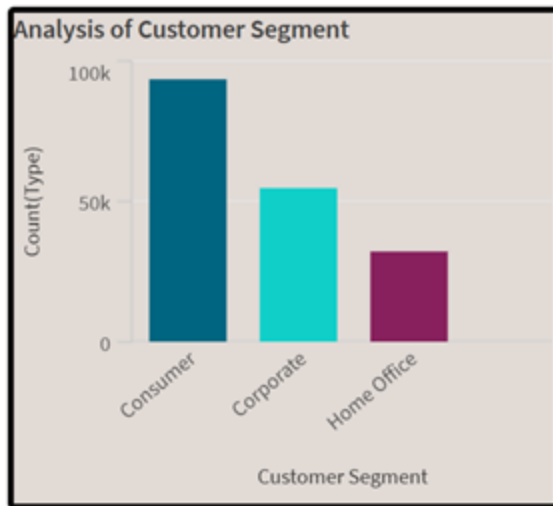This shows that debit is the most preferred mode of payment

Shipment Data

This is the comparative analysis of data shipment in real and the scheduled time
-Real shipments are delayed in general
-This could be the reason affecting the product purchase

Customer Groups Segments and Product purchase

Analysis of Customer Segment

Evaluating the distinct needs and behaviors of different segments to tailor strategies for each group to:

-> enhance marketing
-> improve product offerings
-> overall business growth.

Distribution based on Product category with frequency
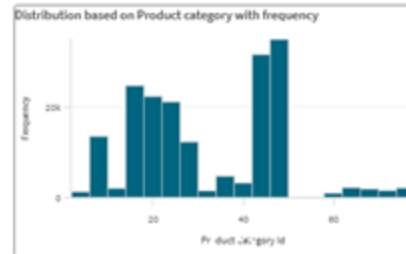
Conclusion

 In conclusion, the examination of progress in supply chain management emphasizes the crucial role that SCM plays in the success and longevity of businesses in today's global market. By exploring different definitions, core issues, challenges, inefficiencies, research endeavors, and future obstacles, numerous insights surface. The intricate nature of SCM necessitates a comprehensive understanding that covers strategic integration, cooperation, and value generation throughout supply chain networks.

This comprehension is vital for tackling the various challenges brought about by globalization, technological changes, evolving customer expectations, and sustainability issues. The drawbacks of inadequate supply chain management, such as surplus inventory, product shortages, and costly transportation, highlight the significance of streamlining supply chain operations and fortifying resilience to disruptions. Companies need to prioritize efficiency, flexibility, and customer-centric approaches to stay competitive in today's fast-paced business arena.

 Additionally, the changing research landscape in SCM underscores the importance of continuous innovation and adjustment to tackle emerging challenges and prospects. Future research endeavors should concentrate on utilizing digital technologies, enhancing sustainability measures, and promoting collaboration among supply chain associates. Fundamentally, efficient supply chain management goes beyond handling logistics and activities—it involves generating value, establishing a competitive edge, and providing exceptional customer service. Through embracing innovation, cooperation, and sustainability, organizations can navigate the complexities of contemporary supply chains and excel in an ever-evolving business environment.

References

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