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The Supply Chain Management in Construction Material for Pimpri Chinchwad City Area Construction Activities

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Abstract: Effective management on supply chain in construction material is crucial for country's progress as it constitutes a significant aspect of the economy. The primary responsibility of supply chain management is to maintain discipline and excellent condition for construction material. Root Cause Analysis (RCA) is a popular and often used technique, Pareto chart these two processes is very essential and effective that helps people answer the question of why the problem occurred in first place. The supply chain also represents the steps it takes to get the product or service from its original state to the customer on time-to-time basis. In the study that was carried out, it was found that the problems that these businesses face on day-to-day basis are related to Delay in delivery, loss of materials in storage/transportation, whose one of the root causes found to be the absence of Forecasting method, this study focuses on choosing the best suitable forecasting method that they can implement in their business activities for reducing the impact of particular problems.

Vital few is very important aspect of supply chain management as it focuses on items which are causing some type of damage or delay or quality of material. In order to correlate various factors such as delay, damage of material, Vital few comes in handy.

Keywords: Root cause analysis (RCA), Pareto chart and Pareto principals, Vital few, Data Analysis, Loss of material during storage, damage of product during storage, Delivery on time, Unavailability of transport vehicle, Trouble reaching address, Difference in product ordered and delivered.

I. INTRODUCTION

In the study that was carried out, it was found that the problems that these businesses face on day-to-day basis are related to Delay in delivery, loss of materials in storage/transportation, whose one of the root causes found to be the absence of Forecasting method, this study focuses on choosing the best suitable forecasting method that they can implement in their business activities for reducing the impact of particular problems Surely, it allows the decision-making process to become more efficient, focusing on key activities (business drivers). Indeed, the whole concept is based on the vital few and trivial many concepts. This project wants to point out the problems that construction material traders or suppliers faces in their day-to-day operations which significantly impact their overall business. Significance of the study for every business, there are both the suppliers and customers are involved. Considering these two entities, either buying or selling of goods/materials takes place. Each business has their supply chain and operation strategy. A supply chain is a network between an enterprise and its suppliers to produce and distribute a specific product to the final buyer.

This network includes different activities, people, entities and resources. This study will focus on the supply chain of a construction equipment trading business which deals with the goods/material like Cement, AAC blocks (Autoclaved Aerated Concrete), Clay Bricks, River sand, etc. This project research will also include the study of problems that these business faces on day-to-day basis when it comes to transporting the goods and focus on the problems related inventory of those goods. This study will collect and analyse the data related to problems faced by construction material traders on day-to-day basis. This study will focus on the problems in this sector and try to focus on most profit giving problems if they are eliminated. This research aims to provide practical solutions for problems that occur.

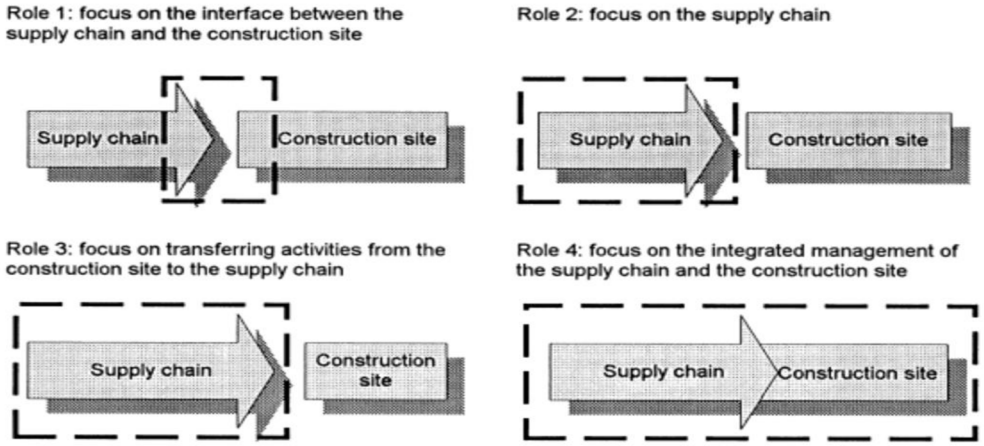
II. LITERATURE REVIEW

1) *Oncioiu et al, (November 2021). "Improving Business Processes in a Construction Project and Increasing Performance by Using Target Costing" [1]*

The case study outlines how to optimize business processes by using Swimlane charts and how to reduce operating costs by applying the target cost method. The article concludes with our conclusions about the real benefits of optimizing business processes in a construction project by using the target cost method and increasing the performance of entities in this field.

2) *Dr. Gwaith Al - Werikat, (December 2017). "Supply Chain Management in Construction; Revealed" [2]*

This paper discusses the construction supply chain characteristics, challenges and problems supply chains encounter and the benefits of an integrated supply chain in the construction sector.



3) *S. Hasim, M. A. Fauzi, Z. Yusof, et al. (April 2018). "The material supply chain management in a construction project: A current scenario in the procurement process" [3]*

It presents the existing research in the field of materials procurement of SC which includes SC concepts and traditional management versus supply chain management (SCM). The discussions on the evolution of SCM have also been included to show how SC is defined and practised today, with the intention of highlighting new opportunities to improve the performance of materials SCM.

4) *Atiq Ur Rehman, M., Chaabane, A., and Khan, S.A., (September 2021). "Review of Construction Supply Chain Optimization Papers for Performance Improvement" [4]*

The findings of this study shows that there is need of a framework that integrate all CSC processes for its overall optimization as very few studies incorporated design phase processes with procurement and execution phase processes in their optimization model.

5) *H.L. Lee, Z.-J. (M. Shen) (September 2020). "Supply chain and logistics innovations with the Belt and Road Initiative" [5]*

It studied that the Belt and Road Initiative (BRI) is a massive, ambitious, long-term project initiated by the Chinese government, with participation from many other countries, to facilitate trade and improve logistics in an effort to promote global economic development.

6) *Butković et al. (July 2017). "Supply Chain Management in the Construction Industry – A Literature Review" [6]*

It aims at providing guidance for future research related to supply chains in construction, is to review existing research and synthesize main approaches and findings. In particular, this review seeks to screen existing studies (published in period 2010-2016 using ProQuest database) with regard to their: level of analysis, research focus, type of study/paper, the sample used, analysed relationships and the different types of construction subjects which are covered and linked into supply chains.

III. PARETO ANALYSIS

Pareto analysis is a statistical technique in decision making that is used for the selection of a limited number of tasks that produce significant overall effect. The results of a Pareto analysis are typically represented through a Pareto chart.3.

Pareto analysis is a statistical technique in decision making that is used for the selection of a limited number of tasks that produce significant overall effect. It is one of the most commonly used, and easy to implement method. Pareto analysis is a relatively simple methodology that is used when trying to determine which tasks or factors in an organization will have the most impact. It ranks the data/factors in the descending order from the highest frequency of occurrences to the lowest frequency of occurrences. The total frequency is summed to 100 percent. The "vital few" items occupy a substantial amount (80 percent) of cumulative percentage of occurrences and the "useful many" occupy only the remaining 20 percent of occurrences, which is also known as the 80-20 rule.

IV. FORECASTING USING TREND

For a business, according to sales for a particular time scale, the trend of sales is essential for calculating the forecast because of the fact that, business is either on good run (rise) or bad run (fall). According to that forecast gets impacted. So, it very essential for the forecast to be made considering the trend in which business is going.

Following are the parameters that are taken into consideration for the calculation of the trend:

X_i = Time periods (In a monthly time series for a year X will be 12)
Y_i = Actual demand during respective X_i.
α = intercept (at point 0)
β = Slope of the line
X = Time period
Y = Forecast for the period X

Formulas:

a. $\bar{X}$ (Mean) = $\sum X_i / n$

b. $\bar{Y}$ (Mean) = $\sum Y_i / n$ (Where n= number of periods)

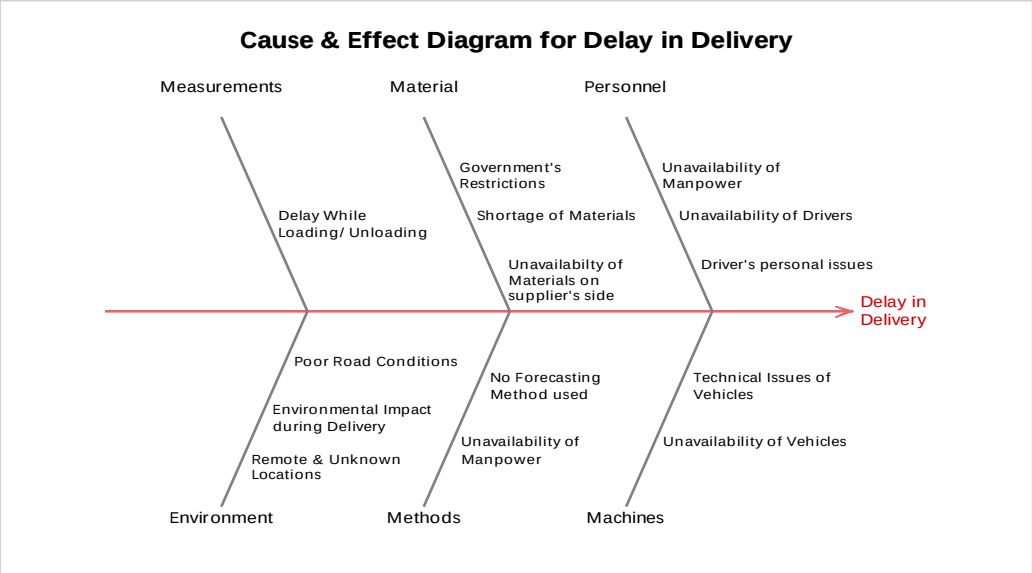
c. $\beta = \frac{\sum Xi\ Yi - n\bar{X}*\bar{Y}}{\sum Xi^2 - n\bar{X}*\bar{X}}$,

d. $\alpha = \bar{Y} - \beta * \bar{X}$

e. Linear Trend for Time series is given by ($Y = \alpha + \beta * X$)

V. PROBLEMS AND THEIR CAUSES

The Causes/issues that cause 'Delay in Delivery' are illustrated with the help of Ishikawa / Fishbone diagram:



A. *On Time Delivery to Customer*

On time delivery drives better collaboration with your customers, ensures reliability of delivery and most importantly customer loyalty. Customer expects you to meet the promised delivery date and time. It is important to set the right expectations with your customers and meet them. On time delivery (OTD) is metric used to access the ability of a business in fulfilling the shipment order within the period of promised delivery time. Consider any business, OTD is important. But In this particular kind of research related to Construction material traders business.

B. Unavailability of Transport vehicles/ Drivers

Availability of transport vehicles/drivers directly affects to the On-Time Delivery for the customers. When you are in trading business, delivery of the products defines your business. As for Construction material trading business, as per the requirement of material on particular day, delivery has to be made. In case of demand bulge, majority of this problem arises.

C. Trouble reaching Address (Remote locations)

Some of the delivery locations are unknown for a driver/transport vehicle, and delivery for such kind of locations is sometimes becomes difficult. This problem generally occurs when a particular location is new to the driver or if it is located at the remote location in rural area.

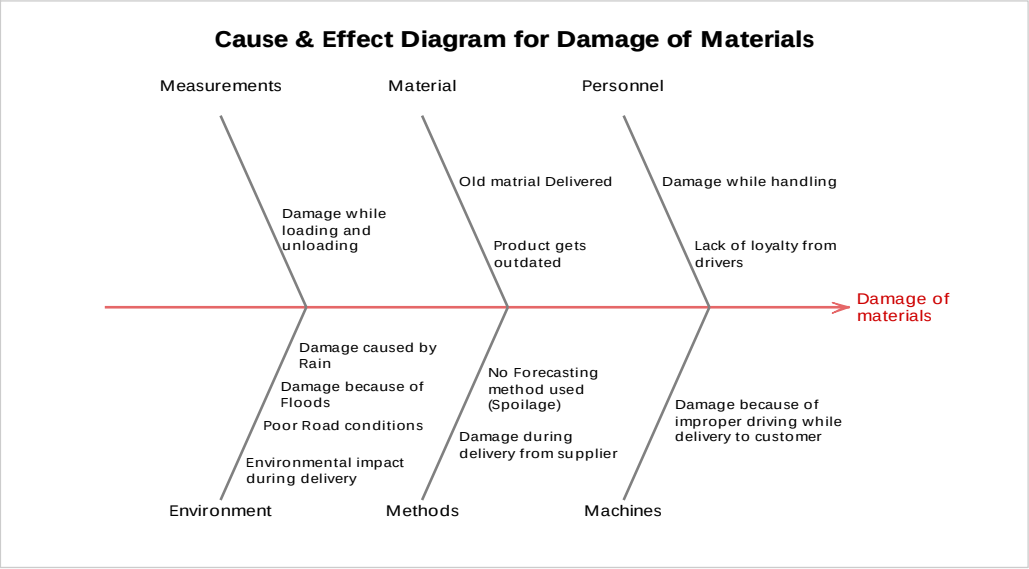
D. Delivery in time (At the time of Buying)

Delivery in time from the supplier plays an important role for any kind of business as it reflects in availability of material for the further operations. Consider any kind of business, any further operation such as manufacturing, or production is dependent on the availability of raw materials from the respective supplier for the further operation.

For achieving this, supplier relations must be maintained. And the supplier must be at the minimum distance from the shop for the which can provide you the best quality of materials that you required for the shop in less possible time.

E. Damage / loss of Materials (Storage & transportation)

The Causes/issues that cause 'Damage/loss of Materials' are illustrated with the help of Ishikawa / Fishbone diagram:



F. Damage of product during transport (Buying and selling)

As for any business, especially for trading business, transporting is major operation which has to be conducted by taking all the safety measures. If the materials that are transported are fragile, they can get damaged while transporting. The damage that occurs depend upon following factors:

1) Depend on Road (route) quality.
2) Quality (Condition) of transporting vehicle.
3) Skill of Driver.

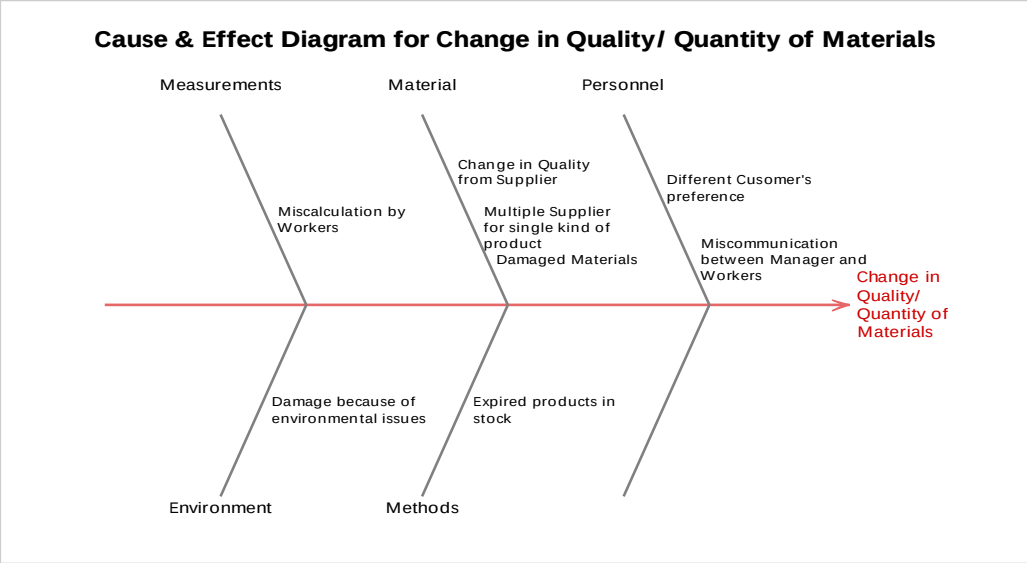
G. Loss of material during storage (Damage due to improper way of inventory management or because of environmental issues)

Inventory is the goods that a business owns that it plans to sell. If your company is apparel retailer, products become inventory when you take possession of shirts, dresses, suits and accessories from the suppliers. Those products leave the stock when they are sold to customers. Inventory can be stored in premises, warehouses etc.

As per the survey conducted, It was observed that all the shops that have been surveyed for the problem of Environmental factors such as Moisture, Rains, Floods affect the storage of the materials as the Shops are in coastal region.

H. Change/Difference in Quality & Quantity

The Causes/issues that cause 'Change/Difference in Quality & Quantity' are illustrated with the help of Ishikawa/Fishbone diagram:



I. Difference in Quantity ordered and delivered (Buying and selling)

Difference in quantity ordered and delivered while buying and selling of the materials is a problem that occurs mostly because of human errors. This error occurs due to following reasons:

1) Miscommunication between shop manager and labours.
2) Miscalculation while loading of materials by labours.

J. Difference in Quality of product

Difference in quality of products occurs mainly because of multiple suppliers. For some of the trading shops, the suppliers change because of issues during operations (quality of products, more time for delivery from suppliers). Because of these reasons supplier for a particular product change. This results in changing of quality for that particular product as the supplier changes.

Some of the customers may prefer a particular quality of product but as the supplier changes that customer might nit prefer that particular new product quality and can move for other traders for the order. This can impact business. That's why selecting a proper supplier for a product is important as far as the smoother operation of business is concerned.

VI. METHODOLOGY

Supply chain management refers to the coordination and oversight of the flow of goods, services, and information from the initial sourcing of raw materials to the delivery of the final product to the end consumer. Here is a concise methodology for effective supply chain management:

1) *Plan:* Develop a strategic supply chain plan that aligns with the organization's overall goals. Identify key objectives, such as cost reduction, customer satisfaction, and flexibility, and establish performance metrics to measure progress.
2) *Source:* Identify and evaluate potential suppliers based on criteria such as cost, quality, reliability, and sustainability. Establish strong relationships with selected suppliers and negotiate favourable terms and conditions.
3) *Make:* Optimize production processes to ensure efficient and timely manufacturing or assembly of products. Implement technologies, such as enterprise resource planning (ERP) systems, to manage inventory, production schedules, and capacity planning.
4) *Deliver:* Design an effective logistics network to manage the transportation and distribution of goods. Optimize transportation routes, select appropriate carriers, and establish efficient warehousing and distribution centres.

5) *Track:* Implement real-time monitoring and tracking systems to gain visibility into the movement of goods throughout the supply chain. Utilize technologies like RFID, barcodes, or GPS to improve accuracy and traceability
6) *Improve:* Continuously analyse supply chain performance, identify areas for improvement, and implement corrective actions. Embrace process optimization, lean principles, and data analytics to enhance efficiency, reduce costs, and enhance customer satisfaction.
7) *Collaborate:* Foster collaboration and communication with suppliers, customers, and other stakeholders. Establish collaborative relationships to share information, anticipate demand fluctuations, and jointly develop innovative solutions.
8) *Adapt:* Stay agile and responsive to changing market conditions, technological advancements, and customer preferences. Continuously monitor industry trends and proactively adapt supply chain strategies to remain competitive.
9) *Mitigate Risks:* Identify and assess potential risks to the supply chain, such as natural disasters, geopolitical uncertainties, or disruptions in logistics. Develop risk mitigation strategies, including contingency plans, alternative sourcing options, and business continuity plans.
10) *Sustainability:* Integrate sustainable practices into the supply chain to reduce environmental impact, ensure ethical sourcing, and support social responsibility. Consider factors such as carbon footprint, waste reduction, and fair labour practices.

Remember that this methodology provides a high-level overview, and each step may involve numerous sub-processes and considerations. The specific implementation of the methodology will vary based on the organization's size, industry, and specific supply chain requirements.

VII. RESULTS

1) *Cost Reduction:* Efficient supply chain management can help reduce costs throughout the entire value chain. By optimizing inventory levels, streamlining production processes, and minimizing transportation and warehousing expenses, organizations can achieve cost savings and improve their bottom line.
2) *Improved Customer Service:* Supply chain management focuses on meeting customer demands efficiently and effectively. By ensuring timely delivery, accurate order fulfilment, and responsive customer support, organizations can enhance customer satisfaction and loyalty.
3) *Increased Efficiency:* Supply chain management enables organizations to eliminate inefficiencies and bottlenecks in their processes. This leads to improved resource utilization, reduced lead times, faster response to market changes, and higher overall operational efficiency.
4) *Enhanced Collaboration:* Supply chain management encourages collaboration and information sharing among suppliers, partners, and customers. This fosters better coordination, improved visibility, and enables quick decision-making, leading to smoother operations and reduced disruptions.
5) *Risk Mitigation:* A well-managed supply chain can help organizations identify and mitigate risks. By diversifying suppliers, establishing backup plans, and implementing robust risk management strategies, organizations can reduce the impact of disruptions and ensure business continuity.
6) *Innovation and Competitive Advantage:* Effective supply chain management promotes innovation and the adoption of new technologies. Organizations can leverage data analytics, automation, and emerging technologies to gain insights, optimize processes, and gain a competitive edge in the market.
7) *Sustainability and Social Responsibility:* Supply chain management plays a crucial role in integrating sustainable practices and promoting social responsibility. By implementing environmentally friendly initiatives, ensuring ethical sourcing, and supporting fair labour practices, organizations can enhance their reputation and meet the growing demand for sustainable products and practices.

Overall, successful supply chain management results in improved operational efficiency, cost savings, customer satisfaction, risk mitigation, innovation, and sustainability. These outcomes contribute to the overall success and competitiveness of organizations in today's complex and rapidly changing business environment.

VIII. DISCUSSION

Supply chain management is a critical aspect of modern business operations. It involves the coordination and integration of various activities, processes, and stakeholders across the entire supply chain to ensure the efficient flow of goods, services, and information. Effective supply chain management can provide numerous benefits, while poor management can lead to disruptions, increased costs, and customer dissatisfaction.

One key aspect of supply chain management is demanding forecasting and planning. Accurate demand forecasts are crucial for aligning production, procurement, and inventory levels with customer demand. By leveraging historical data, market trends, and customer insights, organizations can optimize their supply chain to meet customer expectations while minimizing excess inventory or stockouts.

Supplier management is another critical area within supply chain management. Selecting reliable suppliers, negotiating favourable terms, and maintaining strong relationships is essential for ensuring a consistent and high-quality supply of raw materials or finished goods. Supplier performance monitoring, risk assessment, and continuous improvement initiatives are vital to mitigate potential disruptions and maintain a resilient supply chain.

Inventory management is a complex task that involves finding the right balance between holding sufficient stock to meet customer demand and minimizing excess inventory costs.

Techniques such as just-in-time (JIT) inventory, vendor-managed inventory (VMI), and efficient replenishment strategies can help optimize inventory levels, reduce carrying costs, and improve cash flow.

Efficient transportation and logistics management are critical for timely delivery and cost optimization. Organizations need to consider factors such as transportation modes, carrier selection, route optimization, and warehousing strategies to minimize transportation costs, reduce lead times, and ensure accurate order fulfilment.

Technology plays a significant role in supply chain management. Advanced software systems like enterprise resource planning (ERP), warehouse management systems (WMS), and transportation management systems (TMS) provide real-time visibility, data analytics, and automation capabilities, enabling organizations to streamline processes, improve decision-making, and enhance overall supply chain efficiency.

Collaboration and communication are fundamental elements of effective supply chain management. Organizations must collaborate closely with suppliers, customers, and other stakeholders to share information, anticipate demand fluctuations, and jointly solve problems, strategic partnerships can lead to improved supply chain performance and responsiveness.

Sustainability and social responsibility have gained increasing importance in supply chain management. Organizations are expected to incorporate sustainable practices, such as reducing carbon emissions, minimizing waste, and promoting ethical sourcing, to meet environmental and social standards. Supply chain management provides opportunities to optimize transportation routes, select eco-friendly packaging, and ensure fair labor practices throughout the supply chain.

In conclusion, effective supply chain management is essential for organizations to stay competitive in today's global marketplace. By implementing sound strategies, leveraging technology, fostering collaboration, and embracing sustainability, organizations can achieve cost efficiencies, enhance customer satisfaction, mitigate risks, and drive overall business success. Continuous improvement and adaptation to changing market dynamics are key to maintaining a resilient and agile supply chain.

IX. LIMITATIONS

Lack of sight: One obstacle to effective supply chain management is the absence of adequate chain-wide visibility.

As a result, there may be difficulties with inventory management, erroneous demand forecasting, and the inability to spot bottleneck s or disruptions.

Collaboration and information sharing: The absence of efficient communication and cooperation among the many supply chain play ers is another barrier. This may result in a breakdown in communication,delays in making decisions and ineffective coordination.

Networks with several tiers of suppliers, distribution centres, and transportation routes make up complicated supply chains.

It can be difficult to manage such complex networks, especially when it comes to increasing productivity, cutting expenses, and guar anteeing on-time delivery. Demand volatility: Variations in Risk management: There are several hazards that can affect supply chains, including natural disasters, geopolitical unrest, supplier failures, and disruptions in transportation. Proactive tactics and backup plans are necessary for managing and mitigating these risks.

X. FUTURE SCOPE

1) *Artificial intelligence (AI) and Advanced Analytics:* Supply chain management will benefit greatly from the use of AI and advanced analytics technology. By enabling real-time data analysis, demand forecasting, inventory level optimisation, and predictive maintenance, these technologies can improve productivity and responsiveness.

2) *Internet of Things (IoT) and connectivity:* As IoT devices and connectivity become more widely used, it will be possible to track and monitor products more effectively across the supply chain. In addition to enabling proactive issue detection and logistics operation optimisation, this can offer real-time visibility.
3) *Block Chain Technology:* It has the capacity consumer demand can be difficult Supply chain management will place an everincreasing emphasis on sustainability and the circular economy.This entails cutting down on waste, lowering carbon emissi ons, implementing ecofriendly practises, and setting up closedloop supply chains that encourage material recycling and reuse.
4) *Collaboration and Partnerships:* Stakeholder collaboration and partnerships will be emphasised in future supply chains.This en tails tighter cooperation with vendors, clients, logistical service providers, and even rival businesses in order to streamline opera tions, pool resources, and spur innovation.
5) *Automation and Robotics:* The supply chain will undergo a considerable change as a result of the use of drones, autonomous ve hicles, and robotics.Tasks like picking, packing, sorting, and transportation may all be done more quickly, accurately, and effici ently thanks to them.Agile and responsive supply networks will become more prevalent in the future.lt for suppliers to meet.

XI. CONCLUSION

Supply chain management is a critical discipline that involves the coordination and optimization of activities, processes, and stakeholders across the entire supply chain. Its effective implementation can yield significant benefits for organizations, including cost reduction, improved customer service, increased efficiency, enhanced collaboration, risk mitigation, innovation, and sustainability. By strategically planning, sourcing, producing, delivering, and tracking products or services, organizations can achieve operational excellence, maintain a competitive edge, and meet customer expectations. Leveraging technology, fostering collaboration, and embracing sustainability are key factors in successful supply chain management. Continuous improvement, adaptability, and responsiveness to market changes are crucial for maintaining a resilient and efficient supply chain in today's complex business landscape.

XII. APPENDICES

1) *Glossary:* A list of key terms and definitions related to supply chain management, ensuring a common understanding of terminology.
2) *Diagrams and Flowcharts:* Visual representations of supply chain processes, such as order fulfilment, procurement, transportation, and inventory management.
3) *Data Tables:* Relevant data, such as historical sales figures, inventory levels, lead times, or supplier performance metrics, can be presented in tabular format for reference.
4) *Case Studies:* Detailed examples of successful supply chain management practices or notable supply chain disruptions and their resolutions.
5) *Supplier Profiles:* Background information on key suppliers, including their capabilities, geographical locations, certifications, and performance history.
6) *Regulatory Compliance:* Appendices containing relevant regulatory requirements or industry standards that impact supply chain management, ensuring compliance and adherence.
7) *Risk Assessment:* Detailed analysis of potential supply chain risks, such as natural disasters, geopolitical issues, or supplier failures, along with mitigation strategies.
8) *Performance Metrics:* Examples of key performance indicators (KPIs) used in supply chain management, such as order accuracy, on-time delivery, inventory turnover, or fill rate.

Root cause analysis, Vital few and Pareto analysis this are the very important methods in the supply chain management as it solves major problems of supply chain management in construction activity and hence, they should be use widely. Remember, the specific appendices included will depend on the context, purpose, and requirements of the supply chain management documentation.

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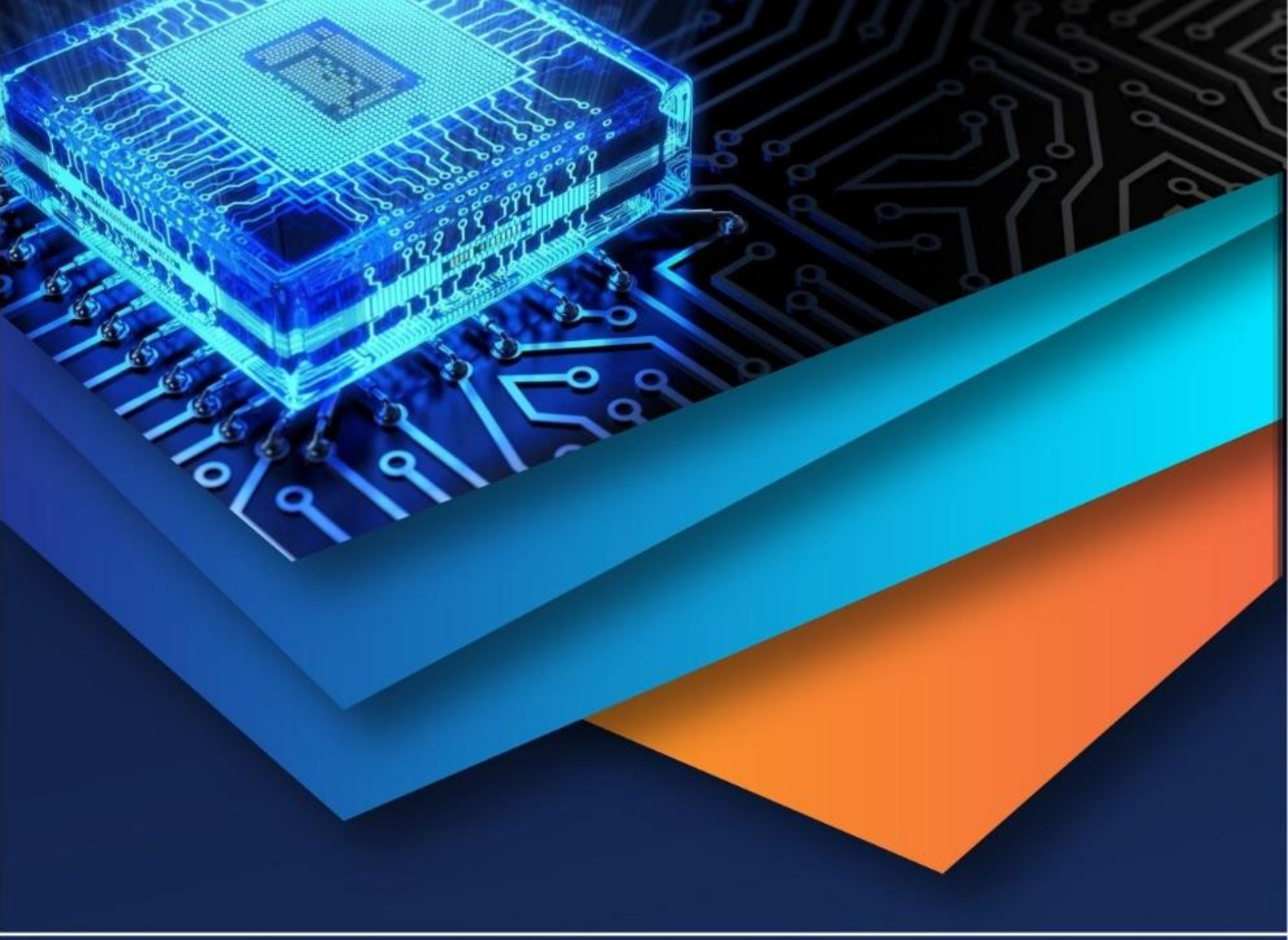

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