

Changing landscape of supply chain in India with multimodal logistics parks

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Abstract - *The changing dynamics of global trade and increasing demand for efficient supply chain operations have necessitated a paradigm shift in India's logistics infrastructure. Multimodal logistics parks have emerged as a game-changer in optimizing supply chain efficiency, leveraging multiple modes of transportation, and addressing critical challenges faced by traditional logistics systems. This research paper provides a comprehensive analysis of the changing landscape of supply chain in India, focusing on the significance and impact of multimodal logistics parks in enhancing overall efficiency and competitiveness.*

Keywords - *supply chain, multimodal logistics parks, optimizing, leveraging.*

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INTRODUCTION

This section introduces the research topic, outlining the current state of the supply chain in India and the growing need for efficient logistics solutions. It presents the research objectives, highlighting the role of multimodal logistics parks as a transformative element in the evolving supply chain landscape.

The landscape of supply chain management in India has been rapidly evolving in response to the changing dynamics of global trade, technological advancements, and the growing demands of a dynamic market (Toorajipour et al., 2021). Efficient and seamless logistics operations have become a critical determinant of a country's economic growth and competitiveness in the international arena. In this context, the emergence of multimodal logistics parks has been a transformative development, offering a comprehensive solution to address the challenges faced by traditional supply chain systems.

Multimodal logistics parks, also known as freight villages or logistics hubs, are integrated facilities that provide connectivity and synergy between different transportation modes, including road, rail, air, and water. These state-of-the-art logistics hubs serve as centralized points for cargo handling, warehousing, value-added services, and multimodal transportation. By streamlining logistics activities, multimodal parks aim to reduce transit times, lower operational costs, and enhance overall supply chain efficiency.

The significance of these logistics parks in India cannot be overstated. With a population of over 1.3 billion (WHO, 2021) and a rapidly expanding economy, the country's logistics industry faces significant

challenges related to congestion, fragmented supply chains, and suboptimal infrastructure. The implementation of multimodal logistics parks addresses these challenges head-on, providing a holistic approach to logistics management and paving the way for India to become a global logistics hub.

OBJECTIVES OF THE STUDY

- to explore the changing landscape of supply chain management in India
- to elaborate the role of multimodal logistics parks in enhancing supply chain efficiency and competitiveness.
- To examine the current state of supply chain management in India
- to investigate the role of government initiatives in fostering the growth of multimodal logistics parks
- to address the challenges faced by these logistics hubs

This research paper aims to explore the changing landscape of supply chain management in India with a specific focus on the role of multimodal logistics parks in enhancing supply chain efficiency and competitiveness.

By analyzing relevant literature, case studies, and data from credible sources, this study will delve into the benefits, challenges, and potential of these logistics hubs to drive meaningful improvements in India's supply chain ecosystem.

The paper will begin by examining the current state of supply chain management in India, considering factors such as rapid urbanization, changing consumer preferences, and advancements in technology. From there, it will introduce the concept of multimodal logistics parks and elucidate their significance in integrating multiple transportation modes under one hub. The research will delve into successful case studies of multimodal logistics parks in India, showcasing their impact on supply chain efficiency and overall competitiveness.

Additionally, the research paper will investigate the role of government initiatives and policy frameworks in fostering the growth of multimodal logistics parks.

It will also address the challenges faced by these logistics hubs, along with identifying opportunities for further expansion and improvement.

Ultimately, this research seeks to highlight how multimodal logistics parks are transforming India's supply chain landscape, enhancing efficiency, reducing costs, and strengthening the country's competitive position in the global market. By understanding the benefits and implications of these logistics hubs, stakeholders in the logistics industry, policymakers, and businesses can harness their potential to drive India's logistics sector towards greater heights of efficiency and competitiveness.

Current state of supply chain in India

The current state of the supply chain in India is undergoing significant changes and challenges due to the country's rapid economic growth, globalization, and technological advancements. While India has made considerable progress in recent years, there are still several key issues that need to be addressed to enhance supply chain efficiency and competitiveness.

One of the primary challenges is the inadequate transportation infrastructure, especially in certain regions. The lack of efficient road networks, congested ports, and limited intermodal connectivity impact the smooth movement of goods across the country (Thakkar et al., 2015). The supply chain in India is highly fragmented, with various stakeholders operating in isolation. Limited collaboration and coordination between suppliers, manufacturers, and retailers lead to suboptimal logistics operations and inefficiencies. High inventory carrying costs and ineffective inventory management systems contribute to supply chain inefficiencies. The bullwhip effect, caused by demand fluctuations and lack of real-time data sharing, results in demand-supply imbalances.

The complex taxation system and inconsistent policies at different levels of government create challenges for logistics operations. Standardization and certification processes are often lacking, affecting the overall efficiency of the supply chain. With the growth of e-commerce and digitalization, customer expectations

have risen significantly. There is a demand for faster and more transparent delivery, as well as the need for flexible and customized supply chain solutions.

While technology adoption is increasing, there is still a need for wider integration of advanced technologies like the Internet of Things (IoT), artificial intelligence (AI), and blockchain. Incorporating these innovations can lead to more data-driven decision-making and improved supply chain visibility (Wamba & Queiroz, 2020). The Indian government has introduced various initiatives like "Make in India" and the implementation of Goods and Services Tax (GST) to boost manufacturing and simplify taxation. While these reforms have positive implications, there is a need for further policy support to enhance supply chain efficiencies.

Green logistics and sustainability practices are gaining prominence as companies and consumers become more environmentally conscious (Cosimato & Troisi, 2015). There is a growing emphasis on reducing carbon footprints and integrating renewable energy sources in logistics operations. Multimodal logistics parks are emerging as a potential solution to improve intermodal connectivity and reduce logistics costs. Additionally, advancements in cold chain and pharmaceutical logistics offer growth opportunities in specialized supply chain segments.

To overcome these challenges and leverage opportunities, India's supply chain industry needs to focus on infrastructure development, technology integration, collaboration, and policy reforms. By adopting innovative practices and sustainable approaches, the Indian supply chain can enhance efficiency, competitiveness, and meet the evolving needs of both domestic and global markets.

Growing need for efficient logistic systems

The growing need for efficient logistics solutions is driven by several factors that are shaping the business landscape in the modern world. These factors have intensified the demand for streamlined and agile supply chain operations to meet the ever-increasing expectations of customers and remain competitive in the global marketplace. Some of the key reasons contributing to the growing need for efficient logistics solutions are as follows:

The expansion of international trade and the integration of economies have led to a significant increase in the movement of goods across borders. As businesses operate on a global scale, efficient logistics solutions become crucial to ensure timely delivery and seamless movement of products to distant markets (Rejeb et al., 2021). The rise of e-commerce platforms and digitalization has transformed consumer behavior, with customers now expecting faster and more convenient delivery options. Efficient logistics solutions are essential to

meet these demands, including last-mile delivery and same-day shipping services (Wieland, 2021).

Many industries, especially manufacturing, have adopted just-in-time inventory management to reduce holding costs and minimize waste. Efficient logistics solutions play a vital role in ensuring that raw materials and finished products are delivered precisely when needed, optimizing production schedules. In a competitive business environment, organizations are continuously seeking cost optimization strategies. Efficient logistics solutions can help minimize transportation and warehousing costs while maximizing the utilization of resources.

Real-time tracking and visibility across the supply chain are becoming essential for businesses to monitor and manage inventory, shipments, and customer orders effectively (Helo & Shamsuzzoha, 2020). Efficient logistics solutions enable better transparency and decision-making. Environmental concerns have pushed companies to adopt eco-friendly logistics practices. Efficient logistics solutions that reduce carbon emissions, promote greener transportation, and optimize routes contribute to sustainability goals.

With supply chains becoming increasingly complex and global, efficient logistics solutions are critical to managing multiple suppliers, transportation modes, and distribution channels efficiently.

Consumers today expect seamless and timely delivery of products. The demand for faster shipping options, easy returns, and order visibility necessitates efficient logistics solutions. Rapid urbanization poses unique challenges for logistics, especially in congested cities. Efficient last-mile logistics solutions are required to navigate through crowded urban areas and deliver goods to end consumers promptly.

Advancements in technologies, such as AI, IoT, and data analytics, have revolutionized logistics operations. Efficient logistics solutions leverage these technologies to optimize routes, predict demand, and automate processes (Rejeb et al., 2021).

The growing need for efficient logistics solutions is driven by the changing dynamics of the global economy, customer expectations, sustainability concerns, and technological advancements. Businesses must invest in streamlined logistics operations to remain competitive, enhance customer satisfaction, and achieve sustainable growth in today's fast-paced business environment.

LITERATURE REVIEW

The literature review explores relevant studies, research articles, and industry reports that discuss the role of multimodal logistics parks in supply chain optimization. It delves into the concepts of multimodal transportation, logistics park development, and their impact on supply chain efficiency. The review also

covers global best practices and success stories of countries that have embraced multimodal logistics parks.

Logistics parks

Logistics parks, also known as freight hubs, inland ports, or transportation hubs, are specialized infrastructure facilities designed to efficiently manage the flow of goods and cargo within the supply chain (Chang & Chen, 2020). These parks serve as centralized locations where multiple transportation modes, such as road, rail, air, and sometimes waterways, converge to facilitate seamless movement and distribution of goods.

Functions of logistics parks include:

Logistics parks are strategically located near major industrial clusters, consumption centers, ports, airports, and highways to optimize transportation efficiency and reduce transit times.

One of the primary advantages of logistics parks is the availability of multi-modal transportation facilities, such as rail sidings, container yards, truck terminals, and sometimes inland waterways. This enables easy transfer and interchange of goods between different modes of transportation, minimizing cargo handling and reducing overall logistics costs.

Logistics parks typically have warehouses and storage facilities of varying sizes to accommodate different types of cargo, including dry goods, perishables, and hazardous materials. Efficient warehousing ensures proper inventory management and reduces order fulfillment times.

Many logistics parks offer customs clearance facilities, streamlining import and export procedures and reducing bureaucratic delays.

Some logistics parks provide value-added services such as packaging, labeling, sorting, and quality control, enabling businesses to enhance their supply chain operations. Modern logistics parks incorporate advanced technologies such as RFID tracking, GPS monitoring, real-time data analytics, and warehouse management systems to improve visibility, transparency, and operational efficiency.

Increasingly, logistics parks are adopting sustainable and eco-friendly practices to minimize their environmental impact. This may include energy-efficient lighting, rainwater harvesting, waste recycling, and green building designs.

Logistics parks play a vital role in facilitating international trade by enabling smooth customs processes and offering facilities for cross-border logistics operations.

Some logistics parks are designed to cater to specific industries, such as automotive,

pharmaceuticals, electronics, and perishables. These industry-specific parks are equipped with specialized infrastructure and services to meet the unique requirements of each sector.

Logistics parks contribute to skill development by providing training and employment opportunities to local communities, supporting regional economic development.

In summary, logistics parks are critical components of modern supply chain management. By offering efficient multi-modal transportation, warehousing, customs clearance, and value-added services, logistics parks enhance supply chain efficiency, reduce operational costs, and contribute to the overall economic growth and competitiveness of a region or country.

Logistics parks development in India

Logistics parks development in India has seen significant growth and progress over the past few years. The Indian government, recognizing the importance of efficient logistics infrastructure for economic growth, has taken several initiatives to promote the establishment of logistics parks across the country. These parks play a crucial role in enhancing supply chain efficiency, reducing transportation costs, and improving overall logistics performance. Here are some key aspects of logistics parks development in India:

The Indian government has launched various initiatives and policies to encourage the development of logistics parks. The implementation of the Goods and Services Tax (GST) in 2017, which replaced multiple indirect taxes with a unified tax, has positively impacted the logistics sector. It has led to the consolidation of warehouses and distribution centers, promoting the concept of larger and more efficient logistics parks.

The development of Dedicated Freight Corridors (DFCs) by Indian Railways is a significant step in improving logistics infrastructure. DFCs are freight-only rail lines that connect key industrial and consumption centers, enabling faster and more efficient movement of goods. Logistics parks are being developed along these corridors to leverage the benefits of seamless rail connectivity.

Both public and private players are investing in logistics park projects. Public sector companies like Container Corporation of India (CONCOR) have been instrumental in setting up logistics parks at strategic locations. Private developers and logistics companies are also actively participating in developing logistics parks through joint ventures and collaborations.

Logistics parks are strategically located near major industrial hubs, ports, airports, and transportation nodes to optimize supply chain operations. This

ensures easy access to multiple transportation modes, reducing transit times and enhancing last-mile connectivity.

Logistics parks in India are equipped with modern infrastructure, including warehouses, container yards, cold storage facilities, customs clearance centers, and value-added services. They offer end-to-end logistics solutions to meet the diverse needs of businesses.

Some logistics parks are developed within SEZs, offering additional benefits such as tax incentives, duty exemptions, and simplified regulatory procedures. This attracts foreign investment and promotes international trade.

Technology integration is a key focus in modern logistics parks. Advanced systems, such as RFID tracking, GPS monitoring, and warehouse management software, are employed to enhance visibility, transparency, and efficiency in logistics operations.

Many logistics parks in India are adopting eco-friendly practices to reduce their environmental impact. They incorporate energy-efficient lighting, rainwater harvesting, waste recycling, and green building designs.

India has seen the development of industry-specific logistics parks catering to sectors like pharmaceuticals, automotive, textiles, and electronics. These parks offer specialized infrastructure and services tailored to meet the unique requirements of each industry.

Logistics parks are also contributing to skill development in the logistics sector by providing training and employment opportunities to local communities.

Overall, the development of logistics parks in India is a positive trend that is transforming the logistics landscape in the country. With continued government support, private investments, and technological advancements, logistics parks are poised to play a pivotal role in enhancing supply chain efficiency and contributing to India's economic growth and competitiveness in the global market.

Multimodal logistics parks

Multimodal logistics parks are integrated facilities that provide a wide range of logistics services and support the seamless movement of goods through multiple transportation modes, such as road, rail, air, and waterways. These parks are strategically designed to enhance supply chain efficiency by consolidating various logistics activities in one location and offering comprehensive solutions to meet the complex needs of modern businesses. Multimodal logistics parks play a crucial role in

facilitating trade, reducing transportation costs, and improving overall logistics performance.

The key features and functions of multimodal logistics parks include:

These parks are strategically located near major transportation hubs, ports, and industrial centers, providing easy access to different modes of transportation. The seamless connectivity ensures efficient movement of goods from one mode to another, reducing transit times and enhancing supply chain agility.

Multimodal logistics parks are equipped with specialized infrastructure and handling equipment to facilitate intermodal transfers. Containers and cargo can be smoothly shifted between trucks, trains, ships, and planes, allowing for a flexible and optimized transportation network.

These parks offer state-of-the-art warehousing and storage facilities to accommodate goods of various types and sizes. With proper inventory management and stockpiling capabilities, businesses can maintain adequate stock levels and respond quickly to market demands.

Multimodal logistics parks often have dedicated customs clearance facilities and streamlined documentation processes. This helps in reducing delays and expediting the clearance of goods during international trade.

To provide end-to-end logistics solutions, these parks may offer value-added services such as packaging, labeling, sorting, and assembly. These services add value to the goods and contribute to increased efficiency in the supply chain.

Multimodal logistics parks leverage advanced technologies, such as RFID, GPS tracking, and warehouse management systems, to enhance visibility, traceability, and real-time monitoring of cargo movements.

Many logistics parks focus on eco-friendly practices, such as energy-efficient lighting, waste recycling, and reduced carbon emissions from transportation. This aligns with the growing demand for sustainable logistics solutions.

These parks act as trade facilitation hubs, providing a one-stop solution for businesses engaged in domestic and international trade. They offer a conducive environment for importers, exporters, and logistics service providers to collaborate and streamline their operations.

Multimodal logistics parks comply with local and international regulations, ensuring adherence to safety, security, and quality standards. This enhances the reliability and trustworthiness of the logistics services offered.

Some logistics parks cater to specific industries, such as automotive, pharmaceuticals, and electronics. They are equipped with specialized infrastructure and handling capabilities tailored to meet the unique requirements of these sectors.

Overall, multimodal logistics parks serve as vital enablers for enhancing supply chain efficiency in India. They provide a holistic approach to logistics management, fostering collaboration among various stakeholders and optimizing the flow of goods across different transportation modes. As India continues to witness economic growth and international trade, these logistics parks will play an increasingly pivotal role in driving the country's logistics landscape towards greater efficiency and competitiveness.

Global best practices and success stories that have embraced multimodal logistics parks

Several countries around the world have embraced multimodal logistics parks and have successfully implemented them to enhance their supply chain efficiency. Here are some global best practices and success stories of countries that have excelled in utilizing logistics parks:

Singapore is renowned for its world-class logistics infrastructure and efficient supply chain management. The country's logistics parks, such as the Jurong Port and the Changi Airfreight Centre, integrate multiple transportation modes and provide seamless connectivity. Singapore's emphasis on technology integration, streamlined customs procedures, and value-added services has made it a global logistics hub.

The Netherlands is a leader in multimodal logistics, with its strategic location at the crossroads of Europe's major trade routes. The Port of Rotterdam and the Schiphol Airport are prime examples of logistics parks that have contributed to the country's success. The Netherlands' commitment to sustainability, innovation, and digitization has made it a preferred choice for many international businesses.

Dubai has established itself as a major logistics and trade hub in the Middle East, driven by its world-class logistics parks, including Jebel Ali Free Zone and Dubai Logistics City. These parks offer state-of-the-art facilities, tax incentives, and robust customs clearance processes, attracting businesses from across the globe.

Germany's well-developed logistics infrastructure, including logistics parks like Duisburg Intermodal Terminal and Eurogate Container Terminal, has played a crucial role in its manufacturing and export prowess. The country's efficient rail and road network combined with innovative logistics technologies contribute to its success in supply chain management.

China's significant investments in logistics infrastructure have transformed it into a global manufacturing and trade powerhouse. The country's extensive network of logistics parks, such as the Shanghai Waigaoqiao Port and the Yantian International Container Terminals, has been instrumental in supporting its supply chain operations and international trade.

Malaysia's Port Klang and Port of Tanjung Pelepas are exemplary logistics parks that have contributed to the country's competitiveness in the region. These ports offer excellent connectivity to global markets and provide efficient logistics services to businesses.

The United States boasts a well-developed logistics network, including logistics parks like the Port of Los Angeles and the Port of New York and New Jersey. These parks play a significant role in supporting the country's extensive domestic and international trade.

India is rapidly developing its logistics infrastructure, and the establishment of logistics parks such as the Adani Logistics Park in Gujarat and the National Industrial Corridor Development and Implementation Trust (NICDIT) projects across various states showcase the country's commitment to improving supply chain efficiency.

These global best practices and success stories demonstrate the importance of multimodal logistics parks in fostering economic growth, enhancing supply chain efficiency, and promoting international trade. By leveraging their strategic location, efficient customs procedures, advanced technology, and seamless connectivity, these countries have set examples for others to follow in optimizing their logistics operations and driving overall competitiveness.

METHODOLOGY

This section describes the research methodology adopted for this study. It outlines the data collection methods involves analysis of secondary data from credible sources. The research design ensures a comprehensive understanding of the current state and future potential of multimodal logistics parks in India.

Changing Dynamics of Supply Chain in India:

This section presents an in-depth analysis of the current state of the supply chain in India. It examines the existing challenges faced by supply chain managers, such as inadequate infrastructure, suboptimal transportation networks, complex regulatory frameworks, and inefficient inventory management practices. Additionally, it highlights the impact of these challenges on the overall efficiency of the supply chain (Tani et al., 2022).

The research paper analyzes the changing dynamics of the supply chain in India, considering factors such as rapid urbanization, evolving consumer preferences,

and advancements in technology. It discusses the need for integrated and agile logistics solutions to meet the demands of a dynamic market.

Current state of supply chain in India

As of the present, the supply chain in India is undergoing significant changes and facing various challenges and opportunities. The COVID-19 pandemic has further accelerated the need for resilient and efficient supply chain operations. Here is an overview of the current state of the supply chain in India:

The supply chain in India is characterized by its complexity and fragmentation. It involves multiple stakeholders, including manufacturers, suppliers, distributors, retailers, and logistics service providers. Coordinating activities among these diverse players can be challenging, leading to inefficiencies and delays. India's supply chain faces infrastructure limitations, especially in transportation and warehousing. Poor road networks, congested ports, and limited warehousing facilities contribute to delays and increased logistics costs (Issaoui et al., 2019).

Inventory management practices in India can be suboptimal, leading to high carrying costs and stockouts. Many companies still rely on traditional methods, resulting in overstocking or understocking of goods. The complex regulatory environment in India can pose hurdles for supply chain operations. Frequent changes in policies and tax structures can impact logistics and distribution strategies. The rapid growth of e-commerce in India has transformed supply chain dynamics. Companies are now focusing on building efficient last-mile delivery networks to cater to the demands of online shoppers.

Companies are increasingly adopting technology and digital solutions to streamline supply chain processes. Technologies like IoT, AI, data analytics, and blockchain are being leveraged to enhance visibility, track shipments, and optimize inventory.

With the growing awareness of environmental concerns, sustainability has become a key consideration in the supply chain. Green logistics practices, such as eco-friendly transportation and packaging, are gaining traction (Fu et al., 2022). The Indian government has recognized the importance of a robust supply chain infrastructure and has launched various initiatives to promote the development of logistics parks, invest in transportation infrastructure, and ease regulatory barriers.

India's supply chain is closely linked to global trade, and the country's competitiveness in international markets relies on efficient export-import operations. Improved port infrastructure and customs facilitation

are critical for enhancing global trade efficiency. The last-mile delivery remains a significant challenge, particularly in congested urban areas. Companies are exploring innovative solutions such as drone delivery and alternate modes of transportation.

In conclusion, the supply chain in India is witnessing a transformational phase with an increasing focus on technology, sustainability, and efficiency. Addressing the existing challenges and embracing modern logistics practices, including multimodal logistics parks, will play a pivotal role in enhancing the supply chain's overall efficiency and competitiveness in the global market.

Challenges faced by supply chain managers

Supply chain managers face a myriad of challenges in their efforts to ensure smooth and efficient operations. These challenges can vary depending on the industry, company size, and the specific supply chain involved. Here are some common challenges faced by supply chain managers:

1. Demand Forecasting: Accurately predicting customer demand is essential for optimizing inventory levels and ensuring products are available when needed. However, demand forecasting can be challenging due to fluctuating market conditions, seasonality, and changing consumer preferences.

2. Inventory Management: Balancing inventory levels to meet customer demand without incurring excessive holding costs or stockouts is a delicate task. Poor inventory management can lead to increased costs and reduced customer satisfaction.

3. Supply Chain Visibility: Lack of real-time visibility into the entire supply chain can make it difficult for managers to identify potential disruptions or inefficiencies. Visibility gaps can arise from disparate systems and data silos among supply chain partners.

4. Supplier Management: Supply chain managers must maintain strong relationships with suppliers to ensure timely deliveries, quality products, and competitive pricing. Supplier disruptions or quality issues can have a cascading effect on the entire supply chain.

5. Transportation Challenges: Finding the right transportation mode and optimizing transportation routes can be challenging, especially when dealing with global supply chains or navigating congested logistics networks.

6. Regulatory Compliance: Compliance with ever-changing regulations and trade policies, both domestic and international, can pose challenges for supply chain managers. Non-compliance can result in delays, fines, or even legal consequences.

7. Risk Management: Supply chain managers must proactively identify and mitigate risks, such as natural

disasters, geopolitical uncertainties, or supplier bankruptcies, that could disrupt the flow of goods and impact business continuity.

8. Cost Pressures: Balancing cost-effectiveness with service levels is a constant challenge. Fluctuating fuel prices, labor costs, and currency exchange rates can impact supply chain expenses.

9. Talent Shortage: The supply chain industry is experiencing a talent shortage, and finding skilled professionals with expertise in areas like data analytics, technology, and sustainability can be challenging.

10. Sustainability and Social Responsibility: Increasingly, consumers and stakeholders are demanding sustainable and socially responsible supply chain practices. Ensuring ethical sourcing, reducing environmental impact, and promoting fair labor practices are essential considerations for supply chain managers.

11. Technology Integration: Adopting and integrating new technologies can be a challenge, particularly for organizations with legacy systems. Embracing technologies like AI, IoT, and blockchain can enhance efficiency, but it requires careful planning and investment.

12. Global Supply Chain Complexity: Managing a global supply chain involves dealing with diverse cultures, languages, regulations, and time zones. Coordination and communication across international borders can be challenging.

Addressing these challenges requires proactive planning, continuous improvement, collaboration with supply chain partners, and leveraging technology to enhance visibility and decision-making. Supply chain managers must remain adaptable, innovative, and forward-thinking to successfully navigate the complexities of modern supply chains.

Need for agile logistics

The need for agile logistics has become increasingly critical in today's dynamic business environment. Traditional supply chain models are no longer sufficient to meet the demands of rapidly changing markets, disruptive technologies, and unforeseen events. Here are some reasons highlighting the importance of adopting agile logistics:

1. Market Volatility: Markets are constantly evolving, and consumer preferences can change rapidly. To stay competitive, businesses must be able to quickly adjust their supply chain operations to meet changing demands and trends.

2. Demand Uncertainty: Forecasting demand accurately has become challenging due to fluctuating market conditions, global events, and

unexpected disruptions. Agile logistics allows companies to respond swiftly to demand fluctuations and prevent inventory imbalances.

3. Global Supply Chains: As businesses expand their operations globally, supply chains become more complex and prone to disruptions. Agility enables companies to mitigate risks and quickly adapt to changing conditions in different regions.

4. Shorter Product Lifecycles: With technological advancements and changing customer preferences, product lifecycles are becoming shorter. Agile logistics allows companies to bring new products to market faster and adjust production and distribution as needed.

5. E-Commerce Growth: The rise of e-commerce has significantly impacted supply chains, with increasing customer expectations for faster deliveries. Agile logistics helps optimize last-mile delivery and meet customer demands for quick order fulfillment.

6. Seasonal and Promotional Variability: Businesses often experience seasonal spikes or promotional events that require rapid adjustments in supply chain operations. Agile logistics enables flexible capacity planning to handle these fluctuations efficiently.

7. Supply Chain Disruptions: Disruptions like natural disasters, geopolitical conflicts, or supplier issues can cause supply chain bottlenecks. Agile logistics enables quick contingency planning and alternative sourcing to minimize disruptions.

8. Sustainability and Social Responsibility: Customers and stakeholders are increasingly concerned about sustainable and socially responsible practices. Agile logistics helps companies adapt their supply chains to meet these expectations, such as optimizing transportation routes to reduce emissions.

9. Technological Advancements: Advanced technologies like AI, IoT, and real-time data analytics have revolutionized supply chain operations. Adopting agile logistics allows businesses to leverage these technologies to enhance visibility and decision-making.

10. Competitive Advantage: Agile logistics provides a competitive advantage by enabling companies to respond faster to market changes, reduce lead times, lower costs, and improve customer satisfaction.

11. Customer-Centricity: Today's consumers expect personalized and seamless experiences. Agile logistics helps companies become more customer-centric by providing faster deliveries, order tracking, and flexible delivery options.

12. Supply Chain Resilience: Building resilient supply chains that can withstand disruptions is essential for business continuity. Agile logistics

enhances supply chain resilience by incorporating flexibility and redundancy.

In conclusion, agile logistics is crucial for businesses to thrive in the face of uncertainty and rapidly evolving markets. It allows companies to be responsive, adaptive, and customer-focused, ensuring supply chains remain efficient, cost-effective, and capable of delivering value in a highly competitive landscape.

The Emergence of Multimodal Logistics Parks:

This section explores the concept of multimodal logistics parks and their role in addressing the challenges of fragmented supply chains in India. It examines the benefits of integrating multiple transportation modes, including road, rail, air, and water, within a single logistics hub. The research paper highlights the cost-effectiveness, reduced transit times, and enhanced connectivity offered by these parks.

Case Studies of Successful Multimodal Logistics Parks in India:

The research paper presents case studies of established multimodal logistics parks in India, showcasing their impact on supply chain efficiency and overall competitiveness. These case studies provide practical insights into the best practices, challenges faced, and lessons learned in developing and operating successful logistics parks.

1. JNPT Multi-Modal Logistics Park, Maharashtra:

The Jawaharlal Nehru Port Trust (JNPT) Multi-Modal Logistics Park, located in Maharashtra, is one of the largest and most renowned logistics parks in India. It is strategically situated near the JNPT port, one of the busiest ports in India. The park provides seamless integration of various transportation modes, including road, rail, and waterways. It offers state-of-the-art infrastructure, warehousing facilities, and value-added services to cater to the needs of importers and exporters. The park has attracted significant investments from both domestic and international companies and has become a vital hub for trade and logistics activities in the region.

2. Adani Logistics Park, Haryana:

The Adani Logistics Park in Haryana is a prominent example of a private sector-led multimodal logistics park. It is strategically located near the Kandla Port and Mundra Port, providing excellent connectivity to the western and northern regions of India. The park offers a comprehensive range of logistics services, including warehousing, cold storage, container yards, and transportation facilities. It is equipped with advanced technologies and efficient handling systems, making it a preferred choice for various

industries, including automotive, electronics, and retail.

3. APL Logistics Park, Gujarat:

The APL Logistics Park, located in Gujarat, is a joint venture between the Gujarat government and APL Logistics, a global logistics provider. The park is situated near the Mundra Port and is part of the Delhi-Mumbai Industrial Corridor (DMIC) project. It offers world-class infrastructure, including multi-story warehousing facilities, rail-linked container yards, and an Inland Container Depot (ICD). The park has attracted investments from several multinational companies and has emerged as a key logistics hub in Western India.

4. Kribhco Infrastructure Limited (KRIL) Logistics Park, Uttar Pradesh:

The KRIL Logistics Park, situated in Uttar Pradesh, is a public-private partnership project between Kribhco and the Indian Railways. The park is strategically located near the Dadri Inland Container Depot and provides efficient rail-road connectivity to major industrial centers in North India. It offers specialized facilities for the handling of agri-commodities and has become a significant logistics node for agricultural trade in the region.

5. GatewayRail CFS-ICD Logistics Park, Punjab:

The GatewayRail CFS-ICD Logistics Park, located in Punjab, is an integrated logistics facility that caters to the needs of the northern region of India. It is well-connected to major ports, including Nhava Sheva and Pipavav, through dedicated freight corridors. The park offers various logistics services, such as Customs Clearance, warehousing, and container handling. It has played a crucial role in improving supply chain efficiencies for industries in the northern part of the country.

These case studies highlight the success and significance of multimodal logistics parks in India. These parks have not only improved supply chain efficiency but also attracted significant investments and boosted economic growth in the regions they serve. With the Indian government's continued focus on infrastructure development and logistics sector reforms, the role of multimodal logistics parks is expected to further expand and contribute to the overall development of the country's logistics ecosystem.

Government Initiatives and Policy Framework:

This section examines the role of government initiatives and policy frameworks in fostering the growth of multimodal logistics parks in India. It discusses incentives, investment policies, and regulatory reforms introduced by the government to encourage private sector participation in logistics park development.

The Indian government has recognized the importance of multimodal logistics parks in enhancing the efficiency of the supply chain and promoting economic growth. To foster the development of these parks, several initiatives and policies have been implemented:

1. Sagarmala Project: The Sagarmala Project is a flagship initiative of the Indian government aimed at modernizing India's ports and enhancing port-led development. It includes the development of logistics parks near major ports to facilitate seamless movement of goods between different modes of transportation, such as road, rail, and waterways.

2. Bharatmala Project: The Bharatmala Project is another ambitious infrastructure development program that focuses on improving road connectivity across the country. As part of this project, the government plans to set up logistics parks along the national highways to enable efficient cargo handling and reduce transportation costs.

3. Special Economic Zones (SEZs): The government has established Special Economic Zones that offer various incentives to attract investment and promote exports. Many of these SEZs include logistics parks to facilitate smooth movement of goods and enable value-added services.

4. Make in India: The Make in India initiative aims to promote manufacturing and attract foreign investment. To support this initiative, the government has encouraged the establishment of logistics parks near industrial clusters to improve supply chain efficiencies and reduce logistics costs for manufacturers.

5. National Integrated Logistics Policy (NLP): The government has formulated the National Integrated Logistics Policy to address the challenges faced by the logistics sector and promote multimodal transportation. The policy aims to create a single-window system for approvals and promote the development of logistics infrastructure, including logistics parks.

6. Investment in Infrastructure: The government has been investing in developing infrastructure, such as roads, railways, and inland waterways, to improve connectivity and enable the seamless movement of goods to and from logistics parks.

7. Public-Private Partnerships (PPPs): The government has encouraged PPPs in the development and operation of logistics parks to leverage private sector expertise and resources. PPPs have helped expedite the establishment of logistics parks and improve their efficiency.

8. Logistics Efficiency Enhancement Program: The government has initiated programs to enhance logistics efficiency, including the implementation of

IT systems for tracking and monitoring cargo movement, reducing paperwork, and streamlining regulatory processes.

9. Freight Corridors: Dedicated freight corridors are being developed to improve the movement of freight trains and reduce transportation time. Logistics parks are being planned along these corridors to optimize the flow of goods.

10. Export Promotion: To boost exports, the government has focused on improving export-related infrastructure, including logistics parks near ports and industrial hubs, to facilitate easy access to export-oriented industries.

By implementing these initiatives, the Indian government aims to create a conducive environment for the development of multimodal logistics parks, which will play a significant role in enhancing the efficiency and competitiveness of India's supply chain. These parks will act as vital nodes in the transportation network, enabling seamless integration between different modes of transport and driving economic growth and development in the country.

Future Prospects and Recommendations:

The research paper concludes with a discussion on the future prospects of multimodal logistics parks in India. It provides recommendations for policymakers, logistics operators, and businesses to capitalize on the potential of these logistics hubs and unlock further supply chain efficiencies.

The future prospects of multimodal logistics parks in India are highly promising, as they are expected to play a critical role in transforming the country's logistics landscape and enhancing supply chain efficiencies. Several factors contribute to the bright future of these logistics parks:

1. Infrastructure Development: The Indian government's continued focus on infrastructure development, including the construction of new ports, dedicated freight corridors, and expressways, will provide better connectivity and support the growth of multimodal logistics parks. Improved infrastructure will facilitate seamless movement of goods and reduce transit times, making these logistics parks more attractive to businesses.

2. Ease of Doing Business: The government's efforts to simplify regulatory processes and streamline customs procedures will create a more conducive environment for logistics operations. This will enhance the ease of doing business and encourage more companies to invest in and utilize multimodal logistics parks.

3. Foreign Direct Investments (FDI): India's growing economy and increasing integration into global supply chains make it an attractive destination for foreign

investments. Multimodal logistics parks, with their advanced facilities and connectivity, will be key enablers in supporting international trade and attracting FDI into the country.

4. Shift Towards Integrated Logistics Solutions: As businesses seek end-to-end supply chain solutions, multimodal logistics parks offer integrated services, combining various transportation modes, warehousing, and value-added services. This integrated approach will become increasingly relevant as companies look to streamline their supply chain operations and reduce costs.

5. Rising E-commerce Sector: The rapid growth of the e-commerce sector in India has driven a surge in demand for efficient logistics solutions. Multimodal logistics parks provide the necessary infrastructure and capabilities to handle the unique challenges posed by the e-commerce industry, such as last-mile delivery and quick order processing.

6. Industry-Specific Logistics Parks: With the rise of specialized industries in India, there will be a growing need for industry-specific logistics parks tailored to cater to the unique requirements of sectors like pharmaceuticals, cold chain, automotive, and electronics. These specialized logistics parks will enhance supply chain efficiencies and add value to the respective industries.

7. Sustainability and Green Initiatives: The increasing focus on sustainability and environmentally friendly practices will drive the development of green logistics parks in India. These parks will adopt eco-friendly technologies, such as renewable energy sources and waste reduction measures, to support sustainable supply chain practices.

8. Technology Integration: The adoption of digital technologies, such as IoT, AI, and data analytics, will revolutionize logistics operations in India. Multimodal logistics parks will leverage these technologies to optimize processes, improve asset utilization, and enhance overall supply chain visibility and transparency.

In conclusion, multimodal logistics parks are poised to play a pivotal role in India's logistics ecosystem, offering integrated and efficient solutions to businesses across industries. As the country continues to progress on the path of economic growth, these logistics parks will act as catalysts in boosting trade, investment, and competitiveness, making India a significant player in the global supply chain network.

Recommendations for Policymakers:

1. Policymakers should prioritize infrastructure development, including road, rail, port, and airport connectivity, to facilitate the efficient

movement of goods across the country. Special attention should be given to the development of logistics corridors and dedicated freight corridors to reduce transit times and transportation costs.

2. Streamlining customs procedures, reducing bureaucratic red tape, and implementing single-window clearance mechanisms will enhance the ease of doing business and attract more investments in the logistics sector.
3. Introduce incentives and rewards for logistics operators adopting green practices, such as promoting the use of electric vehicles, renewable energy, and sustainable packaging. Encouraging eco-friendly initiatives will contribute to environmental sustainability.
4. Invest in skill development and training programs to create a skilled and capable workforce in the logistics industry. Special emphasis should be placed on digital literacy and technology adoption to stay abreast of global logistics trends.
5. Policymakers should collaborate closely with industry stakeholders, including logistics operators and businesses, to understand their challenges and requirements. A collaborative approach will ensure that policies are practical and effective in addressing real-world logistics issues.

Recommendations for Logistics Operators:

1. Embrace advanced technologies such as IoT, AI, data analytics, and blockchain to optimize logistics operations, enhance supply chain visibility, and improve overall efficiency. Implementing digital solutions will enable real-time tracking, reduce manual errors, and streamline processes.
2. Offer integrated logistics services that encompass various transportation modes, warehousing, distribution, and value-added services. This will attract businesses looking for end-to-end solutions and help build long-term partnerships.
3. Incorporate green practices into operations, such as adopting energy-efficient transportation, waste reduction, and recycling measures. Promoting sustainable logistics will not only benefit the environment but also improve the company's reputation and appeal to environmentally conscious customers.
4. Focus on developing efficient last-mile delivery solutions, especially for the e-commerce sector. Leveraging technology, alternative delivery modes, and collaboration with local partners can significantly enhance last-mile logistics.
5. Foster collaborations and partnerships with other logistics operators, businesses, and technology providers. Sharing resources,

expertise, and best practices will create a more resilient and agile logistics ecosystem.

Recommendations for Businesses:

1. Businesses should invest in optimizing their supply chain by analyzing data, identifying bottlenecks, and implementing efficient logistics strategies. Embracing technologies and automation will streamline operations and improve overall supply chain performance.
2. Select logistics partners based on their expertise, track record, and ability to provide end-to-end solutions. Building strong partnerships with reliable logistics operators will ensure smooth operations and timely delivery of goods.
3. Implement accurate demand forecasting to avoid inventory issues and optimize warehouse management. Forecasting demand will enable businesses to plan their logistics requirements effectively and minimize inventory holding costs.
4. Regularly track and monitor logistics performance metrics, such as delivery times, transit times, and customer satisfaction. Continuous improvement based on data-driven insights will lead to enhanced supply chain efficiency.
5. Align logistics operations with sustainability goals by choosing eco-friendly transportation options, adopting green packaging, and reducing carbon emissions. Meeting sustainability targets will enhance brand reputation and attract environmentally conscious customers.

Overall, effective collaboration between policymakers, logistics operators, and businesses, combined with the adoption of technology and sustainable practices, will contribute to the growth and competitiveness of India's logistics sector. A well-coordinated effort will position India as a leading player in the global supply chain ecosystem.

CONCLUSION

The conclusion summarizes the key findings of the research, emphasizing the critical role of multimodal logistics parks in transforming India's supply chain landscape. It reiterates their significance in enhancing efficiency, reducing costs, and driving India's competitiveness in the global market. Through rigorous analysis and practical insights, the paper offers a comprehensive understanding of the impact and potential of these logistics hubs in driving supply chain efficiency and competitiveness in India's rapidly evolving business environment.

In response to these challenges, the development of multimodal logistics parks has emerged as a promising solution to enhance supply chain efficiency and competitiveness in India.

Multimodal logistics parks offer integrated transportation and storage facilities, allowing for the seamless movement of goods across different modes of transportation. These parks act as hubs for various logistics activities, promoting the consolidation and optimization of cargo, reducing transit times, and minimizing transportation costs. Additionally, they offer value-added services, such as customs clearance, warehousing, and distribution, further streamlining supply chain operations.

The current state of supply chain in India reveals a mix of strengths and weaknesses. While there has been significant progress in infrastructure development and technology adoption, challenges such as inadequate last-mile connectivity, complex regulatory processes, and fragmented logistics operations persist. However, the growing need for agile logistics has opened up opportunities for the development of multimodal logistics parks, which can address these challenges effectively.

Various success stories and best practices from countries that have embraced multimodal logistics parks provide valuable insights for India. These success stories demonstrate how logistics parks can transform the supply chain landscape, enhance efficiency, reduce costs, and attract investments. Learning from these global experiences, India can tailor its logistics park development strategy to suit its unique requirements and business environment.

The government's initiatives in fostering multimodal logistics parks are commendable, with the implementation of dedicated freight corridors, logistics-friendly policies, and financial incentives. However, policymakers must continue to work towards streamlining regulatory processes and providing an enabling environment for private sector participation and foreign investments.

Several successful logistics park case studies in India, such as the Krishnapatnam Port Container Terminal and the Kribhco Infrastructure Ltd. Logistics Park, highlight the positive impact of these facilities on supply chain efficiency. These case studies showcase how multimodal logistics parks have effectively addressed challenges, enhanced operational agility, and contributed to the overall growth of the logistics sector in India.

Looking ahead, the future prospects of multimodal logistics parks in India are promising. As the economy grows, the demand for efficient and integrated logistics solutions will only increase. Therefore, the development of logistics parks must be pursued strategically, focusing on key sectors, trade routes, and industrial hubs to maximize their impact on the supply chain.

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