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A STRUCTURAL APPRAISAL OF SUPPLY CHAIN MANAGEMENT PRACTICES IN INDIA

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ABSTRACT

Supply Chain Management (SCM) in India has undergone significant transformation in recent years, driven by globalization, technological advancements, and evolving consumer expectations. This review paper presents a structural appraisal of SCM practices in India, evaluating key components such as logistics, warehousing, procurement, and ICT integration. It highlights the impact of government initiatives like GST, the National Logistics Policy, and the PM Gati Shakti plan in streamlining supply chain operations and improving efficiency. The literature reveals progress in organized warehousing and digital adoption, particularly in sectors like e-commerce and FMCG, while also noting persistent challenges such as infrastructural bottlenecks, fragmented vendor networks, and skill gaps. A critical analysis of sectoral performance—including agriculture, retail, and MSMEs—demonstrates uneven development across the supply chain spectrum. Emerging trends such as green logistics, digital supply chains, and startup-driven innovation offer promising solutions. This paper concludes with recommendations to strengthen infrastructure, promote digital inclusion, and foster collaborative public-private partnerships. A comprehensive and inclusive approach is essential for India to build a resilient, competitive, and sustainable supply chain ecosystem.

Keywords: *Supply Chain Management, Logistics, Warehousing, ICT, MSMEs, GST, Digital Supply Chains, India, Policy Reforms, Infrastructure*

INTRODUCTION

Supply Chain Management (SCM) has emerged as a cornerstone of competitive advantage in the global business environment. It refers to the coordinated management of activities involved in sourcing, procurement, production, logistics, and customer service, ensuring the seamless flow of goods, services, and information from origin to consumption (Mentzer et al., 2001). In the context of India, SCM has become increasingly important due to rapid economic growth, expanding consumer markets, and the rise of sectors such as e-commerce, manufacturing, and retail. Despite these positive developments, Indian supply chains continue to face systemic structural challenges that affect overall efficiency and performance.

The Indian supply chain landscape is both diverse and complex. With a geography spanning varied terrains, and a population exceeding 1.4 billion, managing logistics, transportation, warehousing, and distribution networks at scale poses significant challenges. Moreover, a substantial part of the Indian economy is still informal and fragmented, especially within the Micro, Small, and Medium Enterprises (MSME) sector, which plays a critical role in manufacturing and supply networks but lacks integration and technological readiness (FICCI, 2020).

Historically, supply chain practices in India were shaped by outdated taxation systems, limited infrastructure, and regulatory bottlenecks. However, several transformative policy reforms have altered the landscape in recent years. The introduction of the Goods and Services Tax (GST) in 2017 replaced a complicated web of indirect taxes with a unified structure, eliminating inter-state checkpoints and enabling supply chain network optimization (EY, 2019). Furthermore, flagship government initiatives like the **National Logistics Policy (2022)** and the **PM Gati Shakti Master Plan** aim to enhance logistics efficiency and integrate multi-modal transport networks, offering a strategic vision for India's supply chain ecosystem.

Technological innovation has also contributed to the modernization of SCM in India. With the rise of Industry 4.0, Indian companies are increasingly adopting digital tools such as Artificial Intelligence (AI), the Internet of Things (IoT), robotics, and blockchain to optimize forecasting, reduce lead times, and improve transparency (NASSCOM, 2021). Yet, this adoption is uneven, with large enterprises driving most of the innovation while small and medium enterprises continue to struggle with cost, digital illiteracy, and a lack of skilled manpower.

Additionally, external shocks such as the COVID-19 pandemic exposed the vulnerabilities of supply chains in India, including inadequate warehousing, lack of real-time visibility, and poor coordination among stakeholders. This disruption has, however, spurred investments in resilient and agile supply chains, further pushing for digital transformation and regional diversification.

This paper seeks to provide a structural appraisal of supply chain management practices in India by analyzing current developments, evaluating key functional areas such as logistics, warehousing, procurement, and ICT, and reviewing recent trends and sector-specific challenges. Through a comprehensive literature review and contextual analysis, the paper identifies both strengths and persistent gaps, offering policy recommendations to enhance the sustainability and global competitiveness of Indian supply chains.

I. LITERATURE REVIEW

The academic and industry literature on supply chain management in India highlights a diverse and evolving landscape.

Mentzer et al. (2001) define SCM as a strategic and integrative function that encompasses the flow of goods, services, and information across the value chain. Chopra and Meindl (2016) elaborate that successful supply chains focus on responsiveness and efficiency, which are often lacking in emerging markets like India.

According to KPMG (2018), the introduction of GST played a transformative role in reshaping supply chains by enabling network optimization, lowering distribution costs, and reducing delays

at interstate checkpoints. Similarly, EY (2019) reported that post-GST implementation, companies began consolidating their warehouses and rethinking their logistics strategies.

PwC (2019) found that while technology adoption in warehousing has accelerated, especially in urban regions, rural and semi-urban areas still lag due to limited digital penetration and skilled manpower. In their warehousing market report, Knight Frank (2022) emphasized the growing investor interest in Grade A warehouses, especially around urban consumption centers.

A study by McKinsey (2021) revealed that Indian supply chains are vulnerable to disruptions due to their dependence on fragmented transport systems and informal vendor networks. They advocate for more robust risk management and digital supply networks. FICCI (2020) similarly notes that India's MSME sector, which plays a vital role in the supply chain, lacks integration and standardization, making collaboration and compliance challenging.

From an environmental and sustainability standpoint, TERI (2022) highlights that Indian supply chains are yet to adopt green practices at scale, although a few large corporates have initiated ESG-compliant strategies.

II. KEY COMPONENTS OF SCM IN INDIA

3.1 Logistics and Transportation

India's logistics sector, valued at over $200 billion, is a vital component of SCM (IBEF, 2023). However, inefficiencies persist due to over-reliance on road transport, accounting for 60% of freight movement, compared to rail or inland waterways (Deloitte, 2021). Poor infrastructure and high logistics costs—13-14% of GDP compared to 8-9% in developed countries—highlight structural inefficiencies (World Bank, 2020).

The government has introduced initiatives such as Bharatmala and Sagarmala to address these concerns. While improvements are evident in highway connectivity and port development, last-mile connectivity and cold chain infrastructure remain underdeveloped.

3.2 Warehousing and Inventory Management

India has traditionally relied on unorganized warehousing, particularly in Tier II and III cities. However, the rise of organized retail and e-commerce has led to a boom in modern warehousing facilities. The warehousing sector has seen a CAGR of 10% in the last decade (Knight Frank, 2022).

The adoption of technologies like RFID, barcoding, and warehouse management systems (WMS) has improved inventory control. Yet, inconsistent implementation and lack of skilled labor hamper efficiency, especially in smaller enterprises (PwC, 2019).

3.3 Procurement and Vendor Management

Procurement practices in India have shifted from cost-focused to value-driven strategies. Vendor development, strategic sourcing, and supplier relationship management have become integral to achieving agility and responsiveness (Monczka et al., 2015).

However, the predominance of informal sectors and fragmented supplier bases, especially in MSMEs, limits collaboration and transparency (FICCI, 2020). Initiatives such as Government e-Marketplace (GeM) are attempting to create more transparent procurement mechanisms in public institutions.

3.4 Information and Communication Technology (ICT)

ICT has become the backbone of modern SCM in India, enabling real-time tracking, demand forecasting, and customer relationship management. Technologies like Artificial Intelligence (AI), Internet of Things (IoT), and Blockchain are being piloted, especially in large-scale manufacturing and retail (NASSCOM, 2021).

Despite this, adoption among small and mid-sized enterprises is limited due to high costs, lack of awareness, and infrastructural constraints. The digital divide continues to be a challenge in rural and semi-urban areas.

III. REGULATORY AND POLICY ENVIRONMENT

India has made significant policy strides to support SCM. Key regulatory reforms include:

- **GST implementation:** Removed inter-state tax barriers, enabling firms to consolidate warehouses and reduce delivery times (EY, 2019).
- **National Logistics Policy (2022):** Aims to bring down logistics costs to 8% of GDP through digitization, standardization, and multimodal transport integration.
- **PM Gati Shakti Plan:** Focuses on infrastructural synergy across rail, road, air, and waterways.

However, the complexity of regulatory compliance, especially for cross-border trade, remains a bottleneck. Procedural delays at ports and customs reduce supply chain responsiveness and increase lead times (World Bank, 2020).

IV. SECTORAL APPRAISAL

An effective supply chain strategy in India must account for the unique challenges and dynamics of each sector. The structural strengths and weaknesses vary widely across industries such as Fast-Moving Consumer Goods (FMCG), e-commerce, agriculture, manufacturing, and pharmaceuticals. This section appraises the current state of SCM practices across key sectors to assess their operational maturity, digital integration, infrastructural support, and policy alignment.

5.1 FMCG and Retail

The FMCG sector in India is among the largest consumers of supply chain services. Companies like Hindustan Unilever, ITC, and Nestlé operate highly complex distribution networks that extend into rural and semi-urban areas. The sector is characterized by high volume, low margin products, which necessitate lean, responsive, and cost-efficient supply chains.

To manage demand volatility and ensure timely deliveries, companies have increasingly adopted warehouse automation, demand forecasting tools, and real-time inventory management systems. The use of ERP software and data analytics for SKU optimization and shelf-life monitoring is becoming common (BCG, 2020).

However, last-mile connectivity remains a significant bottleneck, especially in rural areas. Poor infrastructure, fragmented retail channels, and unreliable transportation systems lead to stockouts and delays. While organized retail chains have adopted modern logistics, the unorganized sector still operates on cash-based, low-tech platforms, limiting end-to-end supply chain visibility.

5.2 E-Commerce

The e-commerce sector has revolutionized the supply chain landscape in India. Led by companies such as Amazon, Flipkart, and Meesho, the sector has driven major innovations in logistics, warehousing, and delivery management. Fulfillment centers, dark stores, micro-warehousing, and last-mile delivery optimization have become standard practices.

Key advancements include real-time order tracking, dynamic route planning, and the use of AI and ML for demand prediction. The sector also heavily depends on third-party logistics (3PL) providers such as Delhivery and Ecom Express, which specialize in reverse logistics and hyperlocal delivery models (RedSeer, 2022).

Nonetheless, challenges persist. High return rates, especially in fashion and electronics, strain logistics operations. Address verification, COD (Cash-on-Delivery) risks, and the lack of standardized delivery infrastructure in Tier II and III cities add to the cost and complexity.

5.3 Agriculture and Cold Chain

India is the second-largest producer of fruits and vegetables globally, but nearly 15-20% of the produce is lost annually due to inadequate cold chain infrastructure (ASSOCHAM, 2019). The

agricultural supply chain is plagued by inefficiencies such as multiple intermediaries, poor post-harvest handling, lack of cold storage, and inconsistent transportation.

While initiatives such as the National Agriculture Market (e-NAM) and Kisan Rail aim to create unified and efficient farm-to-market channels, implementation remains uneven. FDI in food processing and cold chain logistics has led to the development of integrated pack houses and reefer vans, yet coverage is limited to select states.

Cluster-based approaches, farmer producer organizations (FPOs), and digital procurement platforms have the potential to streamline operations. However, farmer awareness, limited rural internet penetration, and lack of financing options continue to hinder progress.

5.4 Manufacturing and Industrial Supply Chains

The Indian manufacturing sector, under the “Make in India” initiative, aims to become a global production hub. Supply chain practices here differ based on sub-sectors—automotive, electronics, textiles, etc.—but all rely heavily on tiered supplier networks and Just-in-Time (JIT) systems.

Large manufacturers are investing in integrated planning systems, supplier performance monitoring, and smart manufacturing through Industrial IoT. Automotive firms, for instance, use Vendor Managed Inventory (VMI) models and lean warehousing to reduce costs and waste.

Yet, manufacturing supply chains face frequent disruptions due to regulatory bottlenecks, raw material shortages, and infrastructural constraints. The over-dependence on Chinese imports for critical components also exposes vulnerabilities. The Production Linked Incentive (PLI) schemes launched by the government are expected to boost domestic supplier ecosystems, but execution is key.

5.5 Pharmaceuticals and Healthcare

The pharmaceutical supply chain in India is complex and highly regulated. India is known as the "pharmacy of the world," yet inefficiencies in temperature-sensitive logistics and quality assurance persist. The COVID-19 pandemic underscored the importance of robust and agile pharma supply chains.

SCM practices in this sector emphasize traceability, quality control, and regulatory compliance. Large firms are adopting blockchain for drug traceability, while cold chain technologies are being enhanced for vaccine and biologics transportation (McKinsey, 2021).

Still, distribution is fragmented, and rural healthcare supply chains are underdeveloped. Inventory hoarding, counterfeit products, and outdated warehousing practices reduce system efficiency. A stronger focus on digital inventory systems, centralized procurement, and end-to-end visibility is required to ensure both efficiency and safety.

V. CHALLENGES IN INDIAN SCM

6.1 Infrastructure Deficiencies

Inadequate road quality, congested urban networks, and port delays contribute to inefficiencies. Despite significant investment, the World Bank Logistics Performance Index ranked India 38th out of 160 countries in 2023 (World Bank, 2023).

6.2 Fragmentation and Informality

A large proportion of India's supply chains operate through informal channels, lacking documentation, standardization, and integration. This leads to poor visibility, quality inconsistencies, and compliance issues (FICCI, 2020).

6.3 Talent and Skill Gap

There is a dearth of trained logistics and SCM professionals in India. Most educational institutions offer limited practical exposure, leading to a disconnect between academic training and industry requirements (CII, 2021).

6.4 Technological Divide

While large firms are quick to adopt modern SCM tools, smaller firms lag due to cost and digital illiteracy. The disparity creates an uneven competitive landscape.

VI. RECENT TRENDS AND OPPORTUNITIES

7.1 Digital Supply Chains

The COVID-19 pandemic accelerated digital transformation in Indian SCM. Companies are now investing in digital twins, cloud-based SCM systems, and advanced data analytics to ensure end-to-end visibility (McKinsey, 2021).

7.2 Green and Sustainable Supply Chains

Environmental concerns have pushed companies to explore electric vehicles, recyclable packaging, and carbon footprint mapping. Government policies now reward green logistics through carbon credits and ESG-based evaluations (TERI, 2022).

7.3 Start-Up Ecosystem

India's logistics tech startups—such as Delhivery, Rivigo, and BlackBuck—have introduced automation, AI-based freight matching, and real-time visibility. These firms play a crucial role in modernizing the supply chain landscape (NASSCOM, 2021).

VII. POLICY RECOMMENDATIONS AND WAY FORWARD

- **Infrastructure Modernization:** Fast-tracking multi-modal transport corridors and investing in rural connectivity will help streamline movement.
- **Capacity Building:** Skill development programs and SCM-focused curriculums are essential for long-term competency.
- **Digital Inclusion:** Financial and technical support for MSMEs to adopt SCM technologies must be prioritized.
- **Public-Private Partnerships:** Greater synergy between government bodies and private players can expedite reforms.
- **Data Transparency:** Standardizing data protocols and enforcing supply chain traceability will enhance compliance and responsiveness.

VIII. CONCLUSION

The structural appraisal of Supply Chain Management (SCM) practices in India reveals a landscape marked by both promising progress and persistent challenges. Over the past decade, India has made significant strides in modernizing its supply chain infrastructure and operational mechanisms through policy reforms, technological adoption, and increased private sector participation. The implementation of the Goods and Services Tax (GST), the launch of the National Logistics Policy (2022), and programs like PM Gati Shakti have played transformative roles in dismantling logistical bottlenecks and enabling integrated multi-modal transportation systems.

Sector-wise analysis reveals uneven growth. While industries like e-commerce, FMCG, and pharmaceuticals have embraced digital supply chains, automation, and customer-centric distribution models, sectors such as agriculture and MSMEs continue to face structural barriers including fragmented supply bases, lack of cold chains, and limited access to digital platforms. The COVID-19 pandemic further exposed supply chain vulnerabilities but also accelerated digital transformation and resilience planning across sectors.

A recurring theme across literature and practice is the urgent need for end-to-end visibility, integrated IT systems, and skill development to make India's supply chains globally competitive. Issues such as unorganized logistics networks, infrastructural deficits, and regulatory complexities continue to obstruct optimal performance. Additionally, environmental sustainability is gaining relevance, yet green logistics practices are still at a nascent stage and need policy prioritization.

India's supply chain ecosystem is at a critical juncture. With rising demand from a growing population, increasing integration with global markets, and the push for self-reliance under the "Atmanirbhar Bharat" initiative, the importance of robust, efficient, and sustainable supply chains cannot be overstated. Future success will depend on the ability of both public and private stakeholders to collaborate on long-term infrastructure investments, promote inclusive digitalization across sectors, and address sector-specific pain points.

In conclusion, while India has made commendable progress in modernizing supply chain practices, the journey toward achieving a seamless, technology-driven, and environmentally sustainable supply chain network remains ongoing. A comprehensive, sector-sensitive, and innovation-led approach will be essential to ensure that India's supply chain systems not only support economic growth but also contribute to resilience, equity, and sustainability.

REFERENCES

- ASSOCHAM. (2019). *Cold Chain Development in India*. Retrieved from [assocham.org]
- BCG. (2020). *The Future of Retail Supply Chains in India*. Boston Consulting Group.
- CII. (2021). *Skill Development for Supply Chain Management in India*.
- Chopra, S., & Meindl, P. (2016). *Supply Chain Management: Strategy, Planning, and Operation*. Pearson.
- Deloitte. (2021). *India Logistics: The Next Growth Story*.
- EY. (2019). *Impact of GST on Logistics*.
- FICCI. (2020). *Strengthening India's Supply Chain Ecosystem*.
- IBEF. (2023). *Logistics and Warehousing Industry in India*. Retrieved from [ibef.org]
- KPMG. (2018). *Indian Supply Chain: Structural Reforms and Future Pathways*.
- Knight Frank. (2022). *India Warehousing Market Report*.
- McKinsey. (2021). *Building Resilient Supply Chains in India*.
- Mentzer, J. T., et al. (2001). "Defining Supply Chain Management." *Journal of Business Logistics*, 22(2), 1–25.
- Monczka, R. M., et al. (2015). *Purchasing and Supply Chain Management*. Cengage.
- NASSCOM. (2021). *Digital Transformation in Indian Supply Chains*.
- PwC. (2019). *India Warehousing: Sector Overview*.
- RedSeer. (2022). *E-commerce Logistics in India*.
- TERI. (2022). *Sustainable Supply Chains in India*.
- World Bank. (2020). *Logistics Performance Index Report*.
- World Bank. (2023). *India Logistics Performance Index 2023*.