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MATERIALS MANAGEMENT REVIEW



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NATCOM 2025



**Newly Elected National President - IIMM,
Mr P M Biddappa felicitated by outgoing
National President - IIMM Mr. Lalit Raj Meena**

IICM, Ranchi and SAIL/MTI, Ranchi signed MoU with the Indian Institute of Materials Management (IIMM)



IICM, Ranchi signed an MoU with the Indian Institute of Materials Management (IIMM) on 22 December 2025, marking a strategic partnership to strengthen capacity building in material & contract management. The collaboration will focus on certification programme & Diploma programme, inter-organizational workshop for senior level officials, and industry-aligned learning initiatives for the Coal and allied sectors.

The IIMM delegation was led by Mr. P. M. Biddappa, National President, IIMM, along with Prof. (Dr.) Suresh Kumar Sharma, Co-Chairman, BOS & Former National President, IIMM, and Mr. Pradip Kumar, Vice President (East), IIMM. The IICM team was led by Dr. Kamakshi Raman, Executive Director, IICM, Sri. Sudhir Kumar, GM and Shri Ravi Ranjan, IICM. The MoU was formally signed by Dr. Kamakshi Raman on behalf of IICM and Shri P. M. Biddappa on behalf of IIMM. This partnership marks a significant step towards strengthening industry–institution collaboration and building future-ready competencies in materials and contract management.

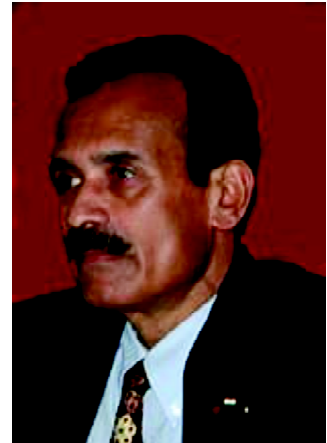


SAIL/MTI, Ranchi signed an MoU with the Indian Institute of Materials Management (IIMM) on 22 December 2025, marking a strategic partnership to strengthen capacity building in materials, procurement, and supply chain management. The collaboration will focus on certified programmes, faculty exchange, joint research, and industry-aligned learning initiatives for the steel and allied sectors.

The IIMM delegation was led by Mr. P. M. Biddappa, National President, IIMM, along with Prof. (Dr.) Suresh Kumar Sharma, Co-Chairman, BOS & Former National President, IIMM, and Mr. Pradip Kumar, Vice President (East), IIMM. The SAIL team was led by Shri Sanjay Dhar, Executive Director (HR-L&D), MTI, and Shri Atanu Mukherjee, Head (Academics), MTI. The MoU was formally signed by Shri Sanjay Dhar on behalf of SAIL and Shri P. M. Biddappa on behalf of IIMM. This partnership marks a significant step towards strengthening industry–institution collaboration and building future-ready competencies in materials and supply chain management.



*From the Desk of National President
& Editor in Chief*



Greetings from your National President!!!

Dear All Members of IIMM,

I hope you must have celebrated Christmas and New Year 2026 with your family and friends. Wishing you and your families a joyful, healthy, and prosperous New Year 2026.

I feel greatly honored to write my first message for MMR after assuming the role of National President on 29th November 2025 at the NATCOM held at Ahmedabad. I am grateful to my immediate predecessor Shri L.R. Meena for handing over leadership to the new team after elevating IIMM to new heights during his two-year tenure. There has been considerable enhancement across education, specialized industry programs and an increase in the overall financial stability of the IIMM.

I extend my thanks to the IIMM community for choosing me as the National President for the 2025-27 term, conferring upon me the responsibility of leading the educational and professional endeavors of the esteemed Indian Institute of Materials Management (IIMM) to greater heights in the coming two years. With the combined expertise of the NEC team and full support from the National Council members, I believe we can meet the hopes of all IIMM stakeholders.

The newly formed NEC team has already begun their work, and in this context, a Business Plan Meeting and National Council Meeting is scheduled. In the meeting, in-depth discussions and deliberations will take place to establish a clear vision and mission for the upcoming two years to ensure the overall growth of IIMM. Each regional VP has begun discussions with representatives from different branches in their regions to gain clearer insights into the various growth initiatives and suggestions that will be considered at the meeting.

Thanking you and wishing all the best.

A handwritten signature in black ink, appearing to read 'P.M. Biddappa'.

Best regards,
P.M. BIDDAPPA
NATIONAL PRESIDENT
pm.biddappa@yahoo.com
mmr@iimm.org



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CIRCULAR BUSINESS MODEL – MOVING TOWARDS SUSTAINABILITY

DEBASIS MALLICK – MEMBER (NC & BOS)
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COP30 held in Belem, Brazil in November has been an utter disappointment. The US does not wish to recognize the threat of global warming. China and other emerging economies like Russia and India are not in the process of taking any significant steps to phase out fossil fuels. The resolution to become a carbon neutral earth by 2050 is drawing so close that the environmentalists monitoring the progress feel the heat of global warming. The politicians, the business houses, the consumers are yet to step on the same platform, leading quite often to work at cross purposes. At this rate of progress when much of the political leadership are refusing to accept the decisions adopted in the Paris declaration of 2015 which aims to keep global warming not exceeding 1.5 degree centigrade relative to the pre-industrial levels, attaining the goal of Paris Agreement to reduce the emissions drastically to reach net Zero by the middle of this century appears to be a remote possibility. Attaining the goal of carbon neutrality within a specific period needs a multi-dimensional strategy.

Nigel Topping, Chairman of Climate Change Committee appointed by the Government Of UK, has advised corporations to comply with Paris Agreement. He suggests the following in an article in HBR (June 2019)

- Commit 100%
- Review your Industry groups
- Get smart on climate governance
- Speak up in support of climate policy
- Communicate your purpose

Companies looking to harness the benefits of climate action need to step up and commit to taking these crucial steps. "Inspiring others to work towards a zero-carbon future is the best way to drive innovation and ensure that you succeed while others fall by the wayside. We all have a responsibility to tackle the climate crisis and to help drive towards a solution that works for our economies and our planet."

The cons about sustainability are the inept attitude of some of the political leaders of the most developed nations and developing nations. "Drill baby drill" is what is promoted by the President of the US to boost oil and gas production contrary to the restrictions on drilling on public lands. The Trump administration has also withdrawn from the Paris Agreement on climate change. The pros are, of course, about the millennials who are seemingly interested in embracing brand sustainability. More companies are also coming to the fray with professional orientation to establish a sustainable business model.

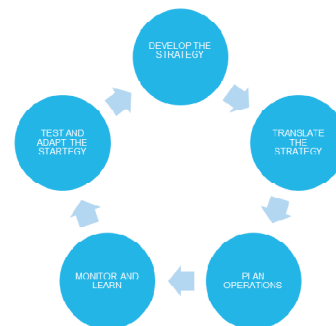


The Idea in brief

Strategy Formulation and Execution - Closed Loop Management System (CLMS)

Robert S Kaplan and David P Norton wrote how CLMS can be used for strategy formulation and its execution. They wrote in Harvard Business Review in January 2008 how a strategy can be successfully implemented through five different stages of CLMS. Kaplan observed that quite often the corporations are bogged down to discuss the operational issues to meet the immediate targets resulting in relegating the good strategy implementation part. When this happens, the companies sacrifice in attaining long-term goals at the cost of short-term achievement. By creating CLMS, companies can avoid such shortfalls. The execution of any strategy formulated by the management of any corporation is the most important aspect in this whole process. Kaplan and Norton have explained in their CLMS model how meticulously the managers should invest their time in formulating, mapping and implementing their strategy.

Let's first explain the CLMS model with its five intertwined stages and see how best this model can be used for sustainability. A company formulates a strategy and then translates the strategy into specific objectives and measures, aligning the organization to the strategy. The subsequent stages include operational planning, monitoring and finally test and adapting the strategy.



CLOSED LOOP SYSTEMS LINKING STRATEGY AND OPERATIONS

1. Develop the strategy : The management can develop a new strategy or modify an existing one to improve depending on the business needs. Before developing a strategy, the managers need to agree on the company's mission, vision and values. The mission is a brief statement of the basic purpose, why it exists, what it offers to the customers. The vision statement is to set its goal in medium to long run. Values of a company prescribe the attitude, behaviour and character of the organization. While formulating the strategy, the management team critically analyses the internal and external factors by applying a SWOT analysis or PESTEL or any other tool that is ideally suitable. The most important issue in strategy formulation is to walk through a process for its implementation.

2. Translate the strategy : The managers need to translate the strategy into objectives and measures which can be communicated to all the employees. To do this, developing strategy maps is a good option. The strategy maps can be comprehensible by slicing it into three to five themes. So, a typical strategy map can be expressed as (a) Financial perspective (b) Customer perspective (c) Process perspective (d) Learning and Growth perspective. The companies assign a manager to take responsibility of each of these strategic themes to facilitate translating the strategy into action.

3. Plan operations : To implement a strategy successfully, achieving operational efficiency is sine qua non. The operational segment will address the process improvement, resource allocation, sales plan, Target costing, budget for Capex and Op Ex, performance mapping. Operational efficiency will determine the efficacy of the strategy, whether any course correction is warranted and if the resources employed are optimum to achieve the goal.

4. Monitor and Learn : The periodicity of monitoring and review of the strategy implementation will depend on the management of the company. Continuous review meeting at the lower strata of the management at the beginning is often adopted to plug the loopholes immediately on detection. Periodic review and analysis of balance scorecard parameters could be an ideal way to watch the performance. The review from the financial, customer, internal business processes, learning and growth perspective can give lot of insights to the top management about the holistic view of strategy implementation. At the end of the day the CEO of the company is to be convinced that the strategy execution is on the right track, problems encountered have suitably been addressed, corrective action taken and finally, if the company is ready to adapt the strategy to achieve its long-term goal.

5. Test and Adapt the Strategy : Formulation and execution of a strategy is a long process. During this long journey, managers responsible for execution may face a few flawed assumptions, some faulty decisions, inept attitude from a few management staff, timely corrective actions taken, but not yielded desired result. It's time now for the management team responsible to rigorously re-examine the strategy and opt for incremental improvements and adapt it or reformulate the strategy. The strategy testing and adapting process

introduces new inputs to the offsite. As suggested by Kaplan and Norton, the strategy offsite, beyond examining the performance of existing strategy, should provide executives with a great opportunity to consider new strategy proposals that managers and employees throughout the enterprise might have recommended. If the management team decides based on internal and external environment, to alter an existing strategy, they can do so by launching another cycle of strategy translation and operational execution.

Moving to a Circular Business Model : Having explained Kaplan's Closed Loop Management System to walk through the strategy formulation and strategy execution process for a business house, we can now establish a strategic process to achieve the objectives of a Circular Business Model (CBM). CBM is a specific type of sustainable business model. A sustainable Business Model encompasses a much larger perspective of economic value, environmental value and social value. In a CBM, the focus is on Design - Use - Reuse - Repair - Refurbish - Recycle. CBM focusses on resources and lifecycle, because it recommends using a product as long as possible. The decision to recycle and reuse a product is feasible only by improving sustainability in the supply chain operations. The corporate world must strategize to inculcate the philosophy of sustainability in the entire supply chain process commencing from the design stage to the end of use and end of life stage followed by the reverse supply chain process. Our proposed CBM borrows from Kaplan's CLMS by treating circularity as an ever-evolving strategy – continuous feedback from customer usage, material flows, repair, reuse, innovative use of waste etc. and their impact on environment at each level. The feedback is used by the management of a company to redefine their plan for refinement of a product, operations over the lifecycle of a product. Our effort shall be to prove our point by drawing instances from some of the leading business houses that have made tremendous progress in the field of sustainability. A circular business model presupposes a customer centric approach with continuous monitoring and review of the strategy during its execution phase. The diagram below indicates how a business organization can plan and execute circularity principle over the lifecycle of its product.



Product Design

The most important strategic decision to initiate circularity principle is right at the design stage. Define the mission, vision and strategic priorities right at the design stage. The circular vision at the design stage of a product can be "Zero Waste." The diagram given above for the circular business is suggestive, its applicability depends on the type and nature of a business house.

Circularity at the product design stage means creating goods for an entire life cycle. The following characteristics and associated costs must be considered during product design stage:

- o Life Cycle Servicing and Cost
- o Focus on eliminating waste
- o Develop products with Line-Replaceable Units (LRUs generally used in aircraft, shipbuilding, automobile industries and electronic items)
- o Reuse and recycling of the product as a whole and units replaced.
- o Use of durable materials, long-lasting materials.
- o Regenerate natural systems
- o Considering product ownership and leasing philosophy.

Adidas

- "Loop" from Adidas is made to be remade
- Product can be returned, broken down and reused

Phillips

- MRIs and CT Scanners taken back and new product supplied at a discounted rate
- Old equipment refurbished and resold

Xerox

- Modular copiers - old modules replaced increasing the life of the machine
- Improve the performance with latest technology

Product Ownership : Retaining product ownership in a CBM, will mean a product is not sold, but the services are sold in the form of leasing or renting. Product ownership helps the company to take care of the serviceability throughout the life of a product. Instead of retaining exclusive ownership of a product, a company sometimes sells a product with the condition to buy it back at the end-use stage. Product ownership ensures longevity, serviceability, recyclability and replaceability leading to customer satisfaction while taking adequate care of sustainability. Xerox, Phillips are typical examples of product ownership and leasing.

Yu Ran writes in China Daily about the driving demand of Zen Z for rental business. Cheng Shuo, 27, an accountant by profession, is passionate about attending live musical performances. She travels almost every month to several cities of China to attend the musical programmes. Before each show she rents a video camera to record her trip. She also rents clothing and other accessories to match the concert themes. "It only takes a few minutes to book what I need, then it's delivered at my door, ready to use, later I just pack it up and send it back." China's rental market is estimated to be worth 10 billion USD this year. Renting clothes has been quite popular in India too, in fact, I had observed way back in 2000 that shops in Kanpur were available to rent out expensive clothing to attend weddings or new year's parties.

Product Life Extension : In product Life Extension, the onus is no longer on making or selling as many goods as possible as done in a linear fashion. Instead, the model continues to give a revenue stream throughout

the product life cycle. Retrofit is also a wonderful concept for Product Life Extension. Retrofit is quite common in the aircraft industry. The life of an aircraft is generally determined based on the number of flying hours. In an aircraft industry, it is quite a common phenomenon to upgrade the avionics system, replace the old analogue system with digital system, improve the performance of powerplant, adding aerodynamic enhancements like blended winglets to reduce the fuel consumption, noise level and emissions. Retrofitting involves calling back the aircraft to the hangars of the manufacturer and carrying out a thorough check and overhaul. In this process the life of the aircraft is extended, Mean Time Between Overhaul (MTBH) is also extended resulting in reduction in the operating cost of the aircraft.

Hindustan Aeronautics Limited has extended the life of Jaguar, a deep penetration striker aircraft which is in service with the Indian Air Force since 1970. The Darin-III upgrade, undertaken by HAL, enhances the aircraft's avionics, radar, and weapon systems enabling it in superior performance in airstrike capabilities and reconnaissance role. The life of the Jaguar squadrons has been extended till 2035.

Customer Interface : In a "Take-Make-waste" model, the producer-customer interface is through selling a product or at the most extended up to the warranty period. In a circular business model, there are several touch points across the whole life cycle of product that establishes customer engagement in continuity. In a Product as a Service (PaaS) scenario, where a customer takes the product as a lease, he is entitled to use the product, gets it upgraded, return the product, and take it back after refurbishing.

Phillips offer "lighting as a service" where customer must pay only for the service, i.e., the light consumed by him and not for the product, whereas Phillips takes care of the entire maintenance and servicing. Many automobile manufacturers sell pre-owned cars in designated show rooms, luring the customers to buy the car at a discounted price with a specific warranty on the product. Renault remanufacturers used auto parts to original standards and sell them with the same warranty as new parts.

Reuse and Recycle : In a circular business model reuse and recycle are the two key strategies that minimize waste and maximize return on resources. In the first place, the model extends the life of a product and when the product comes to the stage of end-use, the product is taken back by the supplier and after recycling the product is fit to be reused.

- o Coca-Cola and Pepsi Co recycle plastic bottles into new bottles, thus reducing the consumption of plastic.
- o Red Bull and Coca-Cola cans are melted and reformed into new cans.
- o Coca-Cola and Pepsi Co collect glass bottles and clean and reuse them as new bottles multiple times.

- o Apple takes back used iPhone, refurbishes and sells these under their Apples Trade-in Programme.
- o Patagonia and Adidas recycle polyester and cotton from old clothes and make new clothes.

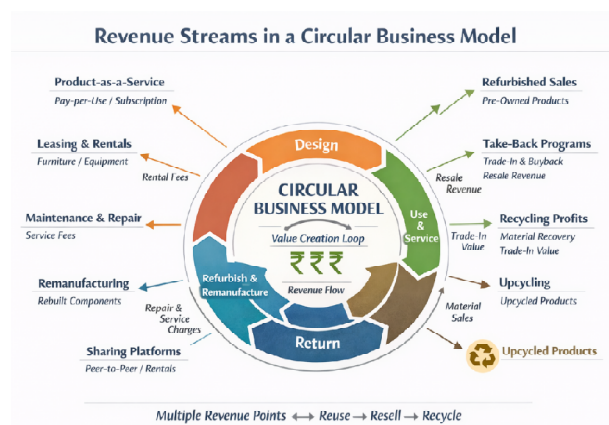
Total Cost of Ownership (TCO) : To make the Circular Business Model acceptable to the CFOs of the companies, it is necessary to analyse the cost of a product over its life span and find out if the return on resources is adequate to run the business. It's an important part of the corporate strategy to work out the ownership cost vis-a-vis the total revenue stream over the life cycle.

How is the TCO calculated?

TCO comprises of all types of cost that an organization incurs from supply of the product to a customer to a stage when a product is declared redundant and its residual value is zero.

- (1) **Acquisition cost:** Purchase price, transport cost, installation and taxes
- (2) **Operating Cost:** Cost to use the product – Energy, fuel, consumables, labour
- (3) **Maintenance Cost:** Repairs, spare parts consumption cost and warranty administration cost and MTBO (Mean Time Between Overhaul) cost, upgrade cost
- (4) **Downtime Cost:** Lost production time, service delays
- (5) **Cost of reuse:** Reverse logistics cost, dismantling, repair and refurbishing cost
- (6) **Resale cost:** Cost associated with resale or return to the customer

Map the Revenue Stream : Revenue stream is to be mapped against the life cycle cost to find out the feasibility of the Circular Business Model. In a linear business model, a product is sold and revenue is earned once, whereas, in a CBM, revenue is earned in multiple phases throughout the life cycle of the product, as shown in the diagram below.



As shown in the diagram, the revenues stream will flow from leasing a product as a service (SaaS), a typical

example of which is Phillips' lighting as a service. Ikea's buyback furniture scheme followed by refurbishing and resale is a wonderful example of earning revenue through recycling. Similarly, Apple's repair of its iPhone and iPad allows its product not only to last longer life but also to earn value in its revenue stream. HAL's initiative to upgrade the avionics, missile system integration of various war planes and helicopters help the corporate house to simultaneously achieve the twin objectives to extend the life of the costly flying machines as well as gain significantly in its revenue stream. Companies looking for upcycling and product renovation can be inspired by the efforts of Adidas using plastic waste from coastlines as yarn for shoe uppers. It's a novel and innovative venture to eliminate plastic waste by upcycling into fibres and then use for their product - an innovative idea indeed, for sustainability with the prospect to earn significant revenue.

Ikea – A Case of successful Implementation of Circular Business Philosophy :

As mentioned earlier that the millennials are embracing carbon neutrality at an increasing pace – so do several business houses including the tech giants like Google and Microsoft. Ikea's adaptation of a circular business model is an appropriate case study to understand how the business houses can significantly contribute towards our goal of zero carbon emission. Ikea is a Swedish home furnishing multinational corporation that specializes in flat furniture. Ikea used to generate lot of waste and product obsolescence leading to environmental hazards. Reuse and recycling of their product was not embedded in the design philosophy of Ikea. Like most other manufacturing firms, environmental issues were not addressed by the designers. To address these, Ikea transitioned toward a circular business model. Ikea created a circular agenda. According to the Ikea management, "Circularity is a key enabler to tackle climate change, reduce pollution and waste, regenerate resources and lessen our business impact on nature." In fact, shift to the principle of circularity has been a major managerial decision that impacted every aspect of its business. These include, inter alia, procurement & sourcing, raw material, processing and operation, product life and customer confidence. Ikea made it a point of a collaborative approach with all its stakeholders. Once the purpose and long-term commitments of Ikea are explained to the suppliers, business partners, NGOs and above all to the customers, the transition from linear to circular economy became absolutely seamless.

Ikea envisions to achieve the key results by 2030. The following are the key results to be achieved by Ikea.

- o The reuse, repair, refurbishing and recycling are embedded in the design ab initio.
- o Absolute decoupling of non-renewable material uses in Ikea product basket.
- o Target circular fulfilment score for the entire product range will be 90 to 100%.
- o Share of renewed and recycled product content will be 90% of overall Ikea product basket.

- o Dedicated circular services are also designed and implemented at least to 80% of the market which makes the customer reuse and recycle the Ikea products.

Key Elements of the Circular Strategy - IKEA

Circular Production Design	Product Life Extension	Circular Supply Chain
<ul style="list-style-type: none"> •Durability •Repairability •Recyclability •Use of recycled material 	<ul style="list-style-type: none"> •Take back scheme •2nd hand stores •Furniture leasing programme •Spare parts service •Repair workshops 	<ul style="list-style-type: none"> •Shift to bio-plastics •Partnership for wood •Work with supplier to reduce waste •Improve logistics efficiency

One important outcome of this business model of Ikea is the generation of by-products – (1) Product as a service (PaaS) that is the pilot project for furniture leasing in Switzerland and Netherlands and (2) Buy back and resale programme where customers can return used Ikea furniture for store credit and they can be resold in as is condition.

Customer Engagement

Circular business model presupposes circular consumption which is promoted through the following steps.

- o **Circular hubs:** Customers can buy second-hand and returned items at a discount.
- o **Educational campaigns:** Educating customers to reuse or recycle products and benefits accruing from it.
- o **Ikea Green Friday Campaign:** Promoting buy-back.

The best way to succeed is customer engagement for a product, because it is the customer who can drive sustainability. For many brands where there is no change in the product configuration, the customer simply buys the product. He is not aware how the manufacturer takes care of the environmental issues relating to the product, process and operation. However, for some other brands it is the usage that determines the sustainability – typical example is the water conservations for use of bathroom gadgets. So, customer engagement can go a long way in maintaining the sustainability chain of a product. There are some other brands where customers' involvement is necessary to maintain sustainability. Prof. Gautam Challangalla writes (Harvard Business Review, November – December 2022) that the most challenging area of customer involvement is where there is brand reinvention with two simultaneous shifts – one, expanding into a new market with a new sustainability purpose and two, repositioning of the brand while asking customer to change their behaviour. **Vanish**, which is a stain removing powder of Reckitt Benckiser, is a typical example of customer behavioural pattern in the domain of circular consumption.

Vanish – Product Life Extension

- Helps in longevity of clothes by removing stains
- Encourage customers to reuse clothes
- Reduces the need to buy new clothes
- Cutting down on textile waste
- Reduce emissions

Vanish – Shift in customer behaviour

- Imbibe circular business model in fashion
- Wash less
- Repair and re-wear

Vanish – Partnership

- Collaboration with fashion cycling initiatives – Oxfam
- Oxfam promoted re-wearing clothes campaigning for textile reuse programme

Thus, Vanish has established its alignment with circular economy by way of life extension of the product intended for use, reduced consumption and awareness campaigns.

Live Lagom : Lagom is a Swedish word for 'just for the right amount' – not too little and not too much. Live lagom teaches the principle to live your life without taking more than you need. Ikea created a Facebook group of Lagomers who must inspire the community to live more sustainably. The group is creating a Lagom lifestyle by arranging workshops, discussing case studies and videos – more than 90% respondents say that the project has helped them to live a more sustainable lifestyle. The Lagom initiatives directly supports Circular Business Model through advocating conscious consumption and customer feedback. Back home, several businesses in India have started adopting the principle of Lagom, as this concept is totally aligned to Indian philosophy of frugal living. Lagom World Ventures and Lagom Sustainable Living Pvt. Ltd. are the two entities created in India to drive sustainability initiatives. Similarly, "Love Not Landfill" is a circular fashion campaign of London encouraging people to buy secondhand clothes by repairing, recycling instead of throwing them into the dustbins.

Days are not far when sustainable business will become smart business.

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FOCUS ON TECHNOLOGY, SUSTAINABILITY, AND EFFICIENCY IN SUPPLY CHAIN MANAGEMENT

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Abstract : The main focus of this study is to identify the applications of various technological tools in supply chain management. The key supply chain performance drivers are facility, inventory, transportation, information, sourcing and pricing. All these drivers are helping to achieve supply chain efficiency (cost efficiency) and responsiveness (ability to respond to the customer demand). The performance driver i.e. information is an enabler to achieve both the efficiency and responsiveness. The author has identified 16 types technological tools used in supply chain management and their applications. Further, a bibliometric analysis is done considering the technology enabled supply chain management for the period from 2015 to 2025 (10 years). The the VoSViewer software is used for number of citations, top 10 authors based on number of citations and top 10 countries where the technology- enabled supply chain management research studies are carried out. The numbers of citations are also studied. From India, very few (39) documents are identified. It is seen that lot of scope is available to conduct further research on this topic.

Keywords: Bibliometric analysis, technology enabled supply chain management, dimensions.ai

Introduction : Supply chain is the coordination of the production, inventory, location, transportation among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served (**Michael Hugos, 2006**). SCM is the management of flow of material, fund, and information from supplier's supplier to customer's customer (**Mckinsey, 2003**). Besides these three flows, two more flows are also involved i.e value flow and risk flow. Supply chain management is all about managing the supply and demand through inventories. Managing the supply, demand and inventory gives lot of challenges to the supply chain managers.

The companies will recognize the importance of SCM practices for gaining competitive advantage. The supply chain performance drivers are: inventory, facility location, transportation, information, pricing and sourcing (**Sunil Chopra, Peter Meindl and Kalra, 2013**). These drivers enable the companies to achieve supply chain efficiency and responsiveness. Supply chain efficiency (cost) and responsiveness (time) are essential two important ingredients in the supply chain

management. The customer's expectations are exceedingly high in terms of low price, quick delivery, more customization and many varieties. This gives some level of challenges in managing the supply chains. Change in technology use and supply chain disruptions also give many challenges to the supply chain managers.

Technology is an enabler to achieve both supply chain efficiency and responsiveness. Key technologies include Electronic Data Interchange (EDI), Electronic Procurement System (EPS), Blockchain Technology (BCT), Internet of Things (IoT), Sensor Technology, Data analytics, Artificial Intelligence (AI), Robotic Process Automation (RPA), Augmented Reality (AR) & Virtual Reality (VR) and 3D printing, which help with everything from product design, process automation to inventory and logistics to data security and transaction processes. Technology isn't just for speed; it's the enabler for achieving sustainability goals efficiently, creating a competitive advantage by meeting customer demands for responsible products while cutting costs.

Technology, especially AI, IoT, and Blockchain, drives efficiency and sustainability in supply chains by enabling real-time tracking, automation, predictive analytics, and transparent traceability, helping reduce waste, optimize routes, lower emissions, ensure ethical sourcing, and meet consumer demand for green practices, ultimately creating more resilient and responsible operations from procurement to delivery.

Key technologies

The key technologies that are used in supply chain management depicted in the table 1

Table 1: Key Technologies

Sl. No / Technology tools used in SCM / Details

1 Internet of Things (IoT) -Uses sensor to provide real time visibility into inventory, asset location and condition (Logistics Management)

2 Artificial Intelligence (AI) & Machine Learning (ML) - Used for comprehensive visibility, demand forecasting and process optimization.

3 Big Data Analytics - Processing large amounts of data to spot inefficiencies predict demand and inform strategic decisions.

4 Robotic Process Automation (RPA)- Automation repetitive, rules-based tasks like data entry and invoice reconciliation.

5 Digital Twins - Creates a virtual real time simulation of the supply chain to test scenarios and make adjustments from a common centre.

6 Augmented Reality (AR) - Overlays digital information on to the real world, used warehouses to guide workers and improve accuracy.

7 Blockchain Technology (BCT) - Creates a secure tamper proof and transparent record of transaction for improved traceability.

8 Electronic Data Interchange (EDI) - The communication system with supplies on the supply side and customer on the distribution side exchanged the data through internet at very low cost. This technology requires a combination of the Global Positioning System (GPS) and wireless communication.

9 Enterprise Resource Planning (ERP) - ERP system monitor inventory throughout the channel often business system. This system also connects the suppliers through Supplier Relationship Management (SRM) and Customers through Customer Relationship Management (CRM).

10 Electronic Procurement System (EPS) - In EPS the business transactions are done through the internet. The suppliers and buyers are connected through Digital Signatures Certificate (DSC). Key applications include automating the entire purchase-to-pay cycle, managing supplier relationships through e-sourcing and e-tendering, improving inventory control, and providing detailed spend analysis to identify cost-saving opportunities.

11 Bar Code System - Bar coding systems are used in supply chain management for inventory management, shipment tracking, and warehouse operations by assigning unique codes to items for quick data capture.

12 Radio Frequency Identification (RFID) Tags - The RFID uses radio frequency electromagnetic fields to extract data from a tag attached to an item for automatic identification and tracking. The RFID hence provides benefits like automatic reading, increased coverage area, no line of sight and many more. It is used to identify the product whether it is genuine or counterfeit. It is used for inventory management and speedy clearance of goods in customs clearance.

13 Global Positioning System (GPS) - The GPS technology enables the supply chain managers to locate the exact position of vehicles, people, or even inventory in the supply chain. GPS based vehicle tracking systems are used to optimize routes, communication, of delivery status to customers and also optimize warehousing operations

14 Geographical Information System (GIS) - GPS uses Geographical Information System (GIS). It is a computerized system for capturing the position of an object and then processing, enhancing, querying, analyzing, and storing it with spatially referred data. It is used in fleet management on real time basis.

15 Virtual Reality (VR) - VR is used in supply chain management for employee training and simulation, supply chain visualization and optimization, and improving collaboration

16 3D Printing - 3D printing or Additive Manufacturing (AM) is emerging as an eye opener for creating complex geometries with desired material and to improve the designing and modeling of implausible structures. It has great advantages over supply chain management by the means of reduction in inventory, shipping costs and capital expenditures on factories and warehouses which provides the potential to evaluate the transformation of global supply chain management

(Source: Author's teaching Notes, 2020)

Role of Technological tools in Supply Chain Management

The technological tools like Bar coding, RFID, GPS and GIS gives more visibility to the supply chain management. Other technological tools like AI, Blockchain, Cloud computing, IoT, 3D printing and Data analytics facilitates to gain sustainability in the supply chains.

Technological tools like EPS / ERP, EDI AI, Sensors etc enables to achieve the supply chain efficiency, wider participation & cycle time reduction and inventory management. Technological tools like AR & VR and Digital twins are used for training & simulation and scenario analysis.

Further, Electronic Procurement System (EPS) has helped the companies to reduce the procurement cycle time, ordering cost, wider participation, fair and transparency in procurement. AI is useful in catalogue management. Robotic Process Automation (RPA) is very much useful to manage the repetitive operations like invoice preparation & billing.

Sustainable Supply Chain Management (SSCM) : Integrating sustainability into supply chain management is both a challenge and a strategic necessity. Industry 4.0 technologies especially Blockchain, Big Data Analytics, IoT, Additive Manufacturing, Cyber-Physical Systems, and Cloud Computing are helping to achieve the sustainability. Through Industry 4.0 technologies, it is thus possible to change a linear supply chain into an SSC (Rajput and Singh, 2019). In this study, six leading-edge I4.0 technologies were identified for SSCM. The key technologies to achieve sustainability are blockchain (BC), cloud computing (CC), cyber-physical systems (CPS), additive manufacturing (AM), big data analytics (BDA) and the Internet of Things (IoT).

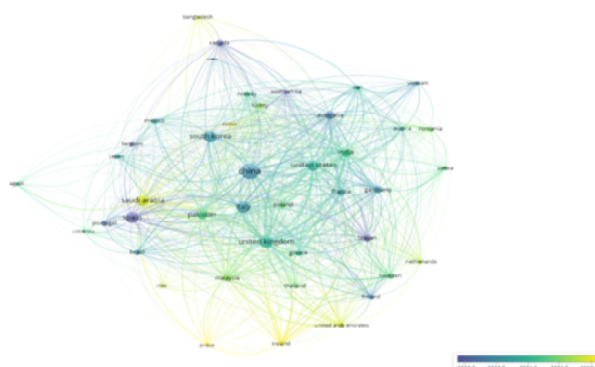
Research Methodology : The researcher has collected data from Dimensions.ai for the Bibliometric study. Technology related keywords such as IoT, AI, Blockchain, ML, Robotics, Big data, Data analytics, Cloud computing & RFID are used in SCM or Logistics management. Boolean operators 'OR' or 'AND' are used. The initial search yielded 2, 65,247 documents and subsequently filtered and 14,201 records exported. After cleaning the data, technology –enabled SCM which consists of 638 documents are found. The research publication from 2015 to 2025 (10 years) were captured. The table 2 shows the top 10 countries by bibliometric coupling.

Table 2: Top 10 Countries by Bibliometric Coupling

Rank	Country	Documents	Citations	Total Link Strength
1	United Kingdom	69	9572	17,299
2	India	39	3453	11,978
3	China	119	7926	11,930
4	United States	52	4894	9,850
5	Italy	62	7205	8,294
6	Saudi Arabia	55	3194	7,951
7	Australia	35	4143	7,367
8	France	25	3979	7,429
9	Germany	28	3948	6,703
10	Malaysia	22	1482	6,760

The bibliographic coupling visualization reveals a dense global research network, with China, the United Kingdom, India, the United States, and Italy positioned at the core due to their strong publication volume and high coupling strength. These countries form the central hubs, indicating substantial intellectual overlap and shared references in technology-enabled supply chain research. Surrounding them are influential contributors such as Saudi Arabia, South Korea, Spain, Malaysia, and Taiwan, which show strong linkages and growing research activity. Figure 1 shows the Top 10 Countries by Bibliometric Coupling.

Figure 1: Bibliometric coupling of Countries



Out of 638 documents fed to the VoSViewer, the above figure 2 presents the citation of documents. It is observed that Liakos (2018) is the most-cited and most influential document in the network. A dense interconnected cluster is seen around authors such as Moeuf (2017), Fatorachian (2020), Nagy (2018), Ivanov (2020), and Pournader (2019). Documents like da Costa (2022) and Lasso (2019) have fewer citations, shown by smaller node sizes.

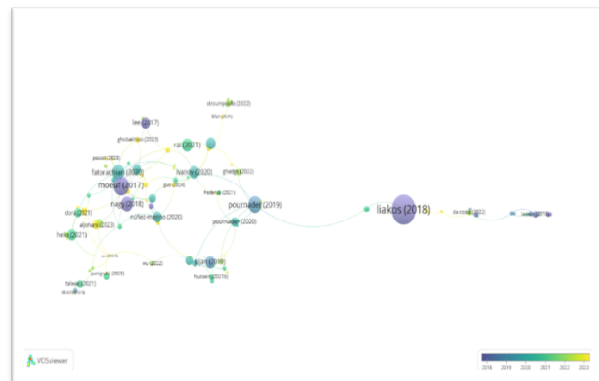


Figure 2: Citation of Documents

Conclusion

Technology is an enabler to achieve both supply chain efficiency and responsiveness. Key technologies include Electronic Data Interchange (EDI), Electronic Procurement System (EPS), Blockchain Technology (BCT), Internet of Things (IoT), Sensor Technology, Data analytics, Artificial Intelligence (AI), Robotic Process Automation (RPA), Augmented Reality (AR) & Virtual Reality (VR) and 3D printing, which help with everything from product design, process automation to inventory and logistics to data security and transaction processes. The technological tools like Bar coding, RFID, GPS and GIS gives more visibility to the supply chain management. Other technological tools like AI, Blockchain, Cloud computing, IoT, 3D printing and Data analytics facilitates to gain sustainability in the supply chains. AR & VR and Digital twins are used for training & simulation and scenario analysis. Electronic Procurement System (EPS) has helped the companies to reduce the procurement cycle time, ordering cost, wider participation, fair and transparency in procurement. AI is useful in catalogue management. Robotic Process Automation (RPA) is very much useful to manage the repetitive operations like invoice preparation & billing. Though these technology-enabled tools are used in supply chain management areas, but research studies are yet to be explored.

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SUPPLY CHAIN VALUE STREAM MAPPING (SC-VSM) - VISUALIZING SUPPLY CHAINS FOR SUSTAINABILITY, GOVERNANCE, DIGITAL ENABLEMENT & PERFORMANCE

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Abstract

**"You cannot improve what you cannot see."
"In visibility lies victory, in mapping lies mastery"**

In an era of global volatility, digital disruption, and sustainability imperatives, characterized by **VOUCA** (Volatile, Uncertain, Complex, Ambiguous) & **BANI** (Brittle, Anxious, Non-linear, Incomprehensible) landscape, traditional silo-based supply chain optimization has proven insufficient, because these systems lack the Nonlinear flexibility required to withstand sudden global shocks or adapt to rapid sustainability mandates. Traditional improvement methods often fail because they optimize parts, not the whole.

Supply Chain Value Stream Mapping (SC-VSM) emerges as a powerful systemic methodology to visualize, analyze, and transform end-to-end value creation across procurement, manufacturing, logistics, and distribution. Supply Chain Value Stream Mapping (SC-VSM) provides a powerful visual and systemic approach to reveal how value truly flows across the enterprise.

LEAD Principles in SC-VSM, is a structured approach to design lean flow, end-to-end visibility, agility, and resilience—integrating Sustainability, Governance & Compliance, Digital Enablement, and Performance Excellence into a single value-creation system and transforming complexity into clarity and execution into competitive advantage.

This research paper presents a comprehensive framework for understanding, implementing, and optimizing value stream mapping within modern supply chain ecosystems. The study outlines principles, methodology, governance, metrics, and transformation outcomes, positioning SC-VSM as a strategic capability rather than an operational tool for achieving operational excellence, eliminating waste, and creating sustainable competitive advantage in an increasingly interconnected global marketplace.

Keywords: Value Stream Mapping, Supply Chain Management, Lean Operations, Process Optimization, Waste Elimination, End-to-End Flow, Supply Chain Integration, Continuous Improvement, Sustainability, Governance & Compliance, Digital Enablement, and Performance Excellence.

1. Introduction: From Fragmentation to Flow

"Flow is the ultimate expression of Value" - "See the Whole. Fix the System. Create Resilient Value."

Modern supply chains operate within **VOUCA and BANI conditions**—marked by volatility, uncertainty, brittleness, non-linearity, and incomprehensibility. These ecosystems are highly interconnected, globally dispersed, digitally driven, and increasingly shaped by **sustainability mandates, governance requirements, regulatory compliance, and rising customer expectations**. Organizations are under continuous pressure to deliver **higher customer value at lower cost**, while simultaneously reducing **carbon footprint**, ensuring **ethical sourcing**, and maintaining **operational resilience**.

Despite digital advancements, many organizations remain trapped in **localized optimization**—improving individual functions such as procurement, logistics, or warehousing without enhancing **end-to-end supply chain performance**. Traditional, siloed management approaches struggle to address systemic risks, hidden dependencies, and non-linear disruptions typical of a BANI environment. This results in fragile supply chains that appear efficient but fail under stress.

Supply Chain Value Stream Mapping (SC-VSM) emerges as a strategic response to this complexity. Rooted in **Lean thinking**, Value Stream Mapping has long proven effective in identifying waste and improving flow within manufacturing. When extended beyond factory walls, SC-VSM provides a **holistic, visual representation of material, information, decision, and digital flows**—from raw material extraction to final customer delivery.

This end-to-end visibility enables organizations to **see the supply chain as a single value-creation system**, rather than disconnected processes. SC-VSM reveals **systemic waste, bottlenecks, compliance risks, sustainability gaps, and brittle nodes**, while also highlighting opportunities for **digital enablement, governance strengthening, and performance acceleration**.

Aligned with the **LEAD framework**, SC-VSM enables organizations to:

- v **L – Lean Flow:** Eliminate non-value-added activities across the entire supply chain
- v **E – End-to-End Visibility:** Improve transparency, compliance, and decision quality

- v **A – Agility:** Respond faster to volatility and non-linear disruptions
- v **D – Decoupling & Resilience:** Reduce brittleness through strategic buffers and alternate flows

Ultimately, SC-VSM shifts the supply chain from **cost-centric optimization to value-centric orchestration**, delivering **measurable improvements in efficiency, agility, sustainability, governance, digital maturity, and long-term business performance**—turning VUCA–BANI challenges into competitive advantage.

2. Conceptual Foundations of Supply Chain VSM

“Systems behave exactly as they are designed.”

Supply Chain Value Stream Mapping (SC-VSM) is grounded in **Lean thinking and systems theory**, focusing on end-to-end value creation rather than isolated functional efficiency. It visualizes **material, information, and decision flows across the entire supply network**, enabling organizations to identify systemic waste, manage VUCA–BANI risks, and design resilient, sustainable, and high-performing supply chains.

2.1 Lean Thinking

Lean Thinking is a **management philosophy focused on maximizing customer value while minimizing waste**, ensuring that every activity contributes meaningfully to value creation. Rooted in the **Toyota Production System**, it emphasizes **flow, pull, standardization, and continuous improvement** to improve quality, speed, cost, and reliability—making it especially powerful for navigating **VUCA–BANI supply chain environments**.

Lean Principles: Define Value; Value Stream Mapping; Create Value Flow; Establish Pull; Seek Perfection.

SC-VSM Clearly define customer value, map end-to-end supply chain flows, eliminate waste to create smooth flow, operate on demand-driven pull, and continuously improve toward zero waste and maximum value.



2.2 Systems Theory

Systems Theory views an organization and its supply chain as a **set of interconnected, interdependent components** that must function as a whole to achieve optimal performance. In supply chains, it emphasizes **end-to-end integration, feedback loops, and cause–effect relationships**, enabling leaders to manage complexity, avoid local optimization, and build resilience against **VUCA–BANI-driven disruptions**.

SC-VSM makes these system dynamics visible, treating the supply chain as a living, interconnected whole rather than isolated functions.

3. Why Traditional VSM Is No Longer Enough

“Optimizing silos is the fastest way to sub-optimize results.”

Traditional Value Stream Mapping was designed for **stable, factory-centric environments**, focusing primarily on internal process efficiency, cost, and lead-time reduction. In today's **VUCA–BANI reality**, supply chains face **brittleness, non-linear disruptions, regulatory pressure, sustainability mandates, and digital complexity**, which extend far beyond the shop floor. Traditional VSM lacks visibility into **multi-tier suppliers, information flows, risk propagation, compliance gaps, and resilience factors**, making **Supply Chain VSM** essential for achieving agility, robustness, and sustainable end-to-end performance.

Traditional linear supply chains focus on sequential steps—Mining, Moving, Making, Marketing, Consumption, and Disposal—treating these stages in a linear sequence. This linear approach fails to address modern complexities such as volatility, sustainability, regulatory compliance, and digital dependencies. Value Stream Mapping in a linear model overlooks end-to-end systemic risks and opportunities, making it insufficient for building resilient, circular, and adaptive supply chains.



3.1. Limitations of Traditional Value Stream Mapping

- v Narrow organizational scope - Ignores upstream and downstream dependencies
- v Limited representation of information and decision flows
- v Absence of supplier and customer integration
- v Minimal consideration of risk and sustainability

These limitations restrict its usefulness in addressing systemic supply chain challenges. SC-VSM overcomes these constraints by adopting an end-to-end perspective.

4. Objectives of Supply Chain Value Stream Mapping (SC-VSM)

Supply Chain Value Stream Mapping (SC-VSM) is a **strategic, end-to-end visualization tool** that helps organizations understand how value truly flows across the extended supply chain. It enables leaders to **identify waste, manage VUCA–BANI risks, and design resilient, high-performing supply networks**.

- v **End-to-End Value Visibility** Visualize material, information, financial, and decision flows across suppliers, operations, logistics, and customers to

overcome siloed optimization.

- v **Waste & Constraint Identification** Expose systemic waste, bottlenecks, delays, redundancies, and non-value-added activities across the extended supply chain.
- v **Agility & Resilience Building** Identify brittle nodes, decoupling points, and alternate flows to respond effectively to VUCA–BANI disruptions.
- v **Performance Improvement** Reduce lead time, variability, inventory, and cost while improving service level, reliability, and throughput.
- v **Sustainability & Compliance Enablement** Highlight carbon hotspots, resource inefficiencies, regulatory risks, and governance gaps for responsible supply chain design.
- v **Digital & Data Alignment** Align digital tools (ERP, analytics, AI) with value creation, ensuring data supports flow, visibility, and faster decisions.
- v **Stakeholder Alignment** Create a shared, visual improvement narrative that aligns cross-functional and multi-enterprise stakeholders around common goals.

Outcome: SC-VSM transforms supply chains from **functionally efficient to systemically effective**, enabling sustainable, resilient, and customer-centric value creation.

5. LEAD Principles – Supply Chain Value Stream Mapping (SC-VSM)

In today's complex and dynamic supply chains, achieving efficiency alone is no longer sufficient. The **LEAD (Lean Flow - End-to-End Visibility – Agility - Decoupling for Resilience)**-based Supply Chain Value Stream Mapping (SC-VSM) framework integrates Lean principles with sustainability, governance, digital enablement, and performance management. It provides a structured approach to enhance flow, visibility, agility, and resilience across the end-to-end supply chain, enabling organizations to respond effectively to disruptions while driving responsible and high-performing operations.



L – Lean Flow: Eliminate non-value-added steps, excess inventory, delays, and handoffs across the end-to-end supply chain, while embedding sustainable practices to reduce waste and carbon footprint.

E – End-to-End Visibility: Map material, information, and decision flows across suppliers, plants, warehouses,

and customers, leveraging digital tools for real-time insights and ensuring compliance with governance standards.

A – Agility: Design flexible processes, alternate routes, and rapid decision loops to respond to volatility, disruptions, and regulatory changes efficiently.

D – Decoupling for Resilience: Implement strategic buffers, parallel sourcing, and decoupling points to prevent brittle failures, enhance recovery speed, and maintain performance under dynamic conditions.

Key Insight: LEAD-based SC-VSM transforms supply chains from purely cost-optimized to disruption-ready, integrating sustainability, compliance, and digital enablement to drive superior flow, speed, and resilience.

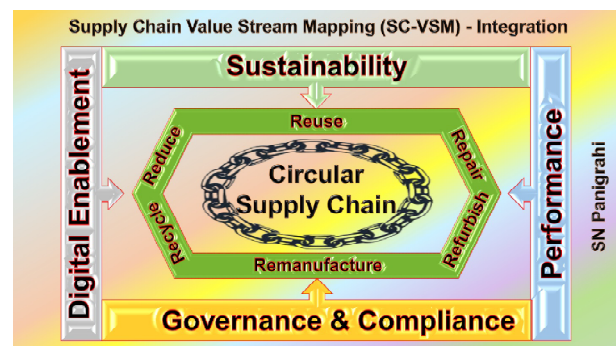
By aligning LEAD principles with sustainability, governance, digitalization, and performance metrics, SC-VSM becomes a strategic tool to build resilient, responsible, and high-performing supply chains.

6. Supply Chain Value Stream Mapping (SC-VSM) Integration

“Map the Flow. Close the Loop. Govern with Trust. Perform with Purpose.”

In a **VUCA–BANI world**, supply chains must move beyond linear efficiency toward **integrated, circular, and resilient value systems**. Supply Chain Value Stream Mapping (SC-VSM) provides an **end-to-end, systems-level view** that connects sustainability, governance, digital enablement, and performance into one coherent improvement architecture. It transforms fragmented initiatives into a **unified value-creation engine**.

By aligning **LEAD principles** with sustainability, governance, digitalization, and performance metrics, SC-VSM becomes a strategic tool to build resilient, responsible, and high-performing supply chains. Organizations that institutionalize SC-VSM move beyond firefighting to designing supply chains that consistently deliver value in an uncertain world.



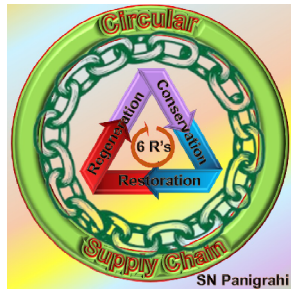
5.1. Sustainability

“SC-VSM: Where Circularity Meets Certainty.”

“Don’t Just Offset the Footprint—Redesign the Path.”

SC-VSM embeds sustainability directly into value creation rather than treating it as a parallel initiative. By visualizing material, energy, waste, and carbon flows, organizations can identify **environmental hotspots and**

circular opportunities across the supply chain. It enables integration of **6 R's : Reduce, Reuse, Recycle, Repair, Refurbish, and Remanufacture (6R's)** into operational design.



This systemic visibility supports **circular supply chains**, minimizing resource dependency and brittleness.

SC-VSM aligns sustainability with cost, service, and resilience—turning ESG from compliance into **competitive advantage**.

Result: **Lower footprint, higher resilience, and sustainable long-term value.**

5.2. Governance & Compliance.

“From Compliance to Competitive Advantage: Mapping a Greener Future.” : In complex, multi-tier supply chains, governance failures often remain hidden until disruption occurs. SC-VSM exposes **decision points, handoffs, controls, and accountability gaps** across the extended network. It helps organizations proactively manage **regulatory compliance, ethical sourcing, trade controls, and ESG governance**. By mapping information and approval flows, SC-VSM reduces ambiguity and non-compliance risk.

This transparency strengthens **trust, audit readiness, and risk resilience** in a BANI environment. Result: **Governed flow, reduced risk, and confidence at scale.**

5.3. Digital Enablement

“Intelligence Over Information. Value Over Volume.”
“Design the Flow, Then Drive the Glow: Digitizing Purpose, Not Process.”

Digital tools create value only when aligned with flow—not when layered on broken processes. SC-VSM acts as the **blueprint for digital transformation**, ensuring ERP, analytics, AI, and automation support true value creation.

It identifies where **real-time data, visibility, and decision intelligence** are most impactful.

SC-VSM reduces digital noise, data overload, and system complexity by focusing on value-critical signals.

By mapping the path before we build the digital highway, we replace data overload with **decision intelligence**. The result is a supply chain that doesn't just process data faster, but moves with purpose, speed, and absolute confidence in an uncertain world.

This enables faster, smarter, and more confident

decisions under uncertainty.

Result: **Digitally enabled flow, not digitized waste.**

5.4. Performance.

“True performance isn't measured by how fast a single link moves, but by how the entire chain endures.”

SC-VSM shifts performance management from local efficiency to **system-wide effectiveness**. It links lead time, inventory, service, cost, sustainability, and resilience into a single performance narrative.

“Built to Endure, Not Just to Optimize.”
By addressing bottlenecks, variability, and non-linear disruptions, SC-VSM improves **speed, reliability, and adaptability**.

“Beyond Local Gains: Orchestrating End-to-End Excellence.” It balances efficiency with buffers, agility, and decoupling to prevent brittle failures. Performance becomes **predictable, resilient, and customer-centric**, even under volatility. Result: **Sustainable performance that endures disruption, not just optimizes today.**

SC-VSM is not a tool—it is the integration logic for resilient, circular, and future-ready supply chains.

Conclusion

“Flow creates value. Visibility creates flow.”

“Flow creates value. Visibility creates flow.” Supply Chain Value Stream Mapping transcends traditional process improvement by offering a systemic, end-to-end perspective on value creation. When executed with rigor, leadership commitment, and data discipline, SC-VSM becomes a strategic enabler of efficiency, agility, sustainability, and resilience.

By aligning **LEAD principles** with sustainability, governance, digitalization, and performance metrics, SC-VSM becomes a strategic tool to build resilient, responsible, and high-performing supply chains. Organizations that institutionalize SC-VSM move beyond firefighting to designing supply chains that consistently deliver value in an uncertain world..

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SUSTAINABLE DEVELOPMENT AND SUPPLY CHAIN MANAGEMENT

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Sustainable Development and Supply Chain Management helps to take adequate care of people and the planet when doing business to earn revenues and profits. Land and resources need to be utilized in a sustainable and long lasting way to ensure that these factors of production are not fast depleted and are useful for our generation and future generations.

SUSTAINABILITY

Social actions
Environmental actions
Economic actions

Sustainable development and supply chain management helps to use materials and resources in an optimized way and also helps preserve the planet in a suitable condition for future generations.

Businesses need to make positive impacts on the societies and communities where they are located in terms of job creation, pollution control, treatment and discharge of effluents, contributions back to their societies and communities etc..

Businesses need to continue to focus on maximizing and optimizing their production volumes and sales in various different customer or market segments using strategies that conserve and sustain material resource consumption and human resources.

New types of renewable energy usage will have to be targeted and utilized to achieve zero – carbon status within the supply chains. There is a natural emphasis on the environmental dimension – i.e. climate change and bio-diversity loss. This leads to forest and green cover conservation and tree planting projects. This also

leads to increased usage of types of renewable energy like solar, wind, hydro-electric, hydrogen, battery storage, ocean energy etc..

Triple Bottom Line is an accounting and business framework to monitor two additional pillars, namely social impact and environmental impact in addition to traditional focus on profits in balance sheets. These are referred to as People, Profit and Planet.

ESG stands for Environmental, Social and Governance, a framework used by investors and companies to assess a company's sustainability, ethical impact and long-term value beyond financials, focusing on climate impact, people & society, ethics and quality of governance achieved by company leadership.

Sustainability involves the following :

People –	Optimizing Social Equity and Human Capital
Profit –	Optimizing Economic Viability and Benefits to Society
Planet –	Optimizing Environmental Sustainability and Natural Capital

The focus is on long-term well-being without adverse impacts on the above areas. Economy should contribute to well-being of Society and Society needs to contribute to well-being and preservation of the Environment. Only this can lead to Sustainable Development and Sustainable Supply Chain Management has a key role to play in this achievement of Sustainable Development and Prosperity.

Sustainable Development Goals i.e. SDGs of the United Nations – 17 Goals are given below:

No Poverty

Quality Education
Affordable & Clean Energy
Reduced Inequalities
Climate Action
Peace, Justice & Strong Institutions

Zero Hunger

Gender Equality
Decent Work & Economic Growth
Sustainable Cities & Communities
Life below Water

Good Health and Well-being

Clean Water & Sanitation
Industry, Innovation & Infrastructure
Responsible Consumption & Production
Life on Land

Partnerships for the Goals

Five pillars of the SDGs

People

Planet

Prosperity

Peace

Partnerships

Environmental Sustainability : Make – Use – Reuse – Remake – Recycle of products is the cycle to aim at when moving towards sustainability. This helps to prolong life of materials and products and reduce material wastages and disposals to landfills. Recycling is the process of turning waste or scrapped materials like paper, plastic, glass and metal into new products reducing landfill waste, pollution and the additional need for raw materials. It involves collecting, sorting, processing and remanufacturing items, saving energy and protecting the environment by conserving material and natural resources and decreasing greenhouse gas emissions. Recyclable materials need to be collected from homes and businesses at periodic intervals and used for recycling or remanufacturing.

Climate change refers to long-term shifts in temperatures and weather patterns. Greenhouse gases that are causing climate change include carbon dioxide, nitrous oxides, fluorinated gases, ozone and methane. Cutting down forests can also release carbon dioxide. The consequences of climate change include temperature rise, intense droughts, severe fires, water scarcity, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity.

Bio – diversity or biological diversity is the incredible variety of life on Earth, encompassing all genes, species, microbes and ecosystems etc.. including forests and coral reefs that help to provide clean air, water, climate regulation, support to agriculture, flood prevention, food, medicines etc.. It can be measured at multiple levels and is crucial for human well-being and a stable planet. Green spaces provide clean air and promote mental health.

Pollution – Carbon accounting :

Carbon accounting or Green house gas accounting is measuring the amount of green house gas emissions from an organization's business activities. This is measured at multiple levels as described below:

Scope 1 emissions: These are all direct greenhouse gas emissions produced within a company – like emissions from equipment like boilers etc., manufacturing facilities, processes, company vehicles etc..

These emissions are from sources that a company owns or controls, such as burning fuel in its own vehicles, boilers, furnaces, generators and industrial equipment including fugitive emissions from equipment like air conditioners. These are a key part of a company's carbon footprint. Every company needs to have a comprehensive time-bound program to control these emissions and move to net-zero status.

Scope 2 emissions: These are indirect greenhouse gas emissions produced from the energy purchased by the company for lighting, steam and heating / cooling used in its operations – which could include non – renewable energy from fossil fuels. These emissions occur at the utility provider's site but the responsibility of reducing these emissions is shared by the purchasing company.

The energy producing utility company also needs to install and maintain properly all the emissions control equipment at its works that are required to regulate and lower the amount of emissions caused when producing this energy.

Scope 3 emissions: These are all indirect greenhouse gas emissions produced from the outbound and inbound supply chains of the company including emissions during product usage and disposal, supply chain emissions, waste, transport emissions etc.. This could be the largest source of emissions and is divided into 15 categories, with the GHG Protocol i.e. Greenhouse Gas Protocol providing the internationally accepted methodology for reporting them. The sources of these emissions are not owned by the company and hence could be more difficult to control and may require longer times.

Climate change solutions to above problems can deliver economic benefits while improving our lives and protecting the environment. UN Sustainable Development Goals and UN Framework Convention on Climate Change can guide progress in these areas.

Some of the solutions are

Renewable Energy: Renewable energy usage in more areas to cut down emissions: Solar, wind and hydro energy power plants produce energy without emissions and using more of this energy and less of fossil fuel energy is the way towards cutting down emissions substantially. Solar energy is abundantly available and is one of the cheaper sources of energy. This is the reason why it needs to be used more and more.

Green Buildings: Leadership in Energy and Environmental Design i.e. LEED is a set of rating systems for the design, construction, operation and maintenance of green buildings developed by the US Green Building Council. Other certification systems that confirm the sustainability of buildings are the British BREEAM and German DGNB.

Forestation and Tree planting: Forestation is the broad term for establishing or restoring forests, encompassing reforestation (planting trees where forests were) and afforestation (planting trees where forests were not before) to combat climate change, enhance biodiversity and restore ecosystems by increasing tree cover, providing vital services like clean air, water and habitat.

Maintaining Bio-diversity: Biological diversity is the vast variety of life on Earth, encompassing genes, species and ecosystems, essential for providing clean air, water, food, medicines and climate regulation. It is measured at different levels and supports crucial ecosystem services like pollination, nutrient cycling and protection from disasters. It is currently threatened by habitat loss, pollution, overexploitation and climate change.

Recycling or Upcycling of Materials: Recycling of materials and products needs to be done wherever possible. Recycling is the process of turning waste

materials like paper, plastic, glass and metal into new products, which conserves natural resources, saves energy, reduces landfill waste and lowers pollution by decreasing the need to extract new raw materials. It involves collecting, sorting and processing used items into raw materials that factories can use to create new goods and products, supporting a more circular economy where material resources are reused. A lot of progress has been made in this area but more needs to be done.

Environmental Cleanups: Environmental Cleanup is defined as the process of managing and restoring contaminated sites, particularly involving the containment of hazardous materials and remediation efforts to remove environmental hazards. Environmentally responsible companies actively promote and participate in such cleanup programs and projects.

Management of Landfills: Landfills are designated sites for burying waste, from simple dumps to engineered facilities / sanitary landfills designed with liners, gas capture and leachate collection to minimize environmental harm like methane emissions (a potent green house gas) and toxic leachates. All these wastes including agricultural or industrial byproducts and municipal solid waste require strict monitoring and management to control pollution levels and protect health. Financing of these environmental solutions needs to be given additional attention and importance and adequate quantities of resources provided to launch and complete useful high cost programs and projects in these multiple areas on time.

Economic Sustainability

Growth : Economic growth of countries and companies drives social progress and well-being of the people. The standards of living of the people are enhanced by increased salaries and purchasing power which contributes to growth of companies selling consumer products. This also contributes towards better consumption of healthcare and educational services leading to growth of the companies in these sectors.

Better living standards : Better living standards can be achieved by creation and development of better infrastructure including transport and mobility, roads and highways,

Less hunger and poverty : Better purchasing power and increased incomes due to economic growth contribute towards lesser hunger and poverty, lowered malnutrition levels, lesser child mortality etc..

Long term prosperity without depleting natural resources: Companies that are doing well in terms of financial key performance indicators, must also ensure that they are using material resources in a mature and responsible way so that these resources are maintained without depletion and these are useful for future generations.

Social Sustainability : Improved Education: In these days

of increased educational costs, better standards of living help to achieve affordability of education, more scholarships for educational courses at universities, easier to repay loans etc..

Better Health and Disease control: Health is an important contributor towards social sustainability and healthcare needs to be given adequate importance in developing countries. Adequate budget allocation for healthcare activities is the first step towards achieving this goal. Maintaining doctor to patient ratio and hospital to population ratio could be among the major goals of this program.

Support for People with Physical Challenges: Public facilities like railway stations, bus terminuses etc. need to be physically challenged friendly with provision of adequate elevators, escalators, wheel chairs, help desks etc.. Some places may need special facilities for visually challenged people.

Better Safety: Safety is the condition of being protected from harm, danger or risk achieved through awareness, precautions and systems designed to prevent injury or loss. This encompasses workplace protocols, product standards, safety precautions, safety awareness & practices and public security. Safety hazards need to be identified proactively and managed adequately to reduce accidents and move towards the goal of Zero Accidents. These procedures and best practices need to be designed and implemented for homes, workplaces, recreation spots, public places, vehicles etc..

Better HDI: HDI stands for Human Development Index, a composite measurement from the UNDP measuring a country's average achievement in key areas of human development: a long & healthy life i.e. life expectancy, access to knowledge i.e. education and a decent standard of living i.e. GNI or gross national income per capita. Published annually, it ranks nations from 0 to 1 – higher the better. This offers a broader view of progress than GDP alone, with India currently in the ' Medium Human Development ' category.

Gender Equality and Women Empowerment: GDP and HDI targets can be achieved better if women who make up approximately 50 percent of the total population are adequately involved in these growth and development programs and activities so that the total output is maximized and optimized, improving the overall levels of development and progress.

Social & Community Welfare services: These services are meant to assist needy individuals and children so that their living standards are improved. These could be free or subsidised public sector or private sector funded services like free meals in schools, free educational or medical facilities, free transport, free playgrounds, free or subsidised child day care centres for working individuals and so on. These services contribute towards raising the living standards and thus positively contribute towards HDI and GDP improvements.

Fair Labour Practices: Promoting local hiring practices from the immediate community or region is a part of achieving social sustainability in underdeveloped communities. This will not exclude hiring of expatriates and outsiders when their skills are required for company growth and development. Local employees do not go through re-location to take up their jobs and their commutes may also be easier.

Human Rights: Human rights are universal, inherent rights belonging to all people, regardless of race, nationality, gender or any other status, encompassing the right to life, liberty, freedom from slavery / torture, education, work and free speech as outlined in documents like the UN's Universal Declaration of Human Rights. Human Dignity, Equality and Non – Discrimination are included in this comprehensive definition. Companies that promote Sustainability need to ensure this in their operations and activities.

Fourth Dimension – Cultural Sustainability : Cultural Sustainability has been recognized as the fourth pillar of Sustainable Development by UNESCO and this will lead to resilient societies and meaningful development.

The United Nations recognizes culture as a vital, cross-cutting force for sustainable development, integrating it into the 2030 Agenda to foster identity, innovation and inclusive solutions for global challenges like climate change and poverty. Through UNESCO, the UN promotes cultural sustainability by safeguarding heritage, supporting creative industries, empowering communities and ensuring cultural rights.

Preserving Cultural Traditions: These are long established practices, beliefs, expressions and skills passed down through generations defining a community's identity, history and values. This includes the way of celebrating weddings and festivals in different communities. Different religious and social festivals are celebrated in different ways in various countries and cultures.

Preserving Heritage Sites: Heritage sites are locations, buildings or areas recognized for their significant cultural or historical value, protected by law and often by international bodies like UNESCO. These could be temples or statues or caves or monuments or buildings etc.. **Promoting Local Practices:** Local practices are the community rooted, time-tested methods of interacting with the environment and these are crucial for localized sustainability and resilience.

Inclusion: Inclusion implies the practice or policy of providing equal access to opportunities and resources for people who might otherwise be excluded or marginalized. Inclusive practices improve the gross contribution of the population to growth and development metrics and has a synergy effect on the total results achieved by companies and communities.

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Indian Institute of Materials Management

MISSION

- To promote professional excellence in Materials Management towards National Prosperity through sustainable development.

OBJECTIVE

- To secure a wider recognition of and promote the importance of efficient materials management in commercial and industrial undertakings.
- To safe guard and elevate the professional status of individuals engaged in materials management faculty.
- To constantly impart advanced professional knowledge and thus improve the skill of the person engaged in the materials management function.
- Propagate and promote among the members strict adherence to IIMM code and ethics.

CODE OF ETHICS

- To consider first the total interest of one's organisation in all transactions without impairing the dignity and responsibility of one's office :
- To buy without prejudice, seeking to obtain the maximum ultimate value for each rupee of expenditure.
- To subscribe and work for honesty and truth in buying and selling; to denounce all forms and manifestations of commercial bribery and to eschew anti-social practices.
- To accord a prompt and courteous reception so far as conditions will permit, to all who call up on legitimate business mission.
- To respect one's obligations and those of one's organisation consistent with good business practices.

THE SUPPLY CHAIN PARADOX: A NUCLEAR SCIENTIST'S PERSPECTIVE

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The Supply Chain Paradox captures a defining tension of our era: the very networks that enable modern civilisation simultaneously expose it to systemic fragility. From pandemics to canal blockages to climate shocks, the illusion of smooth global logistics has dissolved. Sustainability Science now forces a deeper interrogation of value chains revealing hidden emissions, ecological overshoot, labour exploitation, and linear systems fundamentally misaligned with planetary limits. In this transformation, a new professional frontier is emerging: As the world accelerates toward clean baseload power, resilient energy grids, SMRs, advanced reactors, and fuel-cycle sovereignty, nuclear supply chains demand a new cadre of experts trained not only in management principles but in safety culture, regulatory discipline, ethics of stewardship, and technological foresight. Management institutes and professional bodies are beginning to recognise this tectonic shift, integrating modules on nuclear logistics, quality governance, cybersecurity, and circular energy systems. The emergence of these professionals marks an inflection point: supply chain management is no longer about moving goods efficiently but about sustaining civilisation responsibly. Nuclear supply chains with their precision, resilience, and climate alignment are becoming the gold standard for the next generation of managers shaping a sustainable, sovereign, Viksit Bharat.

Sustainable Supply Chain

From Buying, Purchasing, Procurement, Materials management, Materiel management to Supply chain management, we have come a long way only to discover that we have still miles to go. Supply chains were once backstage operations- quiet, invisible, technical. Today they dominate headlines and boardroom anxieties. A single ship stuck in the Suez Canal can delay pharmaceuticals on one continent and inflate consumer prices on another. A heatwave in China can halt semiconductor fabrication, slowing industries from Detroit to Düsseldorf. A war in Europe can redraw energy routes, destabilise fertilizer markets, and push entire regions toward food insecurity. This deep interconnectedness creates a stark paradox: **"Supply chains make modern life possible and make modern life vulnerable."** For decades, efficiency has been the ruling and presiding deity. The gospel was simple: minimise costs, shorten delivery times, shrink inventories. Lean, just-in-time supply chains became symbols of managerial perfection. But as the planet heats, politics fractures, and energy systems strain, the vulnerabilities of this doctrine stand starkly exposed. The supply-chain-

as-machine worldview predictable, linear, optimisable is collapsing. In its place, emerges the supply-chain-as-ecosystem worldview complex, adaptive, and deeply entangled with climate, society, and energy.

Meanwhile, sustainability has evolved from amorous moral appeal to smart scientific discipline. From the Brundtland Commission's clarion call for intergenerational equity to the Sustainable Development Goals (SDGs) and the growth of Sustainability Science, the global narrative has shifted. Sustainability is now measurable, modelled, and monitored. And under this sharper lens, the contradictions become impossible to ignore: global logistics depend on fossil fuels, exploit material-intensive technologies, strain ecological boundaries, and generate carbon at every node from extraction to production to disposal. Thus begins the central existential question of our era: **Can humanity design supply chains that sustain civilisation without destroying its planetary home?**

Sustainability Science: A New Lens for Value Chains

Sustainability today is far more than environmental compliance or a green label appended to corporate reports. It has matured into a scientific lens through which we understand the stability of human life on a finite planet. The Brundtland Commission offered a deceptively simple definition- meeting present needs without compromising the ability of future generations to meet theirs. But beneath its elegance lies a demanding triad: **ecology**, which respects planetary boundaries; **economy**, which ensures value creation; and **equity**, which protects social justice and intergenerational fairness. Sustainability Science emerged to integrate these dimensions, weaving together ecology, economics, engineering, anthropology, public policy, and systems modelling. For global value chains, this discipline operates like a diagnostic MRI revealing the hidden fractures and inflammations beneath smooth managerial dashboards. It helps map where emissions are embedded deep in upstream extraction; where waste accumulates in design choices; where labour is exploited in low-cost nodes; where transport networks amplify vulnerability; and where inefficiencies trigger ecological harm that cannot be reversed.

This scientific framing exposes a structural truth: traditional supply chains were architected for throughput, not longevity. Their linear logic- **take ! make ! waste** served the industrial age but is now utterly incompatible with planetary survival. The sustainability revolution therefore demands a cognitive redesign toward circularity, where materials circulate, energy

regenerates, and products are conceived with repair, reuse, and recovery in mind. In this new worldview, supply chains are not pipelines but **living systems**, requiring resilience, redundancy, ethical grounding, and ecological humility, lest the tragedy of the commons should overtake us.

The Efficiency Trap: When Supply Chains Collide with Sustainability

For four decades, global supply chains have worshipped at the altar of efficiency. Cost minimisation, speed maximisation, and lean inventories defined competitive advantage. Yet the climate-altered world is exposing the philosophical and operational fragility of this model. Global sourcing, once celebrated for reducing unit costs, now amplifies carbon emissions, lengthens ecological footprints, and deepens exposure to geopolitical disruptions. The Just-in-Time doctrine, designed to eliminate slack, collapses instantly when extreme weather events, pandemic shocks, or heat-induced factory shutdowns enter the equation. Sustainability Science exposes why this fragility is not but structural. A supply chain optimised for narrow economic metrics often violates ecological limits and social thresholds. When raw materials travel thousands of kilometres, emissions rise. When labour is squeezed for margins, equity erodes. When factories depend on single-source suppliers in climate-vulnerable geographies, resilience collapses. In other words, **efficiency focuses on “doing things right,” while sustainability demands asking “are we doing the right things?”**

The conflict deepens because linear supply chains externalise ecological costs. Fisheries collapse, forests shrink, water tables fall, carbon accumulates yet the price of the final product rarely reflects this planetary depletion. Humanity thus re-enacts the classic **Tragedy of the Commons**, where individual optimisation leads to collective ruin. What makes the challenge sharper is the rise of digital acceleration. AI-powered forecasting, blockchain tracking, and robotic warehousing make supply chains faster and smarter but not automatically sustainable. Technology solves for speed; sustainability solves for survival. The real paradox of the 21st century is this: **A supply chain may be world-class and yet be world-damaging.** Reconciling these two worlds requires a new design grammar built on resilience, circularity, climate-alignment, and ethical governance

Ethical sourcing adds another dimension to the tension: protecting human rights, ensuring dignified labour conditions, preserving biodiversity, and enabling carbon transparency all raise costs in the short term but are indispensable to long-term planetary stability. Similarly, the quest for speed in logistics increases fuel burn, accelerates packaging waste, and intensifies last-mile emissions. The cheapest transport modes marine bunker fuels, diesel trucking, and air freight become embedded carbon liabilities waiting to be priced into global markets through regulation or carbon border adjustments.

Against this backdrop, nuclear energy presents its own paradox. Nuclear supply chains demand precision manufacturing, rigorous certification, and deep regulatory oversight, making them slower and costlier than fossil fuel alternatives. Yet these “inefficiencies” are precisely what guarantee ultra-low lifecycle emissions, high energy density, and long-term climate resilience. Nuclear challenges the old economic logic: sustainability sometimes requires deliberate friction, engineered redundancy, and uncompromising quality. The world is discovering that efficiency, when untempered by resilience, can become fragility and that sustainability begins where naïve optimisation ends.

The Digital Turn: AI-Enabled Supply

In just a decade, global supply chains have migrated from clipboards and spreadsheets to **autonomous, data-rich, continuously-learning ecosystems**. Artificial intelligence, machine learning, IoT sensors, blockchain registries, and digital twins have not improved efficiency and have rewritten the grammar of logistics. Every node now emits data; every flow can be monitored; every disruption can be modelled before it happens. AI has become a powerful ally of sustainability. **Predictive demand forecasting** prevents overproduction, reducing landfill-bound surplus. **Route optimisation algorithms** cut fuel use and emissions in transportation, the dirtiest segment of most supply chains. **Energy-aware manufacturing** systems shift production to low-carbon hours or cleaner geographies, shrinking operational footprints. **Blockchain-based traceability** offers unprecedented assurance of ethical sourcing, anti-counterfeit protection, and auditable carbon trails. **Digital twins** allow entire factories, ports, or multi-country supply chains to be simulated for climate risk, resilience gaps, resource efficiency, and emissions hotspots. Yet, in this triumph of digital order over physical chaos lies a paradox. The AI that enables sustainable supply chains **consumes enormous energy itself**. Data centres already emit more carbon than the aviation industry. Semiconductor fabs, robotics systems, cloud platforms, and hyperscale AI models operate on a background hunger measured in gigawatts. As AI grows exponentially, so does its energy appetite. This creates an unavoidable truth: **A sustainable digital economy is impossible without sustainable energy.**

Fusion in the future, renewables at scale today, and especially next-generation **nuclear fission** emerge as indispensable pillars. AI can help green supply chains but only if the electrons feeding it are green

Energy as the Master Supply Chain

Every supply chain rests upon a deeper, more elemental one- the **energy supply chain**. It is the master chain that powers all others. Without energy, nothing moves, nothing is shaped, cooled, transported, encrypted, or computed. Every factory, port, warehouse, cloud server, and data centre is simply a dependent node in this foundational energy web.

Fossil Fuel Energy Chains: Coal, oil, and natural gas created

the modern industrial world but now destabilise it. Their supply chains are vast, globalised, and politically combustible. Emissions, methane leakage, refinery flaring, marine spills, and particulate pollution make them ecologically unaffordable. Geopolitical chokepoints—from the Strait of Hormuz to Arctic drilling corridors introduce layers of fragility that ripple across global commodity prices. Fossil energy chains are efficient machines that produce prosperity but also planetary risk.

Renewable Energy Chains: Solar, wind, hydro, geothermal, and bioenergy form the backbone of decarbonisation strategies, yet they come wrapped in their own supply dependencies. Renewable technologies rely intensely on copper, lithium, cobalt, nickel, rare earths, graphite, and large land footprints. Mining is concentrated in ecologically sensitive or politically unstable regions, creating what sustainability scholars call the green-material paradox. Moreover, intermittency demands massive storage infrastructure and smart grids each with its own supply chain vulnerabilities.

Nuclear Energy Chains: Nuclear energy stands apart. It delivers the lowest lifecycle emissions, occupies minimal land, and produces dense, continuous power—qualities no other low-carbon source simultaneously offers. Nuclear uniquely supports industrial heat, hydrogen production, desalination, district heating, medical isotopes, and 24/7 power for AI-driven digital infrastructure.

A 21st-century **nuclear renaissance** is underway globally, powered by:

- **Small Modular Reactors (SMRs)**
- **Gen-IV advanced reactors**
- **HALEU and closed fuel cycles**
- **Fast breeder and thorium pathways**
- **Sovereign pushes for energy security**

This renaissance is catalysing the emergence of a **new nuclear supply chain architecture**, one unlike any other high-precision, high-accountability, geopolitically sensitive, and strategically indispensable for a sustainable energy future.

Anatomy of the Nuclear Supply Chain

The nuclear supply chain is unlike any other in the energy universe precision-bound, regulation-dense, and geopolitically consequential. As the world confronts climate instability, digital hypergrowth, and the fragility of fossil fuel routes, nuclear energy is experiencing a profound resurgence. This renaissance is not driven merely by reactors or new fuels; it is driven by the rebuilding of an entire supply-chain architecture that spans mining pits to deep geological repositories.

At the **upstream** end lies the fuel cycle. Uranium exploration, mining, and milling anchor the chain, followed by conversion, enrichment, and fuel fabrication each step operating under strict quality assurance and international safeguards. Parallel pathways such as thorium-based cycles and HALEU (High-Assay Low-

Enriched Uranium) fabrication are emerging as critical enablers for Gen-IV reactors and SMRs. These upstream operations determine sovereign energy independence more than any pipeline or shipping lane ever could.

The **midstream** is a realm of engineering excellence: reactor pressure vessel forging, high-integrity welding, advanced control systems, neutron-resistant materials, and SMR modularisation. Few industries demand this level of metallurgical purity and fault-tolerant design. Heavy forgings, once the exclusive domain of a handful of global suppliers, are now seeing distributed growth as nations seek supply-chain resilience.

The **downstream** closes the loop: plant operation, predictive maintenance, refuelling, fuel storage, reprocessing, and long-term waste disposition. With modern reprocessing and advanced fast reactors, “waste” increasingly becomes future fuel, reducing environmental load and extending the resource horizon.

The nuclear supply chain matters today because it sits at the intersection of five strategic imperatives: **energy security, climate mitigation, industrial decarbonisation, digital infrastructure stability, and AI-era baseload demand**. As data centres, hydrogen hubs, and green manufacturing accelerate, the world’s ability to scale clean power depends not on ideological debates but on the robustness of this nuclear supply web. The nuclear renaissance, therefore, is not simply a technological revival. It is a **supply-chain revolution**.

N-Supply Chains: Safety, Security, and Sovereignty

Nuclear supply chains are governed by three cardinal imperative safety, security, and sovereignty each shaping the architecture of this uniquely demanding domain. Safety is non-negotiable; every bolt, weld, sensor, control rod, and algorithm must perform flawlessly under extreme thermal, mechanical, and radiological stress. Unlike other industries, a single counterfeit component or a lapse in quality culture can trigger cascading failures with global repercussions. This elevates traceability, metrology, and certification to existential requirements rather than procedural formality.

Security adds another layer of complexity. Nuclear materials must be shielded from diversion, sabotage, cyber manipulation, and insider threats. This necessitates hardened logistics corridors, real-time tracking of nuclear materials, encryption-heavy digital systems, and an institutional culture that balances scientific openness with strategic discretion. In the age of cyber-physical convergence, nuclear cybersecurity becomes as critical as physical containment.

The third dimension, sovereignty, is being rediscovered in a fractured geopolitical landscape. Nations increasingly recognise that energy independence is the bedrock of economic independence. This fuels the expansion of indigenous uranium processing, domestic fuel fabrication, localised SMR module manufacturing, and national regulatory competence. India, France, Russia, South Korea, and now the United States view

nuclear supply chains as strategic assets on par with defence aviation and semiconductor ecosystems. The emerging nuclear order is thus not merely technological but geopolitical: countries that command the nuclear supply chain command their energy future. In a warming and uncertain world, nuclear sovereignty becomes a pillar of national resilience and the supply chain becomes its quiet but decisive backbone.

Digital Nuclear: Intelligence, Integrity, and the New Risk Landscape

The digitalisation of nuclear energy marks one of the most profound transitions in the history of the sector. Artificial intelligence now predicts component fatigue years before it manifests, helping operators prevent failures in systems that cannot afford error. Digital twins replicate entire plants, simulating decades of performance, ageing, and climate scenarios. Blockchain replaces trust with cryptographic certainty, ensuring that no counterfeit bolt or sensor infiltrates reactor cores where tolerances are measured in microns. Robotics enters spaces humans cannot—fuel pools, hot cells, irradiated circuits bringing precision into the most unforgiving environments. Yet this digital leap introduces an equally formidable challenge: cybersecurity. Once isolated systems now sit within interconnected digital ecosystems, vulnerable to malicious code, ransomware, and state-level cyberwarfare. Nuclear infrastructure must therefore implement “zero trust architecture”, treating every digital interaction as suspect until verified. In this fusion of intelligence and integrity, nuclear supply chains evolve from metal and material networks into cyber-physical organisms. Digitalisation strengthens resilience, boosts efficiency, and enhances transparency, but also expands the attack surface. The future nuclear plant is thus part laboratory, part fortress, part brain—an interplay of electrons, algorithms, and engineered restraint.

Circularity in Energy Supply Chains: From Waste Burden to Resource Logic

The sustainability revolution is pushing energy systems toward circularity, where materials circulate in loops rather than fall into landfills or oceans. Nuclear energy, often misunderstood, quietly excels in circular design. Reprocessing extracts unused plutonium and uranium from spent fuel, enabling second and third life cycles. Fast breeder reactors go further, generating more fissile material than they consume—an alchemy of energy renewal unmatched in any other sector. Nuclear waste volumes, though politically amplified, are minuscule compared to the mountains of ash, sludge, CO₂, and toxic particulates generated daily by fossil fuels. Renewables too promise circularity—solar panel recycling, wind blade reuse, battery metal reclamation—but remain constrained by cost, technology gaps, and inconsistent global regulation. Circular supply chains require industrial discipline: traceability, chemical recovery, partnerships between manufacturers and recyclers, and clear regulatory pathways. Yet the global economy still

operates on the linear logic of “take–make–discard”. Transitioning to circularity means redesigning products for disassembly, engineering materials for longevity, and mandating producer responsibility beyond the point of sale. In this landscape, nuclear energy stands paradoxically as both conservative and futuristic—conservative in its caution, futuristic in its resource regeneration. Circular supply chains redefine sustainability not as sacrifice, but as intelligent stewardship.

India's Energy Trilemma and the N-Pivot

India stands at the intersection of three grand imperatives: energy security, economic growth, and climate responsibility. No other large country faces an equivalent developmental scale—urbanisation, manufacturing expansion, agricultural transformation, and the digital boom all demand firm, affordable, continuous power. While renewables rightly dominate expansion strategies, their intermittency and land footprints limit their ability to power steel mills, data centres, rail corridors, fertilizer plants, and megacities. This is where India's nuclear trajectory becomes central to supply chain transformation. Indigenous PHWRs form the backbone; fast breeder reactors expand resource efficiency; thorium-based research unlocks India's unique geological endowment; and small modular reactors promise flexible, factory-built, deployable power across industrial corridors and remote geographies. Nuclear supply chains fuel preparation, heavy forgings, control systems, SMR module fabrication—will become strategic industrial clusters in themselves. India's energy transition is therefore not merely a question of technology choice, but of supply-chain sovereignty. The energy trilemma pushes India toward a hybrid system: renewables + nuclear + storage + hydrogen. In this geometry, nuclear is not a competitor to renewables but the anchor that allows them to flourish. India's nuclear renaissance represents not a return to old ideas, but the emergence of a new energy diplomacy scientific, sovereign, and future-ready.

The Responsibility Renaissance: Reimagining Supply Chains for a Finite Planet

Sustainability and supply chains emerge from fundamentally different philosophies. Supply chains grew out of industrial logic scale, speed, throughput. Sustainability arose from ecological logic limits, balance, justice. The challenge of the 21st century is to merge these logics without compromising either. Redesigning supply chains for sustainability means embedding carbon transparency across supplier tiers, relocating critical material sourcing closer to home, enforcing circular material flows, and governing optimisation algorithms with human ethics. A resilient energy backbone—renewables supported by nuclear and storage forms the infrastructural soil for these transformations. Equally crucial is community integration: no supply chain is sustainable if the people around it are excluded or harmed. Regulatory synchronisation is the final pillar harmonised global

standards for nuclear components, renewable materials, labour norms, carbon reporting, and waste management. Ultimately, sustainability is not a checklist but a civilisation strategy. Supply chains are where that strategy becomes tangible. The nuclear renaissance provides an opportunity perhaps our last to rebuild energy systems compatible with climate realities. But technology alone will not save us; only responsible design, culturally grounded science communication, and institutional courage will. The decade ahead is thus not only an energy transition, but a responsibility renaissance an ethical upgrade for civilisation.

We often speak of the coming decades as an era of energy transition or digital transformation. But underneath those technological labels lies a deeper and more uncomfortable truth: what the world really needs is a responsibility renaissance. It is not enough to deploy solar parks, SMRs, AI tools, and advanced logistics platforms if they are built on narrow optimisation and short-term thinking. The central challenge of our time is to embed moral intelligence into technical intelligence, so that our systems are not just powerful, but prudent.

Supply chains make this challenge tangible. A supply chain is never only a flow of goods; it is a flow of consequences. Every sourcing decision affects a landscape, a community, a river, an atmosphere. Every energy choice writes itself into the climate system. Nuclear energy, in this context, is a demanding teacher. It forces us to confront questions of risk, stewardship, long-term waste, safety culture, and intergenerational equity. Done badly, it can be catastrophic; done well, it can be one of the most responsible ways to power civilisation in a climate-constrained world. That duality is precisely why it belongs at the centre of a moral conversation, not just a technical one.

A responsibility renaissance means regulators willing to say no when needed, companies willing to accept constraints for long-term stability, scientists and science communicators willing to engage honestly with public fears and hopes, and citizens willing to think beyond the next tariff or gadget. It means accepting that sustainability is not a corporate department or a reporting template, but a civilisational strategy. In that strategy, nuclear supply chains, digital systems, and global logistics become test cases of our ethical maturity. The question is no longer whether we can build such systems. The question is whether we can deserve them.

The Sustainability-Supply Chain-Nuclear Triangle

The future of a liveable planet will be determined at the intersection of three massive forces: how we redesign supply chains, how we deploy digital intelligence, and how we choose our energy backbone. This is the Sustainability-Supply Chain-Nuclear Triangle. Each side on its own is powerful; together they define whether humanity stabilises within planetary boundaries or overshoots them irreversibly.

On one side lies supply chain redesign. For over a

century, logistics and value chains have been optimised for cost and speed, not for ecological compatibility. A sustainable future demands a deeper grammar: circular material flows, carbon transparency across tiers, fair labour conditions, regional resilience, and the courage to carry buffers instead of worshipping just-in-time fragility. On the second side stands digital intelligence. Artificial intelligence, blockchain, robotics, and digital twins can map emissions, trace materials, flag fraud, and optimise resource use across complex networks. But digital systems are amplifiers: they can amplify wisdom—or amplify damage depending on the values embedded in their objectives.

The third side of the triangle is the nuclear renaissance. Nuclear power offers reliable, low-carbon, high-density energy capable of supporting 24/7 industrial activity, data centres, green hydrogen production, and resilient grid backbones that enable large-scale renewable integration. Without a stable, clean energy base, sustainable supply chains and digital optimisation will remain intellectually elegant but physically constrained. When these three forces are aligned when supply chains are re-architected for stewardship, when AI and digital tools are governed ethically, and when nuclear energy provides a firm low-carbon foundation humanity has a credible pathway out of ecological overshoot. The triangle is not a metaphor; it is a design space in which our collective future is being negotiated.

Beyond Cost and Toward Value

Albert Einstein once reminded us that “Concern for man himself and his fate must always form the chief interest of all technical endeavours.” In those few words lies the ethical compass for every engineer, manager, policymaker, and scientist shaping the supply chains of tomorrow. Technology without humanity is machinery; technology guided by humanity is civilisation. And yet, as Homi Jehangir Bhabha cautioned with equal clarity, “No power is costlier than no power.” The phrase echoes far beyond nuclear energy. It speaks to the hidden arithmetic of progress: the price we pay for inaction, for delay, for fear, for fractured vision. In the sustainability equation of the new supply-chain avatar, **cost** is what we spend, **price** is what we charge, but **value** is what we choose to stand for. Cost is measured in rupees; value is measured in futures. Price fluctuates with markets; value endures across generations. The emerging nuclear supply-chain renaissance precise, ethical, sovereign, and climate-aligned forces us to rethink this triad not as accounting categories but as philosophical commitments.

In the end, sustainability is not about saving resources; it is about saving meaning. The supply chains we build today will decide not only how we live but whether we deserve the planet we inhabit.

*Nuclear Scientist and Scientwist Columnist, A former Charman IIMM Mumbai Branch. He had a stint as Technical Adviser, Directorate of Purchase and Stores, Department of Atomic Energy.

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INDIA: FOCUS ON BLUE ECONOMY AND AI FOR SUSTAINABLE GROWTH

India is actively pursuing strategic initiatives that reflect its vision for sustainable growth and technological advancement, with recent government measures highlighting both the potential of its natural resources and the transformative possibilities of artificial intelligence.

The focus on the blue economy is being recognised as a new engine of growth, emphasising the sustainable harnessing of ocean resources to support fisheries, maritime trade, coastal tourism and allied industries. These efforts also include strengthening research collaborations, promoting innovative maritime technologies and enhancing the livelihoods of coastal communities across the nation. This initiative aims not only to generate employment and enhance exports but also to strengthen India's position in global maritime affairs.

The government is committed to ensuring that the development of the blue economy is balanced with ecological preservation, supporting marine research, infrastructure development and port-led industrial expansion to create long-term economic and environmental benefits. By encouraging public-private partnerships and fostering capacity-building programs for young marine scientists, India is ensuring comprehensive and inclusive growth in its ocean economy.

By integrating sustainable practices into these initiatives, India seeks to maximise the potential of its oceans while safeguarding biodiversity and natural habitats, demonstrating a forward-looking approach that aligns economic growth with environmental stewardship. These measures are expected to contribute significantly to national prosperity, providing new opportunities for communities along the coast and enhancing India's role as a global maritime leader.

In parallel, the India International Science Festival 2025 showcased the country's focus on artificial intelligence and its potential to shape a technologically advanced, inclusive and resilient India. Industry leaders and policymakers at the festival lauded the government's vision for an AI-driven "Viksit Bharat" and explored the opportunities presented by both artificial intelligence and artificial general intelligence to transform key sectors of the economy. Discussions highlighted the practical applications of AI in healthcare, agriculture, education, governance and other areas, emphasising the importance of innovation, productivity and ethical adoption.

Participants also stressed the need for collaborative innovation ecosystems, advanced AI research labs, skilled workforce development and targeted funding to accelerate technological breakthroughs across India to drive inclusive and sustainable development. The festival provided a platform for scientists, entrepreneurs and policymakers to engage with emerging technologies, exchange ideas and explore collaboration opportunities that can enhance national competitiveness.

A strong emphasis was placed on workforce readiness, infrastructure development and regulatory frameworks to ensure that AI technologies are adopted responsibly, equitably and safely, while contributing to inclusive growth. By prioritising AI research, innovation and practical applications, India is positioning itself as a global leader in technology, ensuring that its population benefits from digital transformation while maintaining ethical and societal safeguards.

Such initiatives reflect India's holistic approach to sustainable growth and technological advancement. Through visionary policy-making, strategic investment and active engagement with both scientific and maritime communities, India is fostering a future-ready economy.

The focus on the blue economy demonstrates a commitment to leveraging natural resources responsibly for economic and social benefits, while the emphasis on AI and technological innovation underscores the country's determination to remain at the forefront of global developments.

By simultaneously advancing environmental stewardship and embracing cutting-edge technology, India is creating a foundation for resilient, inclusive and forward-looking growth that benefits its citizens and strengthens its global position.

These efforts highlight the government's strategic vision to integrate resource-based development with technological leadership, ensuring that India's future is both economically prosperous and technologically advanced, while remaining sustainable and socially inclusive. These integrated strategies signify India's proactive approach to addressing global challenges while unlocking new opportunities for sustainable economic growth, technological advancement and innovation, demonstrating the government's commitment to a future-ready India.

Source: pengovasia.com

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REPORT ON NATCOM 2025

NATIONAL CONVENTION OF THE INDIAN INSTITUTE OF MATERIALS MANAGEMENT (IIMM)

The Indian Institute of Materials Management (IIMM) successfully organized its flagship annual event, NATCOM 2025 – National Convention, on 29th and 30th November 2025 at Ahmedabad. The convention was conducted with exceptional enthusiasm, discipline, and professionalism, reaffirming IIMM's commitment to advancing excellence in materials management, procurement, and supply chain leadership.

Theme of the Convention : "Sustainable Supply Chains: A Pathway to Net Zero Carbon Footprint"

The theme resonated strongly with the current global focus on sustainability, responsible sourcing, decarbonization, ESG integration, and climate-conscious supply chain practices.

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Theme of the Convention

"Sustainable Supply Chains: A Pathway to Net Zero Carbon Footprint"

The theme resonated strongly with the current global focus on sustainability, responsible sourcing, decarbonization, ESG integration, and climate-conscious supply chain practices. NATCOM 2025 provided a powerful national platform to deliberate on aligning procurement and supply chain strategies with India's and global Net Zero objectives.

Pre-Event Initiatives : As a meaningful step toward environmental stewardship, a Pre-Event Plantation Drive was organized by IIMM Ahmedabad Branch, during which 1,000 saplings were planted. This initiative symbolized IIMM's commitment to sustainability and reinforced the spirit of the convention's theme through tangible environmental action.

In addition, a Press Conference was held on the

eve of NATCOM 2025, where dignitaries and office bearers highlighted the importance of sustainable supply chains in alignment with the Hon'ble Prime Minister Shri Narendra Modi Ji's vision on sustainability and the National Logistics Policy. The interaction effectively conveyed the relevance of NATCOM 2025 to national development priorities and climate goals.

Participation and Reach

NATCOM 2025 was attended by 300+ professionals, including procurement leaders, supply chain managers, warehouse heads, project purchasers, and stores in-charges, representing a wide spectrum of industries. The convention witnessed participation from industry, government bodies, PSUs, academia, MSMEs, and young professionals from across the country.

The presence of eminent speakers and dignitaries enriched the deliberations and provided deep insights into policy direction, industry expectations, digital transformation, sustainability frameworks, and future-ready supply chain models.

Day 1 Highlights – 29th November 2025

The inaugural session commenced with a dignified opening and set the tone for two days of impactful deliberations.

Chief Guest: Dr. Sanjay Gupta

Welcome Address: Mr. Awadhesh Yadav

About IIMM: Mr. Pankaj Panchbhai, Vice President (West), IIMM

Presidential Address: Mr. Lalit Raj Meena, President, IIMM

Keynote and Technical Addresses

Keynote Address by Dr. Sanjay Gupta on Sustainable Supply Chain Transformation

Mr. Prem Narayan spoke on Sustainable Supply Chains – Government and PSU Perspectives

Dr. Sanjay Sanghai sensitized the gathering on Driving Global Decarbonisation: Net Zero

Strategies for the Automotive Supply Chain

Panel Discussion : A highly engaging Panel Discussion on IIMM Education Enhancement was conducted with participation from:

Mr. Deodhar, Mr. Harsha, Mr. Sandeep Tare, Mr. Sanjay Kale, Mr. Animesh Chatterjee, Dr. Jayanta Chakraborty, and Ms. Meenal Goswamy.

Institutional Milestones : National IIMM Annual General Meeting (AGM) conducted

Crowning Ceremony of Incoming National President Mr. P. M. Bidappa

206th NEC Meeting held

IIMM National Awards distribution ceremony

Special Address

Dr. Gnan Vatsalji delivered an inspiring talk on “The Art of Spiritual Leadership”.

A handmade Mandala art memento, created by Ms. Vaishali Bhatt, was presented to Swamiji as a token of reverence.

TAMRAPATRA Awards – Day 1

National Level Contribution: Mr. Lalbhai Patel, Mr. Lalit Raj Meena, Mr. V. K. Jain, Mr. Rakesh Kumar Rastogi, Mr. P. M. Bidappa, Mr. Malay Majumdar

Ahmedabad Branch Contribution: Ms. Binal Darji, Mr. D. K. Goswamy, Mr. Sudhir Shah, Mr. Anil Patil, Mr. Pankaj Panchbhai

Day 2 Highlights – 30th November 2025

Chief Guest: Mr. Vikas Chandra Naik (NSIC)

Presidential Address: Mr. P. M. Bidappa, National President, IIMM

Technical Sessions & Discussions

Technical Session by Dr. Jayanta Chakraborty

Panel Discussion on Sustainable Supply Chain Implementation Practices in Cement, Chemical, Automobile, Fabrication, Oil & Gas industries

Panelists: Mr. Bala Iyer, Mr. Malay Majumdar, Mr. S. K. Saxena, Mr. S. K. Sharma, Mr. V. K. Jain, Mr. Shripad Kadam

CRIMM Activities Overview by Dr. Prof. G. Sengupta and Dr. Prof. Suresh Sharma

Interactive Workshop: “Wheel of Life – Mirror 2025: Reflect & Realize” by Mr. Payank Patel

Global Scenario Session on Sustainable Supply

Chains by Mr. Milan Vyas

Nari Shakti Program : A special Nari Shakti Session was conducted by Ms. Priya Mogra and Dr. Bharti Trivedi, highlighting women leadership and empowerment in procurement and supply chain management.

Awards, Recognitions & Valedictory

All IIMM Branches were felicitated with Beautiful Moments Awards by the Ahmedabad Branch

Delegates and Sponsors were honored with commemorative mementos

A Special Memento was awarded to IIMM Ahmedabad Branch for successfully organizing NATCOM 2025

Flag Handover Ceremony: NATCOM 2026 flag handed over to Dr. Y. Ramana, Chairman, Nagpur Branch

Messages Received

Hon’ble Chief Minister of Gujarat, Shri Bhupendrabhai Patel, conveyed his best wishes for the successful conduct of NATCOM 2025

Shri Arjun Modhwadia, Cabinet Minister, Government of Gujarat (Forest, Environment, Climate Change, Science & Technology), sent a special message appreciating the initiative

Carbon Footprint Initiative : In alignment with its theme, NATCOM 2025 consciously promoted environmental responsibility, emphasizing sustainable event practices and awareness on carbon footprint measurement and reduction, reinforcing IIMM’s leadership role in sustainability and responsible supply chain practices.

Conclusion : NATCOM 2025 concluded on a resounding high note, leaving participants with actionable insights, renewed professional purpose, and a shared commitment toward sustainable, resilient, and future-ready supply chains. The convention once again established NATCOM as a premier national thought-leadership platform in materials management and supply chain excellence.

The Indian Institute of Materials Management (IIMM) extends its sincere gratitude to all dignitaries, speakers, delegates, sponsors, organizing committee members, volunteers, and the Ahmedabad Host Branch for their unwavering support in making NATCOM 2025 a grand success.

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NATCOM 2025

Theme - Sustainable Supply Chains: A Pathway to Net Zero Carbon Footprint
29th and 30th November 2025 at Ahmedabad



NATCOM 2025

Theme - Sustainable Supply Chains: A Pathway to Net Zero Carbon Footprint
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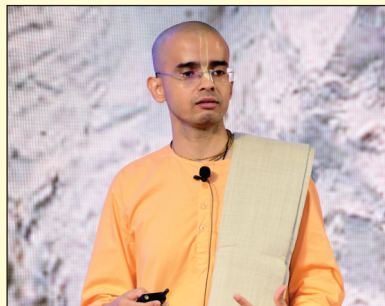
DISHA 2025

Theme - Navigating the Future State of Supply Chain

10th & 11th December 2025

at Hotel Westin, Mumbai





REPORT ON DISHA 2025

MUMBAI BRANCH

Nineteenth edition of Disha - annual signature seminar of IIMM, Mumbai was held on 10th & 11th December 2025 at Hotel Westin, Mumbai, with theme being '**Navigating the Future State of Supply Chain**' with the subthemes - **Innovation AI Powered, Growth Enablement, Manufacturing Excellence, Transformative Value**'.

Technical Sessions on Day 1 - 10/12/25

After having sumptuous breakfast, participants walked into conference hall filled with immersive and relaxing atmosphere created by haunting **Santoor Swar**. The short **santoor recital by Mr Suryakant Mishra** ended with Melodious **Kirwani Raag**.

Day 1 started with singing of National anthem 'Jana Gana Mana' followed by lamp lighting at the hands of **IIMM NP P M Bidappa, Keynote speaker Mr Vijay Kasi, Partner Kearney India**, IIMM Mumbai Chairman **Swapnil Dubey**, Past Mumbai branch Chairmen **Satish Palekar, M H Varma, N D Sadri, Surendra Deodhar, Ashok Mhatre**. Ganesha blessings were then sought **Ganesh Vandana** sung by Mrs Shraddha Dubey (wife of Swapnil Dubey).

In his welcome address, **Swapnil Dubey** shared some highlights of Mumbai Branch programs while also urging for IIMM member ship by announcing special Disha discount for life membership. While narrating some curated industry examples, **Mr Animesh Shah**, Disha 25 convenor, spoke on theme for DISHA 25. Followed by **Past NP, Mr Bala Iyer**, who in his brief address, emphasised universality of Disha 25 theme, by citing some latest research. **NP Mr Bidappa** then gave an over view of IIMM and its recent activities. He also exhorted participants for becoming IIMM Members.

While delivering his chief guest address, **Mr B Narayan, Group President - Projects and Procurement, Reliance Industries Ltd** then highlighted unique concepts like 'Outcome based challenges' or 'Data as a currency'. In his ingenious speech he emphasised on key elements for Supply chain professions strategies like Agility, Accuracy, AI, compliance, Digitisation, efficiency, and Quality etc.

Vijay Kasi in his keynote address outlined 2026 business agenda with some of top priorities being end to end higher Margins, Innovations etc. to deal with Global Poly crisis. He elaborated on how Purpose lead procurement organisation of Coca-Cola evolved its unique bottle design He also explained how AI agents would automate most tasks leading to fluid, cross functional organisation structures and change in skill set requirements.

Mr. Ashwani Narang, Partner, Chief Growth Officer - Technology & Transformation- Deloitte gave some insights on Use of Technology in Supply Chain.

Swapnil Dubey along with Ms Hemal Mahesh then shared about 'Nari Shakti' initiative of IIMM, persuading lady participants in the seminar to join the group and support the initiative.

Next session was by **Mr. Shibu Manuel, Executive Director, Chief- MCoDP Cell & PMC, ONGC** on Procurement Transformation. He shared ONGC experience, explaining how rules-based categorisation led to centralisation and consolidation of most requirements leading to reduction in time frames as well as overall manpower.

Mr. Amit Varma, Sr. VP, Digital Transformation for Procurement & Supply Chain, RIL then expounded on how Procurement BOTs and AI agents are transforming procurement at Reliance.

Mr Vasant Mugada, Vice President – Consulting of GEP consulting then gave insights into AI & Agentic AI for procurement. Elaborating on what is agentic AI, Mr Mugada explained how companies could start using agentic AI to deliver value.

Mr. Ankit Varshneya, Senior Director, SAP enlightened further on AI for Procurement and its benefits, He presented capabilities of AI, Generative AI, Semantic Alto copilot and also showed how Agentic AI reduced errors in bid process and helps compare bids across all bid data at click of button. Also explained how AI can be trained on different data points to make comparison more wider and deeper.

After lunch on Day 1, it was time for panel discussion on Disha 25 Theme- Navigating the Future State of Supply Chains Innovation, A.I Powered, Growth Enablement, Manufacturing Excellence, Transformative Value. With **Swapnil Dubey as a moderator, other panellists**, having experience across diverse sectors and roles, were **Mr. Karthi Kumar Balan, Sr. Vice President (Procurement Centre of Excellence, UltraTech Cement Limited; Mr. Umesh Malik, Head, P&C Academy, RIL; Mr. Murtaza**

Kothari, Vice President and Group Head - Indirect Procurement, M & M Ltd. And Mr. Vishal Mehrotra, Head IT Procurement, TCS. Some of the issues discussed were quality focus though onsite quality checks etc, skill sets required for AI use, Prompt engineering, Innovations in developing sustainable alternative materials like for limestone, Emissions reduction, use of renewable energy thru' practical use cases. Swapnil Dubey led the discussions adroitly to keep it lively.

Next session was conducted by **Mr. TV Karunanidhi, Chief General Manager (CGM) SCO, BPCL** to present on Supply Chain Optimization. He shared case study from BPCL with good amount of data & information on oil industry supply chain.

Post tea, **Mr. Surya Valluri, President, Sustainability Cell, Grasim Industries Ltd** made a succinct presentation on Supply chain sustainability: Compliance, Challenges, and areas of focus. Mr Valluri highlighted how external pressures on sustainability is enforcing certain compliances like BRSR) reporting (Business Responsibility and Sustainability Reporting, Embedding ESG in supply contracts, Sustainability discourses under IFRS S1 and S2(International Financial Reporting Standards) with emerging narratives being circular economy, Supplier Engagements and Agreements, Human Risks, Resource Efficiencies etc.

Finally, **Ms. Aashish Kasad, Partner, National Leader-Chemical and Agriculture sector, India, EY** did compact presentation on Indian Tax Reforms which would support growth.

Brilliant anchoring by inimitable Surendra & equally eloquent Animesh, ensured seamless flow of sessions. In addition, lucky draws, opinion polls on event expectations of participants, Quiz competition by Mr. Sushanta Roy, made the day exciting and lively.

Technical Sessions on Day 2 - 11/12/25

Day 2 began with '**How Spirituality can help reduce Mental Stress**' by motivational speaker **Swami Rasik Raman Das** from ISKCON. Swamiji kept the participants transfixed for next 1 hour with his spiritual discourse on conquering stress. Few of his unique gems of wisdom were, Finger Deep, Selfie Deep, Smiley Deep, Screen Deep. Similarly, He urged everyone to have ICE Factory in Head, Sugar Factory in Tongue, Love factory in Heart to keep stress at bay. His parting advice was 'Life is in the transition. Mastering change in Non-Linear Age is important'

Next topic was '**Value Creation through Power Cost Reduction**' by **Satish Palekar, IC Head - L&T Energy - Carbon Lite Solutions**. Using brilliantly made slides, Mr Palekar explained all aspects of Power Industry like Government approvals, Localisation thrust, Importance of Scale, 10-20% Transmission Losses, 20-30% AT & C losses (Aggregate transmission, and commercial losses), Billing and Collection Efficiency @80%. Ultimately lower losses meant lower power generation and hence lower

costs and emissions too.

Before Tea, **Mr. Krishnan Venkatasubramanian of KPMG** expounded on **Tariff and Geopolitical issues- How to manage the risk**.

After tea **Mr. Harsh Mallya, Senior Vice President P&C, RIL** presented on **Nuances of Service Procurement – Creating Value for Company Business**. Some of the challenges in contract management as per Mr Mallya are cost & schedule overruns, Disputes over scope of contract, Lack of Transparency across supply chain, Complexities in work certifications, Legal Gaps etc.

Then it was time for fire side chat of **Mr. Ranjan Sinha, Chief Procurement Officer, Tata Steel** with **Bala Iyer on Navigating the Future State of Procurement**. Mr Iyer artfully led the chat to cover most points on the topic and to make Mr Sinha forthcoming. Right from volume (@15 billion USD) & variety of procurement, Procurement strategy, vendor management, Quality focus through process improvements, Predictive analytics use, Skills for future, Sustainability etc. Some of the unique take aways were Diversity in work force to cover in addition to 25%women, LGBT community as well as especially abled people; Responsible supplier policy (RSP) to cover scope 3 emissions; Overseas Cultural exchanges like use of round tables in all meetings to convey equality.

Last Technical session was by **Mr. Saurabh Jain. Sr. AVP and Head Procurement**, who made a compact but comprehensive presentation on **Future of Supply Chain**.

Such megaevent calls for astute anchoring. **Surendra Deodhar** did it brilliantly in his inimitable and eloquent style, with able support from Animesh Shah.

Finally, there were 2 lucky draws with prizes galore. First Lucky draw was for the participants who could manage to visit exhibition booths, with lucky delegates winning cash prizes. Second lucky draw was open to all registered participants with 3 lucky participants awards. Quiz competitions based on the event sessions was conducted by **Mr Sushant Roy, Nipun Jain** on both days which kept participants engaged and event lively. Top 3 scorers were awarded. The event concluded after formal vote of thanks by vice chairman **Mr Veer Sidwani**.

This episode, which was extremely well received by a packed hall of delegates and attendees and this was made possible by tireless efforts of Disha committee team along with the EC, NC and Office bearers for weeks before & during the event, shaped under guidance & motivation provided by Disha 25 Convenor Animesh Shah, Past National President Bala Iyer, and Branch Chairman Swapnil Dubey.

Feedback from the event is extremely encouraging and the delegates also shared some ideas for future events.

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SUSTAINABILITY AND EFFICIENCY OF DARK STORES IN SUPPLY CHAIN MANAGEMENT

PALLIKKARA VISWANATHAN LIFE MEMBER IIMM HOSUR BRANCH
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Supply chain management is to optimize delivery routes, due to the potentialities, to reduce transportation cost, mainly confined to distance, wastage, efficiently managing inventory levels, faster delivery on order fulfilment, especially to customers located nearby, as Dark stores are open to in public on designated area to operate like warehouse on a sustainable concepts to boost efficiency in supply chain management.

Reducing transportation cost on distances, on orders placed on Dark Stores in a densely populated areas, distance covered are considered to be shortened, efficient operation, less energy consumption, packaging costs, within the facility, associated with carbon emission, last mile delivery, improved inventory management, with the use of latest technology on automation, is liable to increase selling on sustainability to increase efficiency in supply chain.

Public are not accessed, also not open to everyone, as Dark Stores they are designed to operate more on-line within the operation of a warehouse, or as stores, order fulfilment, manpower allotted to pick, pack, items from the stock available in warehouse, prepare the necessary documents, then liable to ship the items to the collection centre, or to the customer on a sustainable requirement to bring in efficiency in supply chain management.

Increase in selling density on the basic requirement are of the Dark stores, by reducing the aisle space, thus increasing storage facilities, on improving the capacity, can place Dark stores in a densely populated areas, minimizing fuel consumption, associated with carbon emission, on last-mile delivery, thus improving inventory management, with advanced tracking system sustainability, efficiency, in supply chain.

An on-line order in Dark stores enables fulfilment of physical distribution, of orders, that may or may not let customer's enter but that none the less, enhance many aspects of the retail experience, from delivery on conventional to pick-up, packing, on the type of product which, on which Dark stores require better space to

accommodate in huge quantities on sustainability, gaining efficiency, towards activates in supply chain.

In order to enhance delivery customer experience in Dark stores is equipped with automation technology, robotics, in handling order, as there are not likely to be any delayed in time, to prepare shipping orders, as the delivery is confined to customer's nearby on the same day, to the customer's, setting aside of fulfilling order-on-line, which allows customer's choose the preference on the pick-up items, so as to speed up the efficiency, sustainability in supply chain.

Minimizing operation cost, inventory holdings, Dark stores can also ensure speed, accuracy on a real-time of sorting, picking, so as to bring in enhancement on inventory management efficiency, thus reducing errors through proper order fulfilment of efficiency, sustainability in supply chain management.

Retailers are to be equipped of being agile, flexible in order to adapt to the needs of the customer's, market conditions, seasonal fluctuations, with Dark stores having constraints on physical stores, with necessary updates of products, offering more options to manage better efficiency on inventory on-line having sustainability in supply chain.

Changing customers' preferences on the rapid commerce Dark stores are basically retailer's on-line, responses of the requirements of selling to customers, on prompt delivery, with the additional responsibility on distribution adopted system, seamlessly integrating on click-and-collect principles on the norms of customers orders having emerged as a best sustainability solution, with efficiency, on the logistic last-mile in supply chain.

Prioritising sourcing on a sustainable conditions, whose eco-friendly material practice, ethical labour standards, minimizing environmental impact on products, energy efficiency, implementing energy saving measurement, in Dark stores, like LED lighting, thermostats controls, optimising refrigeration, systems is to reduce energy consumption, bringing operational efficiency in supply chain.

Practices of circular economy in Dark stores on a sustainable conditions, implementing initiatives like reversal logistics, programs to reuse, recycle, refurbish materials from products, materials, on engagement of educated manpower, about sustainable practices, encouraging responsible behaviour on the utilisation of manpower, so as to encourage them to participate in the efficiency of green revolution in supply chain.

Inventory management in Dark stores focus on the rapid

turnover, also on the precise stock levels, efficient order picking, to meet the on-line demand, on sustainable conditions, prioritising traditional retail stores, on maintaining displays, browsing by customer on the experiences based efficiency in supply chain.

Rotation of stock position in Dark stores, has the sustainability to improve the stock keeping unit, enhancing through the system, good-to-system on the purpose of the use modern digitalisation technology, where items are bought closely to pickers through the use of automations, rather than pickers walking through the aisle, with augmented, virtual reality, to pick-up, thus speeding up the fulfilment during the peak periods, thus enabling to manage, the efficiency of large scale inventory, packing, shipping process in supply chain.

On line Dark stores handling does play a pivotal role on distribution centres, on a sustainable conditions, as the centre of distribution does become accessible to customers, on reduced operational costs, flexibility in operation, environmental trends, improved customer service, enhancing brand loyalty, on a scalable support, by offering optimal convenience through efficient delivery, pick-up options, with extensive product selection facilitating warehouse management service in supply chain.

The necessity for consumers to buy on-line during emergency requirement, as Dark stores are situated at convenient locations, as Quick Commerce brands have many benefits on a sustainable conditions of getting products to the requirement of customers as Dark stores have become game changer (experience on real changes) as this is considered important, efficient in supply chain.

Retailers in supply chain are allowed a strategic profitable solution to Dark stores, in order to ensure long-term sustainability, as this becomes possible, to essentially to provide the required customers, multiple delivery, pick-up options, in enhancing customer's conveniences, thus reducing delivery costs, among the retailers, also on gaining profitability, popularity among the home delivery, on collaborating with third party logistics provider to handle fulfilment in shipping, on on-line orders, being efficient in supply chain.

Order fulfilment in Dark stores, is necessary to be streamlined efficiently on sustainable conditions, on order placement, suitably designed for on-line shipping, as customers can place orders on on-line platform, on automated picking process systems adopted, in order to pick product from the designated storage place, to be organised with optimal efficiency, once picked to be arranged to a central area of packing, secure on products, ready for delivery, put on quality control, before leaving for final check, performed with accuracy, efficiency, completeness for last mile delivery, depending upon the model on same day, next day delivery, on a scheduled tracking on receiving update of delivery on the website or app in supply chain.

Cost of transportation in movement of goods in Dark stores, are sometimes higher, may be due to longer routes, home-delivery, route mapping, as the need for click-and-collect orders from warehouse, stores, operation also needs additional handling, better efficiency, as these costs are set to be high, as they are

likely to be offset on reduction in costs in picking, lead-time, required to fulfil sustainable orders, also the increase may be in many cases making same day delivery, pickup, as each Dark stores creates an increased fixed operating overhead costs impossible, also difficult in supply chain.

Stock keeping units data in Dark stores does identify each individual unit, thus enabling to track the inventory holding, as retailer codes does contain essential details of such of the products, on the type, size, brand, quantity, so as to easily distinguish from one to another product, as the sustainability on the digitalised activities transforms on the quantity of stock stored, available, efficiency, as they move through the activities of supply chain.

Uses of technology in Dark stores on sustainable conditions, (environmental social conditions) have become increasingly useful among retailers on the use of robotics, artificial intelligence, machine learning, analysing the relevant data thus optimising inventory management, on picking, packing, transportation, efficiency, on faster accurate orders, with minimal usage of human errors, improving demand forecasting, reducing risk on excess inventory, stock-outs, also on route optimisation, on delays, ensuring overall efficiency, that goods are delivered in supply chain.

Technology automation has confirmed the specially designed efficient order handling, on a short processing time, efficiency, on sustainable items, that are to be picked, packed, handed over to the shippers for onward delivery in Dark stores, in matters of minutes, thus streamlining work flow, significantly reducing delivery time, thus fulfilling on-line orders, allowing customers the flexibility, to choose the pick-up time, avoiding waiting time, expediting check-out process, on a seamless efficient on-line shipment in supply chain.

Omni-channel Dark stores are being considered as one of the best solutions in e-commerce, on the optimisation of orders, processing, preparation, inventory, also on the efficiency of handling, managing proper delivery, on the sustainable conditions prevailing on the most complex stages of distributions, as they respond efficiently to any increase on the on-line orders, in supply chain.

Sustainable options in the operation of procurement in Dark stores on the placed orders, also has the potential to reduce transportation costs, optimize inventory management, minimize packaging cost, preference to waste management, by focussing on fulfilment on high demand areas, thereby lowering carbon emission, with proper delivery conditions on loyalty, on implementation of strategic conditions, having considered efficiency as important in supply chain.

Network implementation in Dark stores, becomes liable to expand beyond the limitation, as it becomes highly beneficial on the idea of automations, digitalisation, internet of things, with automated storage facilities, on a retrieval adopted systems, on guiding driverless forklifts, with material handling being adopted on sustainable (conditions) systems, bringing efficiency in supply chain.

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TRYST WITH AI IN AUTOMOBILE INDUSTRY FOR SUSTAINABLE GROWTH

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Every company in India is vying with each other to embrace new technologies so as to remain competitive. Escalating buoyancy, bringing down costs, and improving quality of their planning and products are just a few of them. Advancement in Information Technologies and introduction of Artificial Intelligence has given leeway for making decisions on the basis of automated and data-driven methods rather than on assumptions and intuitions. Auto industry is no exception in this regard. Net result seen is efficiency gains, substantial cost reductions, and improved customer service.

It is interesting to note that a lot of developments have taken place in Automobile Industry based on adoption of new technologies. A few live examples have been drawn from Maruti Udyog, Tata Motors, Eicher Motors, M&M, Hyundai, Ashok Leyland, Kia, Honda and Force Motors.

The automobile giant having more than 40% market share Maruti Udyog, has applied AI in areas like demand forecasting, real time tracking, inventory and logistics management along with other production and HR related areas. In the case of demand forecasting, they have implemented an AI-powered system to predict product demand with greater accuracy, which helps optimize inventory levels and improve working capital management. We can imagine for a company with production of more than 5000 cars per day, how significant application of modern technology for predictions are!!

Real-time Tracking of products is another area where Maruti has implemented new technology. They employ real-time tracking systems to monitor the movement of products from suppliers to dealers, improving supply chain visibility and responsiveness to disruptions. It is through advanced systems like 'e-Nagare', which is an electronic tracking system, Inventory and Logistics Management is efficiently managed. The company coordinates with vendors for just-in-time (JIT) delivery, reducing inventory costs and ensuring timely deliveries and practice lean SCM methods that leverages data-driven decision-making.

The company has made strategic investment in a start-up company specializing in data analytics, ML, and AI solutions to leverage AI/ML for data-driven decision-making, including strengthening the quality of new models and general operations.

AI Adoption in Tata Motors : The largest commercial vehicles manufacturer Tata Motors has introduced Artificial Intelligence (AI) into its Supply Chain Management (SCM) and broader operations to enhance efficiency, resilience, and sustainability. They, as part of their Logistics Innovation, invested an amount of Rs1200 Million in the AI-powered logistics start-up, 'Freight Tiger', to transform freight movement. This includes the development of an Integrated Freight Desk and AI-powered dispatch planning modules.

Another area of technology implementation is Inventory and Logistics Optimization. Case studies are presented using AI for inventory optimization, demand forecasting, and intelligent logistics planning. AI predicts demand and manages inventory levels, reducing waste and ensuring timely supply which has tremendously improved their performance. AI is used in manufacturing and fleet management for predictive maintenance to prevent unscheduled breakdowns, minimize downtime, and improve operational efficiency. The company has reduced their downtime on vehicles as this is helping fleet owners to track vehicle faults and driver performance in real-time.

Tata Motors, in their collaboration with their own group company TCS to launch 'Prakriti', an AI-driven sustainability platform. This platform automates ESG (Environmental, Social, and Governance) data management across the value chain, enabling real-time emissions tracking and supply-chain transparency.

Tata Motors associates with partners like IIM Mumbai to empower leaders in collaboration and supply chain digital transformation and also with SAP for end-to-end supply chain integration, leveraging AI and data insights.

Application of AI in M&M : The auto pioneers Mahindra Group has extensively introduced AI into its SCM and

also other operations. They have a committed AI division to implement various AI-powered solutions to improve efficiency, reduce costs, and enhance resilience across their diverse businesses, including automotive and agribusiness.

AI plays a critical role in optimizing Mahindra's SCM, predominantly in their manufacturing facilities in Nagpur and Chakan. Their Demand Forecasting & Production Planning facilitates smarter production scheduling by integrating real-time data to improve forecast correctness and line up production with market demands. M&M uses an AI-infused, AI-powered platform for modern supply chain orchestration. It combines multiple technologies for full supply chain transparency, from strategic planning to last-mile delivery for end-to-end supply chain visibility and planning. **This AI powered platform** unifies planning, execution, and visibility across M&M's supply chain, leverages for real-time insights, does predictive analytics, and faster problem-solving. Another area of 'Improved Collaboration', it enhances transparency and relationship between different departments, helps M&M adapt quickly to market volatility and disruptions.

In M&M, AI revolutionizes inventory management through predictive demand forecasting, automated replenishment and real-time tracking & optimization, using machine learning to analyze data for accuracy, reduce stock outs as well as overstocking, automate tasks like ordering, and improve warehouse efficiency, leading to significant cost savings and better resource allocation. Major applications include anomaly detection, supplier management, and optimizing warehouse operations with drones for audits.

By introducing AI powered applications, so many benefits have been achieved in M&M like reduced costs, increased efficiency by automating manual tasks and freeing up these staff for more important and strategic works. Improved accuracy could be achieved by reducing human error in tracking and auditing. Also, this has facilitated in better decision-making by providing data-driven insights for proactive inventory. M&M is also exploring and implementing AI for optimizing logistics and supply chain routes to dynamically plan and adjust routes in real-time, moving beyond static, rule-based systems.

Logic of Route Optimization in M&M : AI systems amalgamate large amount of data to make intelligent, real-time decisions which are humanly impossible to optimize delivery paths. The system collects data from various sources, including vehicle GPS and telematics, live traffic Application Programming Interface like

Google Maps, weather forecasts, historical delivery logs, and operational constraints like delivery windows and vehicle capacity. Specialized algorithms, such as genetic algorithms, clustering, and reinforcement learning etc will enable processing this data. They address complex challenges like the Vehicle Routing Problem (VRP) by weighing multiple variables simultaneously to find the most efficient solution. AI analyzes past patterns to predict potential delays, such as frequent traffic jams or peak-season demand surges, allowing for proactive planning and resource allocation. Unlike conventional methods, the most interesting part is that AI systems adapt instantly to unforeseen disruptions like accidents, road closures, or last-minute orders, recalculating optimal routes on the fly to minimize delays.

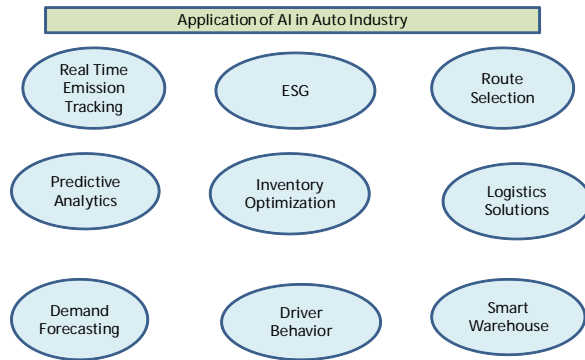
In order to accelerate the adoption of generative AI and other AI solutions across its business functions, including SCM, Mahindra has formed strategic partnerships with technology leaders like Google Cloud and Intel. They have developed proprietary AI platforms like "Mahindra AI" for enterprise use and are working with Tech Mahindra's solutions for advanced analytics and sustainable automation in supply chains.

Applications in Eicher Motors : Coming to another major auto giant, Eicher Motors, we can see that they have introduced Artificial Intelligence (AI) into its SCM and other broader operations to optimize efficiency and reduce costs. Through its joint venture, VE Commercial Vehicles (VECV), with Volvo on global basis, the company has implemented AI-driven and Industry 4.0 technologies in its manufacturing and supply chain processes.

Optimization and Scheduling is one of the crucial areas they have achieved breakthrough. AI-driven systems are used to optimize SCM and production scheduling, leading to improved output and reduced operational costs. Through robotics and automation for streamlined production processes, real-time monitoring of workflows and reduced human errors is efficiently done. In the Inventory and Part Management realm, the systems help track orders from the shop floor and assist greatly in part management and delivery. Even selection of parts is done on automated basis which ensures correct component picking and traceability for all parts. They have a good system of Predictive Maintenance of critical machines, by which they could minimize downtime and maintenance costs and extending the lifespan of vehicles.

Another important area of implementation is Operational Intelligence. VECV has adopted smart

manufacturing processes by implementing Industrial Internet of Things (IIoT)-based solutions, which provide significant insights and enable quicker, data-driven decision-making across the shop floor and at the top management level. For in-plant warehousing and logistics operations, Eicher has aligned with TVS Supply Chain Solutions for, leveraging external expertise in supply chain efficiency.



Kia Motors and Application of AI : Now we will turn our attention to Kia Motors the fast upcoming auto company with market share of around 10%, on how they are adapted to new technologies. Kia Motors has introduced AI into its SCM processes, particularly through systems aimed at monitoring and managing carbon emissions. Kia and its parent company, Hyundai Motor, announced the launch of the Supplier CO2 Emission Monitoring System (SCEMS). This system uses a combination of high-performance blockchain and AI technologies. This enables to securely and accurately collect carbon emissions data from suppliers across the entire manufacturing process, from raw material extraction to part delivery. This enables business partners check and manage their carbon emission levels in their workplaces, a process that was previously time-consuming and costly for them to manage individually. This system enables the precise forecast of future emissions, allowing the companies and their partners to set effective carbon reduction targets and alleviate climate change labours proactively.

Kia also implemented AI in other operational areas like manufacturing using AI-powered robots and computer vision for quality control and precision assembly. For predictive maintenance, utilizes sensors and machine learning to analyze vehicle data and predict potential mechanical issues before breakdowns occur. By implementing AI-powered chatbots, "Kia Mia" to handle customer inquiries efficiently, new technologies take care of customer care also.

'OSCARS' of Ashok Leyland : Ashok Leyland, the second largest commercial vehicle manufacturer has widely introduced Artificial Intelligence (AI) into its SCM and broader operations to boost efficiency, reduce costs, and improve quality. One such area is Supplier Invoice Processing where AI-powered bots and Robotic Process Automation (RPA) which can process nearly 10,000 supplier invoices daily, thus reducing processing costs fourfold and cutting payment times by 60%. Inventory and Cost Management is another area where Ashok Leyland has found AI most suitable. The company has long-standing SCM optimization projects like "OSCARS" and controls data-driven insights to manage inventory, forecast demand, and control costs, including addressing raw material price concerns. In the area of Predictive Maintenance & Quality Control, AI and ML algorithms are used in vehicle health monitoring, allowing the company to forecast potential error codes and maintenance needs. This reduces warranty costs and improves customer uptime. By introducing manufacturing automation, the company could achieve almost 99% accuracy and minimal product rejection rates. In their factories, AI is integrated into a manufacturing process assurance system using computer vision and automated mobile robots (AMRs) for real-time quality checks and material handling. Fleet monitoring is done through platforms like 'iAlert', where AI enables real-time checking and data analytics to provide valuable information on vehicle performance, so that customers can plan maintenance and identify and prevent awful practices like pilferage of fuel. Ashok Leyland is exploring to develop AI-enabled autonomous electric terminal trucks and industrial mobility equipment for future applications in logistics and ports as part of their autonomous solutions development.

The above initiatives of Ashok Leyland demonstrate an all-inclusive, AI-led digital transformation that goes beyond simple automation, integrating intelligence across the entire value chain.

AI and Hyundai Motors : Hyundai Motor has widely introduced Artificial Intelligence into its SCM and related operations. From manufacturing to logistics and R&D, the company is vigorously assimilating AI across its entire business value chain. For logistics automation, Hyundai uses AI-driven simulation tools for enhanced dispatch planning, optimization technology for maximizing loading efficiency, and fully automated inventory management with autonomous AI drones. Another interesting area is supplier monitoring. Hyundai and Kia Motors recently launched an AI-enabled, blockchain-based platform "Supplier CO2 Emission Monitoring System (SCEMS)" to help partners

manage carbon emissions, ensure data transparency, and build a sustainable supply chain, later integrated into a broader system called IGIS (Integrated Greenhouse Gas Information System) for comprehensive emission management. The purpose is to simplify tracking, meet environmental regulations, and shrink the burden on suppliers for accurate data collection and management. In order to bolster production and manufacturing efficiency, AI-based vision systems were introduced for quality control in critical operations like welding and sealing, reducing defects to almost zero.

Hyundai Motor in association with NVIDIA and Unity has introduced AI based systems which aids in real-time monitoring, simulation of various production scenarios, and detection of any hold-up before they dislocate physical operations. The use of AI and big data analytics has helped Hyundai Motors to manage supply chain disruptions more efficiently, which was evident during the COVID-19 pandemic, by providing better visibility and effective management.

SCM applications in Honda Motor : Honda Motor Company, the company which implements latest technologies and engineering excellence, has strategically integrated Artificial Intelligence into its supply chain management to improve operational excellence and efficiency. In the area of demand forecasting, Honda uses AI algorithms to analyze historical sales data, market trends, and external factors like seasonality, to forecast demand more accurately. This predictive analytics approach helps prevent both stock outs and excess inventory. Machine learning models are employed to incessantly calculate demand patterns, supplier activity, and production schedules, allowing for dynamic adjustment of inventory levels. This proactive approach has helped to significantly reduce carrying costs and perk up product availability.

To optimize transportation, AI-based logistics solutions are integrated for routes and schedules using real-time data analysis and this has helped to significantly reduce delivery times and associated transportation costs. In order to ensure efficient procurement, Honda Motors developed AI tools which will analyze extensive datasets, optimize supplier selection, and facilitate strategic sourcing decisions in real time. Honda, within its factories, uses AI for predictive maintenance of equipment to minimize downtime, and AI-driven quality control systems with computer vision to detect defects more correctly.

AI has enabled Honda to create a more agile,

responsive, and cost-efficient supply chain, positioning it as a frontrunner in leveraging AI for operational transformation within the automotive industry.

Recent developments of AI in Force Motors : In the case of India's largest van makers Force Motors, has introduced 'Force iPulse', an AI and hybrid analytics based vehicle platform in collaboration with 'Intangles', a specialist in AI-driven predictive analytics. This platform provides real-time and historical data on vehicle performance, driver behaviour, fuel efficiency, and system health. It performs root-cause analysis on key subsystems (engine, power-train, etc. to detect potential component failures early, allowing for proactive maintenance and preventing unplanned downtime. Force Motors established an Intelligence Command Centre at its Pune headquarters, staffed with experts for round the clock remote monitoring and guided resolution support.

An programme called "Project SwiftChain", recently launched in collaboration with KPMG India helps to streamline material management, optimize inventory and planning processes, and digitize critical areas using technologies like IoT and AI. An SCM control tower was organised, which has helped to save inventory to an extent of 15-20%, decreased line stoppages, simplified buyer workloads, and improved working capital utilization. A more agile, resilient, and future-ready supply chain that can adapt to market fluctuations and improve overall efficiency could be achieved through this AI initiative. These initiatives are part of a broader digital transformation agenda for the company, known as "Project DigiForce".

Conclusion : Thus, Artificial Intelligence is transforming automotive industry in India as in other industries, by boosting efficiency and sustainability through demand forecasting, route optimization, predictive maintenance, quality control and smart warehousing, reducing waste, costs, and emissions while enhancing resilience and transparency. AI is transforming automotive supply chain management from a reactive, manufacturing-centric model to a proactive, software-driven ecosystem. Tremendous achievement has been made through reduced waste, lower costs, decreased inventory, fuel, maintenance, rework costs which has fortified sustainability and saving the earth from fast depletion of resources.

Major auto companies world over has introduced energy management techniques through AI which can deliver measurable sustainability gains alongside financial savings.

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SHAPING THE NEXT WAVE: HOW AI WILL REDEFINE INDIA'S LOGISTICS AND SUPPLY CHAIN ECOSYSTEM IN 2026

ZAIBA SARANG, CO-FOUNDER OF ITHINK LOGISTICS

AI has shifted from the fringes to the forefront of India's logistics ecosystem. As 2025 comes to an end, it is evident that the industry is not merely experimenting with AI anymore; it has fundamentally rewired its operating architecture. Adoption among D2C and SME ecommerce sellers has tripled over the year, delivering measurable outcomes such as faster order resolutions by nearly one-fifth and a sizeable reduction in failed deliveries driven by predictive intelligence. This surge is perfectly aligned with India's broader digital evolution, where almost half of Indian enterprises ran generative AI pilots, the highest in Asia, supported by the strength of more than 130 billion annual UPI transactions and an e-commerce market that is closing in on the 163 billion dollar mark. With the global AI market already above 371 billion dollars, India is rapidly positioning itself as a strategic hub for digital supply chain innovation.

The year 2025 stands out as a pivotal moment in India's logistics modernisation journey. AI's impact has moved well beyond theoretical proof. Courier allocation engines reduced Return to Origin levels by close to one-fifth, significantly improving last-mile economics in a segment where more than half of total logistics costs reside. Predictive non-delivery systems succeeded in recovering nearly three-quarters of delayed shipments, strengthening seller confidence and improving customer experience. AI-enhanced service level governance delivered a strong uplift in metro fulfilment performance, while intelligent forecasting helped brands navigate volatile demand cycles during high-stress events such as Diwali without falling prey to costly overstocking.

This period also saw the sector shift toward more advanced and integrated decision-making tools. Several companies began deploying dynamic delivery planning models that use real-time behavioural signals and historical delivery patterns to predict and prevent RTO events and optimise courier selection. Solutions of this nature, such as our recently launched AI native DDP platform that applies machine learning to delivery decisions at scale, demonstrate how the logistics sector is beginning to operate in a predictive and anticipatory manner rather than reacting to failures after they occur. Early results from these systems point to meaningful reductions in RTO exposure and higher accuracy in non-delivery prediction, signalling a new phase of operational intelligence.

Alongside the industry's technological progress, government-led reforms under the National Logistics Policy and the PM Gati Shakti masterplan have pushed the sector toward integrated real-time visibility, multimodal transport and stronger infrastructure planning. Drone initiatives, hyperlocal warehouse footprints and machine learning based route optimisation are no longer conceptual pilots. They are now becoming essential components of a logistics network that can support an e-commerce sector expanding at more than 27 per cent annually.

Despite the momentum, the industry continues to face structural challenges. Data quality varies sharply across market participants. Privacy and regulatory expectations are evolving rapidly. Integrating diverse AI systems into

complex supply chain environments remains operationally demanding. These realities make it clear that the sector needs consistent data frameworks and robust human-in-the-loop governance to ensure that automated decisions remain transparent, responsible and aligned with a standard of reliability that customers expect.

As India moves into 2026, the logistics landscape is preparing for an even more significant transformation. The domestic AI market is projected to reach 15.9 billion dollars. It is anticipated that every fourth decision in e-commerce logistics will be influenced by AI, marking a shift from predictive systems to agentic, self-optimising architectures. Fleets will begin to manage themselves through digital twins that simulate supply chain behaviours in real time. Conversational AI will replace static tracking with intelligent, personalised delivery interfaces that operate continuously, providing proactive updates and removing the need for manual follow-ups. Visual search, augmented reality try-ons and highly personalised recommendations will reshape consumer behaviour, driving higher conversion rates and reducing uncertainty about purchases. AI-driven dynamic pricing engines and generative marketing tools will advance rapidly, especially in India's tier two and tier three markets. Blockchain-supported hyperautomation is expected to redefine transparency, sustainability and compliance at every stage of the supply chain.

With close to 80 per cent of enterprises expected to deploy these technologies at scale, logistics organisations will make strategic investments in energy resilient operations, regional hub networks and end-to-end AI-enabled warehousing and transportation. The broader logistics sector itself is on a trajectory toward 380 billion dollars in value, with AI at the centre of both operational excellence and competitive advantage.

Leadership teams entering 2026 must prioritise foundational shifts. Data quality must be treated as an institutional discipline, not a corrective action. Courier selection needs to be automated at scale to meet rising consumer expectations, especially now that more than 90 per cent of customers expect same-day delivery experiences. Predictive non-delivery recovery must transition from an optional capability to an operational backbone. Responsible logistics will require that automation and human judgment work cohesively. Governance around explainability, risk, privacy and bias will become a defining mandate as AI becomes embedded in daily operations.

As India's commerce ecosystem moves toward the trillion-dollar threshold, AI is set to become the defining competitive advantage for logistics companies. The coming year will reward organisations that deploy AI with clarity, maturity and foresight. Those that integrate technological intelligence with human insight will set the next generation of benchmarks and shape a logistics environment that is more agile, more resilient and genuinely world-class. The opportunity ahead is transformative, and the time to architect that future is now.

Source: www.expresscomputer.in

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FROM GROWTH ENGINE TO GLOBAL EDGE: SUPERCHARGING INDIA'S LOGISTICS

Key Takeaways

- India's logistics cost has dropped to **7.97%** of GDP.
- **IPRS 3.0**, developed with the Asian Development Bank, rates industrial parks on sustainability, green infrastructure, connectivity, digital readiness, and skills.
- The SMILE program launched **logistics plans in 8 pilot cities** across 8 states to assess existing logistics infrastructure and improve efficiency and reduce costs.

A New Chapter in India's Logistics Story : India's logistics is entering a new phase and converting itself into a faster, smarter, and globally competitive sector. From integrated digital platforms that streamline freight movement to modern infrastructure connecting every part of the country, a next-generation logistics ecosystem is steadily taking shape. Backed by targeted policy reforms, institutional realignment, and technology-driven solutions, the government is transforming logistics into a key driver of India's economic growth and global trade positioning.

A wave of structural changes is reshaping how logistics is planned, executed, and scaled across the country. Platforms like **ULIP (Unified Logistics Interface Platform)** are integrating data across departments, while **LDB (Logistics Data Bank) 2.0** enables real-time visibility of millions of containers. Every **HSN (Harmonized System of Nomenclature) code** is mapped to its line ministry, improving accountability and policy design. Logistics plans at the **city and state levels under the SMILE (Strengthening Multimodal and Integrated Logistics Ecosystem) programme** are being aligned with national priorities. **Inland waterways transported a record 145.84 million tonnes of cargo last year**, while **rail congestion is being addressed through dedicated freight corridors**. In industrial zones, **plug-and-play parks under NICDC (National Industrial Corridor Development Corporation)** offer ready infrastructure for investors. On the ground, reforms such as **GST and the e-Way Bill** have removed long-standing frictions in interstate transport. These interventions are driving a clear objective: **reducing logistics costs, improving efficiency, and strengthening India's position in global supply chains**.

Multimodal Logistics along the Gangetic Plain India is transforming its logistics network along the Gangetic Plain through an **integrated multimodal approach** that combines **road, rail, and inland waterways**, making transport faster, cheaper, and greener. The **Eastern Dedicated Freight Corridor (EDFC)**, a **high-speed rail freight line**, has **reduced wagon turnaround times from 15–16 days to 2–3 days** and **cut transit times from over 60 hours to around 35–38 hours**. **Freight operations are now managed via a central control centre in Prayagraj**, easing congestion on existing rail networks. The **revival of the Ganga Waterway**, linked to the EDFC at **Varanasi**, allows manufacturers to move cargo efficiently to eastern ports like **Haldia**. **Rapid development of warehousing and logistics facilities** near the corridor has **boosted employment, improved inventory management**, and enabled **timely production and export**. These projects involve significant investments from the **World Bank**, including **\$1.96 billion for the Eastern Dedicated Freight Corridor and Rail Logistics initiatives** and **\$375 million** for the Ganga Waterway development. Together, these efforts are creating an **efficient, integrated logistics system** that **reduces costs, lowers carbon emissions, and strengthens India's connectivity to domestic and international markets**.

Why Logistics Matter More Than Ever : India's path to economic growth increasingly relies on efficient logistics, which are key to enhancing competitiveness and global connectivity.

The National Logistics Policy and PM GatiShakti have injected new momentum into this transformation, laying the foundation for a more integrated and data-driven logistics ecosystem. But strategy needs precision, and that starts with knowing the true cost of logistics.

Until recently, India's logistics costs were often overestimated. Commonly cited figures of 13 to 14 percent of GDP were based on partial or external data. This led to confusion in policymaking and misperceptions globally.

That has now changed.

A new, first-of-its-kind study titled Assessment of Logistics Cost in India by the Department for Promotion of Industry and Internal Trade (DPIIT), in collaboration with

National Council of Applied Economic Research (NCAER), provides a scientifically grounded estimate. Using a hybrid methodology that combines primary data from over 3,500 industry stakeholders with secondary data from the Ministry of Statistics and Programme Implementation (MOSPI), Reserve Bank of India (RBI), and Goods and Services Tax Network (GSTN), the report places India's logistics cost at 7.97 percent of GDP and 9.09 percent of non-services output for 2023 to 2024. In absolute terms, the total cost is estimated at 24.01 lakh crore.



This is more than just a headline number. The report offers a detailed breakdown by cost components, firm size, and product type. It highlights a critical insight: **smaller firms face significantly higher logistics costs, which affect their ability to scale and compete.** The study also introduces **benchmark freight costs per tonne-kilometre across various transport modes and distances.** This data is essential for better supply chain planning and pricing.

Multimodal transport is emerging as a key lever for efficiency. For example, the report shows that **for journeys of around 600 kilometres, improving the first and last 50 kilometres can significantly lower the total logistics cost.** This underscores the importance of last-mile infrastructure and multimodal logistics integration.

All findings are available through a new interactive dashboard designed to support real-time analysis and informed decision-making. With this data-backed clarity, both the government and industry can make smarter investments, design sharper policies, and upgrade infrastructure faster. This brings India closer to its goal of becoming a global logistics hub.

In short, logistics is no longer a black box. With accurate

cost estimates, actionable insights, and targeted interventions, India is transforming its supply chains from a hidden burden into a source of strength.

2025: Supercharging India's Supply Chains

Several initiatives launched in 2025 showcase the government's push to refresh logistics across measurement, local planning, infrastructure, and data integration. These new-generation logistics programs were unveiled to break bottlenecks, accelerate movement, and supercharge supply chains.

1. PM GatiShakti: Driving Integrated Planning

During the commemoration of four years of the PM GatiShakti National Master Plan, the transformative impact of this path-breaking initiative was highlighted, and several key initiatives were unveiled. Key launches included:

- **PM GatiShakti District Master Plans** in all **112 Aspirational Districts** to guide social and economic infrastructure projects.
- **PM GatiShakti – Offshore**, consolidating geospatial data from multiple ministries to guide offshore projects like **wind farms, marine resource exploration, and coastal infrastructure**, while **minimizing regulatory and environmental risks.**
- **PM GatiShakti Public**, a web-based platform providing access to **230 non-sensitive datasets** for private entities, researchers, and citizens, promoting transparency, data-driven decision-making, and cross-sector collaboration.
- **Knowledge Management System, NMP (National Master Plan) Dashboard, and Decentralized Data Uploading System**, improving coordination, transparency, and cross-learning across government departments.
- **Compendium Volume-3**, showcasing best practices and successful on-ground use cases across social, economic, and infrastructure sectors.
- **LEAPS 2025** is a **DPIIT initiative** to benchmark logistics performance and promote innovation and sustainability in the sector.

2. SMILE: City-Level Logistics Planning



The **Strengthening Multimodal and Integrated Logistics Ecosystem (SMILE)** program, developed by DPIIT in collaboration with the Asian Development Bank, focuses on streamlining logistics at both state and city levels. As part of this initiative, plans have been launched across **eight pilot cities in eight states**, each selected to demonstrate how local logistics systems can align effectively with national priorities.

SMILE operates on two synchronized fronts:

- **State Level:** It connects growth hubs to trunk routes, economic corridors, and logistics gateways.
- **City level:** It aligns urban freight with city mobility frameworks, master plans, and land use policies. This two-tiered approach makes logistics not an afterthought, but a built-in layer of economic and spatial planning.



Each of the eight pilot cities under SMILE will be building integrated logistics plans that span both urban and peri-urban zones. These plans map and optimize freight-intensive activity such as local retailers, e-commerce delivery routes, warehousing clusters, truck terminals, and last-mile corridors. The aim is to combine data-

driven decisions with clear urban policies and institutional coordination. The plans focus on noise reduction, city decongestion, low- and zero-emission vehicles, process automation, and stronger alignment between freight and passenger flows.

The outcome is a national model where central, state, and city agencies, along with private players and start-ups, act in coordination. This supports sustainable urban freight, faster and more affordable movement of goods, cleaner and less congested cities, and millions of new jobs across the logistics value chain.

3. LEADS 2025: Scoring States on Logistics

The **Logistics Ease Across Different States (LEADS) 2025** initiative sets a new benchmark for measuring the logistics performance of States and Union Territories. Evolving into a more comprehensive framework, LEADS now incorporates both **perception-based inputs and objective data**, with the latter making up **32.5%** of the **framework** and expected to increase further. The assessment covers **regulatory and institutional support, logistics enablers, infrastructure, services, the operating environment, and sustainability**. The initiative **also monitors five to seven key transport corridors, capturing real-time data on journey times, average truck speeds, and waiting periods. API-enabled tools allow for section-wise monitoring of road speeds, enabling the identification of delay points and performance gaps**. By offering detailed insights and tracking the improvement trajectory of logistics systems, LEADS serves as a key mechanism to enhance logistics efficiency and supply chain robustness across States and Union Territories, supporting India's progress toward its long-term development goals.

4. LDB 2.0: Visibility that Moves Markets

The upgraded **Logistics Data Bank 2.0** now syncs with Unified Logistics Interface Platform (ULIP) APIs, offering exporters and MSMEs real-time visibility across road, rail, sea, and even high seas. A live container heatmap highlights where containers are delayed, enabling swift corrective action before minor issues escalate. Now users will be able to track shipments using container number, vehicle number, and railway FNR (Freight Name Record) numbers. What once required days of coordination and guesswork now appears instantly on a single platform.

5. IPRS 3.0: Ranking Industrial Parks

The **Industrial Park Rating System (IPRS) 3.0**, co-developed by DPIIT and the Asian Development Bank, adds transparency and accountability to India's industrial infrastructure. It evaluates industrial parks

across a broad set of performance indicators, helping identify where excellence thrives and where improvement is needed.

Each park is assessed and categorized as a **Leader**, **Challenger**, or **Aspirer**, based on factors such as infrastructure quality, logistics connectivity, digital readiness, sustainability features, and tenant satisfaction. This clear and consistent grading gives investors reliable information to guide decisions, while motivating States and Union Territories to upgrade their facilities and attract more investments.

Under NICDC, 20 plug-and-play industrial parks are in development. 4 are completed, the other 4 are under construction, and several are on the drawing board. These ready-to-use parks reduce entry barriers for industries and send a strong signal to global and domestic investors that India is serious about ease of doing business and industrial growth. With IPRS 3.0, India is not just building more parks. It is building better ones: more competitive, more inclusive, and more geared towards the goals of national development.



6. Guidebook on HSN Codes: Clarity that Counts

A comprehensive guidebook has mapped **12,167 HSN codes** across **31 ministries**. Mapping each HSN code with the respective line ministry will help the industry understand processes related to their sectors. For businesses, it simplifies coordination. For policymakers, it sharpens accountability, and for trade negotiators, it strengthens India's hand on the global stage.

Conclusion : Logistics has long operated behind the scenes and is gradually receiving more attention. The past decades have laid the tracks and built the systems, with the current developments propelling these efforts to roar: faster, greener, and fully connected.

If Make in India builds the factories, logistics builds the highways, waterways, and data flows that carry their output to the world. With initiatives like PM Gatishakti Public/Offshore, SMILE, LEAPS 2025, LEADS 2025, IPRS 3.0, LDB 2.0, etc., and green corridors on the move, India is transforming its logistics from a cost centre into a powerful competitive advantage system. The journey from growth engine to global edge has begun.

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Source: PIB

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INDIA'S AI REVOLUTION

A ROADMAP TO VIKSIT BHARAT

Introduction : India is undergoing a remarkable transformation in Artificial Intelligence, driven by the visionary leadership of PM Modi. For the first time in India's history, the government is actively shaping an AI ecosystem where computing power, GPUs, and research opportunities are accessible at an affordable cost.

Unlike in the past, AI in India is no longer confined to a privileged few or dominated by global tech giants. Through forward-looking policies, the Modi government is empowering students, startups, and innovators with world-class AI infrastructure, fostering a truly level playing field. Initiatives such as the IndiaAI Mission and the establishment of Centres of Excellence for AI are strengthening the country's AI ecosystem, paving the way for innovation and self-reliance in this critical sector.

These efforts align with the vision of Viksit Bharat by 2047, where India aspires to become a global AI powerhouse, leveraging cutting-edge technology for economic growth, governance, and societal progress.

AI Compute and Semiconductor Infrastructure : India is rapidly building a strong AI computing and semiconductor infrastructure to support its growing digital economy. With the approval of the IndiaAI Mission in 2024, the government allocated 10,300 crore over five years to strengthen AI capabilities. A key focus of this mission is the development of a high-end common computing facility equipped with 18,693 Graphics Processing Units (GPUs), making it one of the most extensive AI compute infrastructures globally. This capacity is nearly nine times that of the open-source AI model DeepSeek and about two-thirds of what ChatGPT operates on.

Here are the key developments:

- **Scaling AI Compute Infrastructure:** The initial phase of the mission has already made 10,000 GPUs available, with the remaining units to be added soon. This will enable the creation of indigenous AI solutions tailored to Indian languages and contexts.
- **Opening Access to High-Performance Computing:** India has also pioneered the launch of an open GPU marketplace, making high-performance computing accessible to startups,

researchers, and students. Unlike many countries where AI infrastructure is controlled by large corporations, this initiative ensures that small players have an opportunity to innovate.

- **Robust GPU Supply Chain:** The government has selected 10 companies to supply the GPUs, ensuring a robust and diversified supply chain.
- **Indigenous GPU Capabilities:** To further strengthen domestic capabilities, India aims to develop its own GPU within the next three to five years, reducing reliance on imported technology.
- **Affordable Compute Access:** A new common compute facility will soon be launched, allowing researchers and startups to access GPU power at a highly subsidised rate of 100 per hour, compared to the global cost of \$2.5 to \$3 per hour.
- **Strengthening Semiconductor Manufacturing:** In parallel, India is advancing semiconductor manufacturing, with five semiconductor plants under construction. These developments will not only support AI innovation but also reinforce India's position in the global electronics sector.

Advancing AI with Open Data and Centres of Excellence (CoE)

Recognising the importance of data in AI development, the Modi government has launched the IndiaAI Dataset Platform to provide seamless access to high-quality, non-personal datasets. This platform will house the largest collection of anonymised data, empowering Indian startups and researchers to develop advanced AI applications. By ensuring diverse and abundant datasets, this initiative will drive AI-driven solutions across key sectors, enhancing innovation and accuracy.

- **IndiaAI Dataset Platform for Open Data Access:** The platform will enable Indian startups and researchers to access a unified repository of high-quality, anonymised datasets, reducing barriers to AI innovation.
- **Boosting AI Model Accuracy with Diverse Data:** By providing large-scale, non-personal datasets, the initiative will help reduce biases and improve the reliability of AI applications across domains such as agriculture, weather forecasting, and

traffic management.

- **Centres of Excellence:** The government has established three AI Centres of Excellence (CoE) in Healthcare, Agriculture, and Sustainable Cities in New Delhi. The Budget 2025 further announced a new CoE for AI in education with an outlay of 500 crore, making it the fourth such centre.
- **Skilling for AI-Driven Industries:** Plans are in place for five National Centres of Excellence for Skilling, which will equip youth with industry-relevant expertise. These centres will be set up in collaboration with global partners to support the 'Make for India, Make for the World' vision in manufacturing and AI innovation.

India's AI Models & Language Technologies

The government is facilitating the development of India's own foundational models, including Large Language Models (LLMs) and problem-specific AI solutions tailored to Indian needs. To foster AI research, multiple Centres of Excellence have also been set up.

- **India's Foundational Large Language Models:** IndiaAI has launched an initiative to develop indigenous foundational AI models, including LLMs and Small Language Models (SLMs), through a call for proposals.
- **Digital India BHASHINI:** An AI-led language translation platform designed to enable easy access to the internet and digital services in Indian languages, including voice-based access, and support content creation in Indian languages.
- **BharatGen:** The world's first government-funded multimodal LLM initiative, BharatGen was launched in 2024 in Delhi. It aims to enhance public service delivery and citizen engagement through foundational models in language, speech, and computer vision. BharatGen involves a consortium of AI researchers from premier academic institutions in India.
- **Sarvam-1 AI Model:** A large language model optimised for Indian languages, Sarvam-1 has 2 billion parameters and supports ten major Indian languages. It is designed for applications such as language translation, text summarisation, and content generation.
- **Chitralekha:** An open-source video transcreation platform developed by AI4Bhārat, Chitralekha enables users to generate and edit audio transcripts in various Indic languages.
- **Hanooman's Everest 1.0:** A multilingual AI system developed by SML, Everest 1.0 supports 35 Indian

languages, with plans to expand to 90.

AI Integration with Digital Public Infrastructure

India's Digital Public Infrastructure (DPI) has redefined digital innovation by combining public funding with private sector-led innovation. Platforms like Aadhaar, UPI, and DigiLocker serve as the foundation, while private entities build application-specific solutions on top of them. This model is now being enhanced with AI, integrating intelligent solutions into financial and governance platforms. The global appeal of India's DPI was evident at the G20 Summit, where several countries expressed interest in adopting similar frameworks. Japan's patent grant to India's UPI payment system further underscores its scalability.

For Mahakumbh 2025, AI-driven DPI solutions played a crucial role in managing the world's largest human gathering. AI-powered tools monitored real-time railway passenger movement to optimise crowd dispersal in Prayagraj. The Bhashini-powered Kumbh SahAI'yak Chatbot enabled voice-based lost-and-found services, real-time translation, and multilingual assistance. Its integration with Indian Railways and UP Police streamlined communication, ensuring swift issue resolution. By leveraging AI with DPI, Mahakumbh 2025 set a global benchmark for tech-enabled, inclusive, and efficient event management.

AI Talent & Workforce Development

India's workforce is at the heart of its digital revolution. The country is adding one Global Capability Center (GCC) every week, reinforcing its status as a preferred destination for global R&D and technological development. However, sustaining this growth will require continuous investment in education and skill development. The government is addressing this challenge by revamping university curricula to include AI, 5G, and semiconductor design, aligning with the National Education Policy (NEP) 2020. This ensures that graduates acquire job-ready skills, reducing the transition time between education and employment.

- **AI Talent Pipeline & AI Education:** Under the IndiaAI Future Skills initiative, AI education is being expanded across undergraduate, postgraduate, and Ph.D. programs. Fellowships are being provided to full-time Ph.D. scholars researching AI in the top 50 NIRF-ranked institutes. To enhance accessibility, Data and AI Labs are being established in Tier 2 and Tier 3 cities, with a model IndiaAI Data Lab already set up at NIELIT Delhi.

- **India Ranks 1st in Global AI Skill Penetration:** According to the Stanford AI Index 2024, India ranks first globally in AI skill penetration with a score of 2.8, ahead of the US (2.2) and Germany

(1.9). AI talent concentration in India has grown by 263% since 2016, positioning the country as a major AI hub. India also leads in AI Skill Penetration for Women, with a score of 1.7, surpassing the US (1.2) and Israel (0.9).

- **AI Innovation:** India has emerged as the fastest-growing developer population globally and ranks second in public generative AI projects on GitHub. The country is home to 16% of the world's AI talent, showcasing its growing influence in AI innovation and adoption.
- **AI Talent Hubs:** The India Skills Report 2024 by Wheelbox forecasts that India's AI industry will reach USD 28.8 billion by 2025, with a CAGR of 45%. The AI-skilled workforce has seen a 14-fold increase from 2016 to 2023, making India one of the top five fastest-growing AI talent hubs, alongside Singapore, Finland, Ireland, and Canada. The demand for AI professionals in India is projected to reach 1 million by 2026.

AI Adoption & Industry Growth

India's Generative AI (GenAI) ecosystem has seen remarkable growth, even amid a global downturn. The country's AI landscape is evolving from experimental use cases to scalable, production-ready solutions, reflecting its growing maturity.

- **Businesses Prioritising AI Investments:** According to BCG, 80% of Indian companies consider AI a core strategic priority, surpassing the global average of 75%. Additionally, 69% plan to increase their tech investments in 2025, with one-third allocating over USD 25 million to AI initiatives.
- **GenAI Startup Funding:** According to a November 2024 report by National Association of Software and Service Companies (NASSCOM), Indian GenAI startup funding surged over six times quarter-on-quarter, reaching USD 51 million in Q2FY2025, driven by B2B and agentic AI startups.
- **AI Transforming Workplaces:** The Randstad AI & Equity Report 2024 states that seven in 10 Indian employees used AI at work in 2024, up from five in 10 a year earlier, showcasing AI's rapid integration into workplaces.
- **AI Empowering Small & Medium Businesses (SMBs):** AI-driven technologies, such as autonomous agents, are helping SMBs scale efficiently, personalise customer experiences, and optimise operations. According to Salesforce, 78% of Indian SMBs using AI reported revenue growth, while 93% stated AI has contributed to increased revenues.

- **Rapid Expansion of India's AI Economy:** As per the BCG-NASSCOM Report 2024, India's AI market is projected to grow at a CAGR of 25-35%, reinforcing its potential for innovation and job creation. While AI automates routine tasks, it is simultaneously generating new opportunities in data science, machine learning, and AI-driven applications.
- **AI Startup Support Ecosystem:** India hosts 520+ tech incubators and accelerators, ranking third globally in active programs. 42% of these were established in the past five years, catering to the evolving needs of Indian startups. AI-focused accelerators like T-Hub MATH provide crucial mentorship in product development, business strategy, and scaling. In early 2024, MATH supported over 60 startups, with five actively discussing funding, highlighting India's growing AI startup landscape.

A Pragmatic AI Regulation Approach

India's pragmatic AI regulation balances innovation and accountability, steering clear of overregulation that could stifle growth and unchecked market-driven governance that may create monopolies. Instead of relying solely on legislation, India is investing in AI-driven safeguards, funding top universities and IITs to develop solutions for deep fakes, privacy risks, and cybersecurity threats. This techno-legal approach ensures AI remains a force for inclusive growth, fostering an ecosystem where innovation thrives while ethical concerns are proactively addressed.

Conclusion : India's rapid advancements in artificial intelligence, underpinned by strategic government initiatives, have positioned the country as a global AI powerhouse. By expanding AI compute infrastructure, fostering indigenous AI models, enhancing digital public infrastructure, and investing in talent development, India is creating an inclusive and innovation-driven ecosystem. The emphasis on open data, affordable access to high-performance computing, and AI-driven solutions tailored to local needs ensures that the benefits of AI reach businesses, researchers, and citizens alike. As AI adoption accelerates across industries, India's proactive approach is not only strengthening its digital economy but also paving the way for self-reliance in critical technologies. With a clear vision for the future, India is set to become a leader in AI innovation, shaping the global AI landscape in the years to come.

Source: Ministry of Electronics and Information Technology

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SMARTER, FASTER, STRONGER: HOW AI IS TRANSFORMING MANUFACTURING

In India, adoption is accelerating. TeamLease data shows AI use across industries stood at 48% in FY2024, with manufacturing alone rising from 8% to 22% in just one year

However, challenges persist. Integration costs, talent shortages, and concerns over data governance and model transparency are slowing the broader adoption of generative AI. A 2024 Reuters/Ipsos survey found that 44% of manufacturing leaders remain cautious about scaling generative AI due to concerns about hallucinations and explainability.

Step inside a modern factory, and you might find something quietly extraordinary. Machines no longer wait to fail; they signal in advance. Robots don't just repeat tasks; they adapt and respond. And decisions once made on instinct are now driven by real-time data. This is the new face of manufacturing, where artificial intelligence (AI) is not just an upgrade but a fundamental shift in how things are made, moved and managed.

Across India, from long-established facilities to newly-built plants, AI is being integrated into every layer of production. It is helping manufacturers increase output, reduce waste, adapt to shifting demands and even design more intelligently. Backed by national policy and rising enterprise ambition, India's factories are becoming more agile, more precise and more globally competitive.

Sector on move

The global AI-in-manufacturing market is projected to grow from \$4.1 billion in 2024 to \$5.8 billion in 2025, and is expected to surpass \$25 billion by 2029, according to The Business Research Company.

In India, adoption is accelerating. TeamLease data shows AI use across industries stood at 48% in FY2024, with manufacturing alone rising from 8% to 22% in just one year. This is supported by policy initiatives like the Government of India's 10,372-crore AI Mission, which is investing in infrastructure, talent, and indigenous models.

"From predictive maintenance to intelligent automation, AI and GenAI are turning manufacturing

industries into self-optimising systems. Real-time data is being leveraged to drive smarter decisions, higher throughput, and more sustainable, customer-centric outcomes. When combined with responsible AI frameworks, this shift drives both operational excellence and enhanced customer value," says Sanjay Mittal, senior partner and industrial sector leader, IBM Consulting India & South Asia.

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Intelligence across floor

AI is powering improvements across every layer of the factory. On the shop floor, predictive maintenance uses sensor data to anticipate equipment failures, reducing downtime by up to 30%, according to McKinsey. AI vision systems identify micro-level defects in real time, improving quality assurance.

Cobots—collaborative robots guided by AI—support workers in physically demanding or repetitive tasks. These machines respond to human cues, enabling safer, more efficient man-machine collaboration.

“Today, CPCL generates about 1 TB of data daily. AI-powered CCTVs are helping ensure SOP compliance, while machine learning supports predictive maintenance and smart procurement. Digital twins and centralised safety monitoring are our focus to steadily transform our operations,” says H. Shankar, managing director, Chennai Petroleum Corporation Limited.

Further upstream, generative AI accelerates product development. Digital twins simulate layouts, energy use and asset health, helping engineers optimise operations virtually. In planning and logistics, AI enhances forecasting and enables more agile scheduling. IBM estimates that AI-led planning improves responsiveness by over 20%.

“At ZF Group in India, we’re integrating smart manufacturing technologies like AI, robotics, and automation to transform our operations. AI is helping us redesign workflows by reducing task complexity and enhancing labour flexibility, empowering shop-floor teams to manage more intricate processes. AI-powered vision systems are also improving quality control by eliminating fatigue-related errors and increasing inspection efficiency,” says Akash Passey, president, ZF Group India

Broader digital backbone

AI draws strength from a wider digital ecosystem that enables speed, scale, and integration. At the edge, IoT sensors capture real-time data from machines, materials, and the environment. Edge computing allows instant responses for tasks like robotic actuation and safety control.

Cloud platforms provide the scale to train models, run digital twins, and coordinate cross-site operations. These platforms allow AI to be deployed flexibly and integrated into existing enterprise systems.

Emerging technologies such as autonomous control systems and agentic AI offer even more adaptability. These systems learn, plan and optimise processes with minimal human input.

Crucially, these layers are connected through APIs and integration hubs that link AI with ERP, supply chain, and production systems. This ensures insights are shared across the organisation to enable better decision-making.

More than just efficiency

AI creates value at two levels. First, through operational hygiene. Predictive maintenance, automated inspections, and real-time stock tracking are fast becoming industry norms. These improvements lower costs and improve compliance, but are no longer enough to differentiate.

“We are now exploring AI-driven process optimisation to improve yields and reduce energy use, deploying drones for safer inspections, and planning AI-driven logistics. As AI and automation evolve, the opportunity to unlock smarter, safer, and more efficient operations continues to grow,” adds Mr. Shankar of CPCL.

Second, AI is unlocking innovation. Generative tools speed up design. AI-driven customisation enables personalisation at scale. Companies that embed AI across their value chain—from R&D to delivery—are more agile, responsive, and future-ready.

Looking ahead

Challenges persist. Integration costs, talent shortages and concerns over data governance and model transparency are slowing broader adoption. A 2024 Reuters/Ipsos survey found that 44% of manufacturing leaders remain cautious about scaling generative AI due to concerns around hallucinations and explainability.

Still, the direction is clear. AI will be central to India’s ambition of becoming a \$5 trillion manufacturing economy. With the right mix of strategy, skills, and Indian manufacturers are well positioned to lead the next wave of global industrial transformation.

Source: www.thehindu.com

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2026: THE AI SUPPLY CHAIN ERA REQUIRES FOUNDATION BEFORE TRANSFORMATION

Manufacturing and automotive supply chains are entering what industry leaders call the age of AI—a transformation that will define the next decade of operations. However, organizations are discovering that successful AI adoption requires more than technology deployment. True scalability depends on clean data, standardized processes, disciplined governance, and a workforce ready to adopt them, which most enterprises haven't yet established.

The consensus is growing: future supply chain management is inextricably linked with AI. After two decades of discussing global supply chain optimization, the next generation will center on AI-driven operations. However, practical application follows a measured, strategic path rather than rushed adoption. The sentiment is caution and preparation, not blind technology enthusiasm.

Key Takeaways

- AI-first supply chains require clean data, standardized processes, and disciplined governance before technology deployment delivers enterprise value
- Bridging the gap between AI productivity gains and business outcomes requires portfolio-view measurement frameworks tracking dynamic indicators across operations
- Workforce upskilling is non-negotiable as AI agents become embedded team members requiring new skills for governance, management, and value extraction
- Trust building through transparent communication, clear outcome demonstration, and participatory implementation is essential for successful AI adoption and change management
- Local-for-local manufacturing strategies combining physical proximity with AI-enabled insights create resilient, agile operations that balance efficiency with risk mitigation

Foundation Requirements Before AI Deployment

Organizations are diligently strengthening fundamentals around planning, logistics, and risk management before

attempting comprehensive AI implementation. This reflects lessons learned from failed transformation attempts: sophisticated algorithms can't compensate for fragmented data and unstandardized processes.

Having standard processes and data is foundational for organizations as they begin to integrate AI into operations. As geopolitical uncertainties persist and economic headwinds continue, laying proper groundwork enables AI to build upon resilient, scalable supply chain architectures.

This mirrors patterns across enterprise technology adoption. Whether implementing AI for freight audit, procurement optimization, or demand planning, success requires data normalization that preserves business context while enabling cross-system analysis. Organizations that attempt AI deployment before establishing these foundations experience disappointing returns regardless of algorithmic sophistication.

The Value Realization Gap

A critical challenge is bridging the divide between AI-driven productivity gains and tangible enterprise value. Traditional ROI metrics don't capture how AI transforms operations. Success requires adopting portfolio views of value creation, tracking dynamic indicators across businesses, and connecting immediate efficiencies to long-term outcomes.

Understanding how initial efficiencies create major improvements—better cash management from accelerated financial close, more resilient supply chains from predictive risk identification—enables organizations to link AI adoption to true enterprise growth rather than isolated process improvements.

This requires measurement frameworks that account for:

Direct cost reductions from automated exception handling, optimized routing decisions, and improved forecast accuracy that reduce inventory carrying costs.

Operational velocity improvements are measured by cycle time compression, decision latency reduction, and accelerated response to disruption events.

Strategic capability enhancements, including improved

scenario modeling, enhanced risk visibility, and data-driven decision support that enables faster, better-informed choices.

Organizations that establish these measurement frameworks before AI deployment can demonstrate value throughout implementation, rather than hoping ROI materializes after technology adoption is complete.

The Upskilling Imperative

Comprehensive workforce upskilling programs are equally important as technical foundations. Manufacturers across sectors are evolving the skill sets of their supply chain teams to extract value from AI and grow capabilities with new digital tools.

Data analytics training programs featuring data scientists working with supply chain analysts demonstrate one approach. However, effectiveness depends on how quickly employees can engage with and apply new learning in daily routines. Leaders must balance workforce shape, size, and capabilities while uncertainty about outcomes remains.

What is clear: AI agents will become embedded team members across organizations. This creates an imperative to upskill workers and establish processes to govern, manage, and develop agent capabilities. The dichotomy of skill versus will captures the current balancing act—executing on organizational innovation while simultaneously improving people's skills to thrive in new environments.

Change Management and Trust Building

Given the enormity of the AI transition underway, robust change management is a necessity rather than a recommendation. Organizations must clearly articulate reasons behind AI adoption and how it benefits both the company and employees. However, executing proven change management techniques can be problematic when trust between workers and the company is uncertain.

Building trust requires transparency with data, facts, and results. Change always meets individual reluctance, both personally and professionally. Through demonstrating outcomes and maintaining honesty, leaders can drive effective change management in the AI supply chain era.

Specific approaches include:

Transparent communication about which roles AI will augment versus replace, providing clarity that reduces anxiety and enables productive planning conversations.

Clear demonstration of the outcome showing how AI improves work quality, reduces frustration with manual

processes, and enables focus on higher-value activities that require human judgment.

Participatory implementation involving frontline workers in AI deployment decisions, ensuring systems address actual operational challenges rather than theoretical improvements.

Organizations that invest in change management achieve dramatically higher AI adoption rates and faster value realization than those that treat workforce considerations as afterthoughts.

Local-for-Local Manufacturing Acceleration

Amid compounding volatility and evolving economic challenges, another strategic shift is underway: a rise in local-for-local manufacturing. Companies increasingly prioritize shortening supply chains and locating supply sources close to customers.

The principle of “buy where you make and make where you sell” is no longer a niche strategy but a mainstream approach to building resilience and agility. This local-for-local strategy for production and supply chain has proven remarkably effective amid uncertainty, providing a stable physical counterpart to the digital transformation AI drives.

This trend, combined with AI capabilities, enables responsive, regionally optimized operations that balance cost efficiency with risk mitigation and market responsiveness.

The 2026 Supply Chain Reality

The last half-decade brought challenges that strained supply chains in unforeseen ways. The coming year presents both challenges and opportunities as supply chain leaders seek to effectively embed AI while upskilling employees and scaling efforts appropriately.

Organizations that solidify foundations—especially processes and data management—while engendering trust among employees will be best positioned to navigate turbulent macroeconomic landscapes. Success requires balancing ambitious technology adoption with pragmatic recognition that AI delivers value only when built on proper infrastructure and supported by capable, confident workforces.

Build AI-ready supply chain foundations. Discover how Trax's AI Extractor normalizes complex freight data with 98% accuracy and Audit Optimizer converts fragmented information into strategic intelligence. Contact our team to explore how data standardization accelerates the realization of AI value.

Source: www.traxtech.com

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BRANCH NEWS

DURGAPUR BRANCH

The Indian Institute of Materials Management (IIMM), Durgapur Branch successfully concluded its **National Seminar and Vendor Meet 2025** on 10–11 December at Steel Club, Durgapur. The event, themed **“Harnessing the Power of AI & Data Analytics in Supply Chain Management,”** brought together senior leaders from SAIL, industry experts, global consultants, academicians, and vendor partners from across India.

The programme was inaugurated with cultural performances and a welcome address by **Sri B. S. Popli**, Executive Director (MM), DSP & ASP, who highlighted the growing importance of technology-led supply chain excellence. **Sri Surajit Mishra**, Director-in-Charge, ISP & DSP, stressed that efficient supply chain management is critical to cost competitiveness, especially in the steel sector.

Sri N. C. Parida, Chairman, IIMM Durgapur, outlined the branch's vision to make Durgapur a hub for procurement excellence and technology-enabled SCM capability building. Senior IIMM leaders, including **Sri Pradip Kumar** and **Sri P. M. Biddappa**, appreciated the initiative and emphasised the need for professionals trained in analytics, automation and digital tools.

The Vendor Meet, inaugurated by Sri Mishra, saw participation from **50 vendors** representing engineering, electrical, chemical, casting, raw materials, rolls and refractory sectors. Executive Directors (MM) of major SAIL units visited the stalls, interacted with vendors and explored avenues for cost-effective, innovative solutions. The event was noted as one of the **largest vendor meets in Eastern India**.

Technical sessions were conducted by experts from **KPMG, Deloitte, McKinsey, IIM Ranchi**, along with representatives from SAIL, GAIL, DHL, GeM and Amazon-AWS, making it a rich platform for industry knowledge exchange.

The programme concluded with a vote of thanks by **Sri Rajiv Sehgal**, CGM (MM), DSP. The two-day event served as a key forum for collaboration and the adoption of next generation supply chain practices.

PRESS NOTE

National Seminar & Vendor Meet 2025 Organised by IIMM Durgapur Branch 10–11 December 2025 | Steel Club, Durgapur

The **National Seminar and Vendor Meet 2025**, organised by the Indian Institute of Materials Management (IIMM), Durgapur Branch, concluded successfully today at the Steel Club, Durgapur. The central theme—**“Harnessing the Power of AI & Data Analytics in Supply Chain Management”**—set the tone for a forward-looking and transformative two-day programme focused on the future of supply chain excellence in India.

Inaugural Ceremony : The event commenced on **10th December 2025** with an **inaugural song**, the **National Anthem**, and a cultural presentation by the **Panchajanya** troupe.

Sri B. S. Popli, Executive Director (MM), DSP & ASP and

Chief Patron of IIMM Durgapur Branch, welcomed the **Chief Guest Sri Surajit Mishra**, Director-in-Charge, ISP & DSP, along with distinguished dignitaries, delegates, and vendors. In his address, Sri Popli highlighted that the strong participation of leading industrial houses, consulting firms, academicians, and vendors underscores the fact that **supply chain excellence has emerged as a strategic differentiator for every organisation**.

Delivering the keynote address, **Sri Surajit Mishra, DIC, ISP & DSP**, emphasised that in capital-intensive industries—particularly the steel sector—**materials constitute a major share of production cost**, and therefore **efficient, technology-driven supply chain management has a direct and measurable impact on competitiveness and performance**.

Vision of IIMM Durgapur : **Sri N. C. Parida**, Chairman, IIMM Durgapur Branch, outlined the long-term vision of the branch. He stated that IIMM Durgapur aims to emerge as a **flag-bearer in developing, training, and empowering supply chain professionals**, and envisions Durgapur as a **knowledge hub for procurement excellence, logistics optimisation, inventory intelligence, and AI-enabled SCM strategies** that support profitability, resilience, and long-term competitiveness.

Sri Pradip Kumar, Vice President (East), IIMM, appreciated the Durgapur Branch team for organising a unique and timely event. He remarked that the **deliberations, interactions, and collaborations** over the two days would spark new ideas, forge meaningful partnerships, and contribute significantly to the evolution of supply chain management in India.

Speaking on the growing role of IIMM, **Sri P. M. Biddappa**, National President, IIMM, stated that IIMM is committed to positioning itself as a **centre of excellence in supply chain capability building**. He stressed the need for professionals skilled in **analytics, forecasting, automation, and digital supply chain tools**, which are essential for the next era of industry transformation.

Former National President **Sri Asok Dasgupta**, the First National President of IIMM, graced the occasion and expressed confidence that the initiative taken by the Durgapur Branch would help **shape the next generation of supply chain leaders**.

Vendor Meet 2025

The **Vendor Meet-2025** was inaugurated by **Sri Surajit Mishra, DIC, ISP Burnpur & DSP Durgapur**.

A total of **50 vendors** from across India—representing engineering, electrical, project management, chemicals, casting, rolls, raw materials, and refractories—participated in the meet. Executive Directors (MM) of **BSP, RSP, BSL, CMMG, and ISP** participated and engaged extensively with the vendors.

The leadership team visited all vendor stalls, interacting with companies about their profiles, capabilities, and innovations. Discussions focused on **enhancing cost competitiveness**, strengthening vendor partnerships, and exploring the role of product innovation in reducing input costs across SAIL units. This edition of Vendor Meet was recognised as **one of the largest in Eastern**

India, both in scale and participation.

Technical Sessions

Aligned with the seminar's theme, technical papers and presentations were delivered by global consulting leaders **KPMG, Deloitte, McKinsey**, and academics from **IIM Ranchi**. Industry representatives from **SAIL, GAIL, DHL, GeM, Amazon-AWS**, and others contributed insights on digital transformation, data-driven decision-making, and next-generation supply chain strategies.

The event served as a **significant convergence of materials management professionals, thought leaders, and veterans** from across the country.

Closing

The programme concluded with a **Vote of Thanks** by **Sri Rajiv Sehgal, CGM (IIMM), DSP and Patron, IIMM Durgapur Branch**, who acknowledged the contributions of all organisers, delegates, speakers, and participating vendors.

The **National Seminar & Vendor Meet 2025** emerged as a **collective mission for knowledge exchange, industry collaboration, and actionable learning**, with the objective of enabling implementation of best practices across the industrial ecosystem for overall organisational benefit.

RAJKOT BRANCH

In Association with Rajkot Chamber of Commerce & Industry (RCCI) : The **Indian Institute of Materials Management (IIMM), Rajkot Branch**, in association with the **Rajkot Chamber of Commerce & Industry (RCCI)**, successfully organized the **IIMM Rajkot Industrial Summit**, marking a significant milestone for the region's industrial and professional community.

Notably, this summit also marked the **first structured training workshop organized by IIMM Rajkot Branch specifically for MSMEs and SMEs of Rajkot**, reaffirming the branch's commitment to capacity building, skill enhancement, and value creation for small and medium enterprises.

Inaugural Session & Welcome Address : The summit commenced with a warm and dignified welcome to the **Honorable Chief Guest, Guest of Honour**, esteemed dignitaries, industry leaders, RCCI members, IIMM office bearers, and participants from diverse sectors.

The gathering represented a cross-section of **procurement professionals, supply chain leaders, logistics and warehousing experts, purchase managers, industrial owners, MSME entrepreneurs, and decision-makers**, reflecting the inclusive and industry-driven spirit of the summit.

Theme of the Summit

The theme of the summit,

"Mindset Matters: Transforming Procurement Professionals into Business Value Partners,"

was introduced as both timely and transformative. The theme emphasized the urgent need for procurement professionals to evolve beyond cost-centric roles and emerge as strategic contributors to organizational growth, resilience, and competitiveness.

Dais & Lamp Lighting Ceremony

The dignitaries were invited to the dais, including:

- Honorable Chief Guest
- **Guest of Honour – Mr. Pankaj Panchbhai**, National Secretary & Treasurer (NST), IIMM
- **Speaker of the Day – Ms. Vaishali Parekh**
- **Mr. V. P. Vaishnav**, President, RCCI
- **Mr. Hitendra Patel**, Chairman, IIMM Rajkot Branch
- National Council Members and EC Members of IIMM Rajkot

The traditional **Lamp Lighting Ceremony** was conducted to invoke divine blessings, symbolizing knowledge, wisdom, and prosperity, and setting an auspicious tone for the summit.

Felicitation of Dignitaries : As a mark of respect and appreciation, all dignitaries were felicitated with shawls. The ceremony reflected IIMM's rich tradition of honoring leadership, service, and professional contribution.

Chairman's Address & Rajkot Branch Presentation : **Mr. Hitendra Patel**, Chairman, IIMM Rajkot Branch, delivered an insightful address highlighting the branch's vision, initiatives, and growing role in strengthening industry-institution collaboration. He emphasized that the summit was designed to empower MSMEs and SMEs with contemporary thinking and practical frameworks.

A short **video presentation** followed, showcasing the activities, achievements, and outreach initiatives of the IIMM Rajkot Branch.

Address by the Guest of Honour : Mr. Pankaj Panchbhai, National Secretary & Treasurer of IIMM, addressed the gathering and shared IIMM's national vision, ongoing professional development initiatives, and the institute's expanding role in shaping future-ready supply chain leaders. He underlined the importance of mindset, ethics, and continuous learning in procurement excellence.

Address by RCCI President : Mr. V. P. Vaishnav, President, Rajkot Chamber of Commerce & Industry, spoke on the importance of strong collaboration between industry bodies and professional institutions. He appreciated IIMM Rajkot's initiative to focus on MSMEs and SMEs and reaffirmed RCCI's support for such knowledge-driven programs.





Chief Guest's Address : The Honorable Chief Guest delivered an inspiring and forward-looking address, sharing his perspectives on industrial growth, leadership, and the strategic role of procurement in today's volatile and competitive business environment.

Presentation of Mementos Mementos were presented to all dignitaries by the EC Members of IIMM Rajkot Branch as a token of gratitude for their guidance, presence, and continued support.

Technical Session & Workshop Speaker of the Day: Ms. Vaishali Parekh : The highlight of the summit was the **first training workshop organized by IIMM Rajkot Branch for MSMEs and SMEs**, conducted by **Ms. Vaishali Parekh**, a seasoned **HR and Operations Excellence Consultant** with over a decade of experience working closely with manufacturing leaders, startups, and supply chain teams.

Ms. Parekh strongly advocated that **the future of procurement lies not in sharper negotiations, but in sharper thinking**. In an era defined by volatility, margin pressures, and constant disruption, she emphasized that procurement can no longer function merely as a cost-focused support role—it must evolve into a **strategic business value partner**.

Through her **interactive and highly informative session**, she delivered insights using:

- Real-life case discussions
- Practical group activities
- Impactful videos that challenged conventional thinking

She highlighted that while organizations invest heavily in tools, systems, and processes, **true differentiation comes from mindset**. When procurement professionals shift:

- From savings to value creation
- From process-following to outcome ownership
- From transactional buying to strategic influence

the business impact becomes measurable and sustainable.

Drawing from her extensive on-ground experience, Ms. Parekh demonstrated how decisions based on **total cost of ownership, risk anticipation, and cross-functional alignment** consistently outperform price-driven choices. Her approach reinforced a powerful message for today's supply chain leaders:

"Processes support performance, but mindset defines excellence."

The session was further enriched by her **witty remarks, practical insights, and engaging delivery style**, making it one of the most impactful sessions for participants.

Address by IIMM Ahmedabad & Special Presentations

Post the workshop, **Mr. Awadhesh Yadav**, Chairman, IIMM Ahmedabad Branch, addressed the gathering and shared insights into regional and national initiatives of IIMM.

This was followed by:

- A special video message from the Honorable Prime Minister Shri Narendra Modi Ji on Sustainable Supply Chain
- A presentation showcasing **NATCOM / Glimpses of NATCOM 2025**, highlighting IIMM's flagship national convention and its significance.

Open Forum – Q&A Session An interactive **Open Forum and Q&A Session** was conducted, focusing on:

- IIMM education programs
- Professional certifications
- Membership benefits

Participants actively engaged, reflecting strong interest in professional growth and institutional association.

Conclusion & National Anthem : The summit concluded with the **National Anthem**, with all participants standing in respect, marking a dignified and memorable closure.

Conclusion : The **IIMM Rajkot Industrial Summit**, organized in association with **RCCI**, and featuring the **first MSME-focused training workshop by IIMM Rajkot Branch**, successfully reinforced the message that **mindset transformation is central to procurement excellence**. The event strengthened industry-institution collaboration and reaffirmed IIMM's commitment to developing future-ready supply chain professionals.

LUCKNOW BRANCH

One day seminar of IIMM, LUCKNOW Branch held on 2-11-25 held on IIMM, Conference hall. 1. Topic of Seminar: Role of supply chain Management in AI-speaker Dr Upendra Kumar, Prof. I.E. T. Lucknow. 2. Topic: Repercussion of AI in Supply chain Management-Speaker Prof CM. Mishra, IIM, LUCKNOW

AI is transforming supply chain management by enhancing efficiency, providing greater visibility, and reducing costs through automation and data analysis by **Dr. Upendra Kumar**

AI discipline, formally initiated in 1956 (AI Coined). However, the study of intelligence is one of the oldest disciplines being approximately 2000 years old. The advent of computers made it possible for the first time for people to test models they proposed for learning, reasoning, perceiving, etc. Artificial Intelligence is composed of two words Artificial and Intelligence, where

Artificial defines “man made,” and intelligence defines “thinking power”, hence AI means “a man-made thinking power”.

Machine Learning (ML) is a branch of Artificial Intelligence (AI) that focuses on enabling computers to learn from data and make decisions or predictions without being explicitly programmed. In simple terms, instead of giving the computer a set of fixed instructions, we provide it with examples (data) and let it learn patterns or relationships automatically.

Supply Chain Management (SCM) is the coordination and management of all activities involved in sourcing, procurement, production, and logistics—as well as the flow of information, materials, and finances—from raw material suppliers to the final customer. In simple terms, SCM ensures that the right product reaches the right place at the right time and cost. This includes planning, sourcing, manufacturing, distribution, and logistics, all managed to maximize efficiency, customer satisfaction, and a company's competitive edge.

Artificial Intelligence (AI) is transforming the way supply chains operate by bringing **automation, real-time insights, predictive capabilities, and intelligent decision-making** into every stage—from procurement to delivery. It enables supply chains to be **faster, smarter, more efficient, and more resilient** than ever before.

Smart Manufacturing refers to the integration of **Artificial Intelligence (AI), IoT, Robotics, and Big Data** to create intelligent, adaptive, and self-optimizing production environments. AI enables machines to **analyze data, learn from patterns, and make autonomous decisions**, leading to improved efficiency, quality, and productivity. AI-driven robots and automated systems manage assembly lines, packaging, and quality control with precision. Predictive maintenance powered by AI prevents equipment failures, minimizing downtime.

Supplier Relationship Management is the **systematic approach to managing interactions and relationships with suppliers** who provide goods and services to an organization. The goal of SRM is to **maximize the value** gained from suppliers by improving **communication, collaboration, efficiency, and long-term partnerships**, rather than simply focusing on cost reduction. By integrating **Artificial Intelligence (AI)**, SRM becomes smarter, more predictive, and highly efficient—transforming supplier evaluation, communication, risk management, and collaboration into **data-driven, automated processes**. AI helps evaluate supplier performance, detect risks, and recommend alternative sources during disruptions. It can analyze contracts, pricing, and delivery records to ensure reliability and compliance.

AI provides actionable insights from vast data streams, supporting better decisions in sourcing, pricing, and distribution. AI-powered dashboards enable managers to simulate “what-if” scenarios before making strategic moves. **Artificial Intelligence (AI)** enhances these systems by **analyzing massive datasets, uncovering hidden patterns, generating insights, and automating recommendations**—allowing businesses to make faster, more accurate, and strategic decisions.

Personalization is the heart of modern customer experience. **Artificial Intelligence (AI)** empowers organizations to understand individual customer preferences, predict needs, and deliver **tailored interactions** across multiple touchpoints—improving satisfaction, loyalty, and sales conversion. AI-driven

personalization uses data from **customer behavior, demographics, purchase history, and real-time interactions** to create customized experiences at scale.

AI helps minimize carbon footprint by optimizing transport routes, reducing energy use, and improving waste management. **Artificial Intelligence (AI)** enhances sustainability by making supply chains **smarter, cleaner, and more efficient**, through data-driven decision-making, predictive analytics, and automation.

AI-driven supply chain management offers **greater speed, flexibility, and intelligence** than traditional models. However, successful implementation requires **balanced investment, strong data governance, skilled professionals, and ethical AI practices**. However, challenges such as **high implementation costs, data quality issues, and lack of skilled professionals** must be addressed for AI adoption to reach its full potential.



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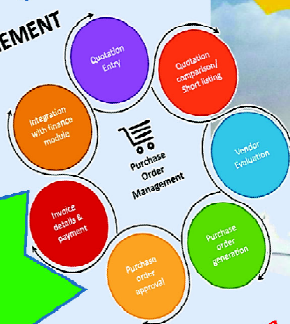
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IIMM Research Centre

CENTRE FOR RESEARCH IN MATERIALS MANAGEMENT (CRIMM)

IIMM has set up CRIMM in Kolkata jointly with the Techno India University which is one of the renowned and largest Private University in West Bengal. A MOU was signed with TIU on 17th of November, 2017. Techno India University, West Bengal, promoted by the well-known Techno India Group is a leading Private University in the state and the country

Objectives and Activities of CRIMM in brief

- To promote research in materials management discipline.
- To collaborate with industry for furthering the academic advancement of materials management and its application to industry.
- To render assistance to industries in problem solving projects, development activities, etc
- To take up project consultancy work in Materials Management. Centre will act as a nodal point for co-ordination and integration of research information in the field of Materials Management for on-going and completed research work in other countries

Research Fellowship

The candidate should have a Master Degree in any subject/discipline or equivalent professional

Management qualification i.e. PGDBM, PGDMM etc. with at least 50% marks in aggregate at the graduation and post-graduation level. The candidate should have experience in working in Materials Management discipline or allied areas in industries. In case of highly experienced candidate in the field of Materials Management, and/or Engineering Graduates, Master Degree may be dispensed with. Preference will be given to industries sponsored candidates

The fees for such research studies will depend on the specific problem/area and the tenure, which will be borne by the sponsoring organisation. Those who will take up such Fellowship research studies on their own expenses, will have to bear the expenditure on their own. Successful Research Fellow from CRIMM shall have the unique opportunity to pursue PhD in Techno India University, West Bengal with condensed course work.

Governing Committee

A steering Committee has been constituted to oversee the working of the centre consisting of nineteen members, eight from Techno India University, West Bengal, eight from IIMM, and three from industry.

For more information please contact

MALAY C MAZUMDAR

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NATIONAL SEMINAR & VENDOR MEET 2025 -DURGAPUR BRANCH





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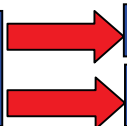
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