KPMG

Industry 4.0 Adoption and Strategic Roadmap for Indian Manufacturing

December 2024

Disclaimer

Foreword

The global manufacturing landscape is rapidly evolving, and India stands at the cusp of an industrial transformation powered by Industry 4.0 technologies. This report highlights the critical role of digitalization in driving innovation, efficiency, and sustainability across sectors. It also provides a realistic assessment of the current state of digital maturity in Indian manufacturing, offering valuable insights into the opportunities and challenges for businesses, particularly MSMEs.

As we move toward a more connected and intelligent manufacturing ecosystem, the emphasis must be on fostering collaboration, enhancing workforce skills, and integrating sustainable practices. The actionable recommendations in this report will empower Indian manufacturers to harness Industry 4.0 technologies effectively and strengthen their position in the global value chain. It is a privilege to contribute to this initiative that aims to shape the future of India's manufacturing sector.

Dilip Sawhney

Chairman, CII National Committee on Smart Manufacturing and Managing Director, Rockwell Automation India Pvt Ltd.

India's manufacturing landscape is undergoing a profound transformation with the adoption of Industry 4.0 technologies. For this change to be impactful and inclusive, we must empower businesses of all sizes to embrace digitalization and foster a culture of innovation. This report is a significant step toward enabling Indian manufacturers to enhance their operational efficiency, build resilience, and position themselves in global value chains. It offers actionable insights for companies to navigate the complexities of digital transformation and addresses the distinct challenges faced by MSMEs, medium-sized, and large firms.

At ANAND Group, we have witnessed firsthand how digital adoption drives innovation and competitiveness, making it a critical element for sustainable growth. I am confident that this report will serve as a guide for stakeholders to build a digitally enabled, future-ready manufacturing ecosystem for India.

Anjali Singh

Co-Chairperson, CII National Committee on Smart Manufacturing & Executive Chairperson, ANAND Group

Foreword

Sandeep Chittora
Technical Director,
KPMG in India

Industry 4.0 technologies have revolutionized global manufacturing by enabling smarter, more efficient, and sustainable production systems. This report is a timely resource for Indian manufacturers, addressing the disparities in digital adoption and providing a strategic roadmap for transitioning to advanced technologies. By aligning digital transformation with business goals, manufacturers can unlock significant operational efficiencies and new growth opportunities.

The findings and recommendations in this report are particularly relevant for organizations striving to bridge the gap between digital readiness and execution. I am confident it will serve as a practical guide for manufacturers, policymakers, and industry stakeholders to build a competitive and resilient manufacturing ecosystem in India.

Virendra Gupta
Deputy Director General,
Confederation of Indian Industry

Indian manufacturing is at the heart of the country's economic growth and global aspirations. Industry 4.0 technologies offer the means to enhance productivity, drive sustainability, and integrate with global markets. This report from CII provides a clear picture of the current state of digital maturity and highlights the key interventions required to unlock the sector's potential. It reflects the collective effort of industry leaders and stakeholders in addressing challenges and shaping the future of Indian manufacturing.

As we strive to position India as a global manufacturing powerhouse, collaboration among businesses, policymakers, and industry bodies will be paramount. The recommendations in this report will help manufacturers navigate their digital transformation journey and create a robust foundation for long-term growth and global competitiveness.

Executive Summary

The adoption of Industry 4.0 technologies marks a transformative shift for Indian manufacturing, offering immense potential to boost productivity, enhance sustainability, and drive global competitiveness. These technologies, including IoT, AI, robotics, and advanced analytics, enable manufacturers to optimize operations and innovate at an unprecedented pace. However, the state of Industry 4.0 adoption in India remains uneven, with varying levels of digital maturity across sectors and company sizes.

Current state of digital maturity

Indian manufacturers display wide disparities in digital maturity. Large firms lead with an average score of 3.4 on a 5-point scale, while medium-sized companies score 2.9 and MSMEs trail at 2.4. Additionally, the top 25% of companies achieve a score of 4.3, while the bottom 25% lag behind at 1.9, highlighting the urgent need to bridge this gap. Despite 85% of business leaders prioritizing digital transformation, only 30% of organizations have successfully scaled their initiatives due to unclear roadmaps, limited expertise, and resource constraints.

Sector-wise industry 4.0 adoption

The pace of adoption varies significantly across sectors. Automotive, electronics, and pharmaceuticals are the frontrunners, leveraging precision and automation to meet global standards. Oil & gas and food & beverage show moderate adoption, focusing on compliance and operational improvements. In contrast, textiles, metals & mining, and heavy equipment manufacturing face significant barriers, including financial and technical constraints, which impede their digital transformation journey.

Key success drivers

Digitally mature firms share common success factors that set them apart. Leadership commitment ensures clear vision and resource allocation for digital initiatives. Continuous workforce upskilling enables employees to manage advanced systems effectively. Robust digital infrastructure facilitates seamless data flow and decision-making. Finally, integrating sustainability goals

into digital strategies allows firms to align with global trends and meet the growing demand for green manufacturing practices.

Barriers to adoption

Industry 4.0 adoption in India faces challenges such as lack of awareness among MSMEs, leading to misconceptions about costs and benefits, and difficulty in creating phased implementation roadmaps. Technological barriers include legacy system incompatibility, complex data integration, and cybersecurity risks. Financial constraints such as high project costs and limited funding access further restrict progress, while a skilled workforce shortage and cultural resistance hinder implementation. Targeted efforts in awareness, financing, skills development, and technological support are essential to overcome these challenges.

Harnessing Global Value Chains (GVCs)

Emerging Global Value Chains (GVCs) present immense opportunities for Indian MSMEs to access global markets and enhance their competitiveness. Participation in GVCs enables MSMEs to adopt advanced technologies, specialize in niche areas, and gain recognition as reliable global suppliers.

Government support and policy interventions

India has launched several initiatives to support Industry 4.0 adoption. SAMARTH Udyog Bharat 4.0 establishes centers of excellence and offers training programs to drive advanced manufacturing adoption. Make in India 2.0 promotes high-tech investments, while Digital India focuses on enhancing connectivity and fostering innovation. Policymakers should expand training programs, offer financial incentives, and develop a unified national roadmap to create an enabling environment for Indian manufacturers.

Industry agenda

- Develop comprehensive digital strategies and phased implementation roadmaps.
- Foster a culture of innovation and continuous improvement.
- Prioritize key technologies such as IoT, AI, and automation through scalable pilot projects.
- Invest in workforce upskilling and create a collaborative learning environment.
- Leverage government initiatives and industry partnerships to support digital transformation.

Policy agenda

- Conduct nationwide awareness campaigns and industry-specific workshops.
- Expand training programs and introducing smart manufacturing courses at ITIs.
- Establish structured public-private partnerships and innovation hubs.
- Accelerate high-speed internet and 5G deployment.
- Implementing financial incentives and tax breaks for digital investments.
- Develop a national digital transformation roadmap with industry consultation.
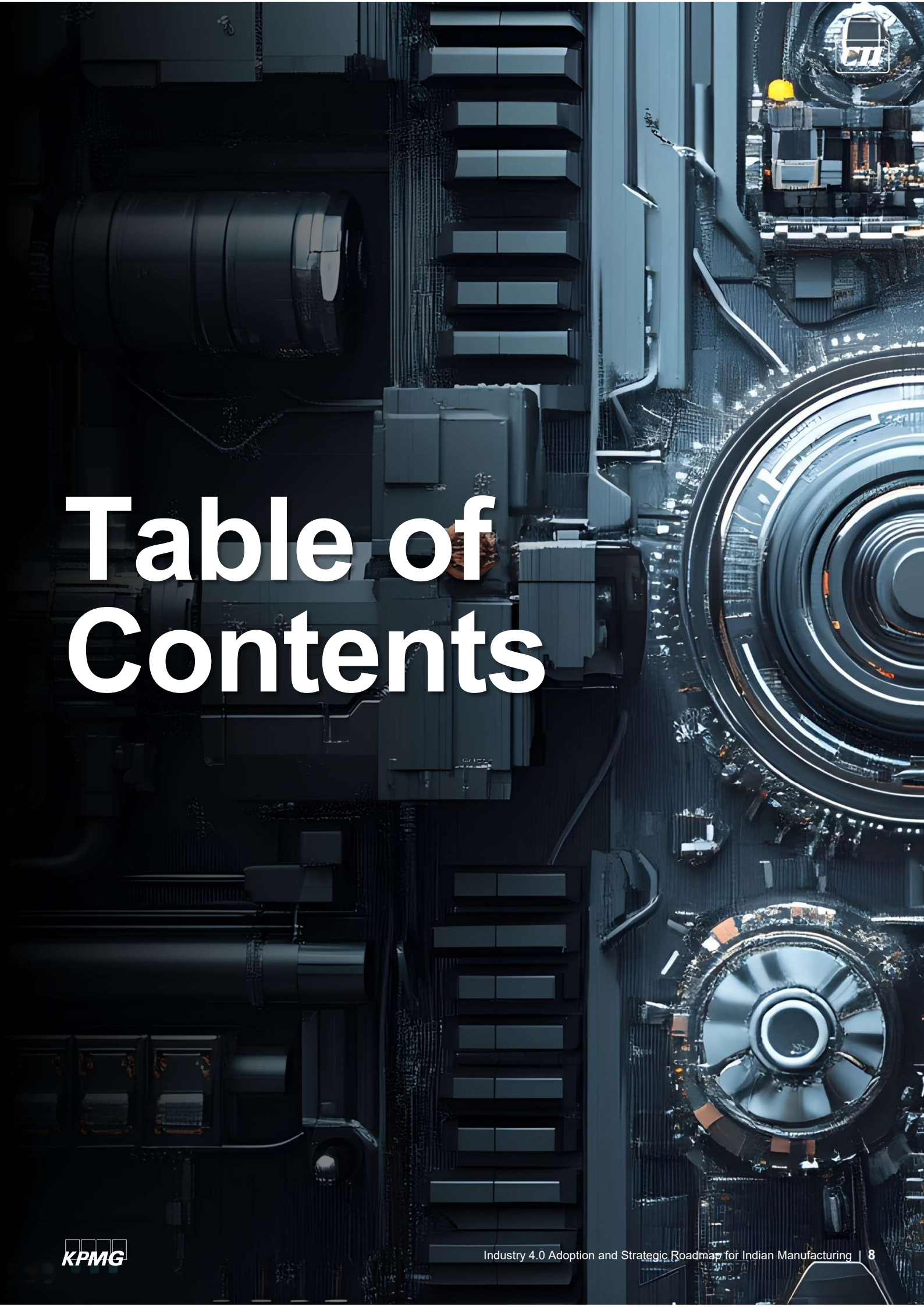
Table of Contents

SECTION 1 ——————

Study Objective and Research Methodology

10

SECTION 2 ——————

The Digital Economy: Fueling Global and Indian Growth

14

SECTION 3 ——————

Understanding Industry 4.0 Maturity of Indian Manufacturers
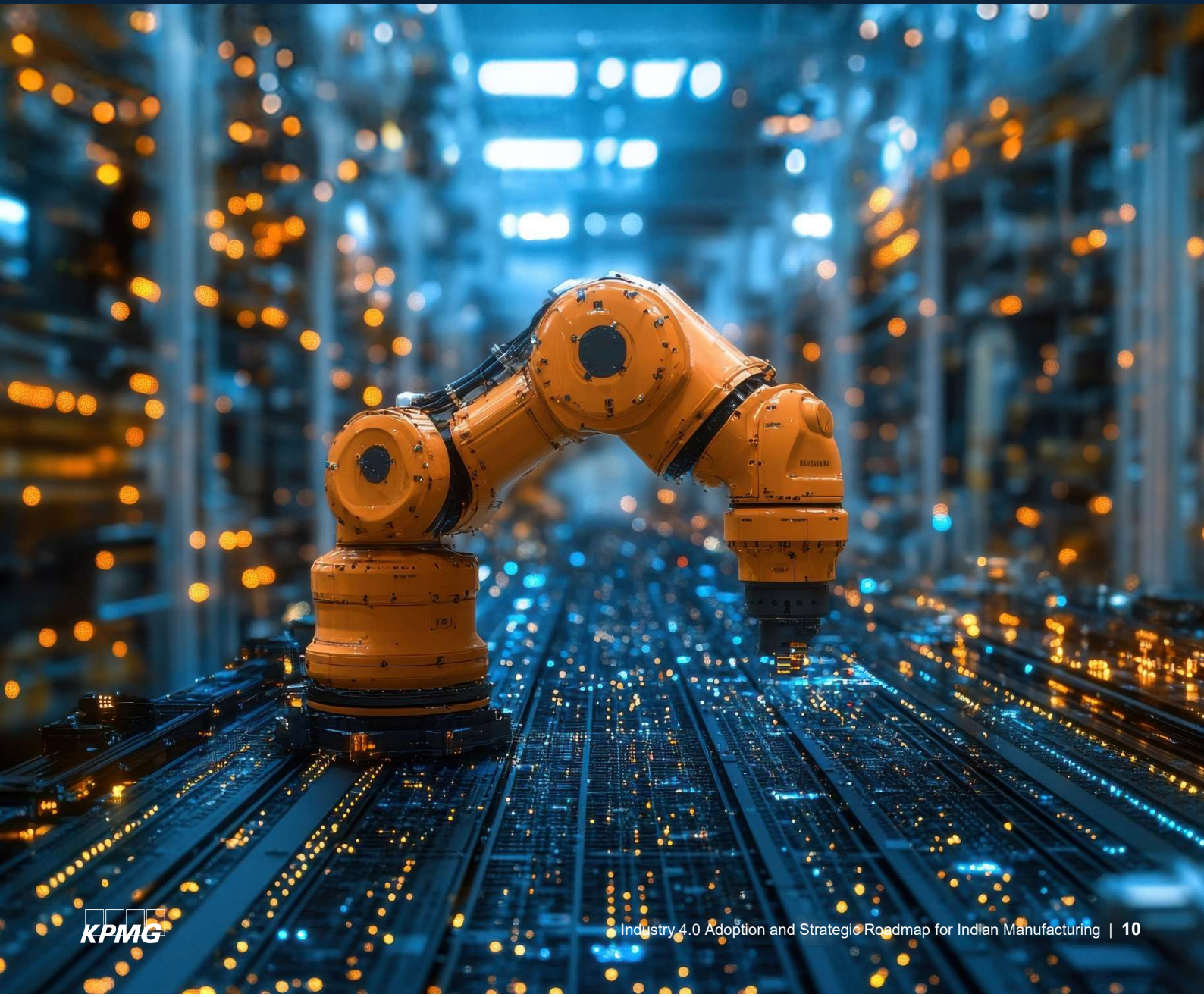
16

SECTION 4 ——————

Government Support for Accelerating Industry 4.0 Adoption

30

Study Objective & Research Methodology

01

Study's objectives

Assess Digital Maturity

Evaluate the **current level of Industry 4.0 adoption** among Indian manufacturers.

Identify Gaps and Opportunities

Highlight the areas **where Indian manufacturers lag** in digital maturity and identify opportunities for improvement.

Provide Strategic Recommendations

Offer actionable insights and **recommendations** for manufacturers and policymakers to accelerate Industry 4.0 adoption and enhance digital maturity.

Research Methodology

Survey Design

Structured questionnaire with questions covering people, processes, and technology aspects of digital maturity.

Response Collection

Collected during CII workshops and seminars via in-person surveys and follow-up interviews.

Expert Interviews

CII arranged expert interviews with industry leaders to validate findings.

Data cleaning & verification

Performed on survey and interview responses to ensure accuracy and consistency.

Data analysis

Correlation analysis, regression models, and ANOVA used to analyze the survey data.

Benchmarking

Comparative analysis conducted against global leaders (Germany, Japan, South Korea, China, the US, the UK, and Singapore).
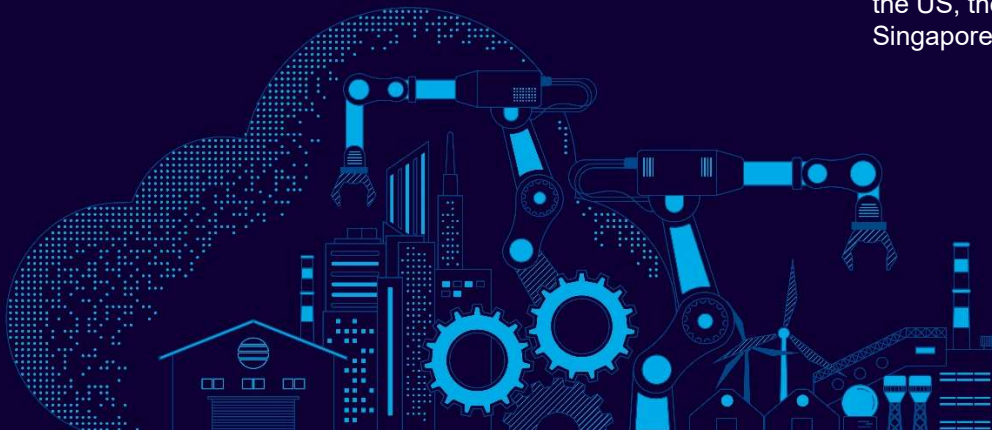
1st comprehensive annual survey

Manufacturers surveyed across 10 industries

1-1 interviews with CXOs

Participants by revenue (INR)

Category	Percentage
MSMEs (<250 Cr)	18%
Medium (1000-5000 Cr)	34%
Large (> 5000 Cr)	48%
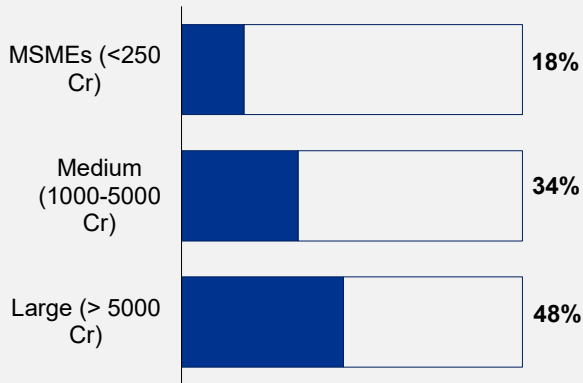
Participants by industry

- Heavy equipment — 25%
- Electronics & Electrical — 22%
- Services — 12%
- Oil & gas and Chemicals — 10%
- Metals & Mining — 9%
- Automotive — 8%
- Textiles — 6%
- Consumer Products — 5%
- Cement & Building material — 2%
- Paper & Packaging — 1%

KPMG

The Digital Economy: Fueling Global and Indian Growth

02
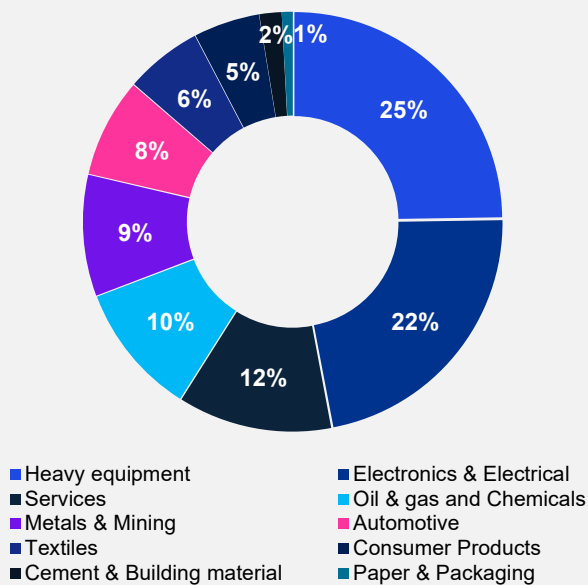
In today's rapidly evolving global landscape, the digital economy stands as a cornerstone of growth and innovation. The fusion of digital technologies with traditional economic practices has not only reshaped industries but also created new opportunities for growth, efficiency, and sustainability.

2.1 Global Impact

Economic Growth

The digital economy is a significant driver of global economic growth, contributing more than 15% to global GDP, with projections suggesting it could account for over 20% of the world economy by 2030. This growth is fueled by the widespread adoption of digital technologies, which enhance productivity, spur innovation, and create new market opportunities across various sectors. According to the World Economic Forum, digital transformation could create up to $100 trillion in value for industry and society over the next decade.

Innovation and Efficiency

Digital technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and blockchain are revolutionizing how businesses operate, driving efficiency and innovation in manufacturing, services, and governance. These technologies enable the development of new products and services, optimize supply chains, and improve decision-making processes. For instance, AI alone is estimated to boost global GDP by over $15 trillion by 2030, illustrating its profound impact on innovation and economic efficiency.
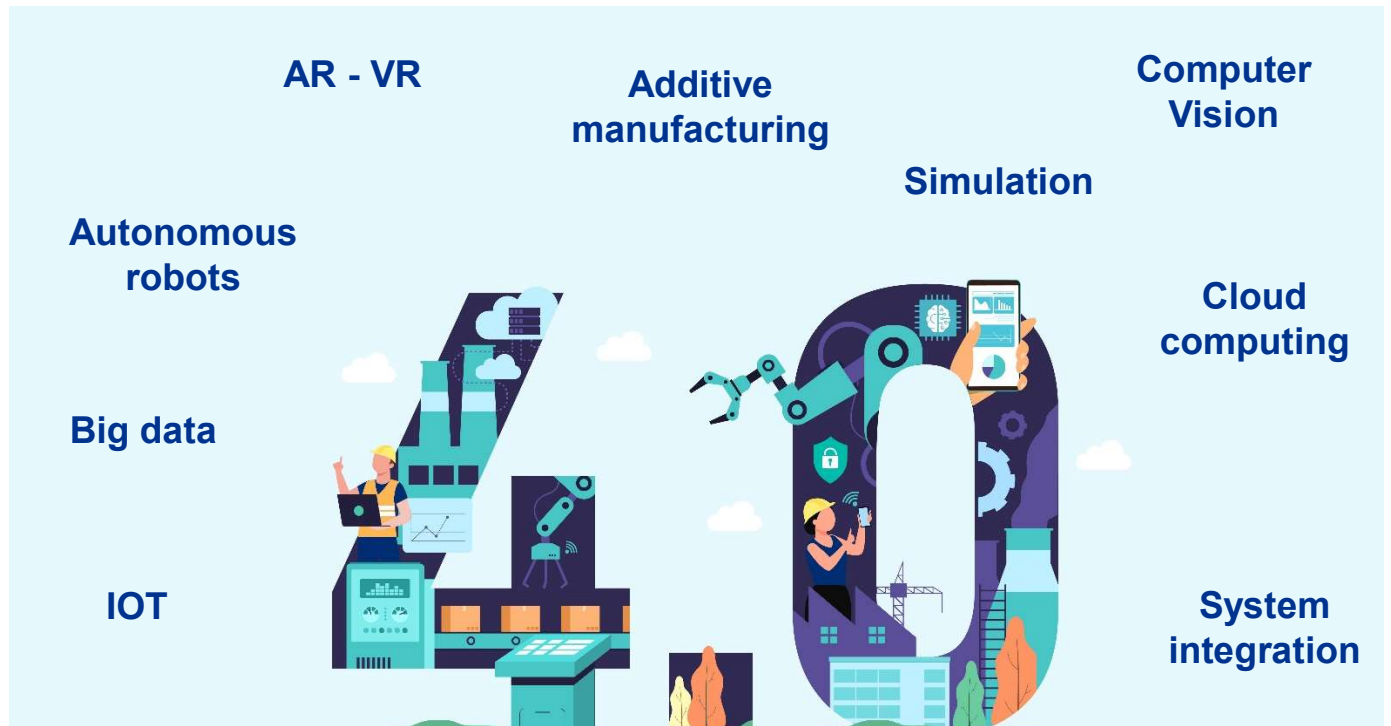
2.2 Significance for India

Economic Development

In India, the digital economy is a key driver of economic growth, contributing approximately 11% to the country's GDP in 2023, with the potential to reach 20% by 2026. The digital economy facilitates job creation, enhances service delivery, and boosts the competitiveness of Indian industries. The National Association of Software and Service Companies (NASSCOM) projects that the digital economy could create over 65 million new jobs in India by 2025, underscoring its critical role in the nation's economic development

Global Competitiveness

Embracing digital transformation positions India as a competitive player in the global market, attracting foreign investments and enhancing trade. This digital shift strengthens India's economic resilience and ability to compete in a technology-driven world. Notably, India's IT and digital services exports reached $257 billion in 2023, highlighting the country's role as a global technology hub

Digital initiatives in India are bridging the urban-rural divide, providing access to markets, education, and healthcare to remote and underserved regions. These initiatives promote financial inclusion, enhance the quality of life, and empower communities. The Digital India initiative, for example, has significantly increased internet penetration, with overall internet penetration reaching 67% as of March 2024, thereby fostering inclusive growth

Digital technologies contribute to sustainable development by optimizing resource use, reducing waste, and enabling green innovations. These technologies support India's commitment to sustainability and environmental protection. For instance, smart city projects leveraging digital technologies aim to create environmentally sustainable and efficient urban spaces across India, furthering the nation's sustainable development goals

Inclusive Growth

Sustainable Development

As India continues to embrace digital transformation, it is poised to reap significant benefits. However, realizing these benefits requires a thorough understanding of the current state of digital maturity among Indian manufacturers, the challenges they face, and the strategies they employ.

Understanding Industry 4.0 Maturity of Indian Manufacturers

03

AR - VR

Additive manufacturing

Computer Vision

Simulation

Autonomous robots

Cloud computing

Big data

IOT

System integration

Through combinatorial concert of emerging digital technologies, Industry 4.0 has revolutionized manufacturing by enhancing productivity, improving efficiency, and driving competitiveness, all while fostering sustainable practices and resource management.

3.1 Industry 4.0 Overview

Industry 4.0 represents the fourth industrial revolution characterized by the integration of digital technologies into manufacturing processes. This transformative shift has the potential to revolutionize Indian manufacturing by enhancing productivity, improving efficiency, and driving competitiveness.

Benefits of Industry 4.0

Enhanced Productivity	Improved Quality	Increased Flexibility	Cost Savings	Sustainability
Automation and real-time data enable more efficient production processes.	Advanced analytics and predictive maintenance reduce defects and downtime.	Smart manufacturing systems adapt quickly to changes in demand and production requirements.	Optimization of resources and processes leads to significant cost reductions.	Efficient use of resources and reduced waste contribute to environmental sustainability.

3.2 Current State

Digital maturity refers to the extent to which manufacturers have adopted and integrated digital technologies into their operations. High digital maturity correlates with improved operational efficiency, innovation, and competitive advantage.

Correlation Between Company Size and Digital Maturity

The survey data revealed a significant correlation between the size of a company and its digital maturity. MSMEs had an average maturity level score of 2.4, medium-sized companies scored 2.9, and large-sized companies scored 3.4 on a scale of 0 to 5. This indicates that larger companies are generally more advanced in their digital adoption.

Disparity Between Leaders and Laggards

There is a wide disparity between the digital maturity of leaders and laggards. The top 25% of companies (leaders) had an average maturity score of 4.3, while the bottom 25% (laggards) scored only 1.9. This gap highlights the uneven adoption of digital technologies across the manufacturing sector and underscores the need for targeted interventions.

Digital maturity comparison: Company size
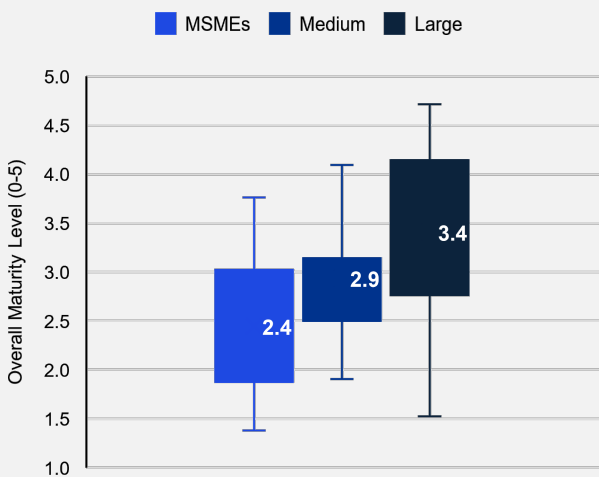
Note: Number in the chart represent average overall maturity score of the category.

Digital maturity comparison: Leaders vs Laggards
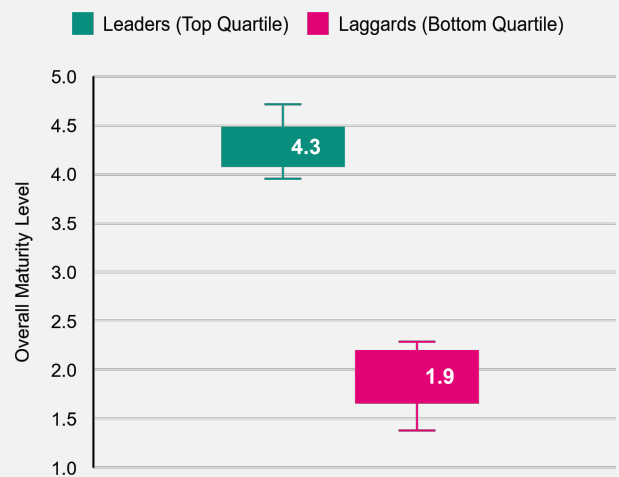
Note: Number in the chart represent average overall maturity score of the category.

Industry 4.0 Paradox: High Priority, Low Execution

Our research revealed that 85% of senior business leaders consider digitalization a top priority for their companies. This high level of awareness underscores the recognition of the potential benefits that digital technologies can bring to manufacturing, including increased efficiency, better decision-making, and enhanced competitiveness.

Despite this high priority, only 30% of organizations have successfully scaled their digital initiatives. This gap between awareness and execution, referred to as the Industry 4.0 paradox, highlights several underlying challenges:

Uncertainty on How to Start

Many companies are unsure about where to begin their digital transformation journeys. They lack a clear roadmap and struggle to prioritize initiatives that align with their strategic goals.

Lack of Clear Roadmap

Without a well-defined strategy, companies find it difficult to navigate the complexities of digital transformation, leading to fragmented efforts and limited success.

Unsure of Results and Benefits

Companies often face skepticism about the tangible benefits of digital investments, which hinders their willingness to commit significant resources.

Lack of Dedicated Teams and Responsibilities

Successful digital transformation requires dedicated teams with clear roles and responsibilities. Many companies lack the organizational structure to support these initiatives.

Experts' opinions

" The gap between recognizing the importance of digitalization and executing it is a major challenge. Companies need clear roadmaps and dedicated teams to drive these initiatives effectively. "

" The apprehension about investing in digital technologies and uncertainty about the results are major roadblocks. Companies need to see documented success stories and case studies to overcome these fears. "

3.3 Sector-wise Industry 4.0 Adoption Levels

Laggards   **Early Adopters**

- Automotive & Auto Components
- Electronics & Electrical Equipment
- Pharmaceuticals & Biotechnology
- Oil & Gas and Chemicals
- Metals & Mining
- Machinery & Heavy equipment
- Food & Beverage
- Cement & Building Materials
- Paper & Packaging
- Textiles & Apparel
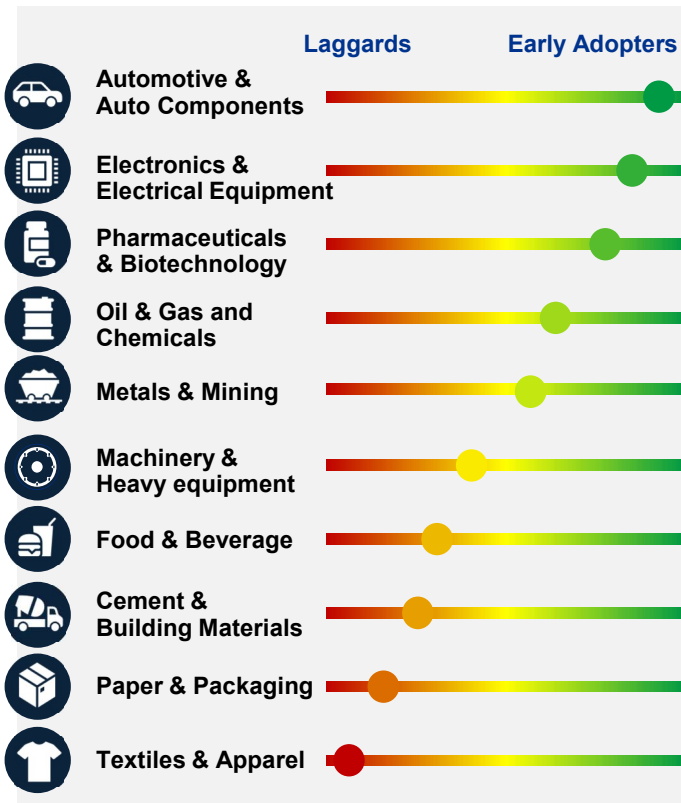
1. Leaders

- **Automotive:** is at the forefront of Industry 4.0 adoption, driven by the need for high precision, efficiency, and competitiveness in a global market. Companies are leveraging IoT for real-time vehicle monitoring, and robotics for assembly line automation. This has resulted in improvements in production efficiency, quality control, and supply chain management.

- **Electronics & Electrical:** High adoption levels are observed due to the sector's inherent reliance on advanced technologies and the rapid pace of innovation. Manufacturers are heavily investing in smart manufacturing technologies.

- **Pharmaceuticals & Biotechnology:** Regulatory requirements for traceability and quality control have accelerated the adoption of digital technologies in this sector. IoT for environmental monitoring, AI for drug discovery, and blockchain for secure supply chains are prominent.

Experts' opinions

" The disparity in Industry 4.0 adoption across sectors is evident. While some sectors like automotive and electronics are forging ahead, others like textiles and machinery are still grappling with fundamental challenges. "

" Each sector faces unique challenges and opportunities in adopting Industry 4.0 technologies. A tailored approach, addressing sector-specific needs and barriers, is essential for successful digital transformation. "

2. Followers

- **Oil & Gas and Chemicals:** This sector shows moderate adoption levels. Technologies like digital twins for process optimization, IoT for safety monitoring, and AI for predictive analytics are gradually being integrated.

- **Food & Beverage:** The sector is adopting Industry 4.0 technologies to ensure quality and compliance with food safety regulations. Automation in production lines, IoT for supply chain management, and AI for quality control are increasingly used.

3. Laggards

- **Metals & Mining:** Adoption is relatively low due to the high initial investment costs and the complexity of integrating new technologies with legacy systems. However, there is growing interest in using IoT for equipment monitoring and AI for resource optimization.

- **Textiles & Apparel:** The sector faces significant challenges due to financial constraints and a lack of skilled workforce. Adoption of digital technologies is limited to larger firms, with MSMEs struggling to keep pace.

- **Machinery & Heavy Equipment:** This sector lags in adoption due to the complexity and customization required for implementing Industry 4.0 technologies. There is potential for growth, particularly in using IoT for equipment monitoring and predictive maintenance.

- **Paper & Packaging:** Adoption is low, but there are emerging efforts to integrate digital technologies for process optimization and supply chain management.

- **Cement & Building Materials:** The sector has been slow to adopt Industry 4.0 technologies, primarily due to financial constraints and a traditional mindset.

3.4 Key Success Drivers of Digitally Mature Firms

1 ## Leadership Commitment

- **Strong Vision and Commitment:** Leadership teams in digitally mature companies prioritize digital transformation by setting a clear vision and allocating necessary resources.
- **Empowering Culture:** These companies foster a culture of innovation and continuous improvement, where employees are encouraged to experiment and learn from failures.

2 ## Continuous Upskilling of Workforce

- **Personalized Training Programs:** Digitally mature companies invest in continuous upskilling programs tailored to specific roles and skill needs.
- **Adoption of Advanced Training Methods:** These organizations utilize advanced training methods, including e-learning, simulations, and hands-on workshops.

3 ## Robust Digital Infrastructure

- **Integrated Digital Applications:** Mature companies have integrated digital applications across all organizational functions, enabling seamless data flow and informed decision-making.
- **Advanced Technologies:** Investments in advanced technologies such as IoT, AI, and cloud computing are common among these companies.

Experts' opinions

" The fundamental driving factor is the culture of the organization - a culture fostering learning is very important. Failures should be acceptable. "

92% of top-quartile companies rated their leadership's commitment to Industry 4.0 technologies as high (ratings 4 or 5), compared to only **19%** in the bottom quartile.

85% of top-quartile companies have established upskilling programs for digital technologies, compared to **17%** of bottom quartile.

75% of top-quartile companies have invested in advanced digital infrastructure, compared to **24%** of the bottom quartile.
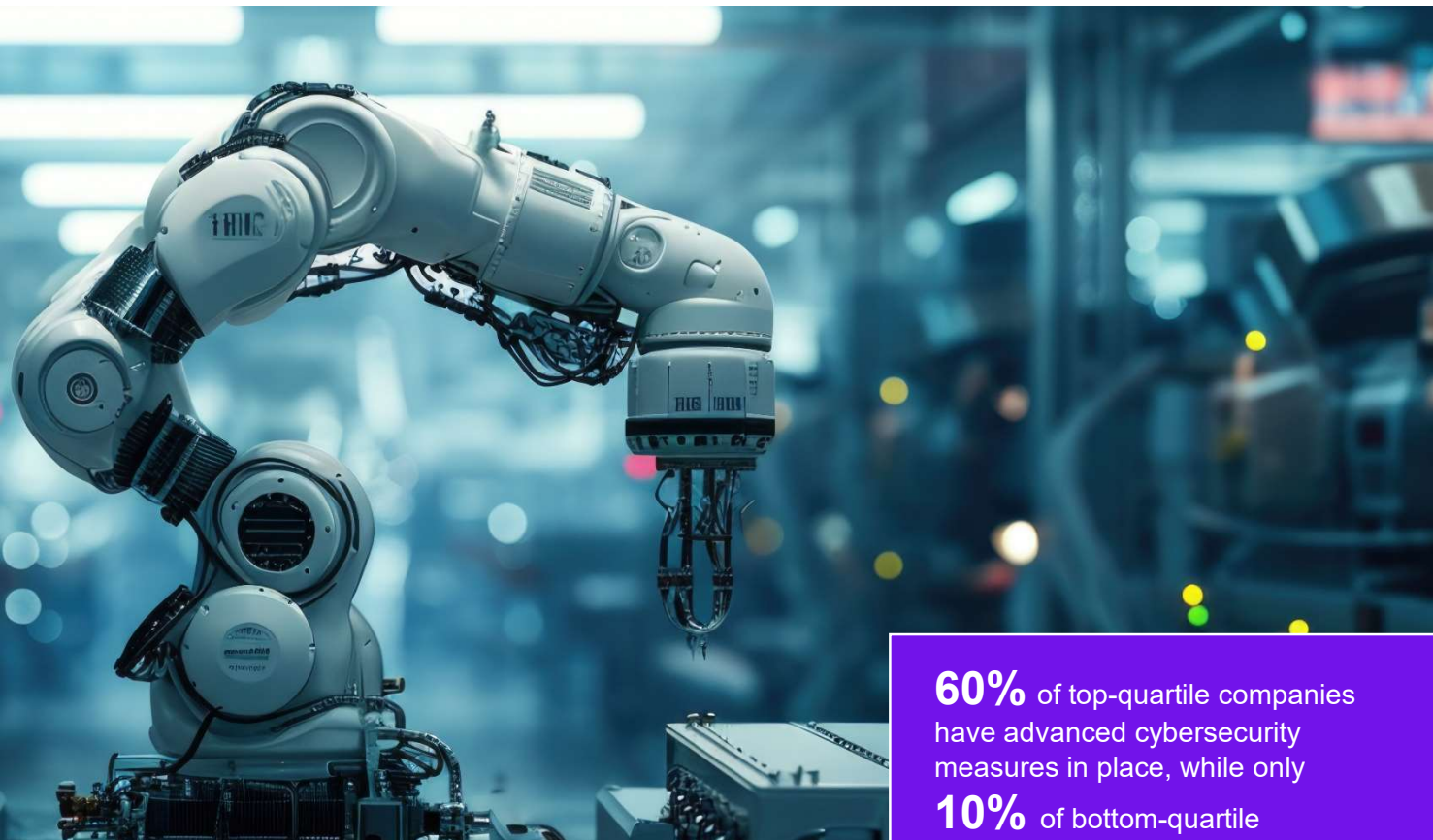
60% of top-quartile companies have advanced cybersecurity measures in place, while only **10%** of bottom-quartile companies do.

3.5 Overcoming Cybersecurity Challenges

1

Comprehensive Security Policies

Establishing Policies
Implement comprehensive security policies that cover all aspects of digital operations.

Regular Updates
Ensure that security policies are regularly updated to address emerging threats.

2

Advanced Security Technologies

Multi-Factor Authentication (MFA)
Utilize MFA to enhance security by requiring multiple forms of verification.

Encryption and Data Protection
Implement advanced encryption techniques to protect sensitive data.

3

Regular Vulnerability Assessments

Continuous Monitoring
Conduct regular vulnerability assessments and penetration testing to identify and address security gaps.

Employee Training
Provide ongoing training for employees to recognize and respond to cyber threats.

3.6 Integrating Sustainability with Industry 4.0

(1) **Sustainable Manufacturing Practices**

- **Resource Optimization:** Use digital technologies to optimize resource use, reduce waste, and enhance efficiency.
- **Energy Management:** Implement IoT and AI to monitor and manage energy consumption, reducing environmental impact.

(2) **Supporting Sustainability Goals**

- 70% of top-quartile companies incorporate sustainability into their digital transformation strategies, compared to 15% of bottom-quartile companies.
- **Aligning with Global Standards:** Ensure that digital transformation strategies align with global sustainability standards and goals.
- **Transparent Reporting**: Use digital tools for transparent reporting on sustainability metrics and progress.

(3) **Innovation for Sustainability**

- **Green Innovations:** Invest in green technologies and innovations that support sustainable manufacturing processes.
- **Circular Economy:** Leverage digital tools to promote circular economy practices, such as recycling and reusing materials.

Case Studies

CEAT incorporated Industry 4.0 in creating **Lighthouse** factory at Halol to leverage technology for maximizing efficiency and driving sustainable growth.

Digital Solutions Implemented

Energy Management | Resource Optimization | Waste Reduction

- Advanced data analytics & IoTs for Inventory management..
- Use of AI/ML, AR/VR for resource training and decision making.

18% ↓ Energy Consumption

20% ↓ Cycle Time

50% ↓ Waste Generation

ASIAN PAINTS' focus on innovation in manufacturing led to use of I4.0 in their value chain to enhance productivity and achieve sustainable growth.

Digital Solutions Implemented

Energy Management | Resource Optimization | GHG Emission Reduction

- IoT & Digital Twin implementation for process improvement.
- Automation and installation of energy efficient devices.

36% ↓ Energy Consumption

5% ↓ Service Level

45% ↓ GHG Emissions

CII

3.7 Major Challenges in Adopting Industry 4.0 Technologies

01

Lack of Awareness

1. **Misunderstanding of Costs and Benefits:** Many MSMEs lack a clear understanding of the financial implications of Industry 4.0 technologies, often overestimating upfront costs while underestimating the long-term savings and operational efficiencies these technologies can deliver.

2. **Implementation Roadmap Challenge:** Companies find it challenging to create a phased implementation plan that aligns with their unique operational needs.

02

Technological Barriers

1. **Legacy Systems Incompatibility:** Existing infrastructure often lacks compatibility with new digital solutions, requiring significant modifications or replacements.

2. **Data Integration Challenges:** Integrating data from various sources and systems within a company can be a complex and resource-intensive task. Ensuring that new technologies can scale effectively within existing operations is a significant challenge.

3. **Cybersecurity Concerns:** The interconnected nature of Industry 4.0 technologies increases exposure to cyber threats, necessitating robust cybersecurity measures.

03

Financial Constraints

1. **High Actual Costs for Larger Projects:** Scaling Industry 4.0 adoption can involve significant expenses for hardware, software, training, and infrastructure upgrades, creating genuine financial challenges for many MSMEs.

2. **Ongoing Maintenance Costs:** The costs related to the maintenance and upgrading of digital systems make digital transformation efforts financially burdensome.

3. **Limited Access to Financing:** Many financial support schemes have stringent eligibility criteria, making it difficult for MSMEs to access necessary funds.

04

Lack of Skilled Workforce

1. **Shortage of Skilled Workers:** Skilled workers are in high demand, leading to high turnover rates and difficulty in retaining talent.

2. **Inadequate Training Programs:** Existing workforce training programs are often inadequate to meet the demand.

3. **Cultural Resistance:** Employees may resist adopting new technologies due to fears of job displacement or lack of understanding.

3.8 Strategic Recommendations for Indian Manufacturers

Enhancing Digital Maturity

1. **Developing a Comprehensive Digital Strategy**

   - Conduct a thorough assessment of current digital capabilities and identify gaps. Use maturity models to evaluate digital readiness and identify areas for improvement. Conduct internal audits and gather feedback from key stakeholders.

   - Define specific, measurable goals for digital transformation aligned with business objectives. Set short-term and long-term targets for digital initiatives. Use key performance indicators (KPIs) to track progress.

   - Create a phased implementation roadmap, starting with pilot projects. Identify high-impact areas for initial pilots, scale successful projects across the organization.

2. **Fostering a Culture of Innovation**

   - Promote a culture where experimentation and learning from failures are encouraged.

   - Implement incentive programs to reward innovation and digital achievements.

Implementing Industry 4.0 Technologies

1. **Prioritizing Key Technologies**

   - Leverage IoT for real-time data collection and monitoring. Implement IoT sensors to monitor equipment health and production parameters. Use IoT data for predictive maintenance and process optimization.

   - Use AI and ML for predictive analytics and process automation. Develop AI models for predictive maintenance, quality control, and supply chain optimization.

   - Enhance precision, speed, and productivity through automation. Invest in robotic systems for repetitive and high-precision tasks. Integrate automation with existing workflows.

2. **Starting with Scalable Pilot Projects**

   - Select pilot projects that address specific business challenges. Identify areas with clear success metrics and high potential impact. Monitor and evaluate pilot performance.

   - Scale up successful pilot projects across the organization. Use lessons learned from pilots to refine the implementation plan. Ensure scalability and integration with existing systems.

Companies with clearly defined digital strategies report a **30%** higher success rate in their transformation projects.

Pilot projects help mitigate risks and build confidence in digital initiatives.

Companies that foster a culture of innovation are **50%** more likely to succeed in digital transformation.

IoT adoption can reduce maintenance costs by up to 30% and increase equipment uptime by **20%**.

Automation can increase productivity by **15%** and reduce error rates by **50%.**

AI alone is expected to boost global GDP by over **$15 trillion** by 2030.

Developing a Skilled Workforce

1. **Continuous Upskilling and Reskilling**

   - Conduct regular assessments to identify training needs by using surveys, interviews, and performance data to evaluate skill gaps. Use the insights to develop personalized training plans tailored to address these gaps effectively.

   - Develop programs focusing on digital skills, such as data analytics, IoT integration, and cybersecurity. Partner with educational institutions and training providers to deliver high-quality training programs.

   - Encourage employees to pursue certifications from reputable industry-recognized institutions, fostering professional growth and enhancing expertise.

2. **Fostering a Collaborative Learning Environment**

   - Create internal platforms for employees to share knowledge and best practices. Implement collaboration tools and organize regular workshops and seminars.

   - Encourage collaboration across functions to drive innovation by forming cross-functional teams for digital transformation projects. Foster an environment that values diverse perspectives and encourages creative problem-solving approaches.

Leveraging Partnerships

1. **Engaging with Government Initiatives**

   - Leverage government schemes like SAMARTH Udyog Bharat 4.0 for financial support by staying informed about available grants and subsidies and applying for funding to drive digital transformation projects.

   - Actively participate in government-supported training programs to upskill employees and build internal capabilities for managing advanced technologies.

   - Collaborate with public research institutions to engage in R&D initiatives, fostering innovation and aligning with cutting-edge Industry 4.0 practices.

2. **Collaborating with Industry Bodies**

   - Use platforms provided by industry bodies like CII and NASSCOM to share best practices, success stories, and lessons learned from digital transformation projects.

   - Actively participate in industry events, webinars, and forums to engage in knowledge exchange and learn from other industry leaders.

   - Contribute to working groups and industry research to stay updated on emerging trends and foster collaboration within the manufacturing ecosystem.

Companies with clearly defined digital strategies report a **30%** higher success rate in their transformation projects.

3.9 Practical Strategies for Indian MSMEs

01

Enhancing Awareness and Understanding

1. **Leveraging Industry Associations:** Industry associations like CII and NASSCOM offer valuable resources for MSMEs. Engage with these associations to access webinars, case studies, and online materials that explain Industry 4.0 technologies and their benefits.

2. **Peer Learning Networks:** MSMEs can benefit from joining or forming peer learning networks. Create or join local groups of MSMEs to share experiences, challenges, and strategies for adopting Industry 4.0 technologies.

02

Financial Support and Incentives

1. **Accessing Government Schemes:** MSMEs should stay informed about government schemes that provide financial support. Regularly check government websites and consult with industry associations to learn about schemes like the Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE).

2. **Flexible Financing Options:** Many banks offer specialized financing products for MSMEs. Explore low-interest loans, leasing options, and pay-as-you-go models designed for MSMEs.

03

Training and Upskilling Workforce

1. **Online Training Programs:** Online platforms offer affordable and flexible training options for MSMEs. Encourage employees to enroll in courses on platforms like Coursera, Udemy, and government initiatives like NPTEL.

2. **Industry Certifications:** Industry-recognized certifications enhance employee skills and credibility. Provide financial support and incentives for employees to pursue certifications from recognized institutions like CII, NASSCOM, or ISO.

04

Developing Digital Infrastructure

1. **Investing in Basic Digital Tools:** MSMEs can begin their digital transformation with cost-effective tools. Implement open-source tools or affordable ERP systems, CRM software, and cloud computing solutions.

2. Building IoT-Enabled Systems: IoT-enabled systems provide real-time monitoring and control, enhancing operational efficiency. Start with integrating IoT sensors for monitoring equipment health and production parameters.

3.10 Opportunities for MSMEs in Global Value Chains

What are Global Value Chains?

Global Value Chains (GVCs) refer to the international networks of production where different stages—design, manufacturing, assembly, distribution, and services—are performed across multiple countries. These interconnected systems allow firms to specialize in specific tasks or components, enhancing efficiency and cost-effectiveness while fostering global trade. For example:

- Electronics in Southeast Asia: Vietnam has become a critical hub for electronics manufacturing, supplying global brands like Samsung and Apple.

- Automotive in Mexico: Mexico's automotive sector thrives as a key supplier of parts to the U.S., driven by regional supply chain integration and technology adoption.

- Pharmaceuticals in India: Indian MSMEs supply critical APIs (Active Pharmaceutical Ingredients) to global biopharma chains, leveraging cost-effective production and quality compliance.

- Renewables in China: China dominates solar panel production globally, integrating GVCs with advanced manufacturing and green technology.

Why Should Indian MSMEs Participate?

- Global Market Access: Integration helps MSMEs expand their customer base and diversify revenue streams by connecting with international clients.

- Technology and Innovation: GVC collaboration offers access to advanced tools like IoT and robotics, enhancing MSME productivity and operational efficiency.

- Competitiveness: Working within GVCs builds the reputation of MSMEs as reliable, high-quality suppliers in global markets.

- Skill Development: Exposure to international practices helps MSMEs upgrade workforce skills and adopt global compliance standards.

How Should Indian MSMEs Integrate with GVCs?

- Adopt Advanced Technologies: Invest in Industry 4.0 solutions like IoT, AI, automation, and ERP systems to improve efficiency and meet GVC requirements.

- Obtain Certifications: Acquire ISO and similar certifications to ensure compliance with global buyer expectations.

- Focus on Niche Expertise: Specialize in high-value sectors like automotive components, textiles, or pharmaceuticals to carve a unique position in global supply chains.

- Leverage Government Support: Utilize schemes like SAMARTH Udyog Bharat 4.0, PLI incentives, and support from organizations like CII for training and funding.

- Collaborate with Networks: Partner with MSME clusters or larger firms integrated into GVCs to share resources, reduce costs, and gain market access.

Government Support for Accelerating Industry 4.0 Adoption

04

4.1 Key Government Initiatives

SAMARTH Udyog Bharat 4.0

Smart Advanced Manufacturing and Rapid Transformation Hub (SAMARTH) Udyog Bharat 4.0 is a flagship initiative by the Ministry of Heavy Industries aimed at transforming the Indian manufacturing sector through the adoption of advanced technologies.

Key Objectives

- Propagating Industry 4.0 technological solutions across Indian manufacturing firms.
- Enhancing competitiveness by integrating smart manufacturing practices, the initiative seeks to improve the global competitiveness of Indian manufacturers.

Key Components

Established 5 Common Engineering Facility Centers (CEFC):

1. Center for Industry 4.0 (C4i4) Lab Pune
2. IITD-AIA Foundation for Smart Manufacturing
3. I4.0 India at IISc Factory R & D Platform
4. Smart Manufacturing Demo & Development Cell at CMTI
5. Industry 4.0 projects at DHI CoE in Advanced Manufacturing Technology, IIT Kharagpur

Make in India 2.0

Make in India 2.0 is an updated version of the original Make in India initiative, aimed at positioning India as a global manufacturing hub by leveraging advanced technologies.

Key Objectives

- Promoting advanced manufacturing with to enhance manufacturing capabilities.
- Encouraging foreign and domestic investments in the manufacturing sector.

Key Components

- **Production Linked Incentive (PLI) Scheme:** Incentives are provided based on incremental sales of products manufactured in India, covering sectors such as electronics, pharmaceuticals, and automotive.
- **Technology and Quality Upgradation Support to MSMEs:** Programs like Lean Manufacturing Competitiveness and Technology Upgradation Fund Scheme help MSMEs enhance their operational efficiency.

Digital India

Digital India is a comprehensive initiative launched by the Indian government to transform India into a digitally empowered society and knowledge economy.

Key Objectives

- Developing robust digital infrastructure to support seamless connectivity and e-governance.
- Enhancing digital literacy among citizens to enable their active participation in the digital economy.

Key Components

- **Centre of Excellence for Internet of Things (CoE-IT):** In collaboration with NASSCOM and industry partners, CoE-IT provides resources and training for IoT innovation and application.
- **National Super Computing Mission (NSM):** Building a network of supercomputers to support advanced research and innovation.
- **Electronic Development Fund (EDF):** The fund provides financial assistance to startups and MSMEs for developing electronic products and solutions.

4.2 Policy Recommendations

Awareness and Education

1. **Nationwide Campaigns - Ministry of Electronics and Information Technology (MeitY)**

   Conduct nationwide campaigns, such as Melas and Haats, to showcase the benefits of Industry 4.0 technologies. Partner with industry associations, media outlets, and educational institutions to reach a broad audience.

2. **Industry-Specific Workshops - Ministry of Commerce and Industry**

   Organize tailored workshops and seminars for different industries, highlighting successful case studies and practical demonstrations. Collaborate with industry experts and technology providers to deliver hands-on learning experiences.

3. **Smart Manufacturing Compendium - Ministry of Education**

   Partner with associations to publish compendiums featuring case studies, best practices, and lessons learned. Distribute the compendium through digital platforms, industry events, and educational institutions.

Training and Upskilling Programs

1. **Training Programs - Ministry of Skill Development and Entrepreneurship**

   Enhance existing training programs to include advanced digital skills and technologies. Collaborate with educational institutions, industry bodies, and technology providers to develop training programs.

2. **Certification and Accreditation - Ministry of Education**

   Develop certification and accreditation programs in partnership with educational institutions and industry leaders. Offer certification programs that cover key digital competencies.

3. **Smart Manufacturing Courses at ITIs - Ministry of Skill Development and Entrepreneurship**

   Introduce smart manufacturing courses at Industrial Training Institutes (ITIs) across the country. Partner with academia to develop and deliver courses focused on Industry 4.0 technologies.

Global Best Practices

Japan's Society 5.0 campaign successfully integrated technology awareness with societal benefits, promoting widespread adoption.

Germany's Plattform Industrie 4.0 regularly conducts industry-specific workshops to demonstrate the practical applications of digital technologies.

The UK's Made Smarter initiative publishes case studies to inspire manufacturers to adopt digital technologies.

Singapore's Smart Industry Readiness Index (SIRI) provides a suite of frameworks and tools to help manufacturers start, scale, and sustain their manufacturing transformation journeys.

Germany's Dual Vocational Training system integrates theoretical and practical training, ensuring workers are skilled in the latest technologies.

The US offers certifications through organizations like CompTIA and ISACA to validate digital skills.

Singapore's SkillsFuture initiative offers courses on advanced manufacturing technologies to equip the workforce with relevant skills.

Public-Private Partnerships

1. **Formalize PPP Frameworks - NITI Aayog**
   Establish structured public-private partnership frameworks to facilitate cooperation and joint initiatives.

2. **Innovation Hubs and Centers of Excellence - Ministry of Science and Technology**
   Develop more innovation hubs and centers of excellence focused on Industry 4.0 technologies, supported by both public and private funding.

Digital Infrastructure

1. **High-Speed Internet and 5G Deployment - Ministry of Communications**
   Accelerate the deployment of high-speed internet and 5G networks, prioritizing industrial zones and underserved areas.

2. **Smart Manufacturing Parks - Ministry of Commerce and Industry**
   Establish smart manufacturing parks with cloud computing facilities and IoT networks.

Financial Incentives and Grants

1. **Financial Support - Ministry of Finance**
   Create specific financial incentives for Industry 4.0 projects, including subsidies for purchasing advanced equipment and grants for R&D in smart manufacturing.

2. **Tax Incentives - Ministry of Finance**
   Implement tax breaks for investments in digital infrastructure, IoT, AI, and robotics.

3. **Export-Focused Incentives - Ministry of Finance**
   Encourage exports by offering tax benefits and financial assistance for MSMEs that contribute to high-value GVC segments.

Global Best Practices

Germany's Plattform Industrie 4.0 is a PPP that brings together stakeholders to develop recommendations and best practices for Industry 4.0 adoption.

Singapore's Research, Innovation and Enterprise (RIE) 2025 Plan outlines strategies for R&D, including funding for collaborative projects between industry and academia.

China's Digital Silk Road - Digital Infrastructure Investments in fiber-optic networks, 5G technology, and smart city projects.

Singapore's NextGen Network Deployment has created a robust digital infrastructure that supports widespread Industry 4.0 adoption.

Japan's tax incentives for promoting Digital Transformation (DX) investments have significantly boosted digital adoption.

The US provides tax credits like Quality Jobs tax credits and R&D tax credits to support the implementation of advanced technologie.

Digital Transformation Roadmap

1. **National Roadmap - NITI Aayog**

   Develop a national digital transformation roadmap that aligns with various ministries and sectors.

2. **Industry Consultation - Ministry of Commerce and Industry**

   Consult with industry stakeholders to align the roadmap with their specific needs and challenges.

3. **Dedicated Body for Digital Excellence - Ministry of Electronics and Information Technology (MeitY)**

   Create a dedicated body for digital excellence responsible for overseeing and managing digital transformation efforts across the nation. This body will coordinate initiatives, monitor progress, and ensure alignment with national goals.

Global Best Practices

South Korea's Digital Platform Government initiative emphasizes collaboration between government, businesses, and citizens to create an integrated digital strategy.

Germany's Shaping Digitalization strategy outlines key measures to drive digital transformation across sectors, providing a cohesive framework for Industry 4.0 adoption.

Singapore's "Smart Nation and Digital Government Office" acts as a central agency to coordinate the country's digital transformation efforts, ensuring a unified approach.

Contributors

CII

Dilip Sawhney
Chairman, CII National Committee on Smart Manufacturing
Managing Director, Rockwell Automation India Pvt Ltd.

Anjali Singh
Co-Chairperson, CII National Committee on Smart
Manufacturing and Executive Chairperson, ANAND Group

Virendra Gupta
Deputy Director General, Confederation of Indian Industry

KPMG in India

Saurabh Bhatnagar
Partner
T: +91 99532 68421
E: saurabhb1@kpmg.com

Sandeep Chittora
Technical Director
T: +91 99711 70337
E: sandeepchittora@kpmg.com

Pratish Gupta
Manager
T: +91 97035 94358
E: pratishgupta@kpmg.com

Confederation of Indian Industry

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering Industry, Government and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, with around 9,000 members from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 365,000 enterprises from 294 national and regional sectoral industry bodies.

For more than 125 years, CII has been engaged in shaping India's development journey and works proactively on transforming Indian Industry's engagement in national development. CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness, and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Through its dedicated Centres of Excellence and Industry competitiveness initiatives, promotion of innovation and technology adoption, and partnerships for sustainability, CII plays a transformative part in shaping the future of the nation. Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes across diverse domains including affirmative action, livelihoods, diversity management, skill development, empowerment of women, and sustainable development, to name a few.

For 2024-25, CII has identified "Globally Competitive India: Partnerships for Sustainable and Inclusive Growth" as its Theme, prioritizing 5 key pillars. During the year, it would align its initiatives and activities to facilitate strategic actions for driving India's global competitiveness and growth through a robust and resilient Indian industry.

With 70 offices, including 12 Centres of Excellence, in India, and 8 overseas offices in Australia, Egypt, Germany, Indonesia, Singapore, UAE, UK, and USA, as well as institutional partnerships with about 300 counterpart organizations in almost 100 countries, CII serves as a reference point for Indian industry and the international business community.

Confederation of Indian Industry
The Mantosh Sondhi Centre
23, Institutional Area, Lodi Road, New Delhi – 110 003 (India)
T: 91 11 45771000
E: info@cii.in | W: www.cii.in

Follow us on

---

cii.in/facebook   cii.in/twitter   cii.in/linkedin   cii.in/youtube

Reach us via CII Membership Helpline Number: 1800-103-1244