



Department of Heavy Industry
Government of India



Confederation of Indian Industry

Action plan for fostering adoption of Smart Manufacturing

Report



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Executive Summary

Gol's target for manufacturing and Make in India is to grow the existing contribution of the sector from USD 390 billion to USD 1 trillion by 2025, which translates to a growth rate of 12-15% per year. This means doubling the current annual year on year growth rate.

Countries around the world are also looking to grow their share of the manufacturing sector. All of them are leveraging the benefits of smart manufacturing

India too must create a dedicated programme for smart manufacturing and drive it as a mission, critical for the growth of the Indian manufacturing sector.

Smart Manufacturing will need more than just basic training and skill development, it will require creation of an entire eco-system that will foster technology adoption towards building more agile and competitive companies.

Confederation of Indian Industry (CII) has conducted detailed primary and secondary research, which includes a study of various international programmes, discussions with various stakeholders both domestic and international and national consultations and arrived at an 'Action Plan for Fostering Adoption of Smart Manufacturing in India'.

This document outlines the background, approach, recommendations, proposed action plan and potential outcomes w.r.t smart manufacturing.

Background

The Manufacturing sector globally is witnessing paradigm shifts. Several advanced economies are implementing Industry 4.0 / Smart Manufacturing and reaping benefits such as increased competitiveness, share of global trade, re-shoring, sustainability and reliability.

Department of Heavy Industry (DHI) and Confederation of Indian Industry (CII) are of the view that this phenomenon is here to stay and the Indian manufacturing sector will need to prepare for the various challenges and opportunities posed by this new trend. Both DHI and CII have initiated various initiatives to help foster adoption of Smart Manufacturing in India.

DHI initiated the Samarth Udyog Programme in 2017 with the primary objective of building industry 4.0 capacities in the country. This was channelled through creation of 4 Centres of Excellence – Kirloskar Centre for Learning in Industry 4.0, IITD-AIA Foundation for Smart Manufacturing, I4.0 India at IISc Factory R&D Platform and Smart Manufacturing Demo & Development Cell at CMTI. The activities range from running awareness campaigns to training the trainers programme, providing incubators to start-ups, hand-holding SMEs to plan and implement relevant Industry 4.0 projects, collaborating with neighbourhood universities for



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student training/internship programmes, make adequate provisions for e-waste management, etc.¹

CII formulated a dedicated Smart Manufacturing Council in April 2017 to focus on the agenda of smart manufacturing in the Indian context. The council brings together experts from industry (both service providers and users) and academia. The broad agenda of the Council has been to:

- Arrive at a shared understanding of Smart Manufacturing in the Indian context
- Create a framework for identifying macro, meso and micro level imperatives for fostering adoption of smart manufacturing
- Create a roadmap for various stakeholders based on the framework

Amongst other activities pertaining to Industry 4.0, CII has conducted over 30 workshops in the domain of smart manufacturing ranging from overall awareness sessions to more detailed functional topics over the past 3-4 years,

Need for smart manufacturing

The manufacturing sector is an important pillar to any economy as it has the largest multiplier amongst all other sectors (services and agriculture) and each additional dollar generated by the manufacturing sector has the potential to create 2-3 jobs in the economy. Hence, the growth of this sector has also been one of the highest priorities of Government.

Hon'ble Prime Minister Shri Narendra Modi's vision has thus been to propel the Indian manufacturing sector to contribute USD 1 trillion to the economy. To achieve this, the manufacturing sector will need to grow at at-least 12.5% y-o-y for the next 7-10 years. With current aggregate manufacturing growth at 6-7%, this translates to doubling growth of the manufacturing sector.

This growth is only plausible when Indian companies become competitive globally. With governments in countries with a strong manufacturing sector such as Germany, USA, France, etc. creating programmes to bolster their industries competitiveness,

¹ Source: <https://samarthudyog-i40.in/about-samarth-udyog>



India too must focus on similar programmes that enable Indian companies to be participate in global supply chains.

The Smart trade-off



Figure 1: Understanding the smart trade-off

Smart Manufacturing can deliver significant benefits both at the macro and firm level.

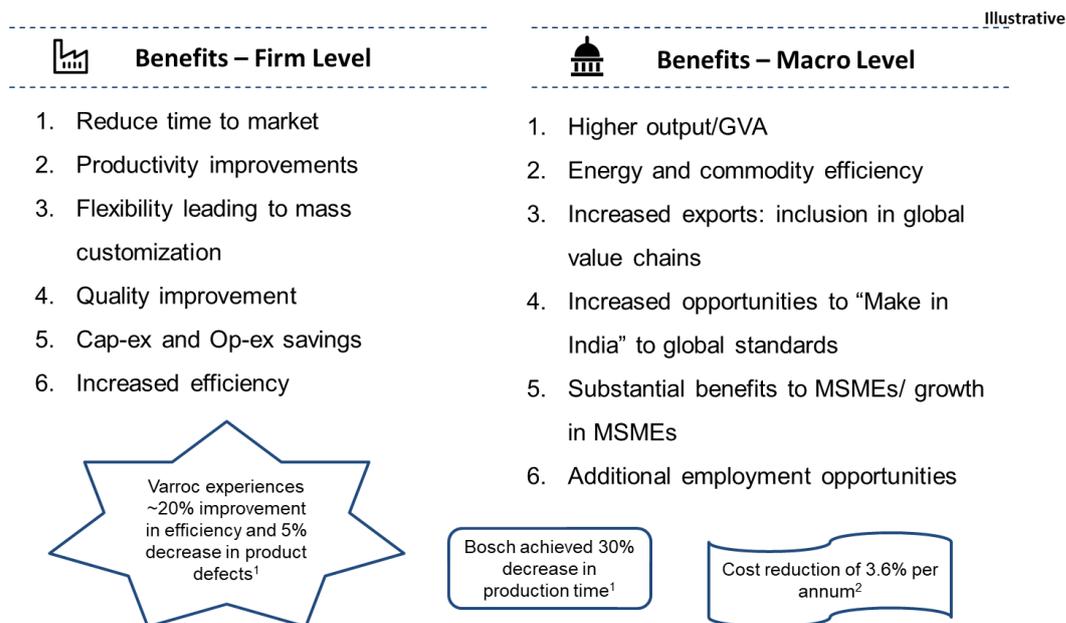


Figure 2: Benefits of Smart Manufacturing at the Macro and Firm Level



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Government programmes on Smart Manufacturing by other countries

In response to potential threats to their domestic manufacturing share, several countries have initiated programmes to foster adoption of smart manufacturing in their respective countries.

A summary of these programme is in table 1.

Table 1: Summary of Government programmes in Smart Manufacturing / Industry 4.0 in Europe

Country	Launch Date	Strategic Focus	Technology / Sector focus
France	2015	Deployment	Transport, IoT, AI, Big Data, HPC, Digital trust, healthcare smart cities
Germany	2011	Deployment	Cyber-physical systems, IoT
Italy	2012	R&D	Generic
Netherlands	2014	Deployment	Generic
Spain	2016	Mixed	Digital platforms, Big data, Collaborative platforms
Sweden	2013	Deployment	Generic
Britain	2012	Deployment	Aerospace, Automotive, Pharma, Electronics
Czech Republic	2016	Deployment	Generic



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Country	Initiative	Focus	Target Audience	Funding model	Budget
Germany	Platform Industrie 4.0	Technological innovation based on pillars like- horizontal integration, end-to-end engineering, vertical integration	Producers, SMEs and policy makers	Mixing public funding with private financial and in-kind contributions – typical ratio 2:1 or 5:1 b/w private and public funding	€200million from BMBF ¹ and BMWI ² Complemented by financial and in-kind contributions from industry
Sweden	Produktion 2030	Develop leadership and skills in sustainable production	Research institutes, universities and SMEs from industry	Public funding & co-financing from industry	€25million offered by VINNOVA ³ for 2013-18, complemented by €25million from industry
France	Alliance pour l'Industrie du Futur	SME diagnostics and modernisation incentives; showcase pilot projects; development of advanced mfg techniques	French industry and production base – SMEs and mid-caps	Mixing public funding instruments like loans and tax incentives with private investments in R&D	Approx 10 billion from public sources including IFTF funding from 2017 onwards, supported by private funding
China	Made in China 2025	Focus on innovation, quality, digitalisation and greenness	SMEs from industry	Public private partnership with immense support from central and provincial govt.	Govt established CNY 20 billion Modern Mfg Industry Investment fund of which CNY 6 billion comes from govt budget



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USA	Manufacturing USA	Network of regional institutes each with a specialized technology. Secure future of mfg through innovation, collaboration and education	Industry and academia	Funded by Govt through private-public partnership	Federal funding level is typically \$70-110M, matched by private industry
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Detailed programmes of select countries

CHINA	USA	GERMANY
<ol style="list-style-type: none"> 1. Launched 2 major initiatives <ol style="list-style-type: none"> 1. Made in China 2025 2. Internet Plus 2. 14 state-run associations from different sectors came together and created a voluntary quality management standard for automated and intelligent manufacturing 3. Focused on increasing <ol style="list-style-type: none"> 1. labor productivity 2. Innovation 3. Integrating the Internet into all its industries 4. overcome lack of coordination between industry, academia and government. 	<ol style="list-style-type: none"> 2. Released / Launched <ol style="list-style-type: none"> 1. National Strategic Plan for Advanced Manufacturing and 2. Manufacturing USA 3. Dedicated Institutes of Manufacturing Innovation (IMIs) for addressing Advanced Manufacturing-related technologies and processes. 4. Manufacturing Extension Partnership (MEP) provides training, technical assistance, and other services to America's SME manufacturers. 	<ol style="list-style-type: none"> 1. Dedicated empowered body called 'Plattform Industrie 4.0' driving initiatives centrally 2. Pursuing high- tech strategy 2020 focused towards coordination of research and innovation initiatives. 3. Focus on <ol style="list-style-type: none"> 1. Widespread adoption of basic technologies and experience to Advanced Manufacturing, 2. Research and development of innovative solutions 4. Provide subsidized vocational training program regulated by the state 5. Promote non-governmental organizations that provide high-quality, short-term affordable applied research



Driving adoption of smart manufacturing in India – Step by Step approach

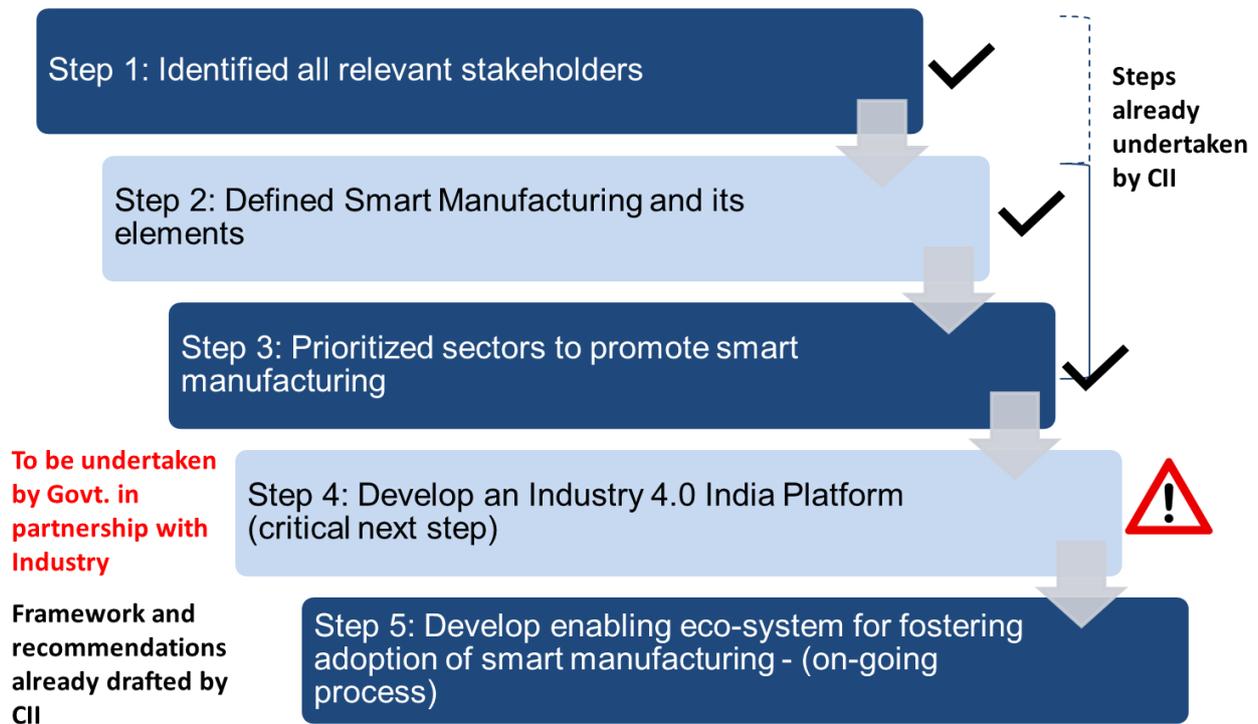


Figure 3: Step by step approach

Detailing of each step

Step 1: Identified all relevant stakeholders

Macro Level	Meso Level	Firm Level
1. Government Departments <ol style="list-style-type: none"> 1. NITI Aayog 2. DHI 3. DIPP 4. DST 5. DSIR 6. MSME 7. MeitY 8. HRD 9. Skills Ministry 10. DoT 	1. Institutes <ol style="list-style-type: none"> 1. SAMARTH Udyog Industry 4.0 Centres of Excellence <ol style="list-style-type: none"> 1. IIT Delhi 2. IISc, Bangalore, etc. 2. IIM, Bangalore 3. IIT Kharagpur 4. IIIT, Hyderabad 5. CDOT 2. Organizations <ol style="list-style-type: none"> 1. IMTMA 2. SIAM 3. ACMA 4. CG associations 5. IMF 6. Fraunhofer 7. VDMA 8. TIFAC 9. World Bank 10. NASSCOM 11. NPC 12. WEF 	1. Service providers <ol style="list-style-type: none"> 1. Hardware manufacturers 2. Systems integrators 2. Early implementers 3. Large enterprises 4. MSMEs 5. Thought leaders



Step 2: Defined Smart Manufacturing and its elements

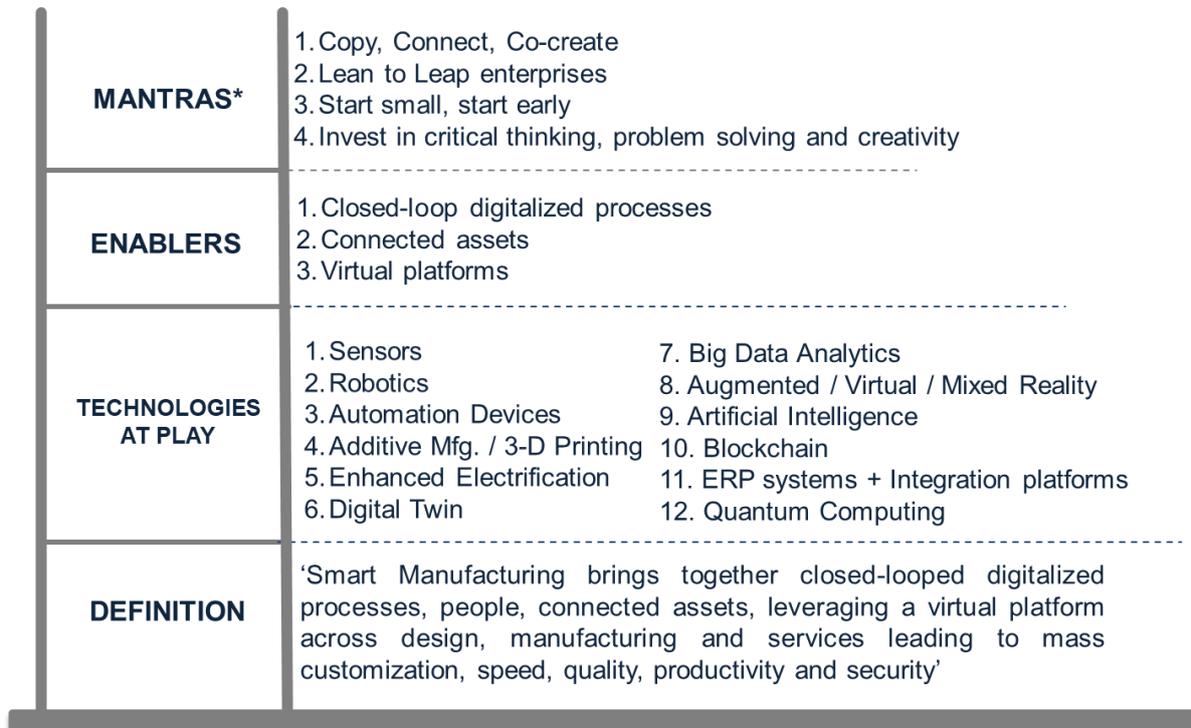


Figure 4: CII Smart Manufacturing Stack

Step 3: Prioritized sectors to promote smart manufacturing

Illustrative

 Automotive <ul style="list-style-type: none"> • 45% of Indian manufacturing sector • Lead adopter of smart manufacturing 	 ICTE Manufacturing <ul style="list-style-type: none"> • Mother sector for all smart hardware such as sensors, shop-floor networking devices etc.
 Engineering <ul style="list-style-type: none"> • Backbone for industrial growth • Lead adopter of smart manufacturing • Comprises of machine tools, electrical machinery, control instruments, construction equipments, etc. 	MSMEs <ul style="list-style-type: none"> • Share of MSME to Indian manufacturing is 45% • Biggest employer after agriculture sector

DHI is the nodal Government dpt. for 2 of the 4 prioritized areas



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Step 4: Develop an Industry 4.0 India Platform

Step 4.1: Create empowered body

- Create a **dedicated and empowered central body** i.e. **Industry 4.0 India Platform**, co-led by:

- Senior Government Official
- President, CII

Supported by a select steering committee

- **Enter into MoUs/ partner with countries** who have already implemented Industry 4.0 programmes e.g. Germany, UK, etc.

Step 4.2: On-board Industry as a partner

Establish a **steering committee** from industry to be created to assist in **formulation** and **implementation** various initiatives.

Step 4.3: Define KRAs and Launch a platform

- **Propagate** need for **Smart Manufacturing** as a **national priority** for manufacturing
- Launch **Industry 4.0 India platform** formally
- **Partnership** with research and Technology institutes
- **Collect use-cases** and commence consulting
- **Incentivize adoption** of smart manufacturing



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Step 5: Develop enabling eco-system for fostering adoption of smart manufacturing

<p style="text-align: center;">Infrastructure</p> <ul style="list-style-type: none">• Sensors and communications devices business to be promoted• Digital Connectivity to be improved• Uninterrupted internet bandwidth to be made available	<p style="text-align: center;">Policy</p> <ul style="list-style-type: none">• Cyber-security• Cloud, Data, Security, Privacy, Spectrum• Regulatory (telecom, standards)• Data privacy• Standards + Interoperability
<p style="text-align: center;">Skilling</p> <ul style="list-style-type: none">• Skilling and re-skilling• Academic curriculum to be revised as per relevance (schools, colleges)• Partnership with academic institutes like IITs, NITs, etc.	<p style="text-align: center;">Technology</p> <ul style="list-style-type: none">• Institutional Eco-system• Hardware, Software• R&D• Collaborations

Recommendations for DHI

Focus of DHI is sought on

- 1. Nudging Innovation and adoption of Smart Manufacturing**
 1. Awareness Programmes
 2. Recognition programmes
 3. Creating collaterals that outline benefits of smart manufacturing
- 2. Institutional Capacity building and access to best practices**
 1. Workshops
 2. Demo Centers
 3. Incubation facilities
 4. Experts and consulting
- 3. Standardization**
 1. Identify various standards for all I4.0 components
- 4. Reducing cost of business**
 1. Exploration of innovative capital subsidy models
 2. Explore mass procurement of select devices



Key activities for DHI include

S. No.	Specific actions to be taken	Sub-Steps
1	<p>Develop recognition programme to encourage manufacturing plants with focus on select sectors - Automotive, Engineering, Electronics for smart manufacturing deployment.</p>	<ol style="list-style-type: none"> 1. Form a steering sub-committee to oversee and design award. (Steering committee to consist of senior industry representatives and Government. Steering committee to meet ` 4 times a year or when needed) 2. On-board organization / agency with experience in awards and appoint agency for executing awards campaign. 3. Pilot award with 1 sector (automotive) and 1 cluster (Gurgaon / Pune) 4. Replicate award for other sectors / clusters (2 sectors - engineering + automotive, 4 clusters (Maharashtra, Tamil Nadu, Haryana, Gujarat, Andhra Pradesh, Karnataka- 8 awards) 5. Transfer responsibility of award to outside agency, funded by application fees to drive sustainability
2	<p>Create centres of competence for smart manufacturing that offer (to be set-up near automotive and engineering clusters)</p> <ol style="list-style-type: none"> 1. Plug and play infrastructure with shared services, infrastructure 	<ol style="list-style-type: none"> 1. Form a sub-committee to draw out overall strategy of development and functioning of Centres of Excellences based on the requirements of the sectors (leveraging cluster approach)



	<p>e.g. 3D printers, testing labs etc. to foster self-contained eco-systems.</p> <ol style="list-style-type: none"> 2. Demo and facilitation services (In partnership with industry) 3. Incubation facilities for development of various I4.0 technologies e.g. sensors, 3-D printers, etc. 4. Capacity development programmes – conceptual as well as technical 	<ol style="list-style-type: none"> 2. Create RFP to identify industry partners to support and represent the Centre of Excellence 3. Identify industry association to execute the implementation of CoE. Implementation partner to define scope, ToR, offerings of CoE, hire staff/ trainers, etc. 4. Set up CoE keeping in mind the regional spread (cluster approach to be followed) 5. Monitor progress and scale-up initiative based on recommendations of steering committee
<p>3</p>	<p>Standardization and mass procurement -</p> <ol style="list-style-type: none"> 1. Launch a programme to identify various standards for all I4.0 components (in line with global standards) 2. Aggregate demand of these components e.g. Sensors, automation devices, shop-floor networking, robots etc. 3. Explore EESL type model for procuring these devices. 	<ol style="list-style-type: none"> 1. Form a sub-committee to drive programme and identify areas where standards for I4.0 components are required. 2. Identify and appoint research partner for conducting extensive research, planning and consultation with various stakeholders. 3. Provide support to steering committee to participate in international standard setting processes / conferences 4. Release report on standardization 5. Release of report on aggregation possibilities 6. Monitor progress and scale-up initiative based on



		<p>recommendations of steering committee</p> <p>7. Partner with EESL to procure requisite devices / hardware</p>
4	<p>On-board domestic and international academic institutes and R&D centers as partners to strengthen in-house intellectual capabilities, skills and qualifications of CoEs</p>	<p>1. Form a sub-committee to drive partnership programmes</p> <p>2. Identify institutes in countries such as UK, Italy, France, Japan, USA, Germany, China to form partnerships with.</p>
5	<p>Explore MSIPS like capital subsidy for companies investing in smart manufacturing in automotive and engineering</p>	<p>1. Form a sub-committee to check feasibility of deploying MSIPS for companies investing in smart manufacturing (for automotive and engineering sector)</p> <p>2. Identify and hire agency to perform cost benefit analysis of scheme</p>

Conclusion

The successful implementation of the roadmap in the next 5 years will be paramount in transitioning the manufacturing sector in India to be future ready and competitive. Participation and support from stakeholders ranging from industry, multi-lateral agencies, academia, associations and Government would be critical to establish a conducive eco-system to foster adoption of smart manufacturing in India. The steps taken at this stage will have far reaching social benefits as well.