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# Moving from Industry 2.0 to Industry 4.0: A case study from India on leapfrogging in smart manufacturing

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## Abstract

Globally, manufacturing continues to grow through the decades. It now accounts for approximately 16 percent of global GDP and 14 percent of employment. However, the manufacturing sector's relative size in an economy varies with its stage of development. In India, Manufacturing accounts for 16% of GDP and has remained relatively stagnant. Manufacturing has also witnessed an onslaught from competitive nations like China, while India suffers from some major technology gaps, and therefore most estimates put India at the level of Industry 2.0 in manufacturing. Germany on the other hand, has maintained its leadership position in Manufacturing and Technology through innovative initiatives like resource efficient manufacturing and Industry 4.0. The Paper seeks to conduct a desk research on the developments on Sustainable Manufacturing processes across the world, and suggest a few critical methods for emerging economies to leapfrog into Industry 4.0., using India as a case study.

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*Keywords:* Sustainable Manufacturing, Gross Domestic Product, interdisciplinary approach, use of ICT, Industry 2.0, Industry 4.0, Industry clusters, digital manufacturing, strategy for manufacturing, human resource, competitiveness.

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## 1. Introduction

Until the year 1991, India was a closed market where the License Raj was in place and the industry was given a 'quota' for production targets. Over production was penalized, and imports from other countries carried astronomical duties, which made it economically irrelevant for the Indian market [1]. However, with the ushering in of economic reforms and the opening up of the Indian market, the scenario has changed dramatically. Prime Minister Narendra Modi has laid impetus in manufacturing lead growth, in his campaign to augment manufacturing sector "Make in India".

The aims of the campaign are:

- To increase manufacturing sector growth to 12-14% per annum over the medium term,

- To increase in the share of manufacturing in the country's Gross Domestic Product from 16% to 25% by 2022, to create 100 million additional jobs by 2022 in manufacturing sector,
- To create appropriate skill sets among rural migrants and the urban poor for inclusive growth,
- To increase domestic value addition and technological depth in manufacturing,
- To enhance the global competitiveness of the Indian manufacturing sector.

While India's service sector has grown tremendously over the last few decades, most manufacturing sectors are still stuck with technology, equipment, and processes from the Industry 2.0 Phase, such as manual inputs, lack of ICT integration in manufacturing, and critical gaps in capability. The "Make in India" campaign aims to increase manufacturing capability and technology upgradation. India's rising demand, favourable policy & the opportunity to setup low cost plants is bringing MNCs (Multi National Company), which will contribute to the growth in manufacturing sector. More than 250 global OEMs like GM, Renault Nissan, Boeing, GE, Daimler etc. have their research & development in India, and the enormous success of the IT sector has made India relevant to be a manufacturing hub of the world.

Table 1: Global manufacturing competitiveness Index 2016.

Table 1: Global CEO survey: 2016 Global Manufacturing Competitiveness Index rankings by country

2016 (Current)			2020 (Projected)			
Rank	Country	Index score (100=High) (10 = Low)	Rank	2016 vs. 2020	Country	Index score (100=High) (10=Low)
1	China	100.0	1	(▲ +1)	United States	100.0
2	United States	99.5	2	(▼ -1)	China	93.5
3	Germany	93.9	3	(↔)	Germany	90.8
4	Japan	80.4	4	(↔)	Japan	78.0
5	South Korea	76.7	5	(▲ +6)	India	77.5
6	United Kingdom	75.8	6	(▼ -1)	South Korea	77.0
7	Taiwan	72.9	7	(▲ +1)	Mexico	75.9
8	Mexico	69.5	8	(▼ -2)	United Kingdom	73.8
9	Canada	68.7	9	(▼ -2)	Taiwan	72.1
10	Singapore	68.4	10	(▼ -1)	Canada	68.1
11	India	67.2	11	(▼ -1)	Singapore	67.6
12	Switzerland	63.6	12	(▲ +6)	Vietnam	65.5
13	Sweden	62.1	13	(▲ +4)	Malaysia	62.1
14	Thailand	60.4	14	(↔)	Thailand	62.0
15	Poland	59.1	15	(▲ +4)	Indonesia	61.9
16	Turkey	59.0	16	(▼ -1)	Poland	61.9
17	Malaysia	59.0	17	(▼ -1)	Turkey	60.8
18	Vietnam	56.5	18	(▼ -5)	Sweden	59.7
19	Indonesia	55.8	19	(▼ -7)	Switzerland	59.1
20	Netherlands	55.7	20	(▲ +3)	Czech Republic	57.4
21	Australia	55.5	21	(▼ -1)	Netherlands	56.5
22	France	55.5	22	(▼ -1)	Australia	53.4
23	Czech Republic	55.3	23	(▲ +6)	Brazil	52.9
24	Finland	52.5	24	(↔)	Finland	49.7
25	Spain	50.6	25	(▲ +2)	South Africa	49.3
26	Belgium	48.3	26	(▼ -4)	France	49.1
27	South Africa	48.1	27	(▼ -2)	Spain	48.4
28	Italy	46.5	28	(▲ +5)	Romania	45.9
29	Brazil	46.2	29	(▼ -3)	Belgium	45.8
30	United Arab Emirates	45.4	30	(▼ -2)	Italy	45.0
31	Ireland	44.7	31	(↔)	Ireland	43.7
32	Russia	43.9	32	(↔)	Russia	43.6
33	Romania	42.8	33	(▼ -3)	United Arab Emirates	42.6
34	Saudi Arabia	39.2	34	(▲ +2)	Colombia	40.9
35	Portugal	37.9	35	(↔)	Portugal	40.1
36	Colombia	35.7	36	(▼ -2)	Saudi Arabia	36.1
37	Egypt	29.2	37	(↔)	Egypt	28.3
38	Nigeria	23.1	38	(↔)	Nigeria	25.4
39	Argentina	22.9	39	(↔)	Argentina	24.6
40	Greece	10.0	40	(↔)	Greece	10.0

Source: Deloitte Touche Tohmatsu Limited and US Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index

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