



Confederation of Indian Industry

12th EDITION
MAN'EXE-2016
Leadership Series on Manufacturing Excellence

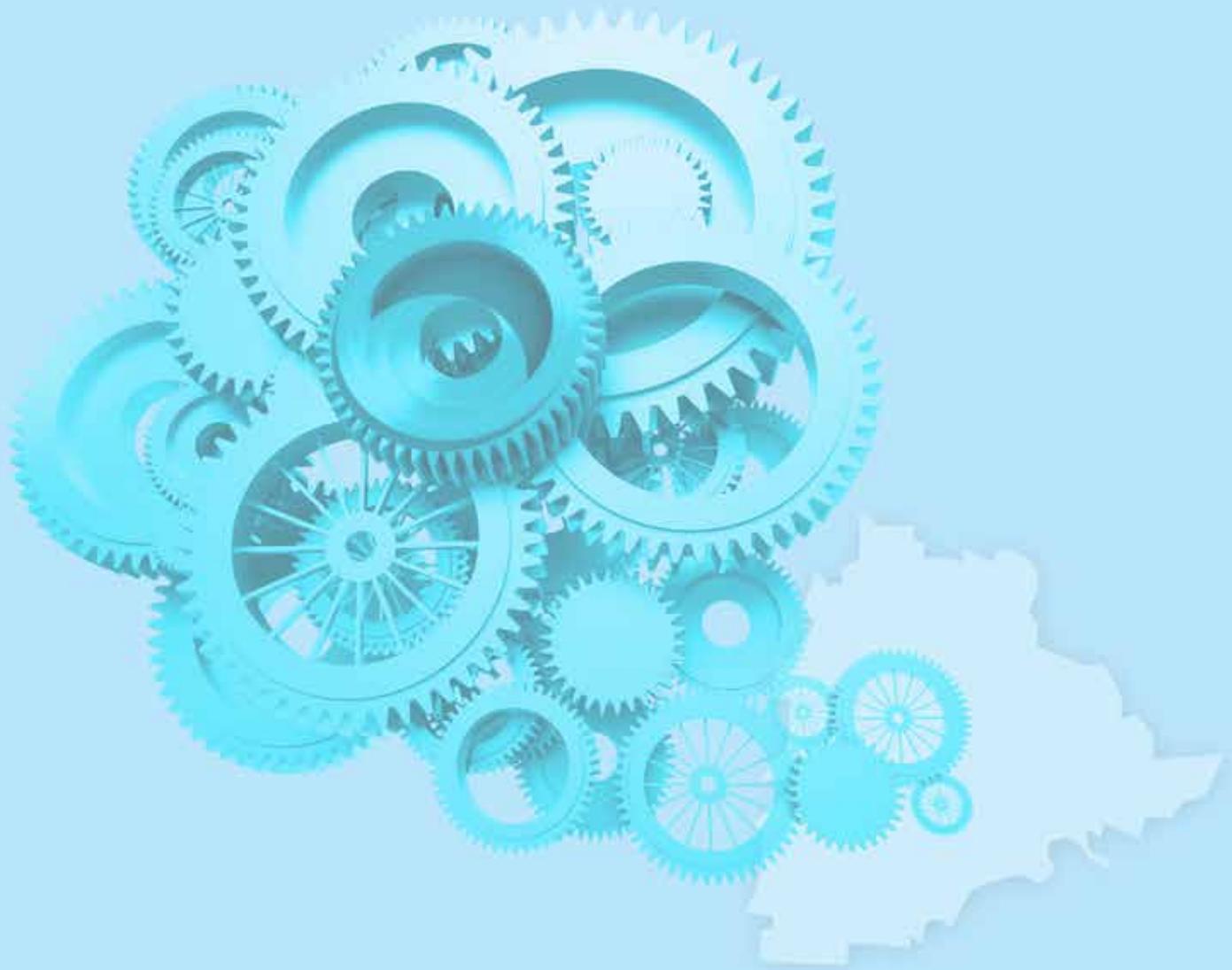
Knowledge Partner



TELANGANA

Gateway to the Future of Manufacturing

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FOREWORD



CII Telangana is happy to release the report on “Telangana – Gateway to the Future of Manufacturing’ during the event of CII Telangana – Man’Exe 2016 - Leadership Series on Manufacturing Excellence. The conference will focus on ‘Make in Telangana: Sustainable Growth through Innovation and Future Technologies.’

The manufacturing sector will need to be the bulwark of employment creation over the next decade. The launch of the ‘Make in India’ program has given a much needed impetus to the Indian Manufacturing sector. The initiative flagged off by Mr Narendra Modi, Hon’ble Prime Minister of India is an effort to place India on the world map as a manufacturing hub. The Government of India has set an ambitious target of increasing the contribution of manufacturing output to 25% of Gross Domestic Product (GDP) by 2025, from 16% currently.

The Industry and the Government in Telangana are geared-up to strengthening the manufacturing sector and create the manufacturing business and job opportunities. The Telangana State Industrial Policy (2015) strives to provide a framework which will stabilize and make existing industries more competitive, and also attract new international and national investments. The focus of the State Industrial Policy is on creation of employment for urban and rural youth and adding value to existing skills.

The report focuses on the Ease of Doing Business in Telangana and also identified focus sectors : Life Sciences, Electronics & IT Hardware, Defence & Aerospace and Textile. The report also discusses the emerging and future technologies in manufacturing that would be vital for the growth of the manufacturing sector in the state, namely,– advanced biotechnology; precision engineering, industrial robots, and energy technologies.

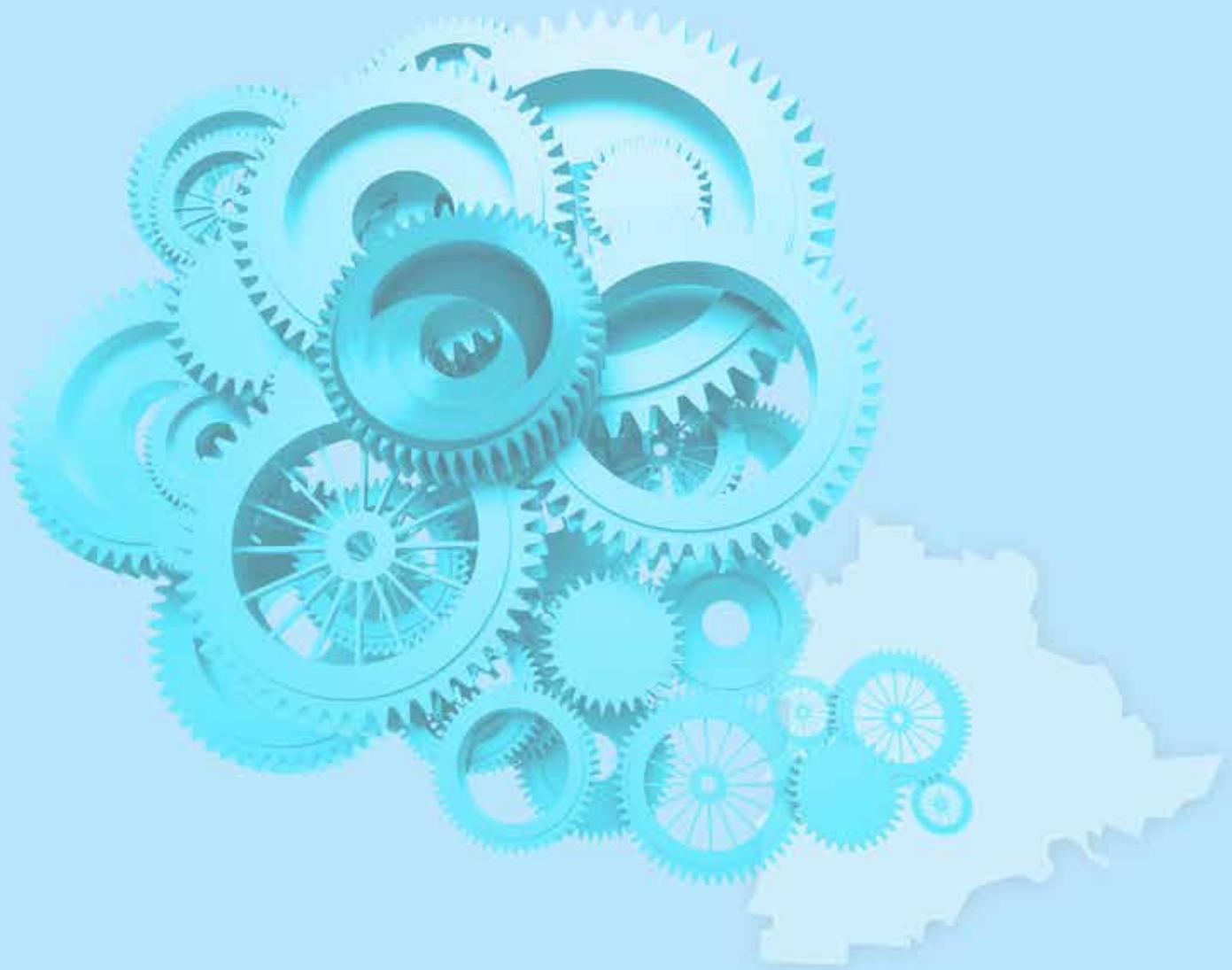
I take this opportunity to thank the CII Telangana Manufacturing Panel under the leadership of **Mr. Debasis Basu**, MD, Voith Turbo Pvt. Ltd., **Mr. NLN Raju**, COO, Signode India Ltd., and **Mr. D Raju**, MD, Kirby Building Systems India Ltd.

I also congratulate **YES Bank**, for being the knowledge partner for the Man’Exe 2016.

Thank you

Mr. Nrupender Rao

CHAIRMAN, CII TELANGANA



FOREWORD



Telangana, the youngest state in India, has experienced a stupendous first 2 years since its creation, under the able leadership of the Hon'ble Chief Minister, **Sri. K Chandrasekhar Rao**. The Hon'ble Chief Minister and his Government has set the right direction and momentum for shaping Telangana's growth trajectory. Telangana is largely a service based economy with the presence of one of the largest IT/ITeS clusters of India in Hyderabad. This is well complimented by the recent addition of Startup clusters in the state including T-Hub, India's largest incubation centre. Together these have contributed well to the state's service driven economy.

With an estimated growth rate of 9.2% (constant prices), Telangana has grown at a faster pace than the National Average. Service sector contributes about 60% to Telangana's GSDP. However with increased focus on manufacturing, the scenario is changing fast. The manufacturing sector has grown at 9.5% in 2015-16 which is higher than the corresponding growth rates of 5.8% in 2014-15. Among the various sectors that the government has laid developmental thrust on, manufacturing and its allied sectors have formed a significant part. Telangana, known as the Pharma Capital of India, is now also being recognized for other manufacturing based sectors like Biotechnology, Aerospace, Defence, Automobiles, Auto components, Electronics & IT Hardware among others. The Cluster-based development model adopted by the states has been well received by the investor community. The Pharma City, Genome Valley, Electronic Clusters, Defence & Aerospace zones & ESDM Clusters are a successful outcome of this ingenious strategy.

Manufacturing sector is the fulcrum to India's economic revival plan. This sector has historically had a significant role in socio-economic development of several economies like Japan, Korea, China, Germany & USA. The "Make in India" is a mega initiative launched for reviving India's manufacturing base. Telangana's efforts to dovetail this initiative by encouraging "Make in Telangana" through the cluster-led developmental model, further complemented by competitive sector policies and innovative initiatives like the TS-iPASS has led to the much needed surge in investments in the state.

CII Man'Exe is an important platform for industry leaders from the manufacturing sectors to interact and share ideas and experience on some of the emerging technologies & sectors that will shape the future of manufacturing. YES Bank is proud to partner the 12th edition of CII Man'Exe 2016 and present the knowledge report 'Telangana – Gateway to the Future of Manufacturing'. The report highlights key advanced manufacturing sectors including Aerospace, Defence, Life-sciences, Electronics & IT Hardware among others that have enormous growth potential. It also focuses on some of the evolving technologies like Additive Manufacturing, Precision Engineering and Industrial Robots that promise to change the manufacturing landscape through technological inclusion in increasing efficiencies and competitiveness.

I wish Telangana CII and its state members the very best for a grand success of Man'Exe 2016.

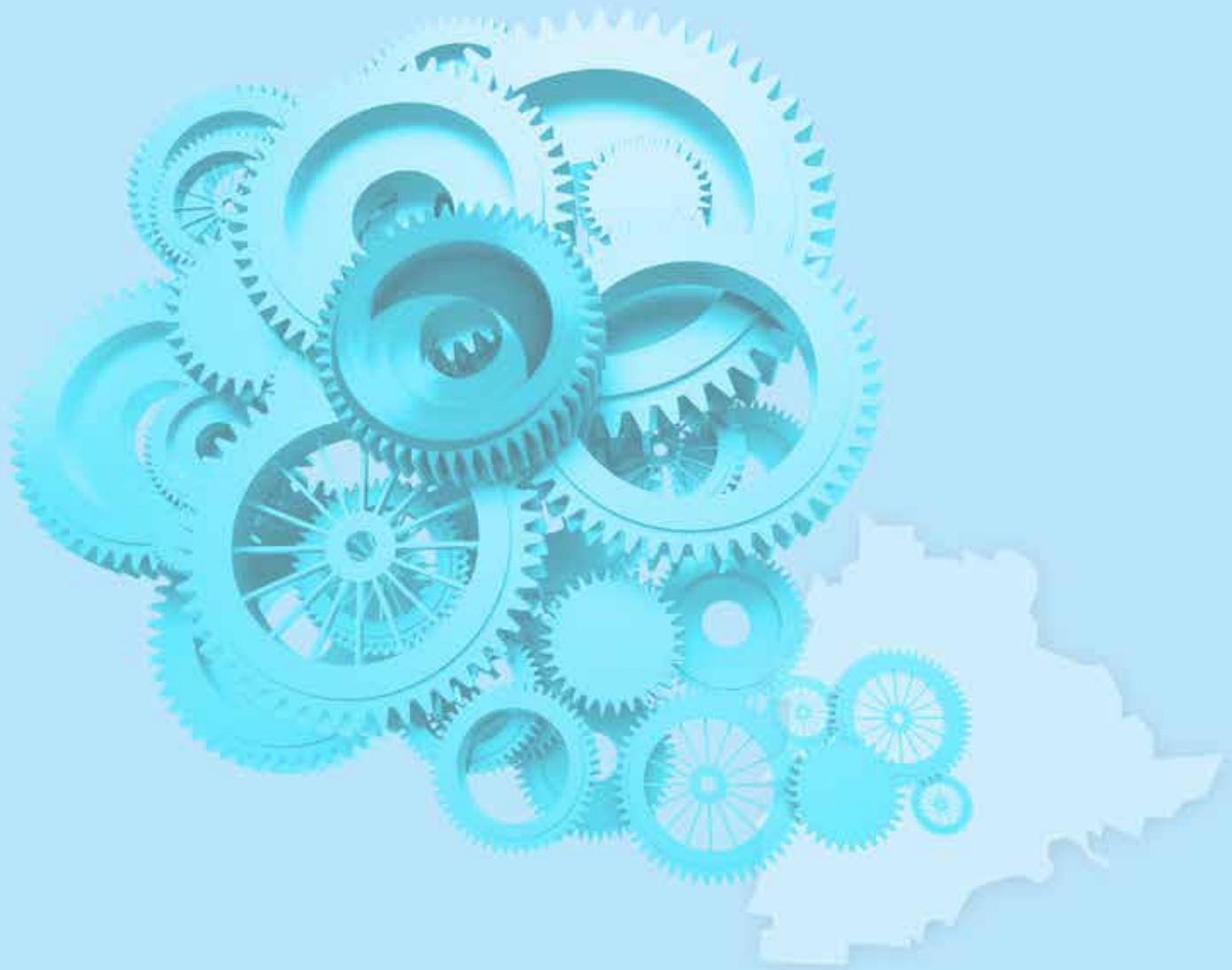
Thank You,
Sincerely,



Rana Kapoor

Managing Director & CEO 

Chairman 



C O N T E N T S

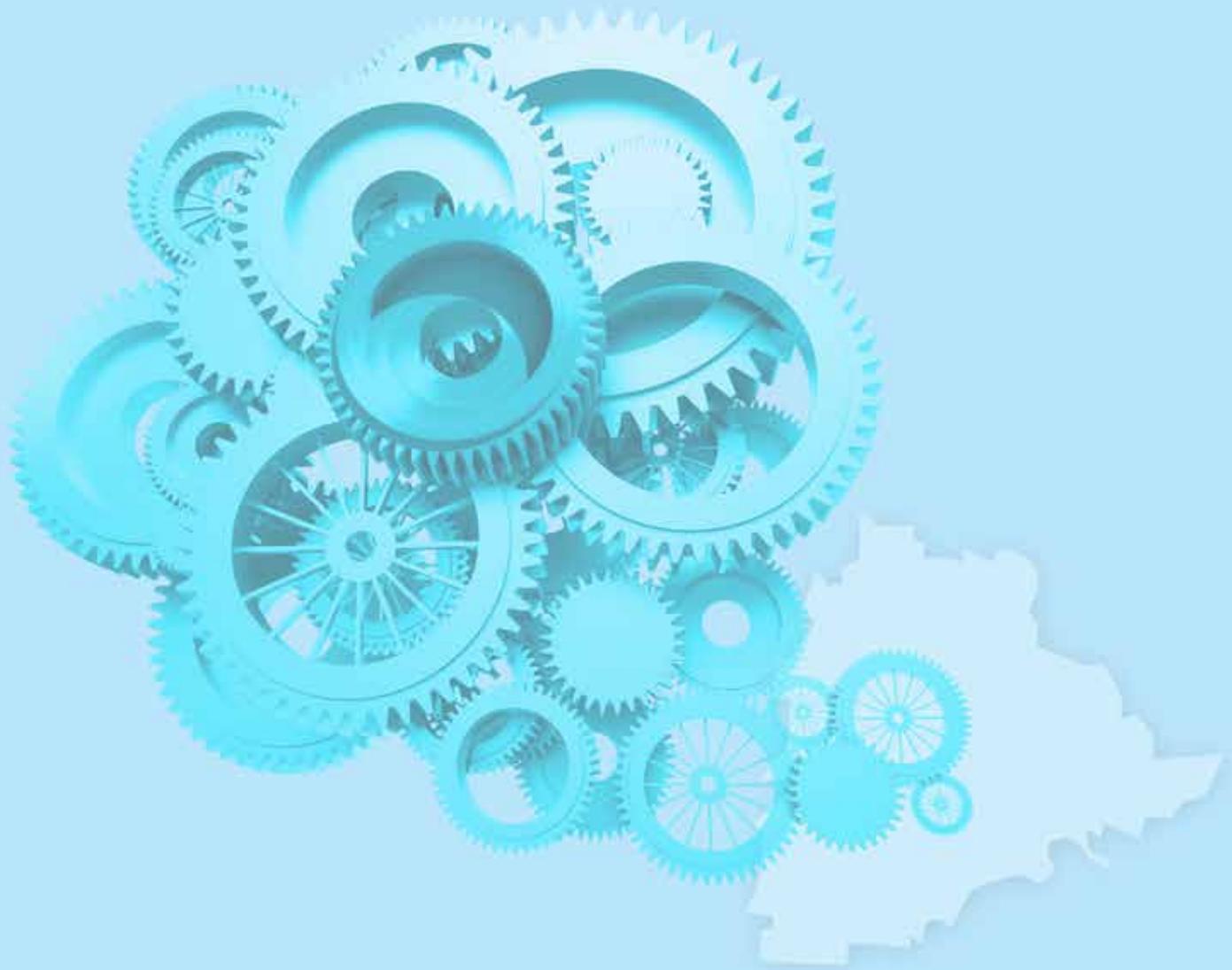
1	Theme note on: CII – Manufacturing Excellence MAN'EXE Conference	13
1.1	Introduction to MAN'EXE	14
1.2	MAN'EXE 2016	14
1.3	Report	15
2	Telangana – An Overview	17
2.1	Introduction	18
2.2	Socio-Economic Profile	19
2.3	Industrial Profile	21
2.4	Industrial Policy of Telangana	23
2.5	Sectoral Thrust Areas	25
2.6	Infrastructure and Resource Availability	25
3	Advanced Manufacturing Sectors	29
3.1	Life Sciences	31
3.2	Electronics and IT Hardware	34
3.3	Defence & Aerospace Sector	40
3.4	Textiles Manufacturing	43
3.5	Automobiles and Auto-Ancillary	46
4	Emerging and Future Technologies in Manufacturing	49
4.1	Additive Manufacturing (3D Printing)	51
4.2	Advanced Biotechnology	53
4.3	Precision Engineering	54
4.4	Industrial Robots	56
4.5	Energy Technology (Advanced Photovoltaics)	59
5	Recommendations	63
5.1	Advantage Telangana	64
5.2	Recommendations for Growth of Manufacturing Sector	65
5.3	Stakeholder Perceptions and Recommendations	68
6	Annexure	71

LIST OF FIGURES

Figure 1	District wise Population of Telangana	19
Figure 2	Trends in GSDP at Constant (2011-12) Prices of Telangana	20
Figure 3	District-wise Share to Telangana GSDP at Constant (2011-12) Prices	20
Figure 4	Gross State Domestic Product at Constant (2011-12) Prices	22
Figure 5	Factories in Selected Manufacturing Sectors by District, 2013-14	22
Figure 6	Economic Indicator of Industrial Sector	23
Figure 7	Volume of U.S. trade in advanced technology products in 2015	30
Figure 8	Global Biotech market by region (2012)	31
Figure 9	List of global top 10 biotech and pharmaceutical companies based on revenue (2015)	32
Figure 10	Pharmaceuticals and Biopharmaceuticals Domestic Sales in India	32
Figure 11	Global electronics industry - Growth outlook 2014-2016	35
Figure 12	IT hardware spending forecast in India 2012-2019	35
Figure 13	Solar PV module manufacturers - Market share based on revenue 2015	36
Figure 14	Solar PV module industry - Worldwide revenue (2007-2014)	37
Figure 15	Global leading Aerospace and Defense manufacturers (2014)	40
Figure 16	Leading textile machinery importers (2013)	44
Figure 17	Global Trend of Automobile Manufacturing (2000-2015)	46
Figure 18	Moving to Future and Advanced Technologies in Manufacturing	50
Figure 19	Projected global additive manufacturing market size from 2013 to 2020	52
Figure 20	Biocon Financial Performance Composition (2011 -2016)	54
Figure 21	Value of shipments of precision turned product USA from 2008 to 2020	55
Figure 22	Annual growth in North American industrial robot sales by customer segment (2015)	57
Figure 23	Worldwide sales of industrial robots from 2004 to 2014	57
Figure 24	Estimated annual industrial robot shipments in selected regions worldwide from 2010 to 2018, by region	58
Figure 25	Global cumulative solar PV capacity at the end of 2015, by country	60
Figure 26	Domestic and Export Demand of Indian PV Modules	60
Figure 27	Stakeholder Perception on Ease of different factors affecting manufacturing sector in the State	68

LIST OF TABLES

Table 1 Demographic and Other Key Characteristics of Telangana	18
Table 2 Major Thrust Sectors	25
Table 3 SEZs in Telangana	26
Table 4 Industrial Clusters in Telangana	26
Table 5 Textile parks in Telangana	45



1

THEME NOTE ON: CII – MANUFACTURING EXCELLENCE MAN'EXE CONFERENCE





1

THEME NOTE ON: CII – MANUFACTURING EXCELLENCE MAN'EXE CONFERENCE

1.1 INTRODUCTION TO MAN'EXE

Manufacturing sector plays a major role in the development of the Indian economy both in terms of growth and employment. With the nation poised to become one of the top three global economies in the coming decade, a competitive manufacturing sector in India is pivotal for achieving this growth. To enhance their global competitiveness, along with policy support from the Government, the manufacturing industries are working on Manufacturing Excellence. Manufacturing Excellence is an imperative tool that leads an organization to the path of required competitiveness at the global level. This includes internal reforms and investments in areas including technology up-gradation and innovation.

Confederation of Indian Industry's flagship Leadership Series on Manufacturing Excellence - Man'Exe, is a platform for various stakeholders in the Manufacturing sector to come together and brainstorm on topics related to Excellence and advances in the Manufacturing sector and overall competitiveness and sustainability of the Industry.

The previous editions of the conference has had speakers discussing about the ecosystem for manufacturing industry to thrive, the opportunities and trends in innovation in the industry, best practices and case studies from across India – all aiming at increasing sustainability and competitiveness of the manufacturing sector in India.

1.2 MAN'EXE 2016

The theme for the 12th edition of the Man'Exe 2016 conference is "Make in Telangana: Sustainable Growth through Innovation and Future Technologies"

Today, with growing demand and easing government policies, advanced manufacturing sectors like Aerospace, Defence, Biotechnology, Electronics, etc have enormous scope of "Making in India". To make the "Make in India" approach competitive and sustainable, it is

required that Indian manufacturers invest in innovation and future technologies on a large scale.

The Man'Exe 2016 conference focuses on this theme and brings in industry leaders from across India to discuss on Making in Telangana, focussing on Advanced Manufacturing Sectors and the importance of innovation and future technologies in achieving sustainable growth.

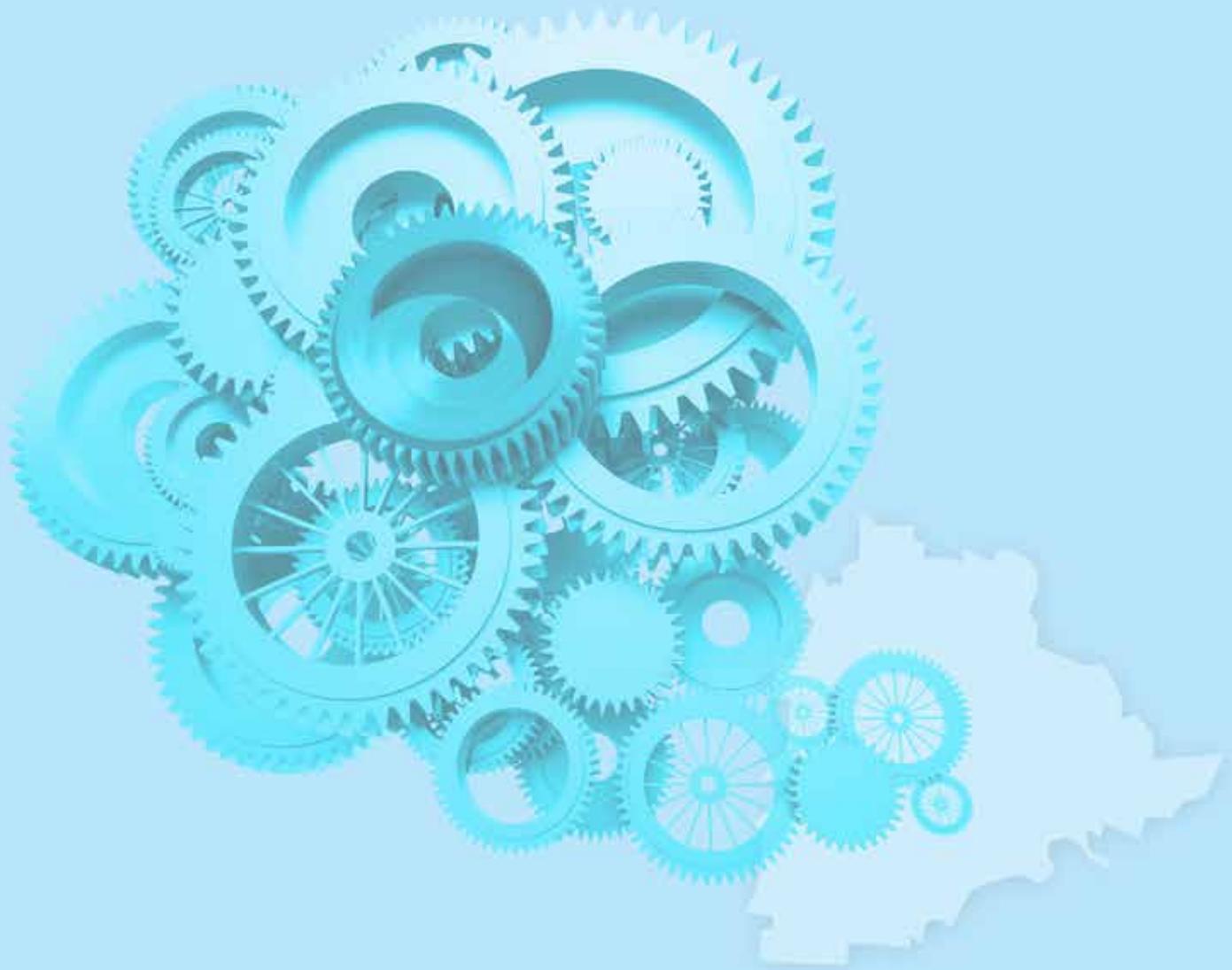
The sessions at the conference include -

1. Make in Telangana – An Ecosystem for Competitive and Quality Manufacturing
2. Evolving Opportunities in Advanced Manufacturing
3. Emerging and Future Technologies in Manufacturing

1.3 REPORT

The report highlights Telangana as a destination for Manufacturing Sector, discusses recent developments in the Advanced Manufacturing sectors and throws light on key Emerging Technologies in the Manufacturing Sector. The report has 5 chapters that include-

- ✓ **Introduction to MAN'EXE 2016** – This chapter talks about the conference and its objectives
- ✓ **Telangana, An Overview** – This chapter talks about the socio-economic and industrial profile of the State of Telangana and talks about the industrial policy, recent developments in the thrust areas and available infrastructure for industrial development in the state
- ✓ **Advanced Manufacturing** – This chapter talks about some of the major advanced manufacturing sectors in Indian & global perspective, supportive policies in India and Telangana and the opportunities that they offer
- ✓ **Emerging And Future Technologies In Manufacturing** – This chapter talks about key emerging and future technologies in manufacturing that has potential to improve the overall manufacturing efficiencies and industry's competitiveness
- ✓ **Recommendations** – This chapter talks about recommendations from industry leaders on making manufacturing sector more competitive and sustainable



2

TELANGANA – AN OVERVIEW





2

TELANGANA – AN OVERVIEW

2.1 INTRODUCTION¹

- ✓ The State of Telangana with Hyderabad as its capital is the 29th state of India
- ✓ With the geographical area of 1,12,077 sq. km and population of 3.5 Crore, as per 2011 census, Telangana is the 12th largest State in terms of both area and population
- ✓ The State is bordered by the States of Maharashtra to the North and North-West and Chhattisgarh to the North, Karnataka to the West, and Andhra Pradesh to the South, East and North-East

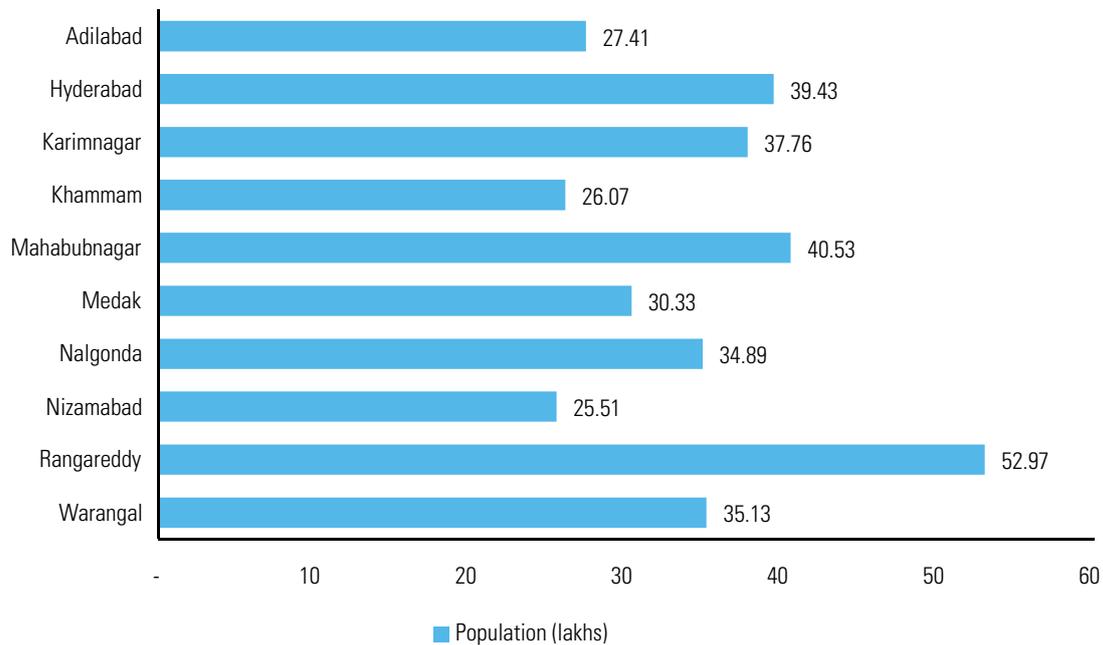
Table 1 Demographic and Other Key Characteristics of Telangana

Item	Unit	Telangana	India
Area	Sq. Kms.	112,077	3,287,263
Districts	Nos.	10	683
Total Population (as per 2011 Census)	Nos.	35,003,674	1,210,854,977
Sex Ratio (Females per 1000 Males)	Nos.	988	943
Density of Population (Per Sq. km.)	Nos.	312	382
Decadal Growth Rate (2001-2011)	Rate	13.58	17.64
Literacy Rate	Rate	66.54	74.04
Total Workers	Nos.	16,341,942	481,743,311

Source: Directorate of Economics and Statistics, Government of Telangana, Census of India 2011

¹Telangana Statistical Year Book, 2016 & Socio Economic Outlook, 2016 Government of Telangana

Figure 1 District wise Population of Telangana (2011)



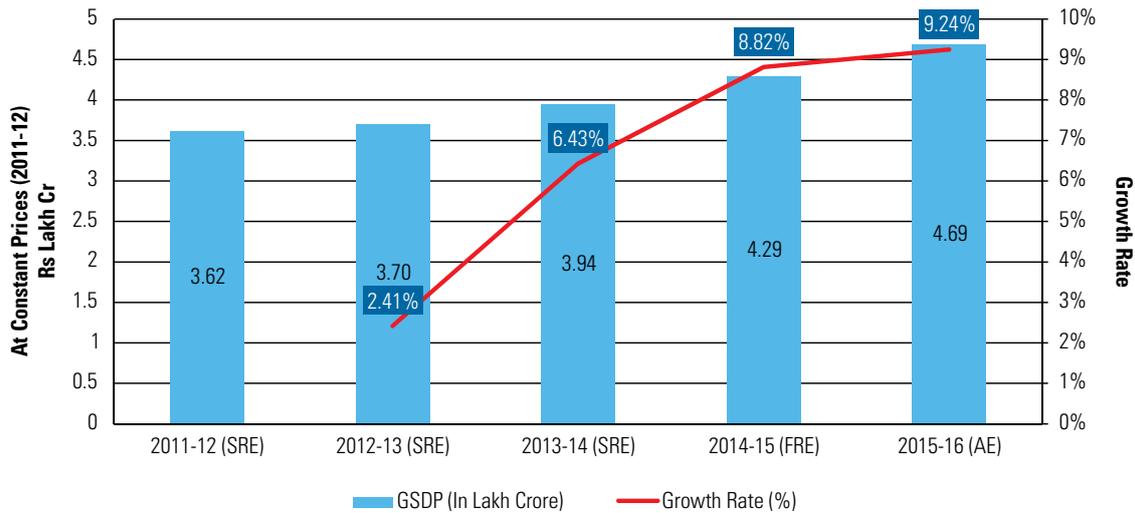
Source: Telangana Statistical Year Book 2016, YES Bank Analysis

2.2 SOCIO-ECONOMIC PROFILE

- ✓ The Gross State Domestic Product of Telangana at constant (2011-12) prices for 2015-16 (AE) stood at Rs. 4,68,656 Crore, against Rs. 4,29,001 Crore for 2014-15 (FRE), registering growth of 9.2%. It contributed about 4% to India's GDP
- ✓ The primary/ agri-based sector contributed about 17% to the state economy for 2015-16. However it has witnessed a fall of about 1.9% over 2014-15
- ✓ For the same year, the secondary/ industries sector contributed 22.5% to Telangana GSDP, having witnessed a growth rate of 8.6% over 2014-15
- ✓ Tertiary/ Services sector contributed to about 60.5% to the state economy for 2015-16. The sector has grown by 11% over 2014-15
- ✓ For 2016-17,
 - o The total Government expenditure is estimated to be Rs 1, 30,416 Crore, a 30.3% increase over 2015-16 (revised estimate) which stood at Rs 1,00,062 Crore
 - o Total Government receipts (excluding borrowings) are estimated at Rs 1,04,849 Crore, an increase of 31.3% over 2015-16 (revised estimate) which stood at Rs 79,835 Crore
 - o Revenue surplus for the next financial year is targeted at Rs 3,718 Crore, or 0.55% of the Gross State Domestic Product (GSDP)
 - o Fiscal deficit is targeted at Rs 23,467 Crore (3.5% of GSDP). Primary deficit is targeted at Rs 15,761 Crore (2.35% of GSDP)

- ✓ Indicators, such as population per bank and Credit-Deposit Ratio (CDR), are used for showing extent of banking penetration. On an average each bank branch is serving population of around 8000 in 2014 as against national average of 9000 per bank branch
- ✓ Credit-Deposit Ratio (CDR) is the ratio of how much a bank lends out of the deposits it has mobilized indicating how much of a bank's core funds are being used for lending. The CDR in the State is about 103 as against national average of 75

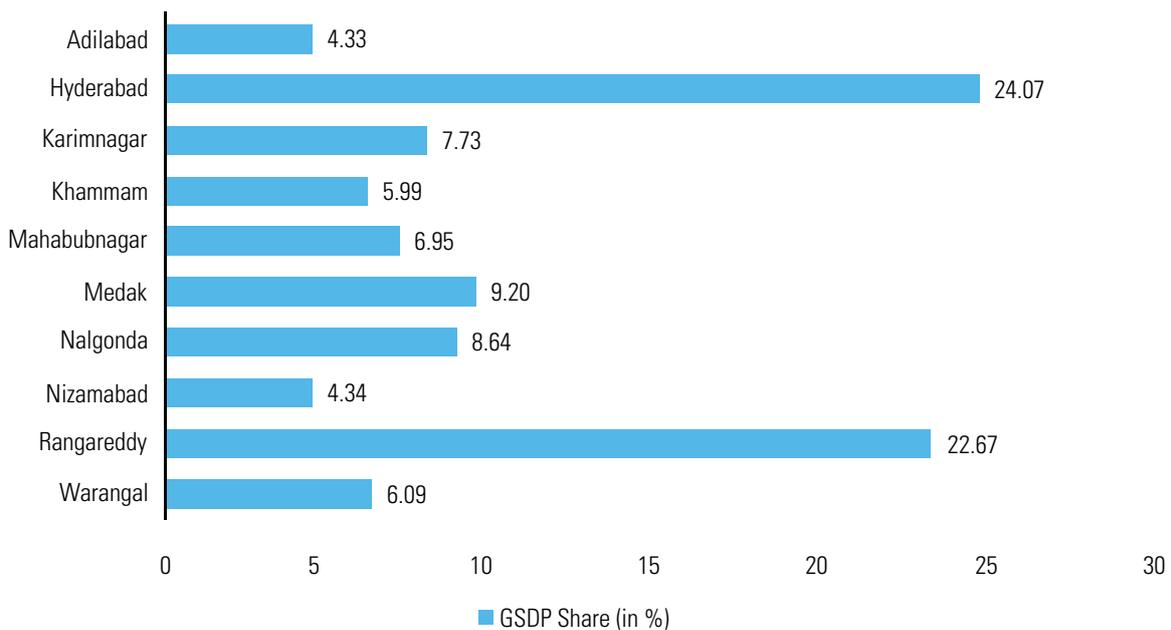
Figure 2 Trends in GSDP at Constant (2011-12) Prices of Telangana



Source: Telangana Statistical Year Book 2016, YES Bank Analysis

Note: FRE: First Revised Estimates; SRE: Second Revised Estimates; TRE: Third Revised Estimates; and AE: Advance Estimates

Figure 3 District-wise Share to Telangana GSDP at Constant (2011-12) Prices

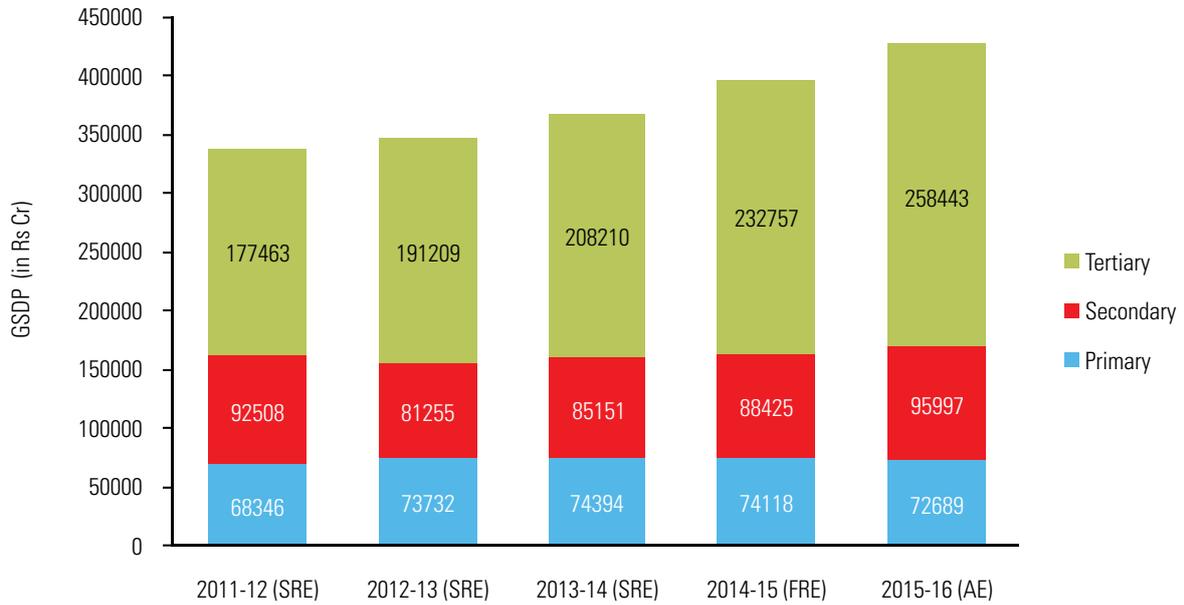


Source: Telangana Statistical Year Book 2016, YES Bank Analysis

2.3 INDUSTRIAL PROFILE

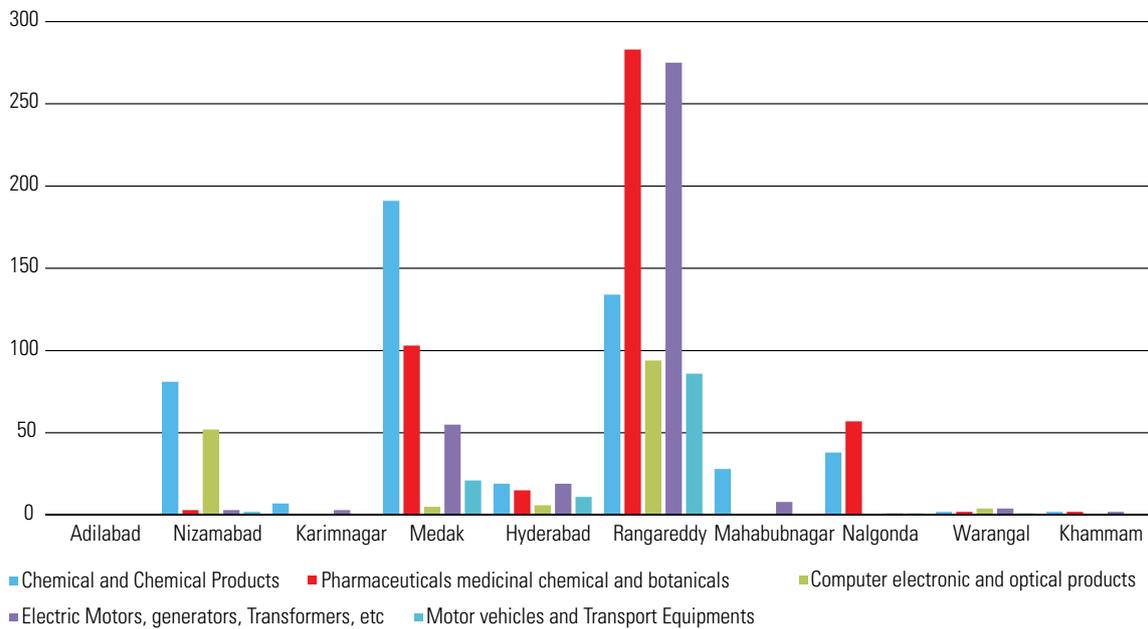
- ✓ The State is home to several major manufacturing industries like bulk drugs, pharmaceuticals, agro-processing, cement & mineral-based industries, high precision engineering, textiles, leather, apparels, automobiles and auto components industry, spices, horticulture, poultry farming, biotechnology, defence equipment, etc
- ✓ The Industry Sector contributed 22.5% to Telangana GSDP for 2015-16. The CAGR of industry sector during the period 2011-12 - 2015-16 is averaged at 6.3% as against GSDP growth of 11.7% in the State
- ✓ However, out of the 22.5% contribution of industry sector, 15.1% is purely from Manufacturing and has been fairly constant from 2012-13. However the growth rates reflect an increasing trend from -14.7% in 2012-13 to 9.5% in 2015-16
- ✓ Manufacturing of pharmaceuticals, medicinal, clinical and botanical products constitute about 29% of the Gross Value Added (GVA) within the manufacturing sector, followed by manufacture of electrical equipment (11%), manufacture of other non-metallic mineral products (9%) and manufacturing of food products (9%)
- ✓ In terms of investment, manufacture of pharmaceuticals, other non-metallic mineral products, rubber and plastic products, electrical equipment and food products account for about 54% of total investment (fixed capital) within overall manufacturing sector in the State
- ✓ Number of factories increased from 7,357 in 2008-09 to 10,279 in 2012-13, registering a growth of 40% in number of factories in the State for the period
- ✓ The GVA of industrial sector in the State as per Annual Survey of Industries, 2012-13 is about Rs. 33,975 Crore - accounting for about 3.37% share in all India GVA
- ✓ The annual fixed capital investment in factories has remained fairly constant in the 2008-2013 period, though the input per factory has increased in this period showing a growth in capacity. The gross value addition per input has remained around 0.28 to 0.34 during this period
- ✓ The Micro, Small and Medium Enterprises (MSME) sector plays a key role in economic and social development of the State. In 2015 alone, the MSME sector attracted investment of Rs. 1586 Crore and provided direct employment to 37,747 people across 3,779 units
- ✓ Out of 3,779 MSME units in 2015-16, around 61% constitute micro enterprises, 38% small enterprises and mere 0.5% medium enterprises

Figure 4 Gross State Domestic Product at Constant (2011-12) Prices



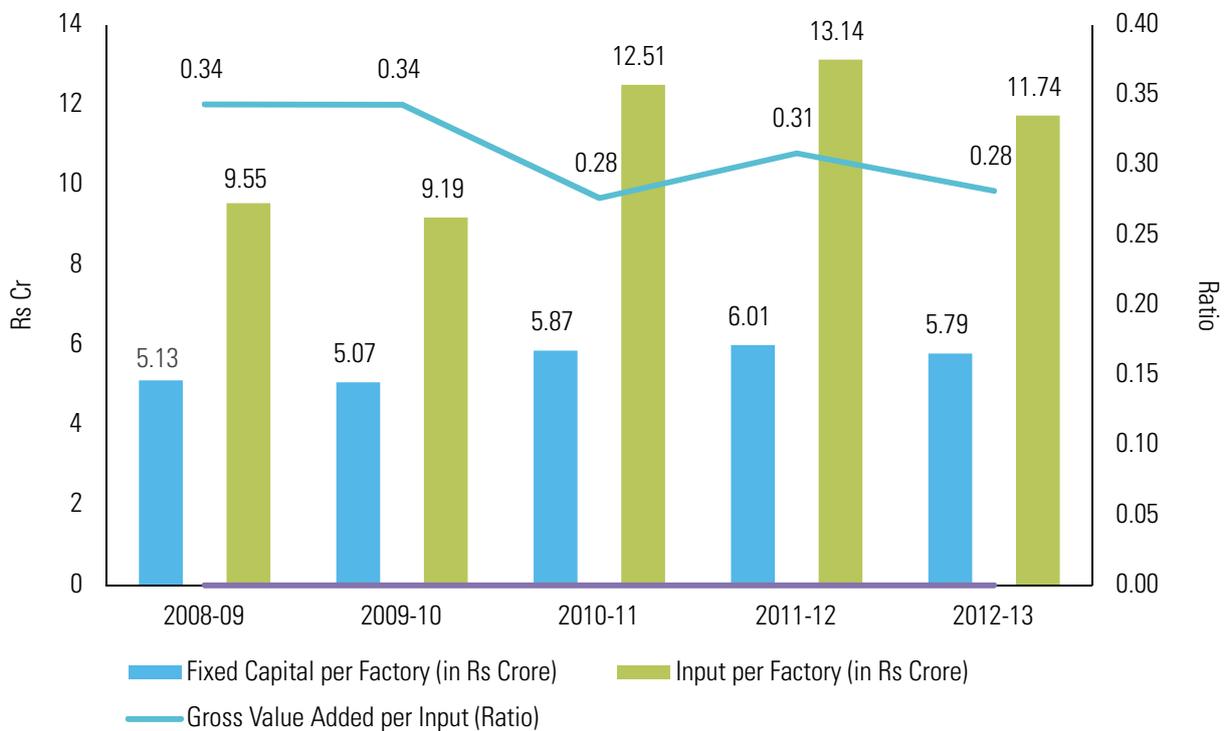
Source: Telangana Statistical Year Book 2016, YES Bank Analysis

Figure 5 Factories in Selected Manufacturing Sectors by District, 2013-14



Source: Telangana Statistical Year Book 2016, YES Bank Analysis

Figure 6 Economic Indicator of Industrial Sector



Source: *Telangana Statistical Year Book 2016, YES Bank Analysis*

2.4 INDUSTRIAL POLICY OF TELANGANA

- ✓ **Industrial Policy of Telangana, 2015**-The State of Telangana has envisioned industrialization in the state with a Vision of - “Research to Innovation; Innovation to Industry; Industry to Prosperity”. The industry policy framework has set up a goal of “In Telangana-Innovate, Incubate, Incorporate.”
- ✓ **The “Telangana State Industrial Project Approval and Self Certification System (TS-iPASS) Act, 2014”** has been enacted to create an investor friendly environment in the State. The salient features of the Act are:
 - o A single Common Application Form (CAF) for all departmental approvals
 - o All relevant departments have been brought under purview of TS-iPASS
 - o Depending on complexity of the approval, a time limit has been set varying from 1 day to 30 days depending upon the complexity of the project
 - o Applications are Pre-scrutinized at state and district level enabling proper submission of applications and thus avoiding delays in processing the same
 - o It has been made mandatory for the competent authorities to seek shortfall/additional information, if any, limited to one time, within three days of receipt of application
 - o In case approvals are not accorded by departments within stipulated timeframe, the projects shall be deemed approved
 - o Increase of transparency with information being shared with entrepreneurs on reasons for delay, if any, in getting the clearance within time limits
 - o A provision has been provided for automatic approval system on submission of a self-certification by the entrepreneur

- A “Telangana State-Wide Investment Facilitation (T-SWIFT)” Board under the chairmanship of the Chief Secretary to Government has been constituted to provide approvals within 15 days to mega projects (projects of over Rs. 200 Crore investment)
- ✓ **Industrial Infrastructure Development Fund (IIDF) Scheme:** IIDF shall provide 50% of the cost of the infrastructure (with a ceiling of Rs 1 Crore) for standalone units for building the access to roads, power and water
- ✓ **Incentives for setting up of new Industrial Enterprises:** T-IDEA scheme has been introduced to provide incentives for first generation entrepreneurs and women entrepreneurs, and T-PRIDE has been introduced for developing entrepreneurship among SCs, STs, etc.
- ✓ **Telangana State Industrial Infrastructure Corporation (TSIIC):** TSIIC was established in the year 2014. It aims at identifying and developing potential industrial growth centres, along with developing the required infrastructure in these centres. Following are some of the initiatives undertaken by TSIIC:
 - **Establishment of Hyderabad Pharma-City:** A World Class ‘Pharma City’ is being developed in Rangareddy and Mahabubnagar districts of the State. The Project, with an estimated cost of Rs. 13,064 Crore, shall include a university, R&D Lab, Township along with the required common facilities like Common Effluent Treatment Plant, Sewage Treatment Plant, etc.
 - **National Investment and Manufacturing Zones (NIMZ):** A NIMZ has been approved by the Government of India to be established at Zaheerabad in Medak district. The estimated investment shall be Rs 17,303 made in 3 phases, with the 3rd phase ending in the year 2040. This NIMZ is estimated to generate direct and indirect employment to 2.4 lakh people
 - **Aerospace and Precision Engineering SEZ at Adibatla:** The Aerospace SEZ at Adibatla in Rangareddy is being developed. It hosts 10 operational aerospace components manufacturing units
 - **Genome Valley:** Genome Valley, which is being developed in 4 phases, is the largest organized biotechnology cluster in the country, spreading over 1500 acres, the cluster harbours 150 life science companies, providing direct and indirect employment to over 50,000 people
 - **Special Economic Zones (SEZs):** There are 67 SEZs in the State at different stages of completion in the State
- ✓ Along with the manufacturing sector, to support service sector, which ultimately can boost the manufacturing competitiveness in the State, the Government has introduced many initiatives that include-
 - **T-HUB:** T-Hub has been developed aiming at making Hyderabad as a start-up city and Telangana as a start-up State
 - **Information Technology Investment Region (ITIR) at Hyderabad:** The ITIR, Hyderabad has been cleared by the Government of India. From this ITIR, IT products worth Rs. 2,35,000 Crore are expected to be exported, with direct and indirect employment to about 15 lakh and 53 lakh people respectively
 - **Telangana Academy for Skill & Knowledge (TASK):** TASK has been developed with an objective of offering quality human resources and services to the industry in the state along with enhancing the employability quotient of youth in the State

2.5 SECTORAL THRUST AREAS

- ✓ The Government of Telangana recognizes the following 14 sectors as thrust areas, and investments in these sectors are accorded high priority

Table 2 Major Thrust Sectors

SN	Thrust Sector
1.	Life Sciences (Bulk drugs, Formulations, Biologicals, etc)
2.	IT Hardware (Electronics, Bio-medical devices, etc)
3.	Precision Engineering (Aviation, Aerospace, Defence)
4.	Food processing and nutrition products
5.	Automobiles (Transport Vehicles, Auto-components, Tractors, etc)
6.	Textiles and Apparel
7.	Plastics and Polymers, Chemicals and Petro-chemical, glass and ceramics
8.	FMCG and Domestic Appliances
9.	Engineering and Capital Goods (Castings, Foundry and Ferro-alloys, etc)
10.	Gems and Jewellery
11.	Waste Management and Green Technologies
12.	Renewable Energy and Solar Parks
13.	Mineral-based and wood-based Industries
14.	Transportation (Logistic Hub, Inland Port, Container Depot, etc)

Source: Government of Telangana

2.6 INFRASTRUCTURE AND RESOURCE AVAILABILITY

- ✓ **Developed Land:**
 - The state has 68 SEZs at different stages of completion which would include the required infrastructure facility for the industries
 - Other than SEZs, the state land bank in terms of developed Industrial Parks (IP) are developed into 6 zones that are Warangal zone with 25 IP, Shamsabad zone with 32 IP, Patancheru zone with 29 IP, Karimnagar zone with 15 IP, Jeedimetla zone with 35 IP and Cyberabad Zone with 22 IP²
 - 10 Industrial clusters based on the parameters like demand and the availability of the products in the surrounding areas of the cluster locations are being developed in 3 phases³

²<http://tsiic.telangana.gov.in/information-on-industrial-parks/>

³Industrial Clusters in Telangana - <http://tsiic.telangana.gov.in/industrial-clusters/>

Table 3 SEZs in Telangana

Sl. No.	Type of SEZs	Number
1	AP MARKFED	1
2	Urban Development Authority	1
3	TSIIC - Joint Ventures	3
4	SEZs – TSIIC	7
5	Urban Development Authority Formal Approval	12
6	TSIIC Allottees Notified as SEZs	17
7	Private Developers	27
	Total	68

Source: Socio Economic Outlook 2016 -Government of Telangana

Table 4 Industrial Clusters in Telangana

SN	Location	Type of cluster
Phase I		
1	Ibrahimpattam , Rangareddy	Fiber Glass cluster
2	Duddada, Medak	General Engg – Electronics & Electrical Park
Phase II		
3	Madaram – RR Dist	Agri & Food processing, Fiber Glass cluster / Composite Material cluster Defense cluster
4	Jedcharla , Mahaboobnagar	Leather Design cluster
5	Buggapadu and Sattupalli, Khammam	Leather Design cluster
6	Madikonda ,Warangal	Jewellery Manufacturing
7	Manthani , Karimnagar	Agri Implements cluster
Phase III		
8	Nalgonda	Furniture City
9	Armoor , Nizamabad Dist	Spice / Agro products, Seed processing
10	Buchinalli – Medak Dist	Auto ancillary cluster

Source: TSIIC Government of Telangana

✓ **Energy:**

- The state has a generation capacity of 8,871 MW of power with the generation being 39,571 MUs in 2015-16
- The total power consumption in the state in 2014-15 stood at 39,512 MUs⁴
- To increase power generation capacity, Telangana is aggressively encouraging renewable sources like Solar power along with conventional power generation sources like the recently inaugurated Rs 10,598 Crore National Thermal Power Corporation's (NTPC) 1,600 MW Telangana Super Thermal Power Project (Phase I) in Ramagundam city⁵

✓ **Skilled Man Power:**

- The total workers in the state count to 1.63 Crore
- With initiatives like Telangana Academy for Skill & Knowledge (TASK) the state Government is working on enhancing the employability quotient of youth in the State
- The state is also planning to soon launch its Skill Development Policy that aims to address the quality & availability of skilled manpower in the state

✓ **Transport and Communications:**

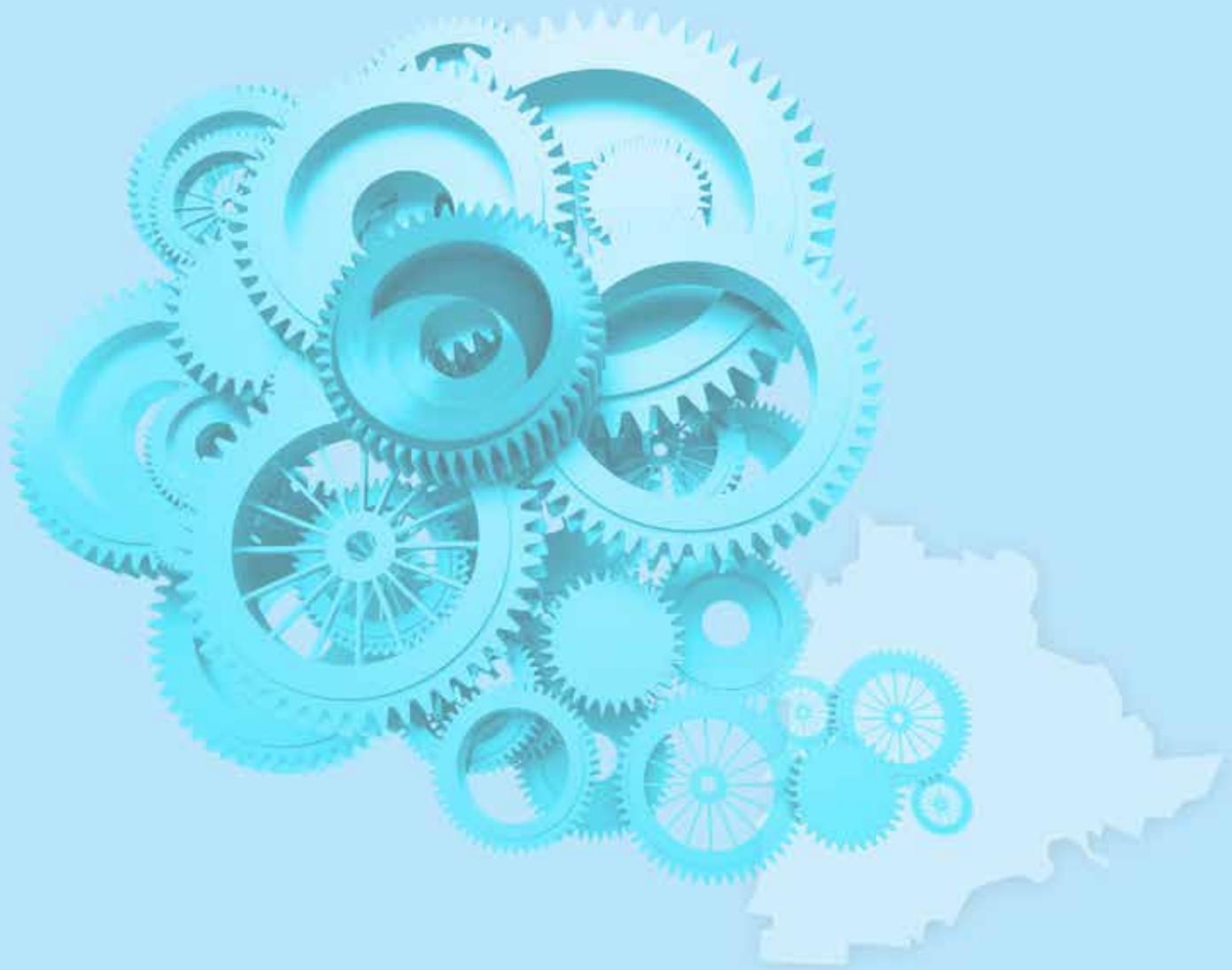
- Total Road Network of 97,019.33 kms of which 2,365.93 kms. is cement concrete; 46,174.11 kms. is Black Top; 14,758.23 kms. is metalled and 33,721.66 kms. un-metalled. The road density stands at 23.4 kms/100sqkms⁶
- The state has 229 railway stations with a route coverage of 1676 kms
- Rajiv Gandhi International Airport (RGIA), Shamshabad is one of the largest 7 modern airports in India
- The Government has proposed a greenfield airport in Kothagudem in Khammam district⁷
- The state has over 3.7 Crore mobile and landline connections, with a tele-density of 105%

⁴Telangana Socio Economic Outlook, 2016

⁵National Thermal Power Corporation Press Release Dated 6th August 2016

⁶Telangana Road department - <http://tsroads.cgg.gov.in/getInfo.do>

⁷Telangana government to push hard for Kothagudem airport, The New Indian Express, Dated 27th July 2016



3

ADVANCED MANUFACTURING SECTORS



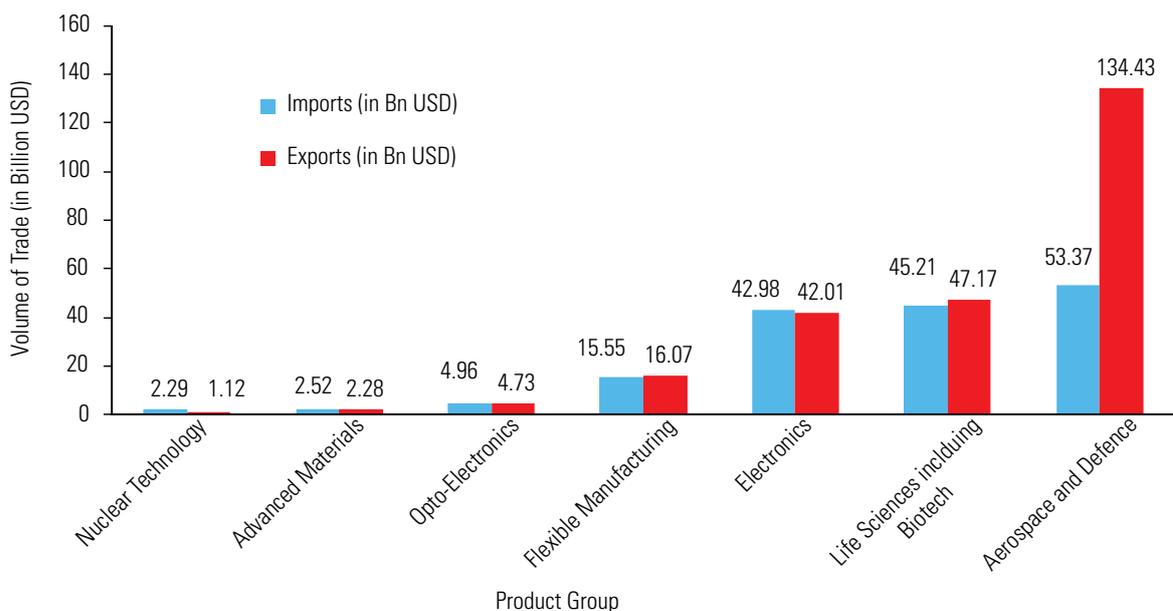


3

ADVANCED MANUFACTURING SECTORS

In the United States, trade worth USD 134.43 Billion in exports and USD 53.37 Billion in imports took place for advanced manufacturing sectors like Aerospace and Defence in the year 2015. The same stood at USD 47.17 Billion in exports and USD 45.21 Billion in imports for Life Sciences sector, including Biotechnology. In Electronics sector the US market witnessed USD 42.01 Billion in exports and USD 42.98 Billion in imports during the year. This showcases the enormous scope and opportunities the advanced manufacturing sectors have worldwide.

Figure 7 Volume of U.S. trade in advanced technology products in 2015



Source: US Census Bureau; US Department of Commerce, Accessed from Statistac.om^{8,9}; YES Bank Analysis

⁸<http://www.statista.com/statistics/258753/us-exports-of-advanced-technology-products/>

⁹<http://www.statista.com/statistics/258753/us-imports-of-advanced-technology-products/>

As highlighted earlier, Telangana Government has identified fourteen thrust sectors where it has a competitive advantage based on its geographical location, resource availability, skill-base, raw material availability, existing manufacturing practices and expertise and new opportunities¹⁰. Of these fourteen thrust sectors, five sectors have been identified to be highly dependent on **advanced manufacturing techniques for their competitive advantage**.

These sectors include:

- A) Life Sciences including, bulk drugs, formulations, vaccines, nutraceuticals, biologicals, etc.
- B) IT Hardware and Electronics including solar photovoltaic panels, bio-medical devices, electronics, cellular communications, etc.
- C) Defence and Aerospace Sector
- D) Textiles Manufacturing
- E) Automobiles and Auto-Components

This chapter highlights the relative strengths of these sectors with a focus on advantages in India and Telangana. The opportunities for these sectors are also highlighted along with the factors that need attention. Additionally, institutes of excellence offering specialised courses in these sectors have been listed.

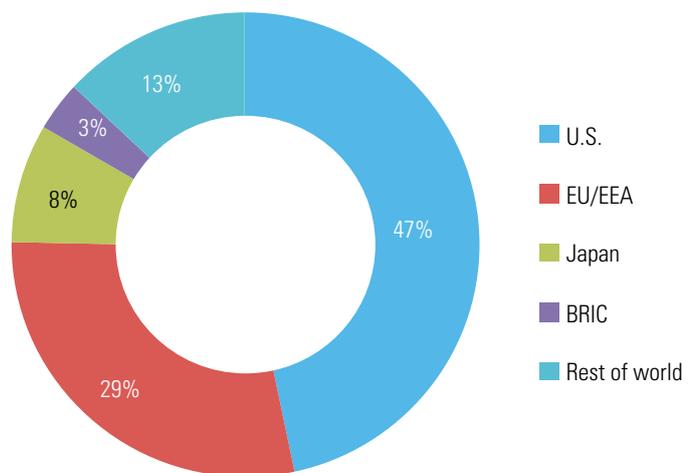
3.1 LIFE SCIENCES

Life Science is a unique industry with its own workflows, regulatory frameworks and business risks requiring advanced manufacturing, meaning that significant benefits can be obtained through the deployment of advanced automation and manufacturing information systems. It is set apart from other industries by being forward thinking, using leading edge technologies, being highly competitive and fast paced; whilst doing all of these things within a regulatory framework. The products are highly complex batches of high value, and are potentially lifesaving to the end user. The majority of the products are consumer goods, such as medications, vaccines, etc. It is thus paramount that production processes be as efficient and safe as possible. This industry includes sectors like bulk drugs, formulations, vaccines, nutraceuticals, biologicals,

etc.

The major life sciences markets are the USA and the EU region with 76% of the market in 2012 followed by Japan and BRIC nations. Some of the largest industries in the life sector, including biotechnology and pharmaceuticals include Johnson & Johnson (USA), Pfizer (USA), Novartis (Switzerland), Roche Holding (France), Sanofi (France), etc.

Figure 8 Global Biotech market by region (2012)

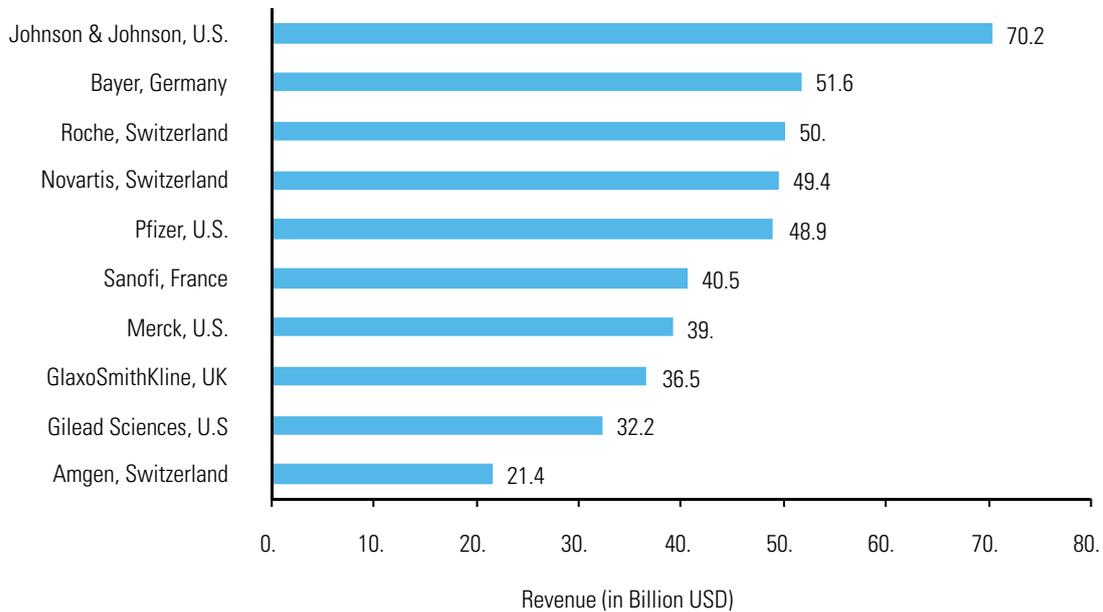


Source: EvaluatevGroup, Accessed from Statista.com¹¹; YES Bank Analysis

¹⁰<http://tsiic.telangana.gov.in/sectoral-thrust-area/>

¹¹<http://www.statista.com/statistics/316143/global-biotech-market-distribution-by-geographical-area/>

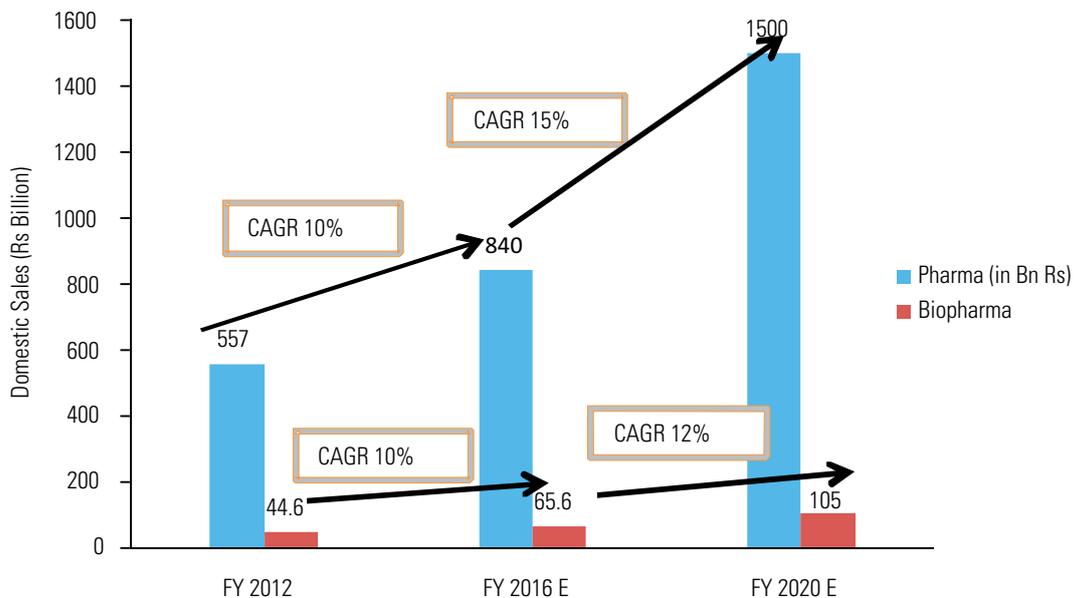
Figure 9 List of global top 10 biotech and pharmaceutical companies based on revenue (2015)



Source: Forbes¹²; YES Bank Analysis

Indian pharmaceutical sector accounts for about 2.4% of the global pharmaceutical industry in value terms and 10% in volume terms¹³. The domestic Pharmaceutical and Bio-Pharmaceutical sectors are expected to grow at CAGR of 15% and 12% respectively during 2016-20 in India. The growth rate of Life Sciences sector in the Hyderabad cluster achieved a CAGR of 13.5% and exports registered a growth of 17.3% since 2010.

Figure 10 Pharmaceuticals and Biopharmaceuticals Domestic Sales in India



Source: CRISIL Research¹⁴, YES Bank Analysis

¹³<http://www.eximbankindia.in/sites/default/files/Research%20Brief/WP%2037%20Pharma.pdf>

¹⁴Indian Pharmaceutical and Bio-Pharmaceutical outlook 2016 - www.crisilresearch.com

1) Initiatives and Policy of the Government of Telangana

Telangana Life Sciences policy (2015-20) aims to attract investments worth Rs. 20,000 Crore by 2020. The policy covers biotechnology, bulk drugs, formulations, vaccines, nutraceuticals, biologicals, biosimilars, incubation centres and research and development facilities¹⁵. Telangana State Industrial Infrastructure Corporation (TSIIC) and Pharmaceuticals export promotion council of India (Pharmaexcil) of the Union Commerce Ministry plan to set up a World Pharma Trade Centre in Hyderabad to facilitate pharma exports from Telangana.

2) Sector Analysis - Life Sciences Sector

WHY INVEST

1. Hyderabad is the bulk drug and vaccine capital of the country with availability of research facilities and qualified manpower
2. Telangana has a dedicated policy for Life Sciences
3. Other initiatives proposed by the Government will further boost the pharma sector in the state
4. Hyderabad offers good social infrastructure and connectivity for setting up of pharma units
5. Growth of the regional flagship biotech event – BioAsia
6. FDI investment up to 100% is permitted via the automatic route in Greenfield pharmaceuticals and upto 74% in Brownfield pharmaceutical
7. Government of India Biotechnology Industry Partnership Programme (BIPP) to further strengthen industry through partnerships
8. Biotechnology Industry Research Assistance Council to boost research in this sector

Opportunity

1. Potential of pharma sector to become USD 55 Billion industry by 2020 driven by increasing consumer spending, rapid urbanization, and increasing healthcare insurance penetration¹⁶
2. Opportunity to tap emerging trends in life sciences including personalized medicine, digital health technology and health data mining
3. Development of novel technologies such as regenerative medicine, nanotechnology & nanotoxicology, OMICS, biologics and bio-similars
4. New generic drug launches as drugs go off patent in developed markets
5. National Rural Healthcare Mission has been launched to boost healthcare spending

AREAS REQUIRING ADDITIONAL FOCUS

1. Limited R&D investment for development of new drugs in pharma sector. However, Indian firms are gradually seen moving up the value chain
2. Under developed medical devices sector in the country, that is largely dependent on imports

¹⁵<http://tsiic.telangana.gov.in/pdf/Life-Sciences-Policy.pdf>

¹⁶IBEF Pharmaceuticals Report, Jan 2016

3. Limited industry- academic interface needs to be addressed on priority
4. Lack of quality institutions for providing skilled labour matching industry demands
5. Lack of easy access to capital for entrepreneurs due to increased global and domestic competition for investments. Lack of institutions producing required skill sets matching industry demands
6. Lack of emphasis on applied research and technology commercialization
7. Regulatory overhang including intensified USFDA compliance checks; drug pricing control policy, etc

3) Institutes of Excellence for Education/Skill upgradation in the sector

Hyderabad cluster has trained and skilled manpower for employment in the pharma industry with the presence of a number of renowned R&D facilities, including the Indian Institute of Chemical Technology (IICT), National Institute of Pharmaceutical Education & Research (NIPER) and Indian Institute of Life Sciences (IILS). Other key research institutes in Telangana in this sector are -

1. Centre for Cellular and Molecular Biology : An Indian Biotechnology research establishment of the Council of Scientific and Industrial Research located in Hyderabad
2. The Centre for DNA Fingerprinting and Diagnostics (CDFD): An Indian Biotechnology research centre, located in Hyderabad, operated by the Department of Biotechnology, Ministry of Science and Technology, Government of India.

Other institutes of excellence offering specialised courses in this sector include:

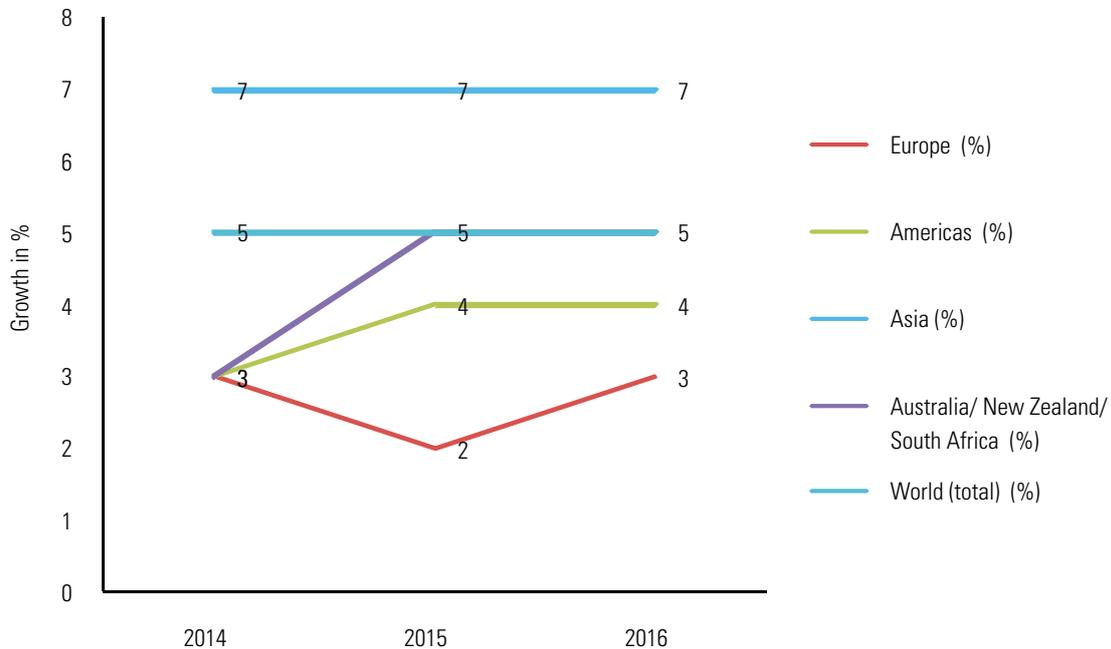
- ✓ Indian Institute of Science, Bangalore
- ✓ Indian Institute of Technology, Kharagpur
- ✓ Indian Institute of Technology, Roorkee
- ✓ Indian Institute of Technology, Guwahati
- ✓ Vellore Institute of Technology, Vellore
- ✓ National Institute of Technology, Warangal
- ✓ Manipal Institute of Technology, Manipal
- ✓ Manipal College of Pharmaceutical Sciences, Manipal
- ✓ University Institute of Pharmaceutical Sciences, Chandigarh
- ✓ Jamia Hamdard, New Delhi
- ✓ Bombay College of Pharmacy, Mumbai
- ✓ Poona College of Pharmacy, Pune

3.2 ELECTRONICS AND IT HARDWARE

Electronics Manufacturing Industry is one of the largest and fastest growing industries in the world. Size of the industry was estimated at nearly USD 1.75 Tn in 2012 and is expected to reach USD 2.40 Tn by 2020. With growing population and increasing income levels, Indian market is estimated to account for ~17% of the global demand by 2020 i.e. around USD 400 Bn. However, with a low domestic manufacturing base, the domestic production is expected to be able to cater to a demand of USD 100 Billion by 2020, leaving a demand-supply gap of nearly USD 300 Billion by 2020¹⁷ which could impact India's trade deficit further. To address this gap in the Electronics sector, the Department of Electronics and Information Technology (DEITY), Ministry of Communications and Information Technology (MCIT), Government of India (GOI),

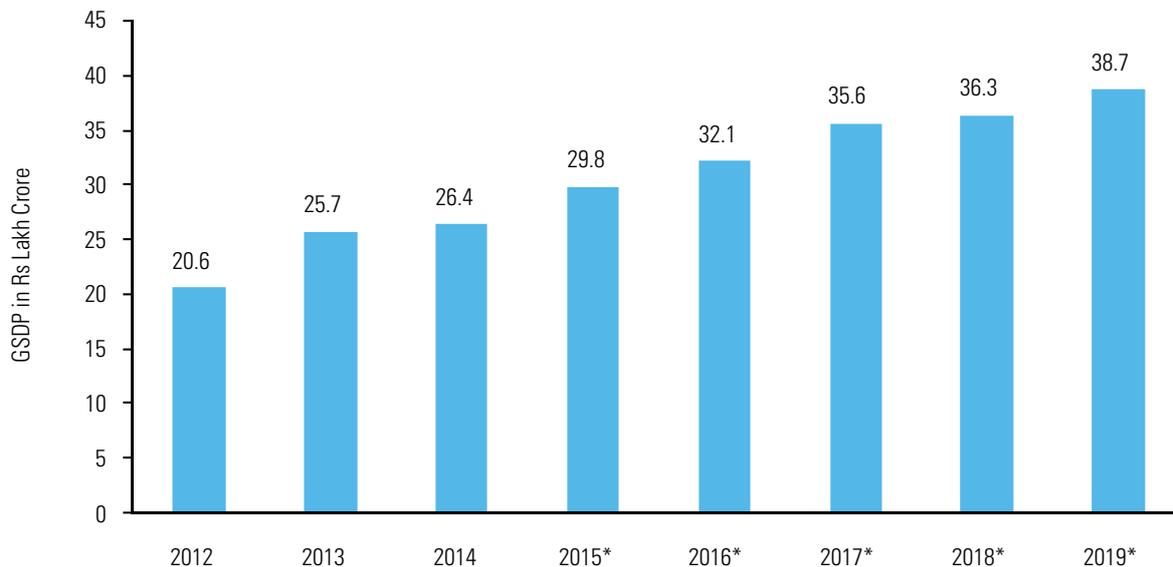
notified the National Policy on Electronics (NPE) in 2012. The NPE 2012 seeks to attract investments to the tune of USD 100 Bn and to create employment of 28 Mn by 2020¹⁸.

Figure 11 Global electronics industry - Growth outlook 2014-2016



Source: ZVEI, Accessed from Statista.com¹⁹; YES Bank Analysis

Figure 12 IT hardware spending forecast in India 2012-2019



*Estimates for 2015 to 2019, Source: IDC, Accessed from Statista.com²⁰; YES Bank Analysis

¹⁷National Policy on Electronics, 2012 as accessed from http://deity.gov.in/sites/upload_files/dit/files/NPE_Notification.pdf, Electronic Policy of Telangana, 2016 as accessed from <http://www.it.telangana.gov.in/telangana-electronics-policy-2016/>

¹⁸National Policy on Electronics, 2012 as accessed from http://deity.gov.in/sites/upload_files/dit/files/NPE_Notification.pdf

¹⁹Estimated growth rates for the global electronics industry accessed from <http://www.statista.com/statistics/268396/estimated-growth-rates-for-the-electronics-industry-by-region/>

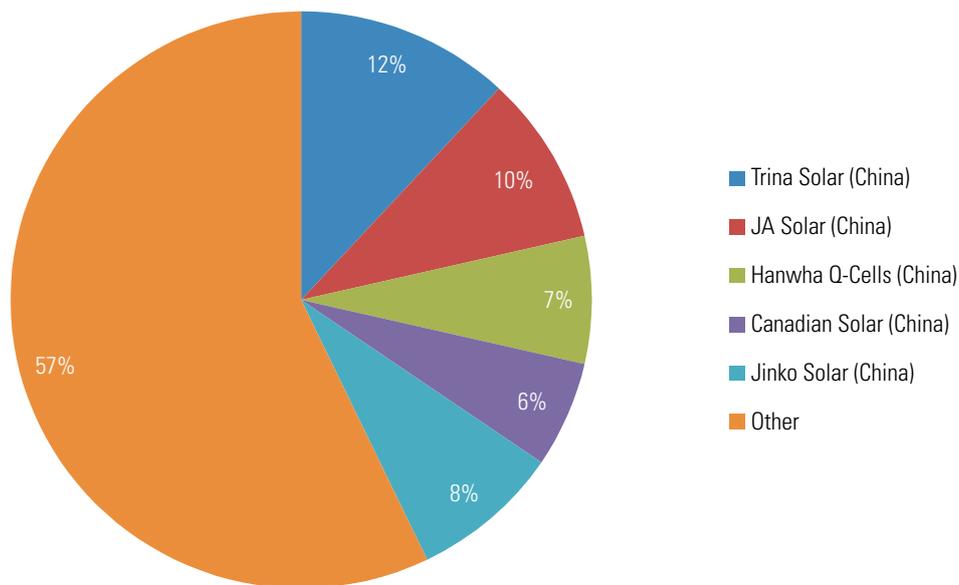
²⁰Forecasted IT hardware spendings in India accessed from

It is forecasted that IT hardware spending will almost double up to USD 38.7 Billion in 2019 from about USD 20.6 Billion in 2012. The electronics goods industry growth outlook shows the market in Asia growing at continuous 7% in the 2014-16 period, with the overall global growth rate being 5% annually. Some of the leading IT hardware and Electronics companies include Samsung (South Korea), Foxconn (Taiwan), Hewlett-Packard (USA), Apple (USA), etc.

An area within Electronics manufacturing viz. **Solar PV module manufacturing** is also gaining widespread attention. Global economies, including India, are promoting renewable energy like never before. Specifically, Gol has set for itself an ambitious target of generating 100 GW from Solar by 2022²¹. This has resulted in substantial increase in demand for Solar Photovoltaic module (resulting in upstream raw material demand for silicon wafers & ingots, PV cells and balancing equipment). And under the Make in India initiatives, the Gol is trying to attract significant investment towards manufacturing of Solar equipment. Globally the Solar PV module market stood at USD 35.7 Bn in 2014²².

China has emerged as the leader in this market with most of the larger Solar panel manufacturing companies being Chinese.

Figure 13 Solar PV module manufacturers - Market share based on revenue 2015



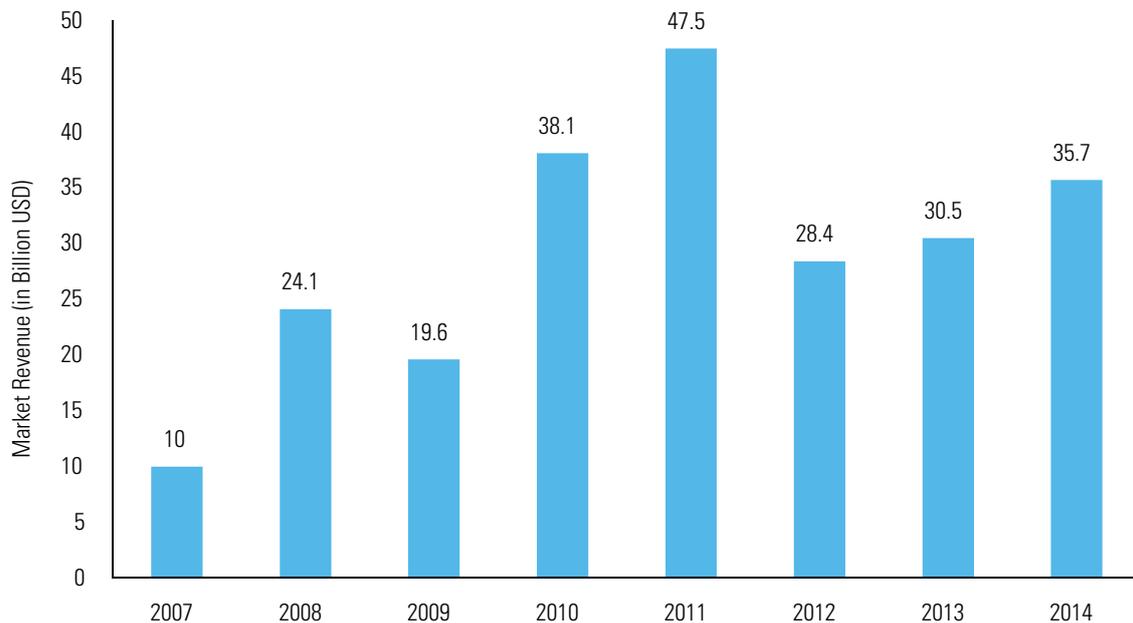
Source: Greentech Media, Accessed from Statista.com²³; YES Bank Analysis

²¹<http://pib.nic.in/newsite/PrintRelease.aspx?relid=122566>

²²Estimated size of the global solar photovoltaic module market as accessed from <http://www.statista.com/statistics/270026/worldwide-revenue-of-the-solar-energy-industry/>

²³Estimated size of the global solar photovoltaic module market accessed from <http://www.statista.com/statistics/270026/worldwide-revenue-of-the-solar-energy-industry/>

Figure 14 Solar PV module industry - Worldwide revenue (2007-2014)



Source: Renewable Energy World, Accessed from Statista.com²⁴; YES Bank Analysis

1) Initiatives and Policy of the Government of Telangana

Telangana ICT Policy Framework 2016²⁵ aims to make Hyderabad a global hub for Electronics by attracting investments to the tune of USD 3 Billion in the Electronics sector.

Telangana has continuously been at the forefront of the electronics sector in the country. Hyderabad houses global giants such as Nvidia, Motorola, Qualcomm, AMD, CDAC, Cypress, etc., in addition to home-grown companies such as Bharat Heavy Electricals Ltd. (BHEL), Bharat Electronics Ltd., Electronics Corporation of India Ltd., etc. Recently, Hyderabad has attracted investments from giants such as Apple, Micromax, etc. and has cemented its position as a promising electronics investment zone on the global map.

Analysis of the success stories of other states in India (Noida-UP, Tamil Nadu, Maharashtra) helps in identifying certain factors/aspects which are critical for the development of the Electronics Sector such as:

- ✓ Ease of acquiring licenses/clearances
- ✓ Land Allotment
- ✓ Financial support by way of benefits
- ✓ Workforce availability.

²⁴Source: Greentech Media, Accessed from Statista.com ; YES Bank Analysis accessed from <http://www.statista.com/statistics/269812/global-market-share-of-solar-pv-module-manufacturers/>

²⁵Telangana ICT Policy Framework 2016 accessed from <http://www.cmai.asia/digitalindia/pdf/Telangana-ICT-Policy-Framework-2016.pdf>

Government of Telangana (GOT) has addressed the said aspects in its recently announced Electronic Policy. Salient features of the policy are given below²⁶:

- ✓ Covers 4 major areas – Electronic products, electronic manufacturing services, Semi conductor design and Electronic components (defense & strategic equipments, LED, Mobile manufacturing, etc.)
- ✓ Focus is on creating Electronic Manufacturing Clusters (EMCs) and providing support in following aspects:

Regulatory	Infrastructure	Consulting
<i>(Single window system, time bound approvals, etc.)</i>	<i>(Allotment of land, common facilities centre, etc.)</i>	(Formation of a committee – Consultative Committee on Electronic System Design and Manufacturing, which would focus on providing technology support and consulting services to MSME entities)
Human resource	Financial	
(Skill development programs, workforce training subsidies, etc.)	(Reductions/exemption of excise, VAT, income tax, import duties, etc.)	

To ensure inclusive growth and promote innovation, additional support is provided to women entrepreneurs, SC/ST entrepreneurs and R&D institutions in Electronics industry.

- ✓ Further, GOT is undertaking several efforts to build required infrastructure and attract investment in Electronics industry. These include:
 - Development of two identified Electronic Manufacturing cluster
 - Development of Fab City (SEZ) in Ranga Reddy district for Solar Equipments and Semi Conductors
 - Development of Electronic Hardware & Industrial Park at Shamshabad for Aerospace, Solar equipment and Electronic hardware
- ✓ Holding International Conferences periodically to ensure regular interaction between all stake holders

2) Sector Analysis - IT Hardware and allied Sector

WHY INVEST

1. Availability of skilled man power at competitive rates
2. Presence of established distribution network in urban as well and rural regions of the country
3. Presence of a vibrant knowledge economy in Hyderabad
4. Telangana has a robust software industry which supports development of electronic manufacturing industry

²⁶Electronic Policy of Telangana, 2016 - <http://www.it.telangana.gov.in/telangana-electronics-policy-2016/>

5. Photovoltaic
 - o Geographical location of India suitable for Solar energy
 - o The Telangana Solar Power Policy 2015 has included multiple measures to promote solar power in the State.

Opportunity

1. Rising disposable income of the Indian middle class and availability of finance resulting in huge potential for incremental domestic demand
2. Increasing thrust of GoI and GoT on promoting Electronic sector resulting in drafting of incentives based policies and increased government spending
3. Photovoltaic – Solar generation capacity in India is targeted to reach to 100 GW by 2022 and 200 GW by 2050, which presents a large opportunity

AREAS REQUIRING ADDITIONAL FOCUS

1. To strengthen integration into global manufacturing chain
2. Limited innovation and new product development initiatives within India & Telangana
3. Cheaper imports from East Asia is a key challenge
4. Encourage setup of ancillary units and dependence on imports for the same
5. Strengthen the ecosystem for innovative products from other global markets

3) Institutes of Excellence for Education/Skill upgradation in the sector

Institutes of excellence offering specialised courses in this sector include:

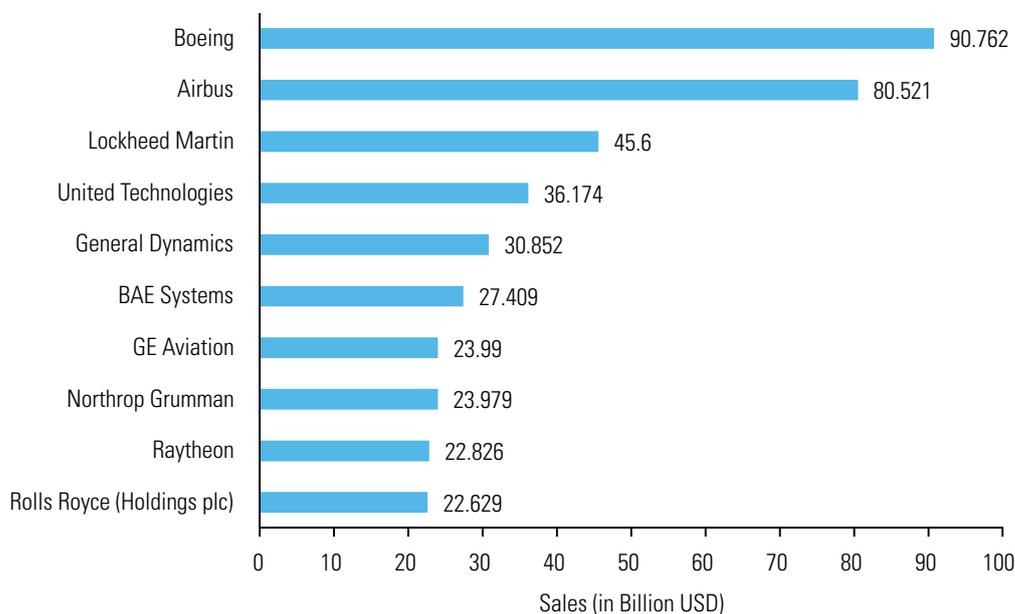
- ✓ Indian Institute of Technology, Kanpur
- ✓ Indian Institute of Technology, Kharagpur
- ✓ Birla Institute of Technology and Sciences, Pilani
- ✓ Indian Institute of Technology, Bombay
- ✓ Indian Institute of Technology, Madras
- ✓ National Institute of Technology, Warangal
- ✓ BHU Varanasi
- ✓ Indian Institute of Technology, Hyderabad
- ✓ Indian Institute of Science, Bangalore
- ✓ National Institute of Solar Energy, Gurgaon
- ✓ National Power Training Institute, Faridabad
- ✓ Amity University, Noida
- ✓ Gujarat Energy Research & Management Institute, Gandhinagar
- ✓ Anna University, Chennai

3.3 DEFENCE & AEROSPACE SECTOR

The Indian Defence & Aerospace industry has seen unprecedented growth in recent years and offers enormous potential and a multitude of opportunities, both in the military and civil aviation sectors. India is one of the highest importers of defence and aerospace products, thereby generating a huge potential for in-house production of defence and aerospace products.

Government owned Defence Organizations and PSUs like Hindustan Aeronautics Limited, Indian Space Research Organization, Defence Research and Development Organization, Bharat Electronics Ltd, Bharat Dynamics Ltd, etc have been the forerunners in this sector in India. Gradually with the market opening up to private manufacturers, there is enormous scope of investment and growth in this sector in India. Globally the market leaders in this sector include Boeing (USA), Airbus (France), Lockheed Martin (USA), etc.

Figure 15 Global leading Aerospace and Defense manufacturers (2014)



Source: PWC, Accessed from [Statisa.com](http://www.statisa.com)²⁷; YES Bank Analysis

The Indian Government has taken a number of initiatives for development of defence sector in the country, which include

1. The Government of India has a strong focus on 'Make in India' in defence and aerospace sectors and the same is reflected in Defence Procurement Policy 2016 (DPP 2016). DPP 2016 has introduced a new category of Buy (Indian Designed, Developed and Manufactured) or Buy (IDDM) which would be the most preferred mode of defence procurement going forward.
2. In June 2016, the Union Government has allowed 100% FDI in defence sector through the Government approval route (earlier 49% FDI permitted through automatic approval route) in cases resulting in access to modern technology in the country.
3. The Government wants to develop India as a Maintenance, Repair and Overhaul (MRO) hub in Asia and has taken steps for the same in the National Civil Aviation Policy (NCAP) 2016. GOI has exempted

²⁷Leading aerospace and defence manufacturers worldwide accessed from <http://www.statisa.com/statistics/257381/global-leading-aerospace-and-defense-manufacturers/>

the tools and tool-kits used in MRO from customs duty, restriction on utilization of duty free parts has been extended from 1 year to 3 years and import of unserviceable parts by MROs has been allowed for providing exchange. Further, the foreign aircraft brought in to India for MRO work would now be permitted to stay up to six months or as extended by aviation regulator Directorate General of Civil Aviation (DGCA)²⁸.

Telangana has an immensely fast-growing economy, especially in the Defence & Sector and hosts top multinational defence establishments alongside many small-medium innovative companies and joint ventures located in its industrial parks, Special Economic Zones (SEZ), economic areas and designated hubs. Currently, with a major defence hub, there exists huge potential for business and growth and with new international cooperation and the capacity and capability of the Indian market; the scope for this sector is limitless.

1) Initiatives and Policy of the Government of Telangana

- ✓ The Telangana government is preparing a policy for Defence and Aerospace sector
- ✓ The Telangana government has taken a number of initiatives to develop a Defence & Aerospace segment by developing an exclusive Hub, Aero Skills Academy in collaboration with Aerocampus Aquitaine, France and Aerospace Incubation Centre in collaboration with IIT, Hyderabad
- ✓ Aerospace and Precision Engineering SEZ at Adibatla: The Aerospace SEZ at Adibatla, Ibrahimpatnam Mandal of Rangareddy spread of 500 acres is fully functional
- ✓ Tata Advanced Systems Ltd (TASL) and their JV partners have set up facilities with Sikorsky and Lockheed Martin for the manufacture of helicopter cabins, aircraft and its components²⁹
- ✓ Telangana government is proposing to set up three more Defence and Aerospace parks on the outskirts of the city here over the next four years with an investment of Rs 2,500 Crore

2) Sector Analysis - Defence & Aerospace

WHY INVEST

1. Government of India's Make in India initiatives for the Defence & Aerospace sector plans to attract large investments in this sector for local manufacturing
2. 100% FDI in defence sector is permitted
3. Defence Procurement Policy 2016 has strong focus on domestic manufacturing
4. The Telangana Aerospace and Defence policy is currently being developed to be released in 2016
5. Hyderabad has a large number of defence aero-space and defence research laboratories and private sector investments, including in ancillary units, in this sector
6. The Aerospace SEZ at Adibatla, Ibrahimpatnam Mandal of Rangareddy is being developed hosting 10 operational units manufacturing aerospace components

²⁸National Civil Aviation Policy 2016

as accessed from http://www.civilaviation.gov.in/sites/default/files/Final_NCAP_2016_15-06-2016-2_1.pdf

²⁹Telangana Government proposes 3 more aerospace, defence parks as accessed, DNA dated 27th November, 2015

Opportunity

1. India is one of the large importers of defence equipments with 2.3% of GDP being spent on Defence expenses. Governments' increasing focus on import substitution presents a huge opportunity to domestic manufacturer
2. Effective implementation of offsets in defence procurement contracts will provide boost to the domestic industry
3. Tie-ups of Indian players with foreign companies will further aid the defence and aerospace manufacturing in India
4. Scope of export to other developing nations
5. Modernization of Indian military is a priority of current government, and this shall call for larger domestic market
6. Scope for ancillary and repair/overhaul industry

AREAS REQUIRING ADDITIONAL FOCUS

1. To address skilled gap in defence manufacturing in India
2. Regulatory compliance could be friendlier for boosting indigenous manufacturing
3. To focus on increased transparency in weapons procurement
4. Boost setup of ancillary units in India, to counter high dependency on imports

3) Institutes of Excellence for Education/Skill upgradation in the sector

Various skill development initiatives have been undertaken in the Defence & Aerospace sectors.

1. In July 2016, Defence Research and Development Organisation (DRDO) has signed an agreement with IIT-Bombay and IIT-Madras to establish a bi nodal 'Centre of Propulsion Technology' (CoPT) at the two institutions³⁰ which will undertake multidisciplinary directed research in aerospace technologies.
2. National Skill Development Corporation (NSDC) under the 'Skill India' initiative has established two sector councils 'Strategic Manufacturing Sector Skill Council' and 'Aerospace and Aviation Sector Skill Council' for skill development and quality assurance of personnel in Defence and Aerospace sectors.
3. Many foreign companies like Airbus, Boeing, Snecma, Textron, Honeywell, Rockwell and GE Aviation have established their global R&D centers in India. Most of these are in Bangalore³¹.
4. Boeing has launched two programs under the aegis of the National Employment Enhancement Mission (NEEM), an initiative of Government of India. Post Diploma in Aerospace Inter-connect Solutions (PDAIS) is sponsored by Boeing and conducted in partnership with Rossell Techsys and Tata Advanced Materials Limited (TAML).³² The "Learn and Earn" was launched by Boeing, TAML and Nettur Technical Training Foundation (NTTF) in March 2016 and offers students a diploma in Aerospace Manufacturing Technology (Advanced Composites)³³.

³⁰DRDO inks pact with IITS, Business Standard Dated July 9th, 2016

³¹Unlocking defence R&D in India, FirstPost dated April 6th, 2016

³²Skill India as accessed from <http://www.boeing.co.in/boeing-in-india/skill-india.page>

³³Boeing Tata announce skills program as accessed from <http://www.boeing.co.in/news-and-media-room/news-releases/2016/march/boeing-tata-nttf-announce-skills-program.page>

Institutes of excellence offering specialised courses in this sector include:

- ✓ Indian Institute of Technology, Madras
- ✓ Indian Institute of Technology, Kharagpur
- ✓ Indian Institute of Technology, Kanpur
- ✓ Indian Institute of Technology, Bombay
- ✓ Indian Institute of Science, Bangalore
- ✓ Anna University, Chennai
- ✓ Defence Institute of Advanced Technology, Pune
- ✓ Punjab Engineering College, Chandigarh
- ✓ Birla Institute of Technology, Ranchi
- ✓ Indian Institute of Space Science and Technology, Thiruvanthapuram
- ✓ Manipal Institute of Technology, Manipal
- ✓ Amity University, Noida

3.4 TEXTILES MANUFACTURING

India's Textile sector is one of the oldest industries of the Indian economy. It is one of the largest contributors to India's exports with approximately 11% of total exports. The textile sector is also labour intensive and is one of the largest employers. It has two broad segments:

1. Unorganized sector consisting of handloom, handicrafts and sericulture, which are operated on a small scale and through traditional tools and methods.
2. Organized sector consisting of spinning, weaving, apparel and garments segment which apply modern machinery and techniques.

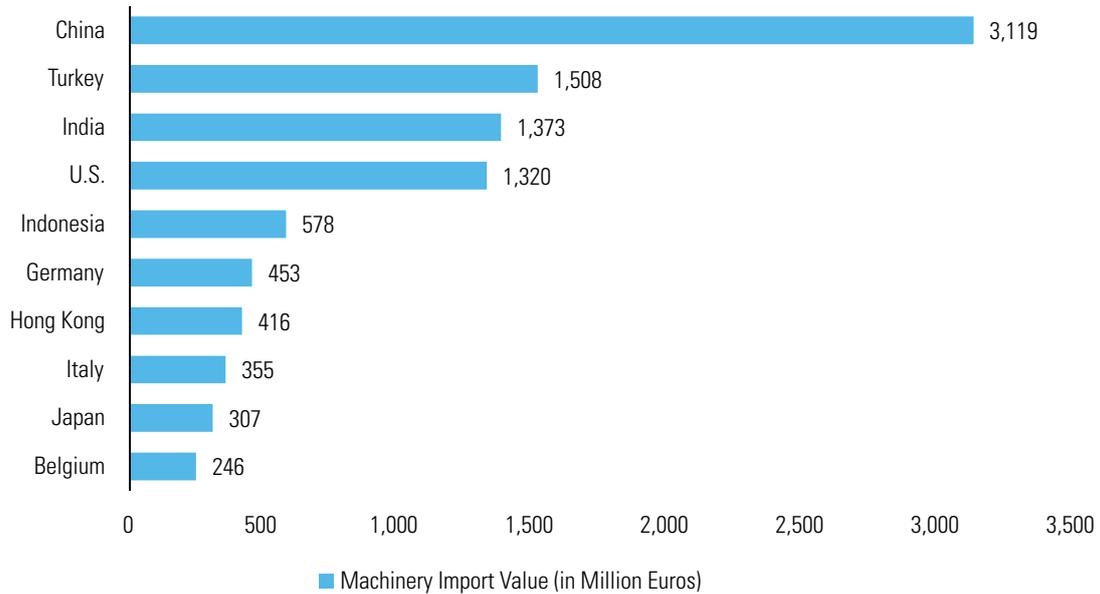
Indian Textile industry is estimated at USD 108.00 Bn in 2014-15 and is expected to reach USD 223.00 Bn by 2021. Of this, industry realized exports worth USD 41.40 Bn in 2014-15.³⁴

Recently in June 2016, Union Cabinet Minister gave approval to a special package for promotion of exports and employment generation in textile and apparel sector. According to Ministry of Textiles these sops would enable India to grow its apparel exports from USD 17.00 Bn in 2015-16 to USD 43.00 Bn in next three years. Textile manufacturers currently enjoy various incentives schemes like Technology Upgradation Fund (TUFS) and similar State incentives.

With technologies like automation being taken up by these industries on a large scale, India is one of the largest importers of textile manufacturing industries in the world with machinery imported worth 1373 Million Euros in 2013.

³⁴Ministry of Textiles, *Indian Textile Journal*, Department of Industrial Policy and Promotion, Press Information Bureau accessed from <http://www.ibef.org/industry/textiles.aspx/>

Figure 16 Leading textile machinery importers (2013)



Source: Statistisches Bundesamt; VDMA, Accessed from Statista.com³⁵, YES Bank Analysis

1) Initiatives and Policy of the Government of Telangana

Telangana currently grows ~17% of India's total cotton (~ 60 lac bales out of ~352 lac bales across India)³⁶ ranking third behind Gujarat and Maharashtra. Predominantly, Telangana textile sector comprises of unorganized sector with main focus on handlooms and powerlooms. Unorganized sector employs ~1.1 lac workers while organized sector employs ~ 0.4 lac workers.³⁷

Inspite of growing ~60 lac bales of cotton the state currently consumes only 20% of the cotton produce. The consumption is on the lower side mainly due to non-availability of investment incentives and benefits which are currently available in other states. Apart from this there is power shortage in the state.

To overcome these issues and make the state competitive with other states (like Gujarat and Maharashtra), Government of Telangana (GoT) has recently announced that it is working on a new policy. The policy will also ensure protection of handloom industry while framing new laws for promoting organized industry. Few areas that GoT needs to currently address are: availability of continuous power, suitable capital expense/operating expense incentives to make the state competitive vis-à-vis other states.

³⁵Leading textile machinery importers in 2013 as accessed from <http://www.statista.com/statistics/271888/leading-textile-machinery-importers-based-on-revenue/>

³⁶Telangana working on new policy on textile, Financial Express dated 22nd July, 2016 and Cotton Corporation of India website.

³⁷Department of Handloom, Government of Telangana accessed from <http://tghandtex.nic.in/>

In the past, GoT has taken initiatives to set up textile parks, aimed at promoting development of textile sector in the state, as below:

Table 5 Textile parks in Telangana

S. No	Name of the Park	Name of the District	Status
1.	Apparel Export Park, Gundlapochampally	Ranga Reddy	Operational
2.	Textile Park, Siricilla	Karimnagar	Operational
3.	Textile Park, Pashamylaram	Medak	Operational
4.	Textile Park, Malkapur	Nalgonda	Operational
5.	Mini Textile Park, Warangal	Warangal	Announced
6.	Handloom Park, Gadwal	Mahabubnagar	Announced

Apart from above development, announcement was made in January 2016 to set up the largest “cotton-to-garment” textile park in Warangal for which Rs 1.00 Bn has already been sanctioned for acquisition of land. In addition power tariff for spinning mills has been reduced to Rs 2/- per unit.

Implementation of above mentioned initiatives will not only provide a boost to the sector but will also create employment opportunities and increase in-state conversion of cotton that is available (which is currently shipped out of the state). This will help to attract investment in the sector and will develop revenue for the state.

Essentially, the state needs to leverage on the below analysis for realizing the potential of the Textile sector.

2) Sector Analysis - Textile Manufacturing

WHY INVEST

1. Adequate production of cotton in the state
2. Proactive State government initiatives
3. Good infrastructure and connectivity for setting up new units

Opportunity

1. Increase in demand for textiles globally
2. Rise in Indian middle class population leading to increase in consumption demand
3. Potential of Indian Textile sector to reach at USD 223.00 Bn by 2021

AREAS REQUIRING ADDITIONAL FOCUS

1. Power shortage/intermittent power
2. Sector is underdeveloped as compared to other states
3. Cheap export policy from neighbouring countries
4. Better textile policies in other states of India making investment in Telangana less competitive

3) Institutes of Excellence for Education/Skill upgradation in the sector

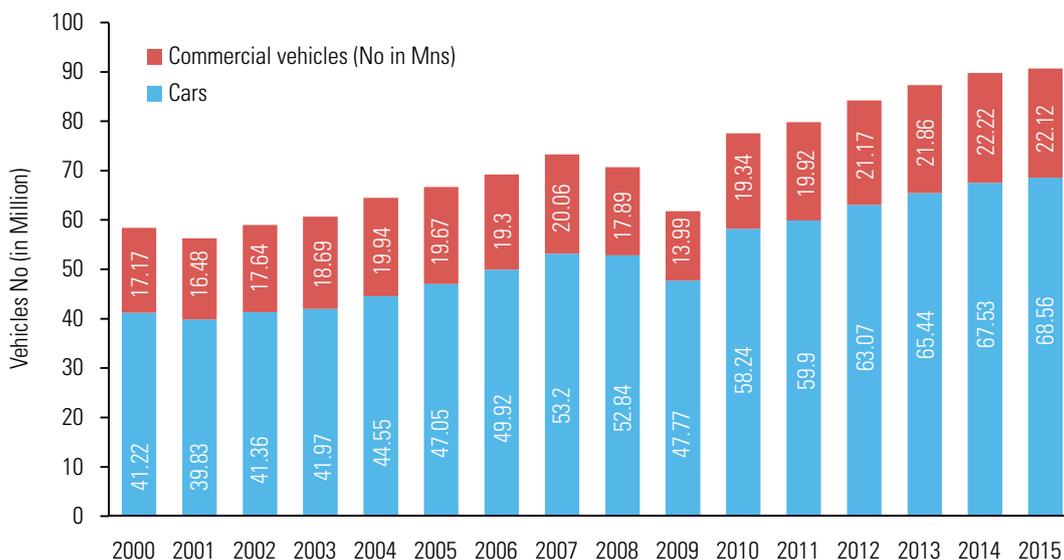
- ✓ Indian Institute of Textile Training, Tirupur
- ✓ Apparel Training and Design Centre, Nashik
- ✓ Sardar Vallabhbhai Patel International School of Textiles, Coimbatore
- ✓ Various Government schemes like Integrated Skill Development Scheme (ISDS) through institutes like Powerloom Weaver's Service Centres, Textile Research Associations etc throughout various states, Textile Sector Skill Council (TSSC), New Delhi etc.

3.5 AUTOMOBILES AND AUTO-ANCILLARY

Although the term “advanced manufacturing” is used in various endeavours, it is still most closely associated with the automotive industry, where it originated. Experts agree the Automotive Industry still leads the way in advanced manufacturing, with other sectors following its lead.

Global sales of passenger cars was about 68 Million vehicles in 2015. Along with China, the United States is counted among the largest automobile markets worldwide, both in terms of production and sales. Over the next decade, Internet-connected car technologies and autonomous vehicles are set to stir up yet another revolution in the automotive sector. The size of automotives market was expected to be 620 Billion Euros in 2015 which is more than twice its size in 1985, which stood at 290 Billion Euros³⁸.

Figure 17 Global Trend of Automobile Manufacturing (2000-2015)



Source: OICA, Accessed from Statista.com³⁹; YES Bank Analysis

1) Initiatives and Policy of the Government of Telangana

- ✓ As per Telangana Industrial Policy, the State will plan each Industrial park in such a way that along with anchor units, enough plots are available for setting up Suppliers/Vendors Park. Mega projects will have to compulsorily set up a Suppliers/Vendors park to encourage growth of local ancillaries. This will greatly benefit the automobile sector which is dependent on the auto-ancillary units.

³⁸<http://www.statista.com/statistics/269618/size-of-the-automotive-supplier-market-worldwide-since-1985/>

³⁹<http://www.statista.com/statistics/262747/worldwide-automobile-production-since-2000/>

- ✓ Medak district is slowly becoming an automobile manufacturing hub. After Mahindra's enhanced presence with a 100,000-unit capacity tractor manufacturing plant at Zaheerabad in Medak district, the upcoming auto-sector in Telangana received yet another boost with an addition of a bus manufacturing plant, Deccan Auto Limited, which also seeks to tap export markets.

2) Sector Analysis - Automobile and Auto ancillary Sector

WHY INVEST

1. Evolving industry with huge potential with the Indian middle class, India being the 3rd largest automobile market
2. India is a low cost export hub with presence of most of the global OEMs
3. Availability of ancillary industries in India
4. Telangana State industrial policy states Automobile manufacturing as a Thrust sector

Opportunity

1. Introducing fuel efficient or green vehicles
2. Scope of exporting to developing economies
3. Moving up the value chain with complete development of more number of new vehicle models in India as has been demonstrated by some OEMs.

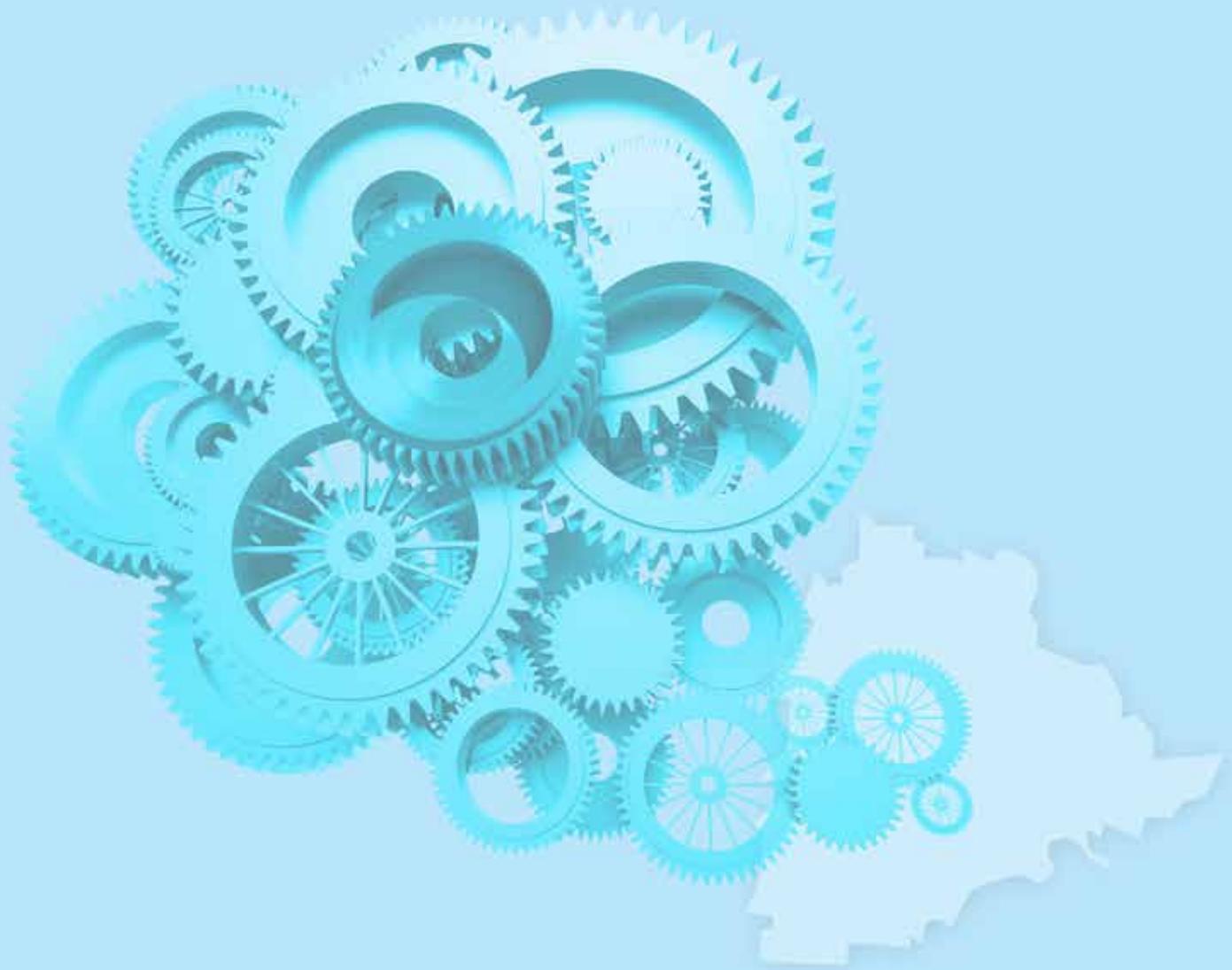
AREAS REQUIRING ADDITIONAL FOCUS

1. Presence of limited number of OEMs in Telangana limits the cluster development and ability to attract auto-component/ancillary businesses
2. Reducing product lifecycles implying continuous need for product innovation

3) Institutes of Excellence for Education/Skill upgradation in the sector

Institutes of excellence offering specialised courses in this sector include:

- ✓ Delhi Technical University, Delhi
- ✓ PSG College of Technology, Coimbatore
- ✓ Manipal Institute of Technology, Manipal
- ✓ SRM University, Chennai
- ✓ Vellore Institute of Technology, Vellore
- ✓ Sathyabama University, Chennai
- ✓ Anna University, Chennai
- ✓ Madras Institute of Technology, Chennai
- ✓ Birla Institute of Technology and Sciences, Pilani



4

EMERGING AND FUTURE TECHNOLOGIES IN MANUFACTURING





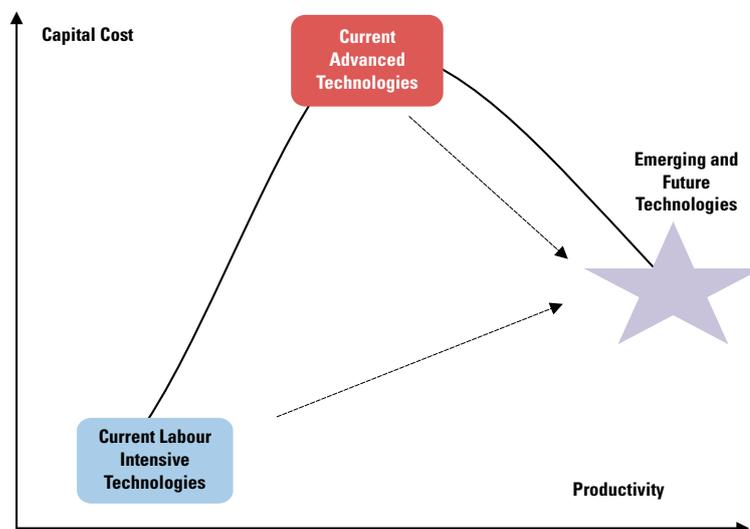
4

EMERGING AND FUTURE TECHNOLOGIES IN MANUFACTURING

In the last few decades, the manufacturing sector has evolved from a more labour-intensive set of mechanical processes to a more sophisticated and advanced technology-intensive process. The changing nature of manufacturing activities is increasingly being recognized, and countries around the world including India are upgrading their policies and strategies looking into the future of manufacturing.

Looking into the global competitiveness, it has become a necessity that the manufacturing sector invests in and adapts emerging technologies along with focusing on research and development on future technologies. This shall not only help them increase their productivity and competitiveness, but also help in economic, environmental and social sustainability of the manufacturing industries. Emerging and Future Technologies, while improving productivity, also reduces cost of production in the long term.

Figure 18 Moving to Future and Advanced Technologies in Manufacturing



Source: YES Bank Representation

Although, traditional sectors such as textiles, leather, minerals, and food processing are also playing an important role in the industrialization process through backward and forward linkages to large scale industries in Telangana, the State has diversified its industrial base, with the thrust on high-tech sectors including biotechnology and nano-technology.

This chapter explores a few of the emerging and future technologies that can aid the manufacturing sector in increasing its competitiveness through increased cost efficiency and productivity, leading to sustainability in the manufacturing sector. The technologies discussed in this section include-

- 1) Additive Manufacturing (3D Printing)
- 2) Advanced Biotechnology
- 3) Precision Engineering
- 4) Industrial Robotics
- 5) Energy Technology(Advanced Photo-Voltaics)

4.1 ADDITIVE MANUFACTURING (3D PRINTING)

Additive Manufacturing is a process by which digital 3D design data is used to build up a component in layers by depositing material. It is also known as 3D Printing. Through this method, instead of milling a work piece from solid block, the components are built up layer by layer using materials which are available in fine powder form. Additive manufacturing first emerged in 1987 in the form of Stereo-lithography introduced by a company, 3D Systems. This is a process that solidifies thin layers of Ultra Violet light sensitive liquid polymer using a laser⁴⁰.

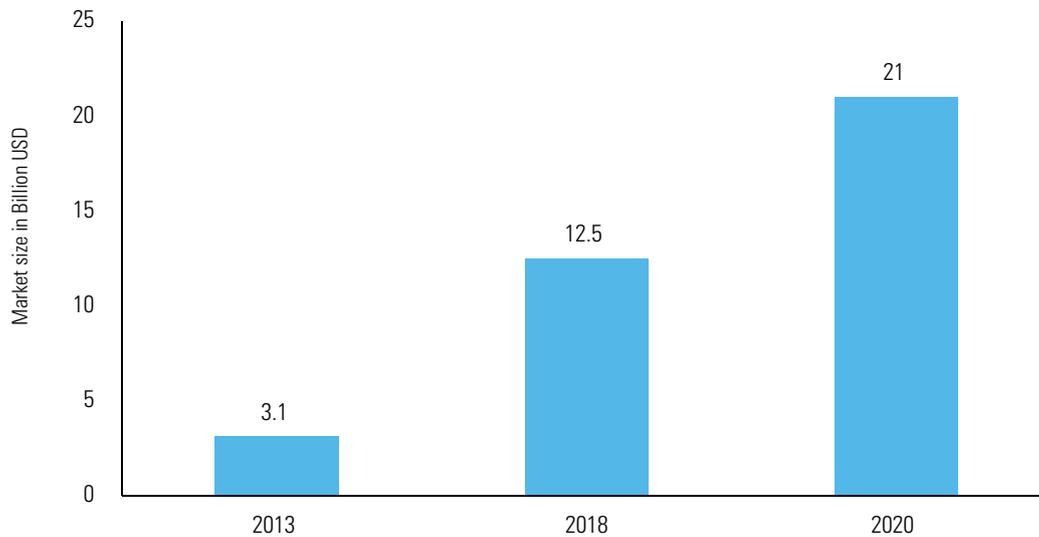
Additive Manufacturing technology enables a design-driven manufacturing process where design determines production. Additive Manufacturing allows for highly complex structures which can still be extremely light and stable. It provides a high degree of design freedom, the optimisation and integration of functional features, the manufacture of small batch sizes at reasonable unit costs and a high degree of product customisation.

The global market in this technology is expected to reach USD 21 Billion by 2020. Some of the biggest Additive Manufacturing companies include Stratasys Ltd (USA), 3D Systems Corporation (USA), Materialize NV (Belgium)⁴¹ among others.

⁴⁰History of Additive Manufacturing - <http://wohlersassociates.com/history2014.pdf>

⁴¹Three of the biggest 3d printing companies - <http://www.investopedia.com/articles/investing/081515/three-biggest-3d-printing-companies.asp>

Figure 19 Projected global additive manufacturing market size from 2013 to 2020



Source: Wohler Associates, Accessed from Statista.com⁴²

Pros and Cons of Additive Manufacturing^{43,44}

Pros	Cons
1. Lower risk, defect rate and higher quality consistency	1. Slow building rates
2. Less labour and Assembly cost reduction	2. High production costs as compared to mass production
3. Eliminating of tooling, Shorter supply chains, lead time and reduced time to market	3. Considerable effort required in application design and setting process parameters
4. More streamlined and versatile manufacturing processes with high degree of customization	4. Requires post-processing
5. Accelerated new product development cycle	5. Discontinuous production process preventing economies of scale.
6. Less material wastage in production steps	6. Limited component size/small build volume
7. Production at or near the point of use	

Applications of the Technology⁴⁵

- ✓ The technology is being used in Defence and Aerospace industry in weight reduction of aircraft. This can be used in future for printing entire aircrafts, manufacturing on battlefields and in development of self-healing military vehicles
- ✓ In Automotive sector it is being used in design and prototyping. Future developments include innovative and customized vehicle production

⁴²<http://www.statista.com/statistics/284863/additive-manufacturing-projected-global-market-size/>

⁴³The advantages of Additive Manufacturing - <http://aaq.auburn.edu/node/1362>

⁴⁴Pros and Cos of Additive Manufacturing - <http://compositesmanufacturingmagazine.com/2014/10/pros-cons-additive-manufacturing/2/>

⁴⁵2015 Roundup Of 3D Printing Market Forecasts And Estimates accessed from <http://www.forbes.com/sites/louiscolombus/2015/03/31/2015-roundup-of-3d-printing-market-forecasts-and-estimates/#c9ee9c51dc67>

- ✓ In the Healthcare sector currently prosthetics and dental implants are being developed using this technology. Future uses include complex printed organs, pharmaceuticals production and nano-scale medicine
- ✓ In general manufacturing sector it is being used in rapid prototyping and product design. Future uses include development of innovative products, retooling and reskilling

Case: Additive Manufacturing in GE⁴⁶

General Electric has been using Additive Manufacturing across its businesses. GE's aviation division, the world's largest supplier of jet engines, is preparing to produce a fuel nozzle for a new aircraft engine by 3D printing the part with lasers. GE chose the additive process for manufacturing the nozzles because it uses less material than conventional techniques. That reduces GE's production costs and, because it makes the parts lighter, yields significant fuel savings for airlines. GE Power & Water, which makes large gas and wind turbines, is manufacturing with additive process, and GE Healthcare has developed a method to print transducers, the expensive ceramic probes used in ultrasound machines are made with this technology. Targeting the future, GE engineers are starting to explore how to use additive manufacturing with a wider range of metal alloys, including some materials specifically designed for 3-D printing.

4.2 ADVANCED BIOTECHNOLOGY

Though Biotechnology has been in use since ages, advanced Biotechnology has been in used since the past few decades with developments in Proteomics, Genomics, Genetic Engineering, Bioinformatics, Tissue Engineering, etc and use of these technology in pharmaceuticals, biofuels, enzymes and other industries. The key regions for the global biotech industry are the United States and Europe. As of 2015, about 670 public companies and over 200 thousand employees in these regions generate some USD 133 Billion of biotech revenue.

Globally, around USD 170 Billion were spent on biopharmaceuticals in 2013. This figure is expected to exceed USD 220 Billion by 2017⁴⁷. The Indian biotech industry holds about 2% share of the global biotech industry. The biotechnology industry in India, comprising about 800 companies, is valued at USD 11 Billion and is growing at a Compound Annual Growth Rate (CAGR) of 20%⁴⁸. Johnson and Johnson (USA), Novartis (Switzerland) and Pfizer (USA) are some of the market leaders in this industry.

Pros and Cons of Advanced Biotechnology

Pros	Cons
1. Flexibility in pharmaceutical development	1. Ethical and Legal issues mar the industry
2. Individualized medical treatments	2. Untested in some of its applications
3. Immediate availability of manpower for reproduction of western formulations	3. Can lead to health complications if introduced without elaborate testing
4. Increases cost effectiveness in mass production	4. High cost of research and development
5. Precise and effective technology	5. Lack of high quality research and development in India

⁴⁶Additive Manufacturing GE accessed from <https://www.technologyreview.com/s/513716/additive-manufacturing/>

⁴⁷Accessed from <http://www.statista.com/topics/1634/biotechnology-industry/>

⁴⁸Biotechnology Industry in India accessed from <http://www.ibef.org/industry/biotechnology-india.aspx>

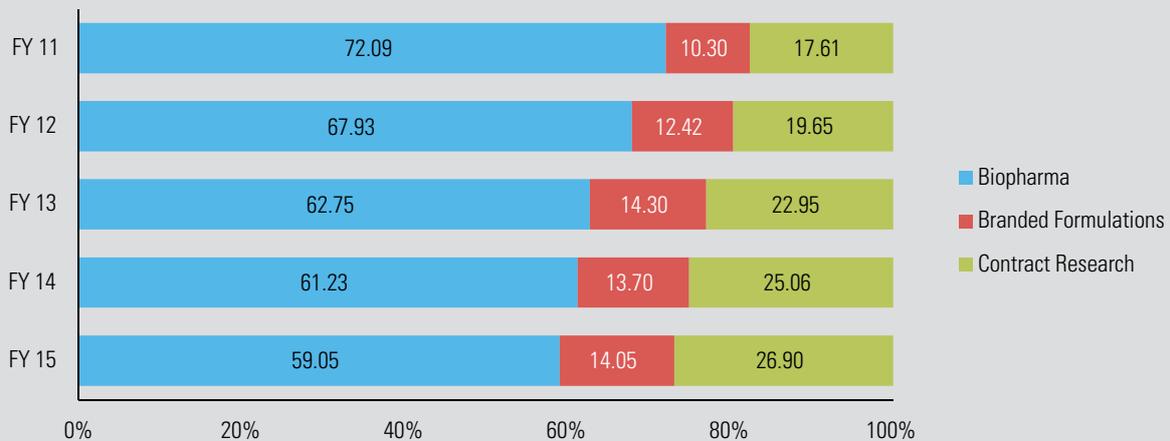
Applications of the Technology

1. Biotech engineering and Pharmacogenomics helps in enhanced pharmaceutical development
2. Gene therapy is one more technique of biotechnology which is used to diagnoses diseases like cancer and Parkinson's disease
3. Used in increasing food productivity
4. Environmental Biotechnology is used in sewage treatment through anaerobic digestion technologies
5. Used in food processing industry for increasing durability and quality

Case Story: Biocon and Advanced Biotechnology^{49,50}

Biocon started as an industrial enzyme manufacturer and commenced exporting to USA and Europe. The company focused on discovery of novel enzymes and novel techniques for development of solid substrate fermentation technology through research and development and that took the company's operations to a new dimension. In 1989, they became the first Indian biotech company to receive US funding for proprietary technology. Today its revenue stands at USD 530 Million in 2015-16 financial year. The company has been focussing on high quality Branded formulations and contract research. The company is investing more on Geonomics, Proteomics and Personalized medicine.

Figure 20 Biocon Financial Performance Composition (2011 -2016)



Source: Biocon, Statista.com, YES Bank Analysis

4.3 PRECISION ENGINEERING

Precision engineering is a subdiscipline of electrical engineering, software engineering, electronics engineering, mechanical engineering, and optical engineering concerned with designing machines, fixtures, and other structures that have exceptionally low tolerances, are repeatable, and are stable over time. These approaches have applications in machine tools, MEMS, NEMS, optoelectronics design, and many other fields.

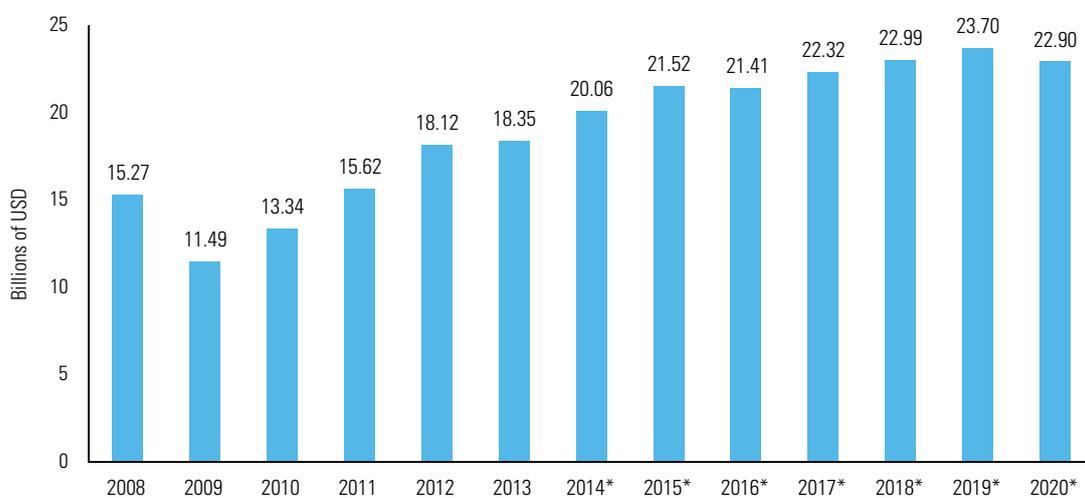
⁴⁹Interview of Kiran Mazumdar Shaw, Deccan Chronicle dated 28th April 2016

⁵⁰Annual Reports, www.Biocon.com

The precision engineering sector in both Europe and North America has historically had a monopoly on the design and development of mission critical components due to the availability of advanced skill sets and the proximity to the end user. However more recently the precision engineering markets in countries such as China, India and Singapore have grown rapidly as the outsourcing model for component production has emerged⁵¹. This technology is used across sectors including defence, aerospace, automobiles, electronics, etc.

In the USA alone precision turned products are expected to reach a market value of USD 23 Billion by 2020. Some of the largest players in this technology include Textron (USA), Illinois Tool Works (USA), Dover Corporation (USA).

Figure 21 Value of shipments of precision turned product USA from 2008 to 2020



Note - * resembles years where values have been predicted for
 Source: US Census Bureau, accessed from Statista.com⁵²

Pros and Cons of Advanced Biotechnology

Pros	Cons
<ol style="list-style-type: none"> High precision and accuracy Increased quality of products Avoidance of human errors Faster production Reduction in Energy and material wastage Faster assembly 	<ol style="list-style-type: none"> Cost factor Need for High and continual research and development

⁵¹Precision Engineering Sector Report - http://www.ascendant.hr/media/reports/pdf/Precision_Engineering_Report_2013.pdf

⁵²<http://www.statista.com/forecasts/409534/united-states-precision-turned-product-manufacture-total-value-of-shipments-forecast-naics-332721>

Applications of the Technology⁵³

- ✓ In Aerospace and Defence sector precision engineering is used for production of Aero-structures, Aerospace systems, Engine components and in Maintenance, Repair and Overhaul (MRO)
- ✓ In Automobile sector this is used for applications including maximising of fuel efficiency and reducing vehicle CO2 emissions
- ✓ In Electronics sector Precision engineering is used in design and production of energy control equipment, state-of-the-art systems used in heating, ventilation, air conditioning and refrigeration (HVACR) equipment, as well as in the design of lighting, power generation and power transmission equipment

World Precision Machinery (WPM), an integrated manufacturer of precision metal stamping machines based in Jiangsu, China, has seen its revenues multiply five-fold between 2005 and 2010. In the first nine months of 2011, the firm had revenues of USD 150.1 Mn, amounting to year-on-year growth of 30%. The company attributes the profitability in the industry to a boom in market demand, price competitiveness and technology innovation. A key part of WPM's strategy is vertical integration: the company has the capability to design 90% of the equipment it produces. Over the next five years, profitability in the Precision Engineering industry will be driven by market demand on the one hand, and cost control, production efficiency and price competitiveness on the other along with continuous technology innovation.

4.4 INDUSTRIAL ROBOTS

Industrial robot as defined by ISO 8373 as an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications⁵⁴. The most commonly used robot configurations are articulated robots, SCARA robots, delta robots and cartesian coordinate robots. Some robots are programmed to do repetitive actions while others are provided with artificial intelligence for flexibility in performing tasks. George Devol applied for the first robotics patents in 1954 (granted in 1961), and founded the first Robot manufacturing company Unimation. Since then industrial robots have been greatly used in areas like automobile manufacturing, material handling, etc.

Worldwide shipments of multipurpose industrial robots are forecast to exceed 207,000 units in 2015, up from around 159,000 in 2012. The tremendous growth in sales is largely driven by the automotive sector which accounted for almost 60% of new industrial robot installations in 2011. Consequently, the robot density is particularly high in countries with a strong automotive industry. In Japan, there are 1,562 industrial robots installed per 10,000 automotive employees⁵⁵.

There are five major markets representing 70% of the total sales volume in 2014: China, Japan, the United States, the Republic of Korea and Germany. Robot sales to India was about 2,126 units in 2014 as is expected to reach 2600 units by 2018⁵⁶. The industrial robotics market is expected to grow at CAGR of 11.92% between 2016 and 2022, and reach USD 79.58 Billion by 2022. The market for industrial robotics in the electrical and electronics industry is expected to grow at the highest CAGR between 2016 and 2022 owing to the introduction of new electronic products into the market, the miniaturization of electrical and electronics equipment, and complexity in manufacturing processes. The major players in the industrial

⁵³Precision Engineering Sector Report accessed from http://www.ascendant.hr/media/reports/pdf/Precision_Engineering_Report_2013.pdf

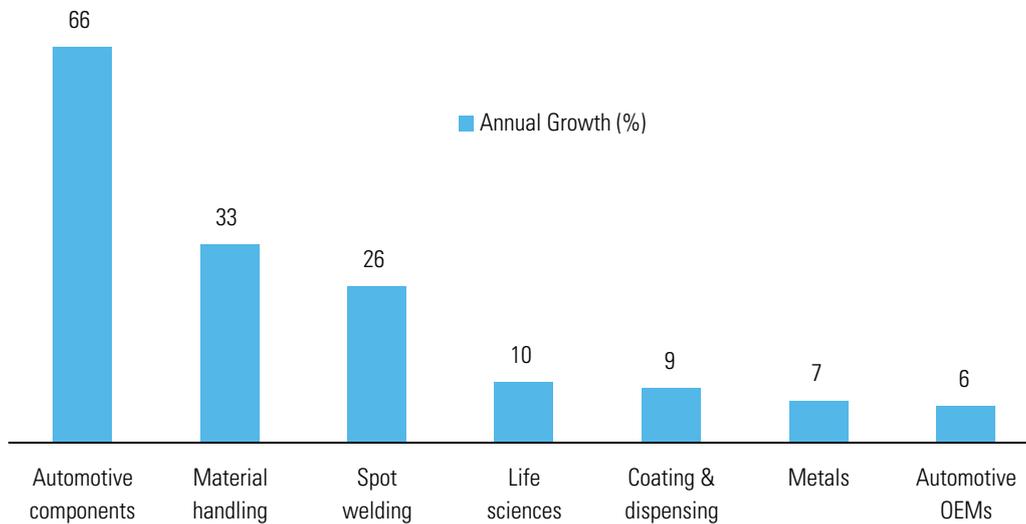
⁵⁴Industrial Robots as accessed from <http://www.ifr.org/industrial-robots/>

⁵⁵Statistics and Facts about the Global Market for Industrial Robots as accessed from <http://www.statista.com/topics/1476/industrial-robots/>

⁵⁶Estimated yearly sales of multipurpose robots as accessed from <http://www.ifr.org/industrial-robots/>

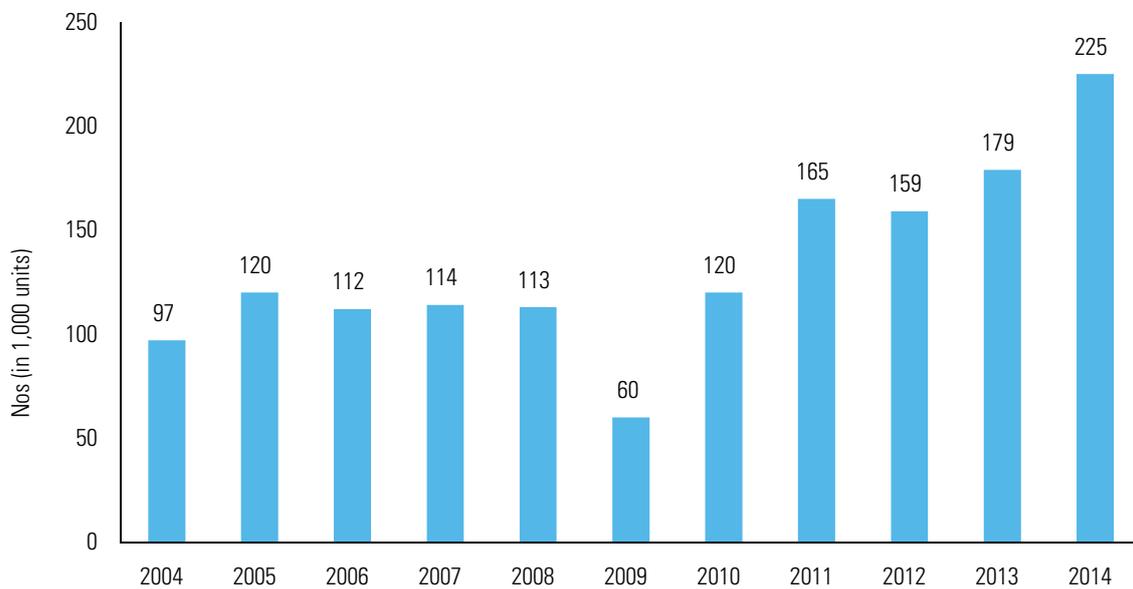
robotics market are ABB Ltd. (Switzerland), KUKA AG (Germany), FANUC Corp. (Japan), Yaskawa Electric Corp. (Japan), and Kawasaki Heavy Industries Ltd. (Japan) among others⁵⁷.

Figure 22 Annual growth in North American industrial robot sales by customer segment (2015)



Source: International Federation of Robotics, accessed from Statista.com⁵⁸

Figure 23 Worldwide sales of industrial robots from 2004 to 2014



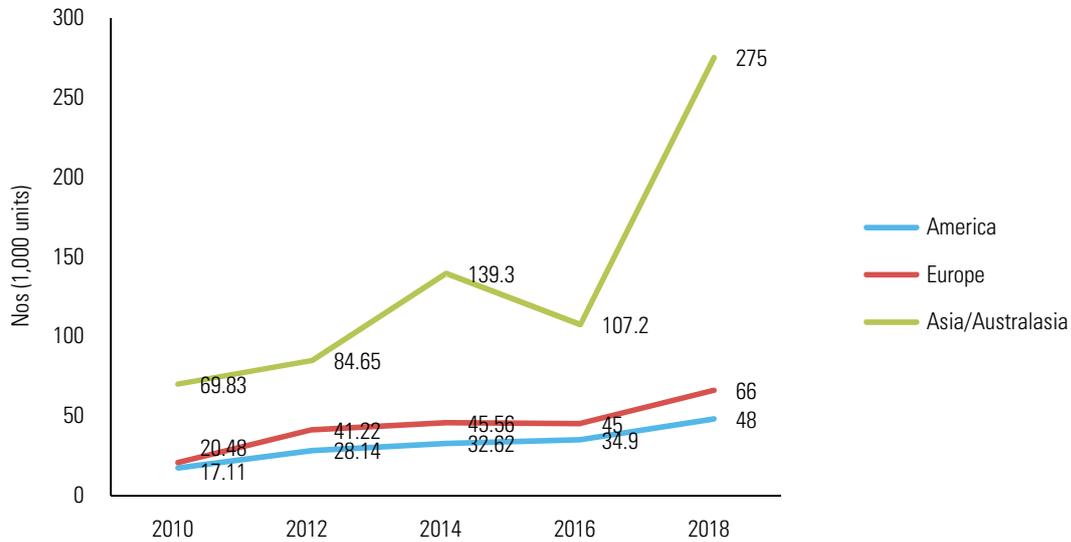
Source: International Federation of Robotics, accessed from Statista.com⁵⁹

⁵⁷Industrial Robotics as accessed from <http://www.marketsandmarkets.com/PressReleases/industrial-robotics.asp>

⁵⁸<http://www.statista.com/statistics/217544/growth-of-north-american-industrial-robot-industry-by-customer-segment/>

⁵⁹<http://www.statista.com/statistics/264084/worldwide-sales-of-industrial-robots/>

Figure 24 Estimated annual industrial robot shipments in selected regions worldwide from 2010 to 2018, by region



Source: International Federation of Robotics, accessed from Statista.com⁶⁰

Pros and Cons of Industrial Robots⁶¹

Pros	Cons
1. Improved Quality of production	1. High cost of technology acquiring
2. High Precision and reliability	2. High cost of maintenance
3. Drastic improvement of speed of production	3. High chances of wear and tear
4. Increases workspace safety as replaces humans in performing dangerous applications in hazardous settings	4. Requirement of expertise and skilled manpower to operate

Applications of the Technology

- ✓ Material handling operations across industries including those where heavy or hazardous materials are involved
- ✓ Welding across industries, including where high temperature welding processes are involved
- ✓ Assembly lines mostly in automotive industries use these technologies for high precision and faster assembly
- ✓ Dispensing in industries like pharmaceutical where accurate amount of combinations of chemicals are required
- ✓ Robotic Process Automation where automation is taken up using artificial intelligence in the production process

⁶⁰<http://www.statista.com/statistics/272179/shipments-of-industrial-robots-by-world-region/>

⁶¹Advantages and Disadvantages of Automating with Industrial Robots as accessed from <https://www.robots.com/blog/viewing/advantages-and-disadvantages-of-automating-with-industrial-robots>

Case Story: Advanced Robotics in Vaillant Group⁶²

Vaillant Group is one of the world's leading heating technology manufacturers, setting the standards in the heating market. The company was unable to meet the increased levels of customer demand in the UK and shifted to robotics to meet this demand. They introduced a KUKA palletising robot solution that reduced the need for manual intervention in the manufacturing process and increased both the efficiency and capacity of the manufacturing track. The demand was a maximum cycle time of 45 seconds between assemblies. The requirement was to process a minimum of 25 pallets every hour. With its powerful motors and high performance gear units, and the ability to stack multiple pallets up to great heights with ease, the KUKA Palletising solution ensured shorter cycle times and greater productivity. By removing manual handling from both the front and back end of the manufacturing process, Vaillant were able to increase the production of its Heat Engines by more than 21% without the need for more staff. The costs of the robots were earned back within 2.5 years of using it.

4.5 ENERGY TECHNOLOGY (ADVANCED PHOTOVOLTAICS)

Photovoltaics (PV) is the conversion of light into electricity using semiconducting materials that exhibit the photovoltaic effect. A typical photovoltaic system employs solar panels, each comprising a number of solar cells, which generate electrical power.

- ✓ Traditional First Generation solar cells are made from silicon and account for around 80 + % of all the solar panels sold around the world. These typically demonstrate a performance about 15-20 %
- ✓ Second-generation solar cells are usually called thin-film solar cells because when compared to crystalline silicon based cells they are made from layers of semiconductor materials that are a few micrometers thick and are more cost effective than first generation cells. These typically demonstrate a performance about 10-15 %⁶³
- ✓ Third-generation solar cells are potentially able to overcome the Shockley–Queisser limit of 31–41% power efficiency for single bandgap solar cells. The third generation cells encompass multiple technologies, including polymers, biomimetics, quantum dot, tandem/multi-junction cells, intermediate band solar cell, hot-carrier cells, photon upconversion and down conversion technologies, and solar thermal technologies, such as thermophotonics. These record efficiencies beyond 20%

Global solar photovoltaic capacity has grown from around five gigawatts in 2005 to a little under 230 gigawatts in 2015. In that year, cumulative solar PV installations reached some 35.7 gigawatts in Germany alone. By 2016, the residential solar PV market in the United States is projected to be worth around USD 4.7 Billion. China was home to seven of the world's ten leading solar module manufacturers in 2015.

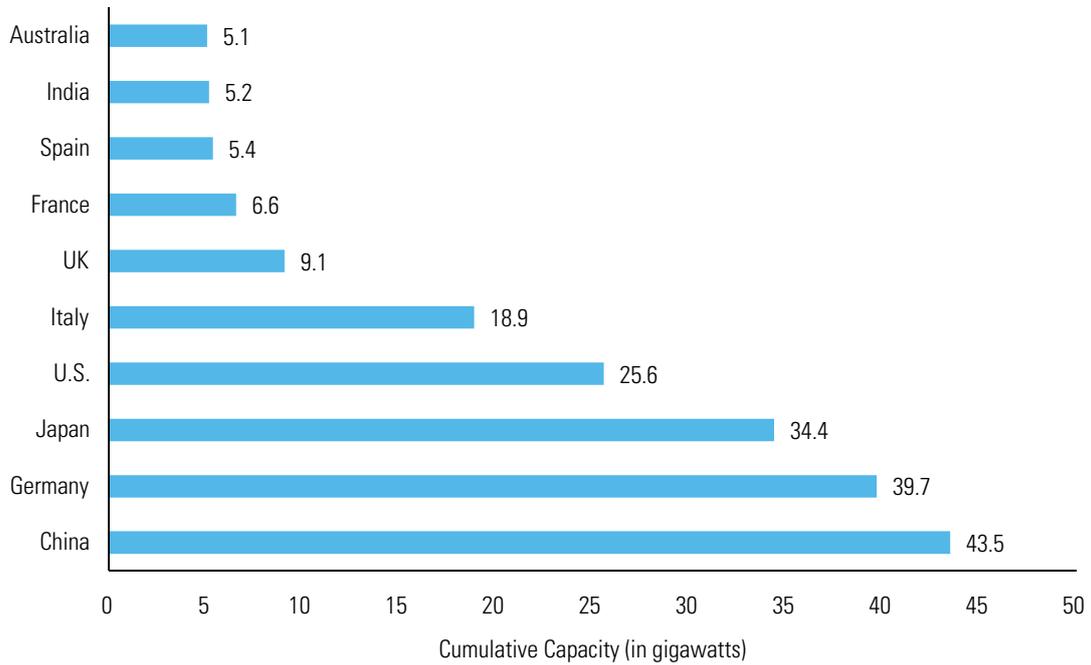
The photovoltaic market is growing rapidly in many segments and applications due to various reasons such as their environmental friendly attributes, minimum maintenance, and cost saving. The major market players are investing heavily in PV technology. Furthermore, many governments are also providing various incentives and funding to this market. Some of the major players in this market include Kyocera Corporation (Japan), Mitsubishi Electric Corporation (Japan), Sharp Corporation (Japan), JA solar Co. Ltd (China), Suntech Power Holdings Co. Ltd (China), Yingli Green (China), and Canadian Solar (Canada)⁶⁴.

⁶²A Kuka UK Case Study – Vaillant as accessed from http://www.kuka-robotics.com/usa/en/pressevents/news/NN_140317_Vaillant.htm

⁶³Solar Cells – Three generations as accessed from <http://plasticphotovoltaics.org/lc/lc-solarcells/lc-introduction.html>

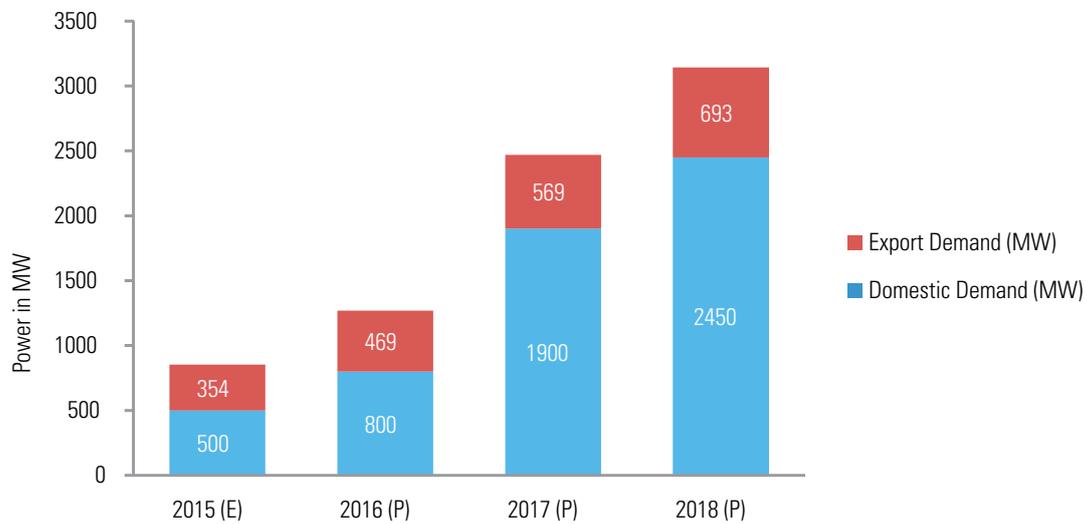
⁶⁴Photovoltaics market - <http://www.marketsandmarkets.com/PressReleases/pv-market.asp>

Figure 25 Global cumulative solar PV capacity at the end of 2015, by country



Sources: Renewable 2016 Global Status Report, Accessed from Statista.com⁶⁵

Figure 26 Domestic and Export Demand of Indian PV Modules



Source: CRISIL research, YES Bank Analysis⁶⁶

⁶⁵<http://www.statista.com/statistics/264629/existing-solar-pv-capacity-worldwide/>

⁶⁶Photovoltaic Cells and Solar Panels, July 2016 - Crisilresearch

Pros and Cons of Advanced Photovoltaics

Pros	Cons
1. Green Technology which is both renewable, using solar energy, and has less pollution load 2. Thirds generation cells show promising efficiency as compared to other older generation cells, thus increasing energy conversion rate 3. These cells can be placed in habitations at remote locations to provide power at inaccessible locations	1. Cost disadvantage with per unit cost for energy being higher than other conventional sources of energy 2. Low Efficiency of the current cells, which requires huge amount of research and development for improvement

Applications of the Technology⁶⁷

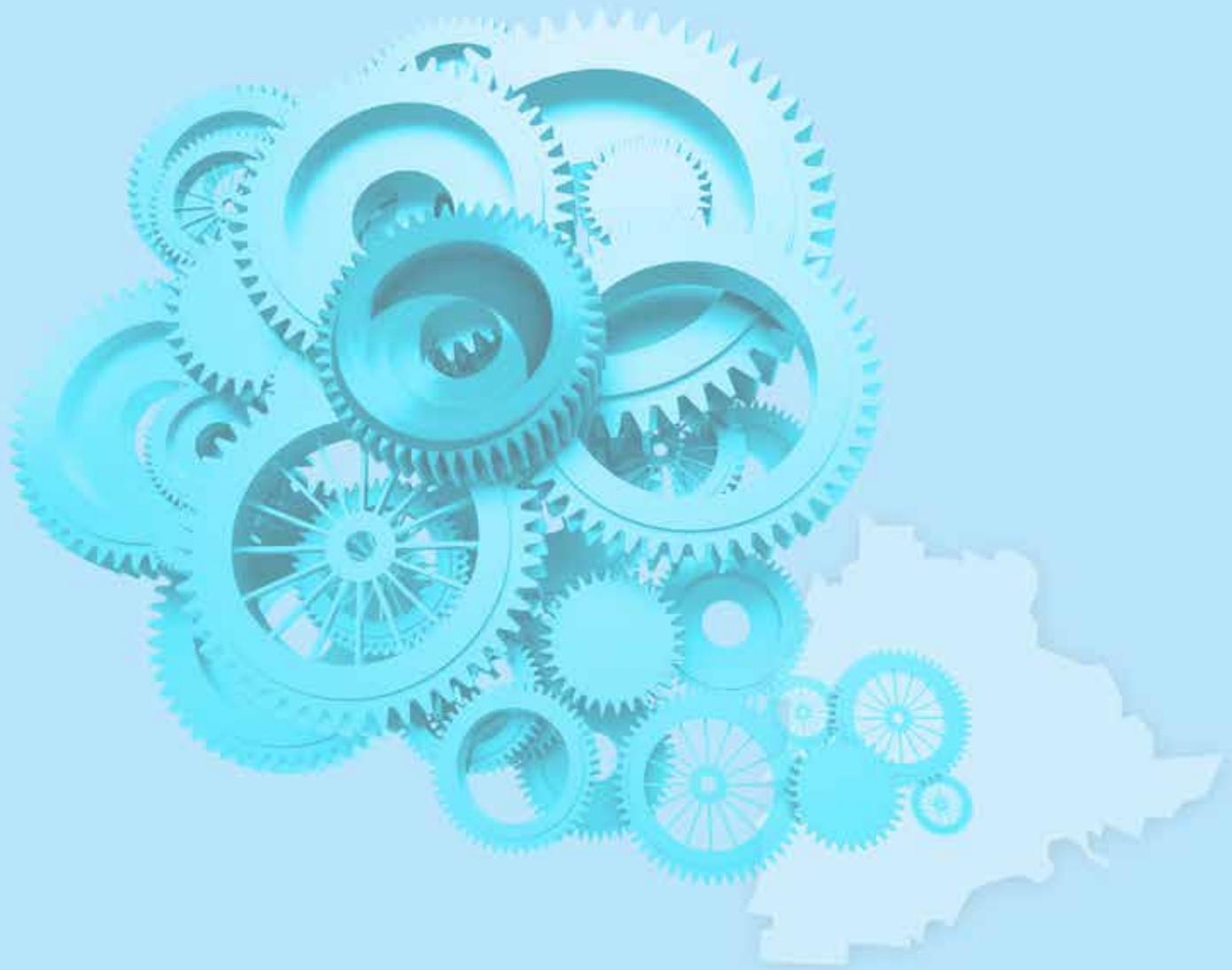
- ✓ Electrification in areas far from the grid or where power is unreliable
- ✓ Water-pumping installations - systems of automatic irrigation
- ✓ Radio/television relay stations: telephone devices; stations for data surveying and transmission
- ✓ Lighting of streets, gardens and public transportation stops; street signalling
- ✓ Such cells are being used in automobiles for developing green and pollution free vehicles
- ✓ This technology is being used for domestic production of electricity, which reduces dependence on grid connectivity for domestic consumers

Case Story: Yingli Solar – A world leader in Solar Photovoltaic⁶⁸

Yingli Solar is the world's largest manufacturer of solar panels, with over 30 Million panels installed in more than 90 countries. With high focus on technology and cost competitiveness Yingli Solar has evolved as one of the largest solar panel manufacturers in the world in a short span of time. Established in 1998 as Yingli Green Energy, it began module production in 2003, with a capacity of 3 MW. By 2004, Yingli reached 6 MW in ingot/wafer/cell production, and 50 MW in module production. After continued expansion and fundraising efforts, Yingli Green Energy completed its IPO on the New York Stock Exchange in June 2007. In 2009, Yingli achieved 1 GW of cumulative output of solar modules since commercial production began in 2003. In 2010, Yingli Green Energy became the first Chinese company and the first renewable energy company to sponsor the FIFA World Cup. The success of Yingli can be attributed to cost effectiveness in its production process and its aggressive expansion with over 14 GW of panels installed in more than 90 countries.

⁶⁷Photovoltaic systems types and applications - http://www.enerpoint.de/photovoltaic_systems.php

⁶⁸About Yingli as accessed from <http://www.yinglisolar.com/en/about/>



5

RECOMMENDATIONS





5

RECOMMENDATIONS

5.1 ADVANTAGE TELANGANA

Manufacturing is an important thrust sector for the State. In addition to the policy measures, incentives & initiatives launched by the state, that have fairly supported the growth of the sector, there are certain inherent advantages in Telangana that positions the state as a potential manufacturing hub. These include –

1. Location and Connectivity

The state is fairly centrally located in India and is surrounded by most progressive states with high domestic demand for finished goods like Tamil Nadu, Karnataka, Maharashtra and Andhra Pradesh. This is further augmented by the strong Road, Rail & Air connectivity to the state. This offers huge opportunity for the manufacturing sector in Telangana, both in terms of availability of raw material & a ready market for finished goods. Introducing GST can further encourage seamless movement of goods across states in the region.

2. Demographic Advantage

With a Labour Force Participation Rate (LFPR) of 66.8%, Telangana's LFPR is higher than the national average of 52.9% as per 2011 Census. As per 2011⁶⁹ census, the total workforce in the state stands at 1.63 Cr. The Industry sector in the state contributes about 26.7%⁷⁰ to GVA of the State, but employs only about 17.8% of the total state workforce. This reflects potential availability of workforce for the growing requirement of this sector.

3. Relatively cheaper Labour Cost

Low cost of labour provides competitive advantage for manufacturing sector. As per the Annual survey of Industries 2013-14, a total of Rs 5317.08 Cr was paid to workers

⁶⁹India Labour Force Participation Rate as accessed from <http://www.tradingeconomics.com/india/labor-force-participation-rate>

⁷⁰Telangana SES Outlook 2016

as wages by the Industries in the State, with the Gross Value Addition per Rupee of wage to Workers being Rs 5.67⁷¹.

4. Existing industrial base

Telangana is an important industrial hub, with units in sectors like Biotechnology, Pharmaceuticals, Electricals, Defence, Information Technology, Textiles and Tourism among others. The State is also a rapidly emerging centre for sectors like Aerospace, Electronics, IT Hardware & Automobile manufacturing. These major industries can act as anchors for attracting similar large industries as also ancillary industries necessary for servicing these large players.

5. Institutions of Excellence

Telangana has some of the best institutes in India like Indian Institute of Technology, Indian Institute of Information Technology, Indian School of Business, National Institute of Technology Warangal, Centre for Cellular and Molecular Biology (CCMB), Defence Metallurgical Research Laboratory (DMRL), Indian Institute of Chemical Technology (IICT), Defence Research Development Organization (DRDO) & BITS among others. The state also has over 300 engineering colleges providing technical manpower needed for the manufacturing industry. Additionally, recent government initiatives like Telangana Academy of Skill & Knowledge (TASK) are also working towards addressing the skill gap & bridging the industry-institute gap in the State.

5.2 RECOMMENDATIONS FOR GROWTH OF MANUFACTURING SECTOR

Basis the various strengths of Telangana, including its inherent advantages highlighted above, following are certain possible recommendations towards positioning Telangana as a major manufacturing base –

1. Focus Sectors

Given the demographic and workforce advantage of Telangana like available manpower, low labour costs, existing industries, institutes of excellence and its centralized location, it is recommended that the State prioritizes development of labour intensive sectors that can provide employment along with achieving manufacturing growth in the state. Some of these industries could include –

a) Textiles and Garments

- ✓ Availability of raw material - Telangana is one of the largest producers of Cotton in India producing 17% of India's cotton
- ✓ Availability of Skilled/Semi Skilled and economical labour in the state

b) Food Processing

- ✓ The State is a leading producer of crops including Paddy, Maize, Jowar, Red gram, Green gram, Bengal gram, Groundnut, Soya bean, Mango, Cotton, Chillies, Sugarcane, etc.
- ✓ Majority of workforce in the state is engaged in agriculture, many of whom can be suitable for employment in food processing industries

c) Gems and Jewellery

- ✓ Hyderabad is the Pearl city of India with large scope for further development, including exports
- ✓ Availability of appropriately skilled workforce for employment

⁷¹Directorate of Economic Statistics, Government of Telangana

d) Electronics assembly units

- ✓ Scope for R&D in this area, in collaboration with institutions of excellence in the region
- ✓ Basic Electronics industry like mobile phone assembly could be taken up given the presence of large number of tech-based qualified workforce in the state

e) MSME/ Ancillary industry

- ✓ Will be supporting the existing & upcoming manufacturing industries in the state
- ✓ Owing to its central location, the state has access to manufacturing hubs like Chennai, Bangalore, Pune and Mumbai, in addition to Hyderabad
- ✓ Existing MSME industry could also be revived through government support to meet growing need for MSMEs and qualified manpower

2. Development of Ancillary Market

Ancillary industries are those which produce parts/ components or provide service required as input by larger industries in their production cycle. Most of these are MSME units that largely depend on local large industries for business, thus establishing a symbiotic association. For example units like fabrication, painting, components, OEMs, auto parts, act as ancillary industries for the larger automobile manufacturers.

Presence of relevant ancillary industries in the state provides strategic advantage to larger industries operating in the region. These could include -

- ✓ Cost efficiency – as most of the large industries can source items locally over other states/ imports
- ✓ Time efficiency – leading to reduced production lead times resulting from local sourcing
- ✓ Supply chain efficiency – local ancillary industries leads to optimization in warehousing requirements & rationalization in transportation & logistic costs
- ✓ Ease of doing business – as a result of stronger engagement with local supplier network & efficient supply ecosystem
- ✓ Stronger local economy – as a result of setting up of several MSMEs in the state
- ✓ Local employment – created in the ancillary/ MSME network of the state

Large industries act as anchors for germination of ancillary network. Hence the large, marquee investments need to be encouraged in the state.

Similarly, the large existing industries in the state need to strongly support the local ancillary units thereby strengthening their capabilities and business, thus developing a vibrant manufacturing ecosystem in the state. The state government could prescribe suitable measures encouraging large industries in the state to support the local ancillary units.

3. Strengthening Existing Industries

While new investments are needed for the development of the state, existing industries need greater amount of support to address their challenges and avoid mortality. As per Ministry of Corporate Affairs, of the total 61,333 companies that closed operations in India during 2012-16 period, 7,627 companies (12.5%) were from Telangana⁷². Such high mortality rate could greatly impact the overall investment

⁷²Lok Sabha unstarred question number 1043 accessed from http://www.mca.gov.in/Ministry/pdf/lok_unstarred_ques_1043_04122015.pdf

climate in the state & adversely influence investor confidence. Hence it is imperative that special measures be taken in the state to support the revival/ growth of existing industries, especially MSME.

4. Government Support in Technology Upgrade

Given the growing quantum of research & development, technology is constantly evolving. Newer technologies promise better efficiencies and competitiveness. However due to lack of awareness/ high cost of technology upgrade, most of these technologies are limited to large industries. The MSME segment that is generally financially stressed has limited access to such important developments. Government interventions in this direction can be an important strategic support to the large MSME segment in the state, which is also one of the largest sources of employment in Telangana.

For example, Ministry of Textile, Government of India has budgeted Rs. 17,822 Cr under the Amended Technology Upgradation Fund Scheme (ATUFS)⁷³. Under this scheme the Textile industry has been divided into 2 sub sectors for capital subsidy on technology upgradation -

- ✓ Apparel, Garment and Technical Textiles, where 15% subsidy would be provided on capital investment, subject to a ceiling of Rs 30 Cr for entrepreneurs over a period of five years
- ✓ Remaining sub-sectors would be eligible for subsidy at a rate of 10%, subject to a ceiling of Rs. 20 Cr on similar lines

The State could utilize such Union Government schemes for facilitating technology upgrade in existing industries across various sectors in the state. It could also launch similar sector-specific schemes for sectors that have high mortality rate due to high cost of production due to usage of primitive technologies.

5. Labour Reforms and Skilled Manpower

Labour reforms in India have come a long way from the Workmen Compensation Act of 1923. Given the need to increase competitiveness at a global level, a healthy industry-labour relation is necessary. Labour reforms that ensure greater flexibility to the industries besides taking into account welfare of the Labour class shall improve productivity in the manufacturing sector. To make the labour more competitive, and make their employment more rewarding, addressing skill gap/ up-skilling is essential. Setting up an academy for the manufacturing sector, akin to TASK for IT sector needs to be prioritized for addressing skill gap in manufacturing sector.

Similarly to encourage skill development in the sector, the state may also consider emphasizing employment of certified/ qualified manpower in the industry/ up-skilling the existing workforce. To support industries in achieving this, appropriate incentive mechanism can be developed.

6. Land and Infrastructure Development

Though the TS-iPASS is an extremely progressive and business friendly initiative to provide timely approval for new industries in the state, it is necessary that that allocation of land be carried out in a defined time limit. Land is a key requirement for establishment of a project and its allocation within a specific time shall boost investor confidence, especially in the manufacturing sector that is land-dependent.

In addition to land allocation, holistic development of industrial infrastructure can be taken up in industrial clusters. These developments could include road connectivity, last mile linkage within the clusters, provision of uninterrupted power and water, common facilities like Common Effluent Treatment Plants (CETPs) and Sewerage Treatment Plants (STPs) among others. This can also boost occupancies in these clusters/ zones.

⁷³Amended scheme to boost 'Make in India' in textile sector as accessed from <http://pib.nic.in/newsite/PrintRelease.aspx?relid=134032>

7. Developing Brand Telangana

Given the advantage that Telangana has, it is required that Telangana be marketed as a brand to attract investments. This can be achieved by catering to the areas of recommendation as elaborated above. "Make in Telangana" and the brand Telangana should be marketed both in domestic and international markets as a state with enormous opportunity for competitive and sustainable manufacturing.

5.3 STAKEHOLDER PERCEPTIONS AND RECOMMENDATIONS

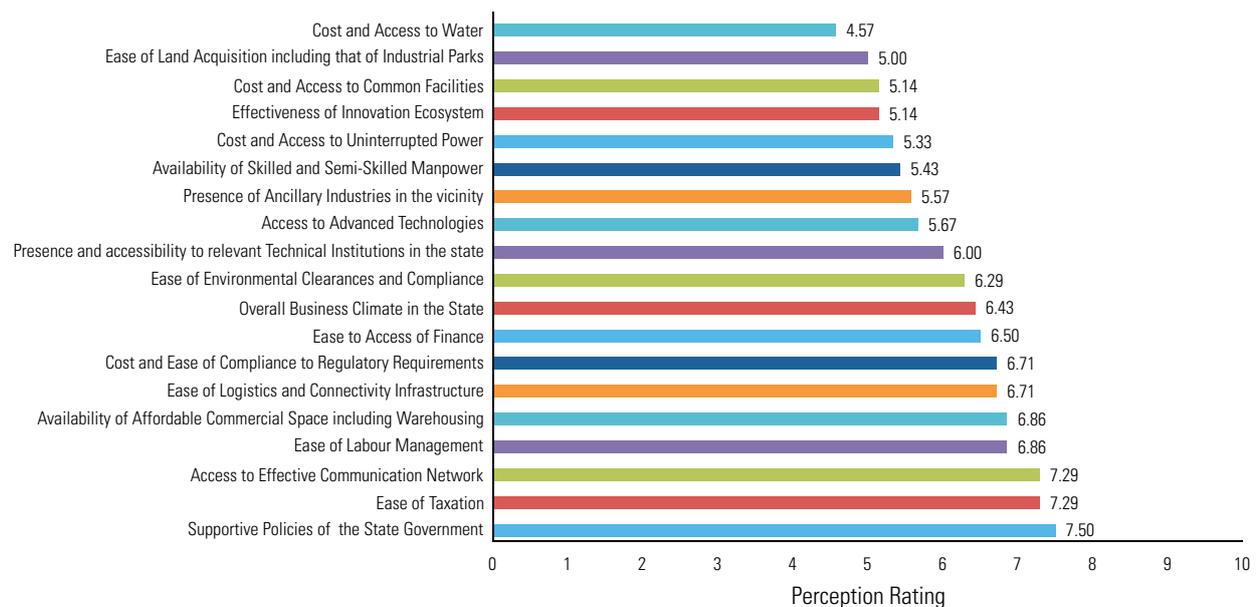
For making Telangana a manufacturing powerhouse of the country, it is necessary to seek inputs from stakeholders operating out of the state, towards enhancing competitiveness of manufacturing sector. So, to seek their inputs, a survey was conducted amongst the CII membership in the State.

Stakeholders from the existing Industries in the state were consulted upon their perceptions and recommendations on 19 different factors ranging from supportiveness of the State Government Policies, to ease in availability and access to quality infrastructure and resources in the State. The survey also sought their viewpoint on awareness and access to the emerging and future technologies in the manufacturing sector. The survey questionnaire is annexed for reference.

Synopsis of responses received from the stakeholder consultations is as follows:

- ✓ The key strengths of the state for ease of doing business include Supportive Policies of the State Government, Ease of Taxation, Access to Effective Communication Network and Availability of Affordable Commercial Space including Warehousing
- ✓ The top areas of concern include Cost and Access to Water, Ease of Land Acquisition including that of Industrial Parks, Cost and Access to Uninterrupted Power, Availability of Skilled and Semi-Skilled Manpower, Cost and Access to Common Facilities and Effectiveness of Innovation Ecosystem

Figure 27 Stakeholder Perception (Average Score) on Ease of different factors affecting manufacturing sector in the State



* In a 10 point scale, with 10 being Best

Source: CII Membership, Industry Stakeholder, YES Bank Analysis

The key recommendations on dealing with the main challenges faced by the manufacturing sector in the State include –

1. Cost and Access to Water

- ✓ There is a need to undertake water capacity studies and direct new industries to be set up in water rich areas
- ✓ Ground water harvesting and tank water storage should be encouraged
- ✓ All industries must be made zero discharge, through 100% efficient recycling through in-house ETPs or government facilitated common ETPs
- ✓ Technologies like Life Cycle Assessments can be used to improve production process to save water through process improvements
- ✓ Less water intensive industries should be encouraged in water deficit areas of the state
- ✓ Industries implementing innovative water saving mechanisms should be incentivized

2. Ease of Land Acquisition including that of Industrial Parks

- ✓ Land acquisition needs to be time bound and transparent
- ✓ GIS should be used for land bank real time updating and providing clear information to industries
- ✓ Industrial parks should be developed as high density clusters, targeting identified industries, thus facilitating easier land acquisition

3. Cost and Access to Uninterrupted Power

- ✓ Fast track the power generation projects in the state, encouraging both conventional and renewable projects
- ✓ Captive power generation must be encouraged for individual or groups of industries through incentives like land, finance, etc

4. Availability of Skilled and Semi-Skilled Manpower

- ✓ Assessment of skill gap and identifying focus areas with need for skill development in them
- ✓ Promotion of sector specific training for manufacturing through the industries and through skill development partners
- ✓ Encouraging in-house training programs for industries to train and recruit manpower with required skills

5. Cost and Access to Common Facilities

- ✓ Develop common facilities for industrial parks and clusters through Government facilitation in Public Private Partnership modes, as needed
- ✓ Incentives should be provided for group of industries to develop their self managed common facilities like Effluent Treatment Plants
- ✓ High density industrial clusters should be developed with ease of access to Common facilities

6. Effectiveness of Innovation Ecosystem

- ✓ Promote innovation centres specific to industrial sectors of the state
- ✓ Facilitate industry-academia tie-ups for research and development
- ✓ For a holistic innovation ecosystem to be created, at the academia levels, research and development on innovation should be encouraged focussing on issues of local industries and also supported by local industries
- ✓ Innovation at industry levels should be facilitated through exposure to global success stories and advancements in new innovations and emerging technologies in the respective industrial sector

The stakeholders felt that their Awareness and Access to emerging and future technologies (like Digitization, Automation, 3D printing, etc) in the manufacturing sector was relatively limited. This reflects the need to increase awareness on such technologies amongst the manufacturing stakeholders of the state through programs and workshops conducted on a frequent basis. It is also imperative that these industries be provided linkages with research and development (R&D) organizations who provide access to emerging and future technologies.

6

ANNEXURE



ANNEXURE 1

CII MAN' EX 2016 - MAKE IN TELANGANA: SUSTAINABLE GROWTH THROUGH INNOVATION AND FUTURE TECHNOLOGIES

QUESTIONNAIRE FOR RECOMMENDATIONS FROM THE CII MEMBERS

Name (optional):

Designation (optional):

Organisation (optional):

Phone (optional):

E-mail (optional):

INDUSTRY REPRESENTED – *(please mention)*

GIVE IN YOUR INPUTS AND RECOMMENDATIONS INTO THE FOLLOWING

General Instructions:

- a) Kindly fill up all the below questions
- b) In case of hand written and need of extra space, kindly use additional papers
- c) Kindly limit to the word limits as prescribed
- d) The replies need to be fact driven and supported by numbers, where ever possible

1. Rate the follow factors (in a 10 point scale, with 10 being Best) with respect to the overall ease of doing business in Telangana.

SN	Factor	Points
i.	Supportive Policies of the State Government	
ii.	Cost and Access to Uninterrupted Power	
iii.	Cost and Access to Water	
iv.	Cost and Access to Common Facilities	
v.	Ease of Environmental Clearances and Compliance	
vi.	Cost and Ease of Compliance to Regulatory Requirements	
vii.	Ease of Taxation	
viii.	Ease to Access of Finance	
ix.	Ease of Labour Management	
x.	Ease of Land Acquisition including that of Industrial Parks	
xi.	Availability of Affordable Commercial Space including Warehousing	
xii.	Ease of Logistics and Connectivity Infrastructure	

SN	Factor	Points
xiii.	Access to Effective Communication Network	
xiv.	Presence of Ancillary Industries in the vicinity	
xv.	Effectiveness of Innovation Ecosystem	
xvi.	Access to Advanced Technologies	
xvii.	Availability of Skilled and Semi-Skilled Manpower	
xviii.	Presence and accessibility to relevant Technical Institutions in the state	
xix.	Overall Business Climate in the State	

2. Is the Manufacturing Sector in Telangana ready for Global Competition? You may choose the top 5 -10 factors from the above to elaborate and provide your recommendation to each of these.

(Kindly limit the recommendation to about 50 words per factor)

SN	Factor	Key Challenges / Recommendation
I.		
II.		
III.		
IV.		
V.		
VI.		
VII.		
VIII.		
IX.		
X.		

3. How would you rate your Awareness and Access to emerging and future technologies (like Digitization, Automation, 3D printing, etc) in the Manufacturing Sector? Kindly give your remarks on the same.

(Kindly limit the remarks to about 100 words)

Ans.

- **AWARENESS –**

- **ACCESS -**

4. Kindly highlight the top 5 Industry Challenges and Recommended Government support necessary towards resolution.

(Kindly limit the remarks to about 100 words)

Ans.



YES BANK, India's fifth largest private sector Bank with a pan India presence across all 29 states and 7 Union Territories of India, headquartered in the Lower Parel Innovation District (LPID) of Mumbai, is the outcome of the professional & entrepreneurial commitment of its Founder Rana Kapoor and its top management team, to establish a high quality, customer centric, service driven, private Indian Bank catering to the future businesses of India.

YES BANK has adopted international best practices, the highest standards of service quality and operational excellence, and offers comprehensive banking and financial solutions to all its valued customers.

YES BANK has a knowledge driven approach to banking, and offers a superior customer experience for its retail, corporate and emerging corporate banking clients. YES BANK is steadily evolving as the Professionals' Bank of India with the long term mission of "Building the Finest Bank of the World in India" by 2020.

YES Institute, a new **practicing think-tank**, has been established as a division of YES BANK, to focus on India's sustainable and inclusive socio-economic growth and development.

YES Institute will focus on six core areas of **(1) Smart Urbanization; (2) Sustainable Economies; (3) Design, Innovation, Creativity & Entrepreneurship; (4) Co-operative Federalism; (5) Doing Business in India and (6) Culture & International Relations.**

The Institute believes that India's economic growth must adopt a low carbon pathway, leapfrogging to a scenario of unique and resource-efficient high technology manufacturing, sustainable agriculture and services and also that India's glorious past and rich culture that is anchored in arts, crafts, frugal innovation and diversity must be leveraged to define the country's growth trajectory along a knowledge driven pathway.



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, playing a proactive role in India's development process. Founded in 1895, India's premier business association has over 8000 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 200,000 enterprises from around 240 national and regional sectoral industry bodies.

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.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, healthcare, education, livelihood, diversity management, skill development, empowerment of women, and water, to name a few.

The CII theme for 2016-17, Building National Competitiveness, emphasizes Industry's role in partnering Government to accelerate competitiveness across sectors, with sustained global competitiveness as the goal. The focus is on six key enablers: Human Development; Corporate Integrity and Good Citizenship; Ease of Doing Business; Innovation and Technical Capability; Sustainability; and Integration with the World.

With 66 offices, including 9 Centres of Excellence, in India, and 9 overseas offices in Australia, Bahrain, China, Egypt, France, Germany, Singapore, UK, and USA, as well as institutional partnerships with 320 counterpart organizations in 106 countries, CII serves as a reference point for Indian industry and the international business community.

Confederation of Indian Industry

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