Automation in Manufacturing – Improving Quality and Productivity while Sustaining Competitiveness

30th May 2014

Automotive Engineering Show

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There are several myths surrounding automation which we will proceed to bust!

Associations of the word "Automation" – generated from internet conversations using Germinait's tool Explic8

Automation leads to jobless growth

In a country like India, we cannot afford to have capital replace labour, as happens in case of automation

Automation benefits on paper often do not translate into practice

Automation increases capital investment

The idea that machines can replace humans is wrong

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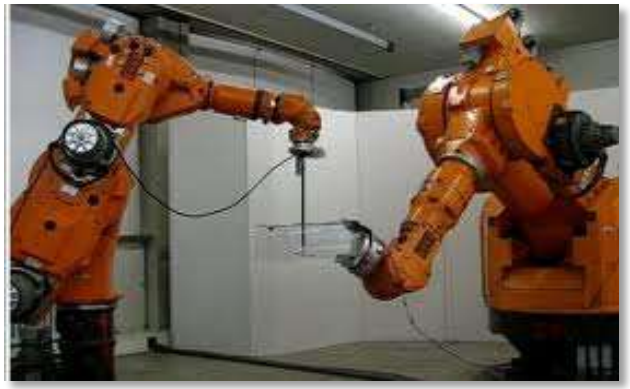
Automation in a broader context is not about Robotics but about productivity enhancement and creating better paying jobs

Automation is "the creation and application of technology to monitor and control the production and delivery of products and services"



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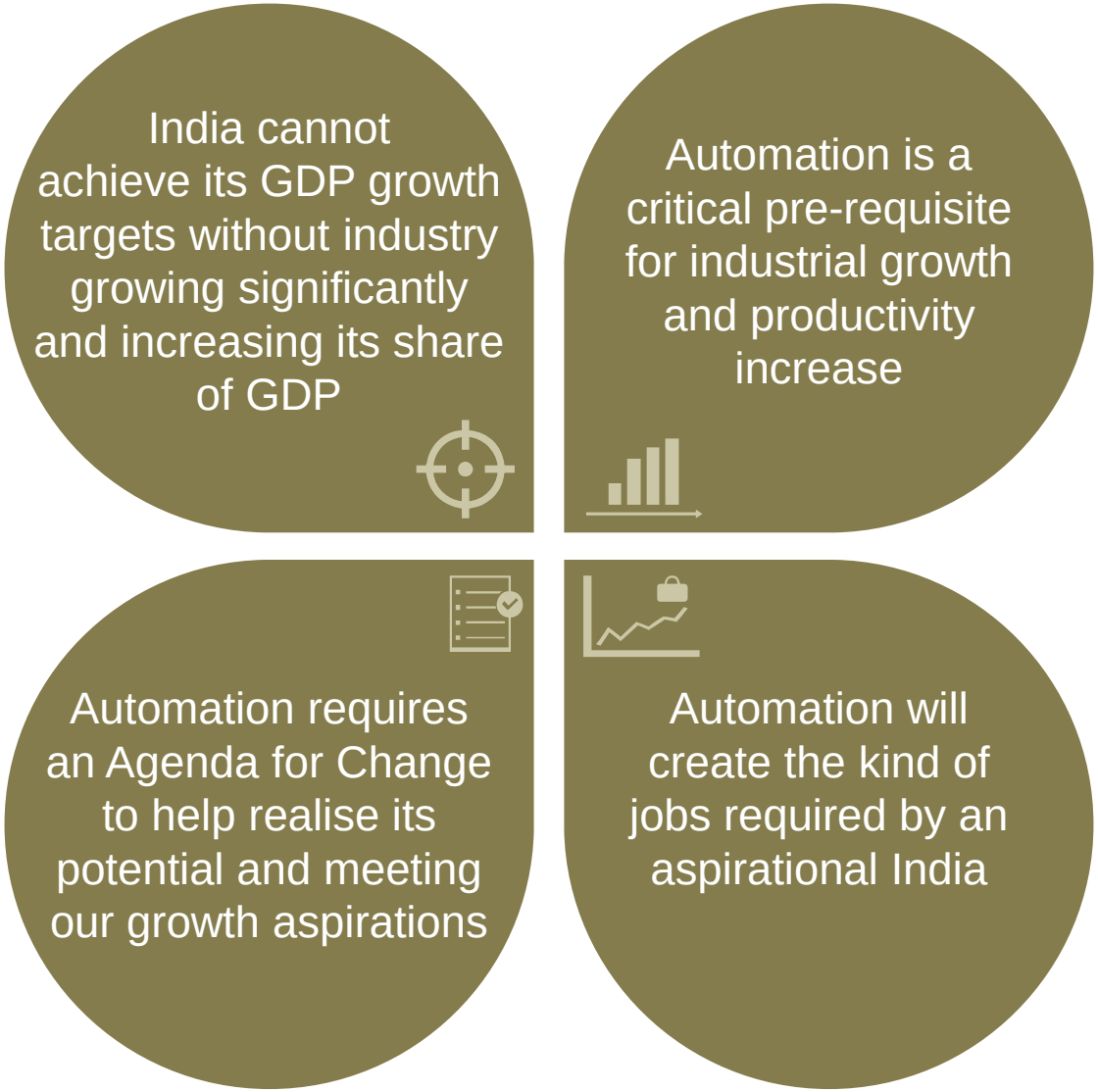
Automation is thus an Imperative for improving Quality and Productivity while Sustaining Competitiveness



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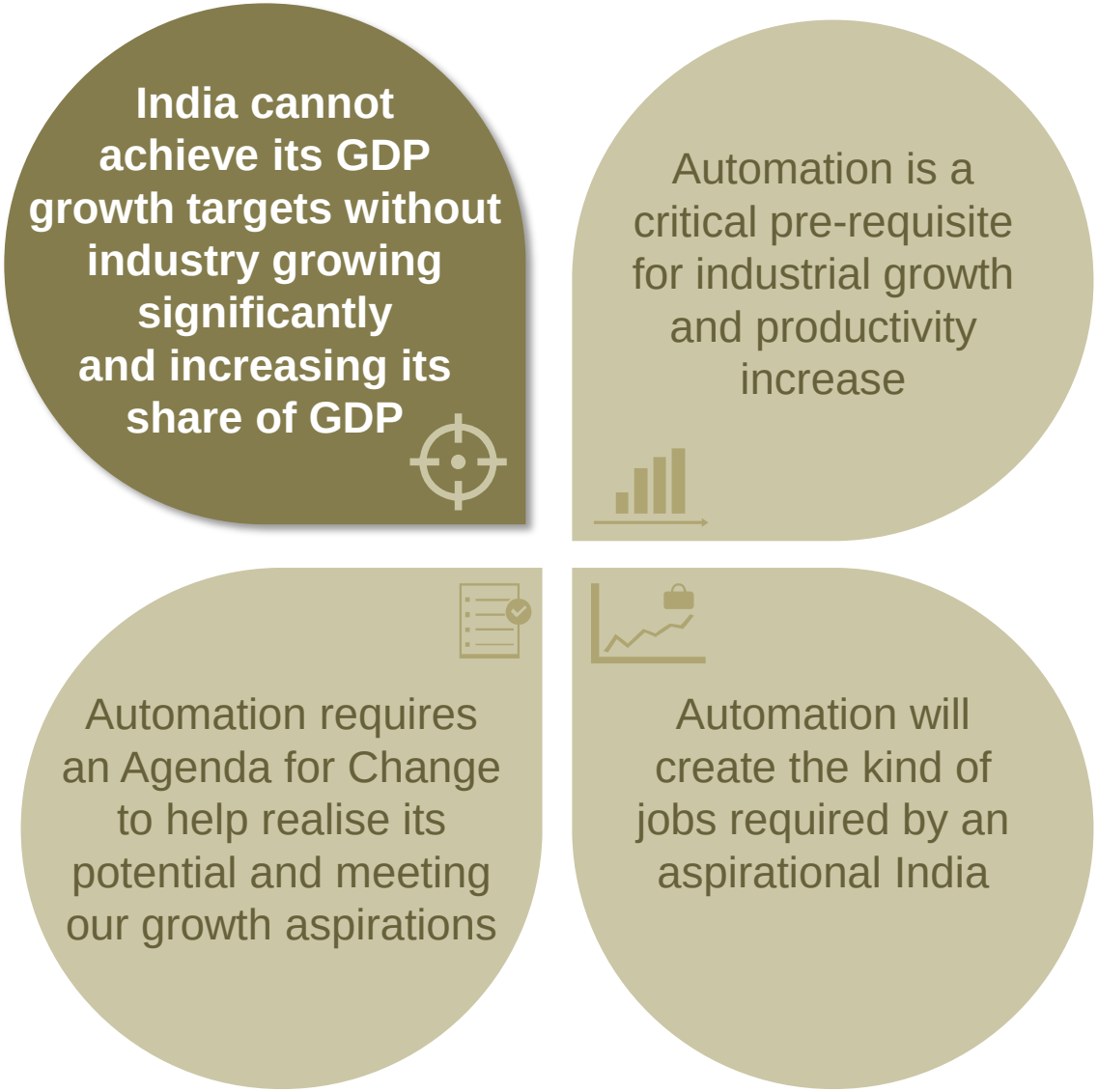

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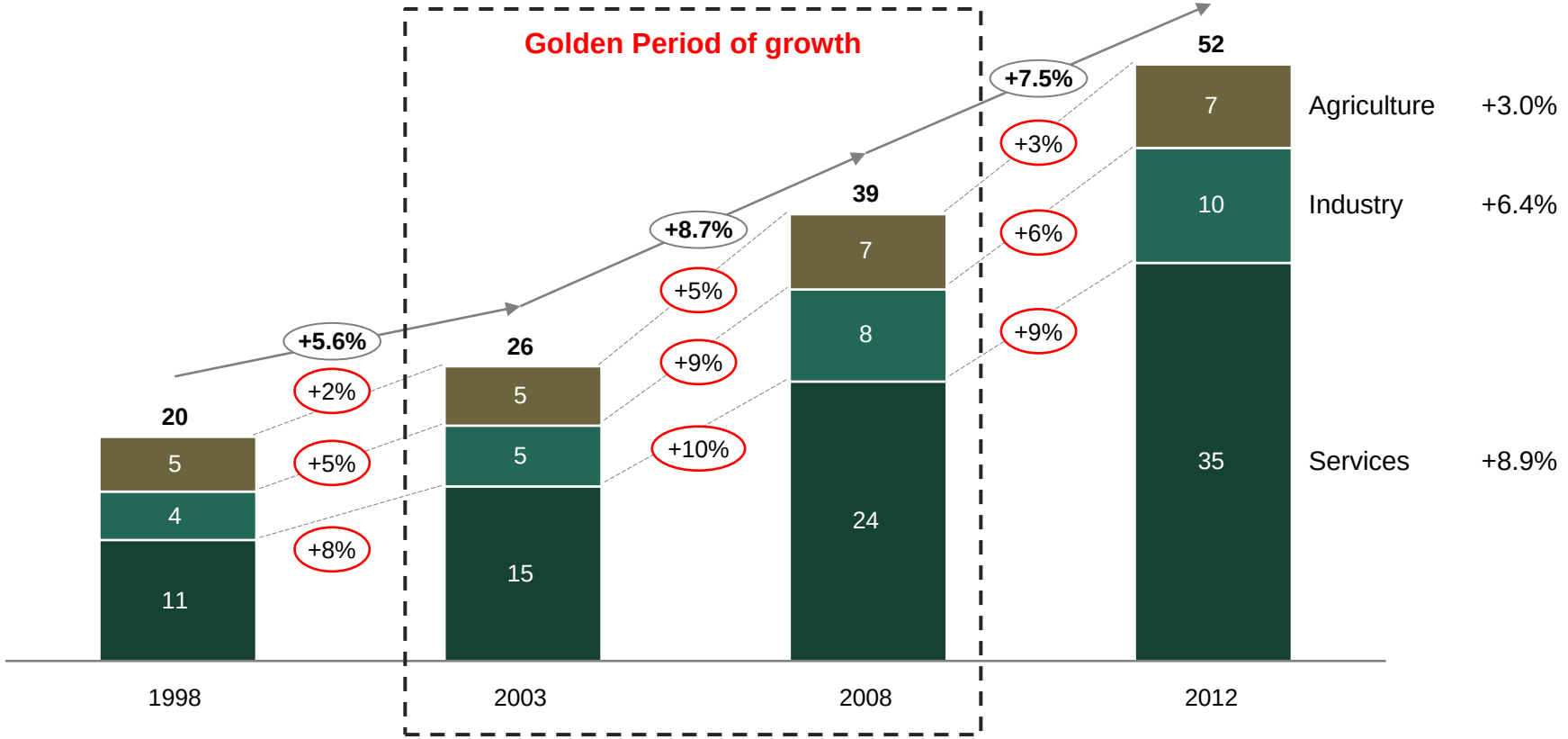
Industry has been a key contributor to our 'golden period' of 8% GDP growth in the last decade

GDP of India by Sector -- INR Trillion, Constant at 2004-05 prices



Source: RBI, Avalon Consulting Research and Analysis

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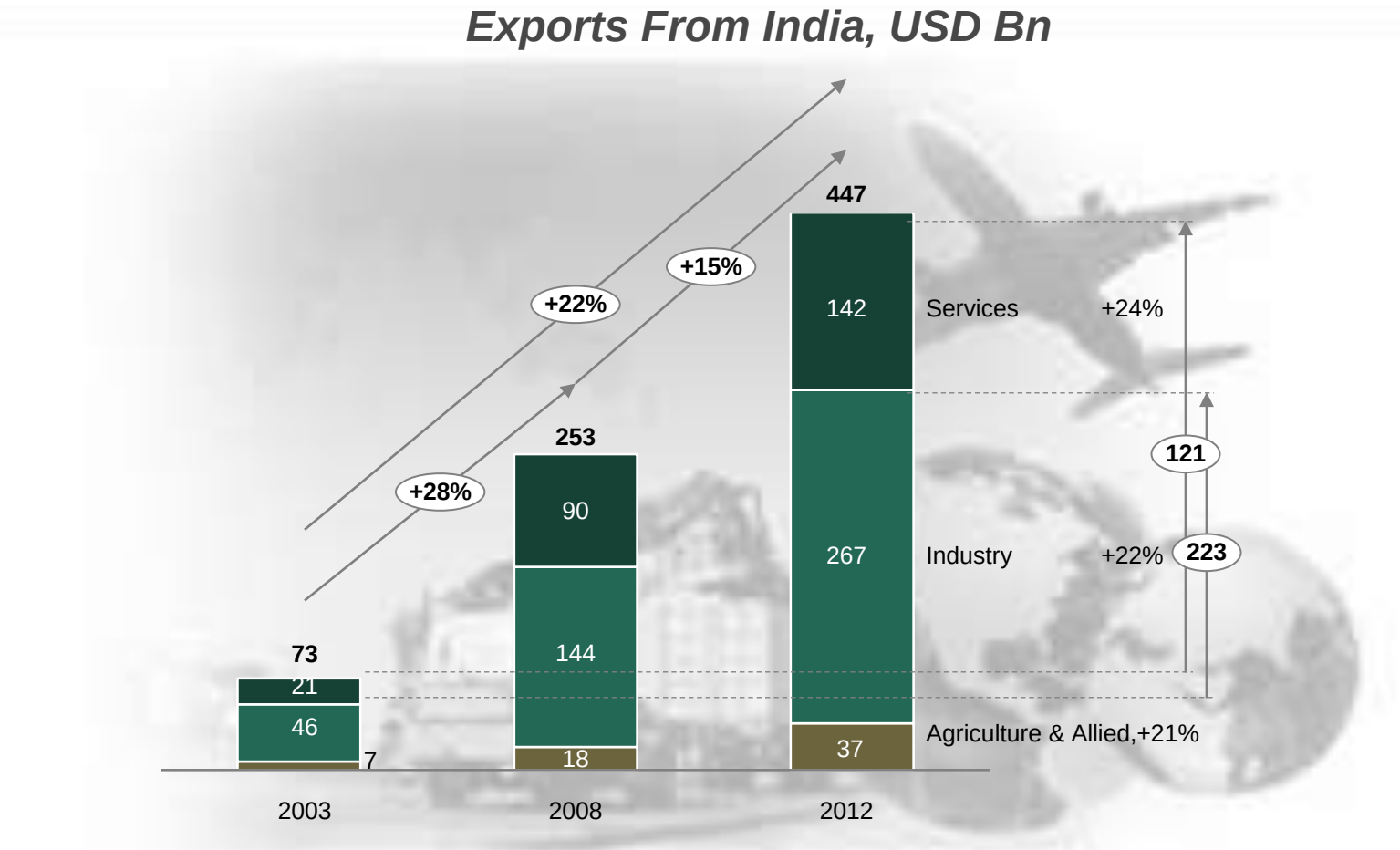
Exports from India have undergone a sea change in the last decade – industry has been a key driver of this revolution in Indian exports



Note: Average exchange rate taken in FY 2012: 1 USD = 48.3 INR
Source: RBI, DGFT, Avalon Consulting Research and Analysis

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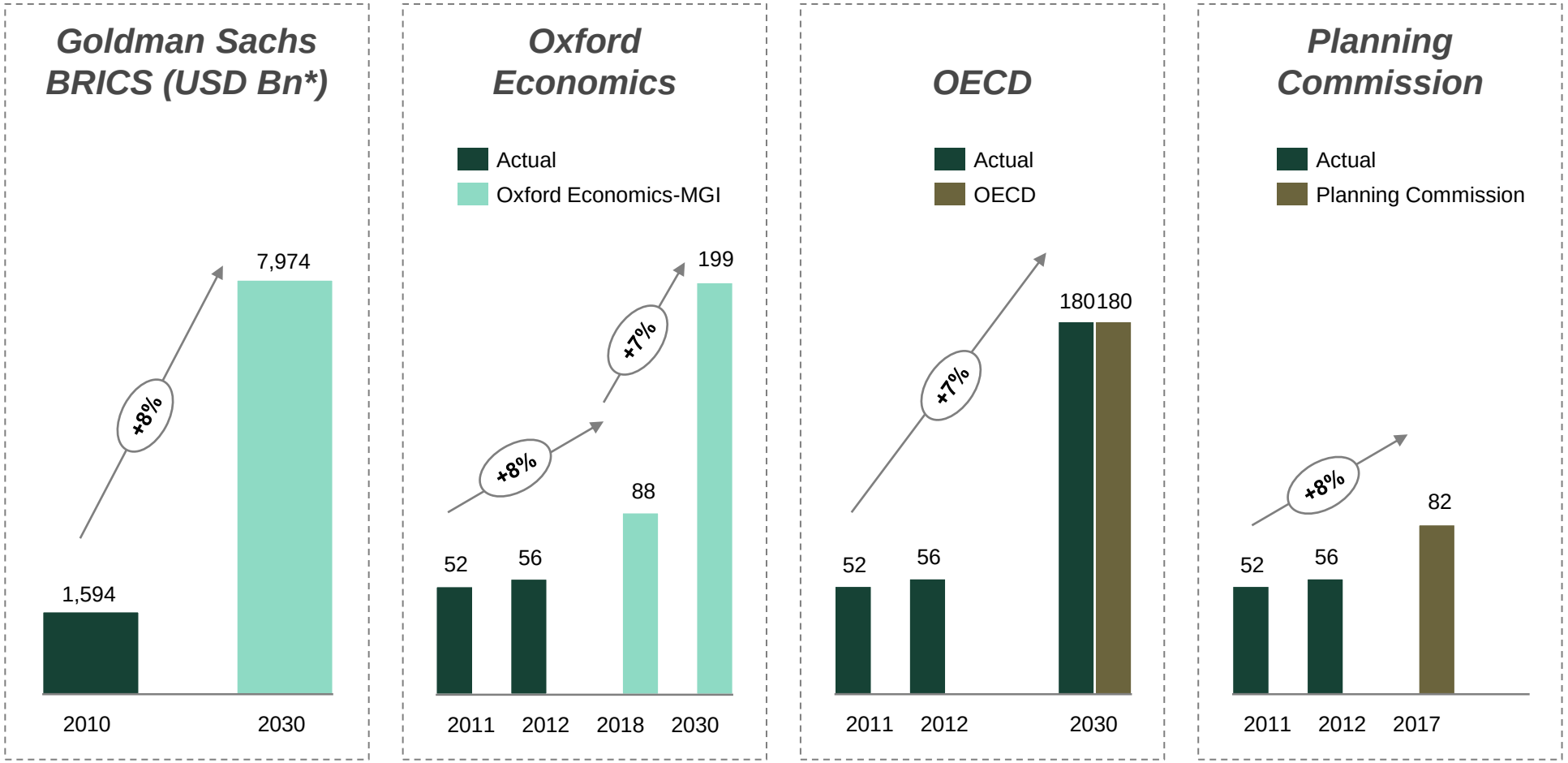
India (and the world) has set itself a target of 8% GDP growth in the coming decades in order to emerge as a key player influencing the global economy

India GDP Projection, Rs. Trillion, 2004-05 prices



** GS 2010*

Source: MGI, Oxford Economics, Avalon Consulting Research and Analysis

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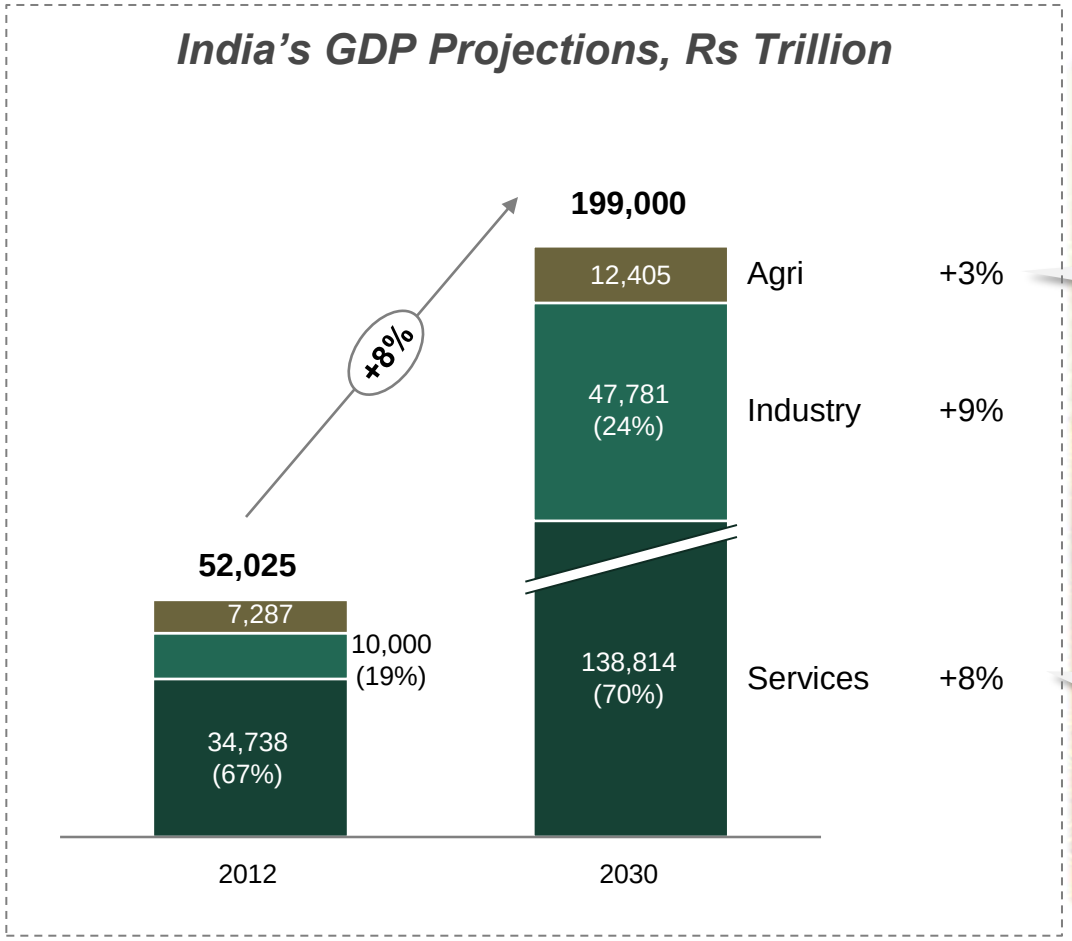
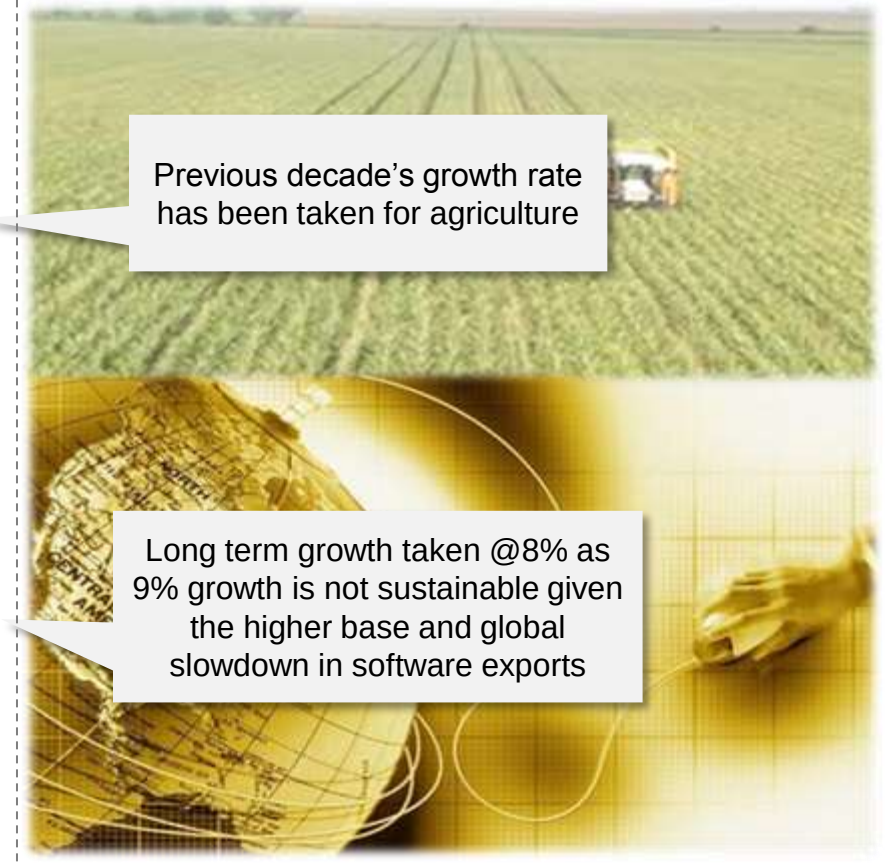
India cannot achieve these growth targets without industry growing significantly and increasing its share of GDP





Source: Avalon Consulting Research and Analysis

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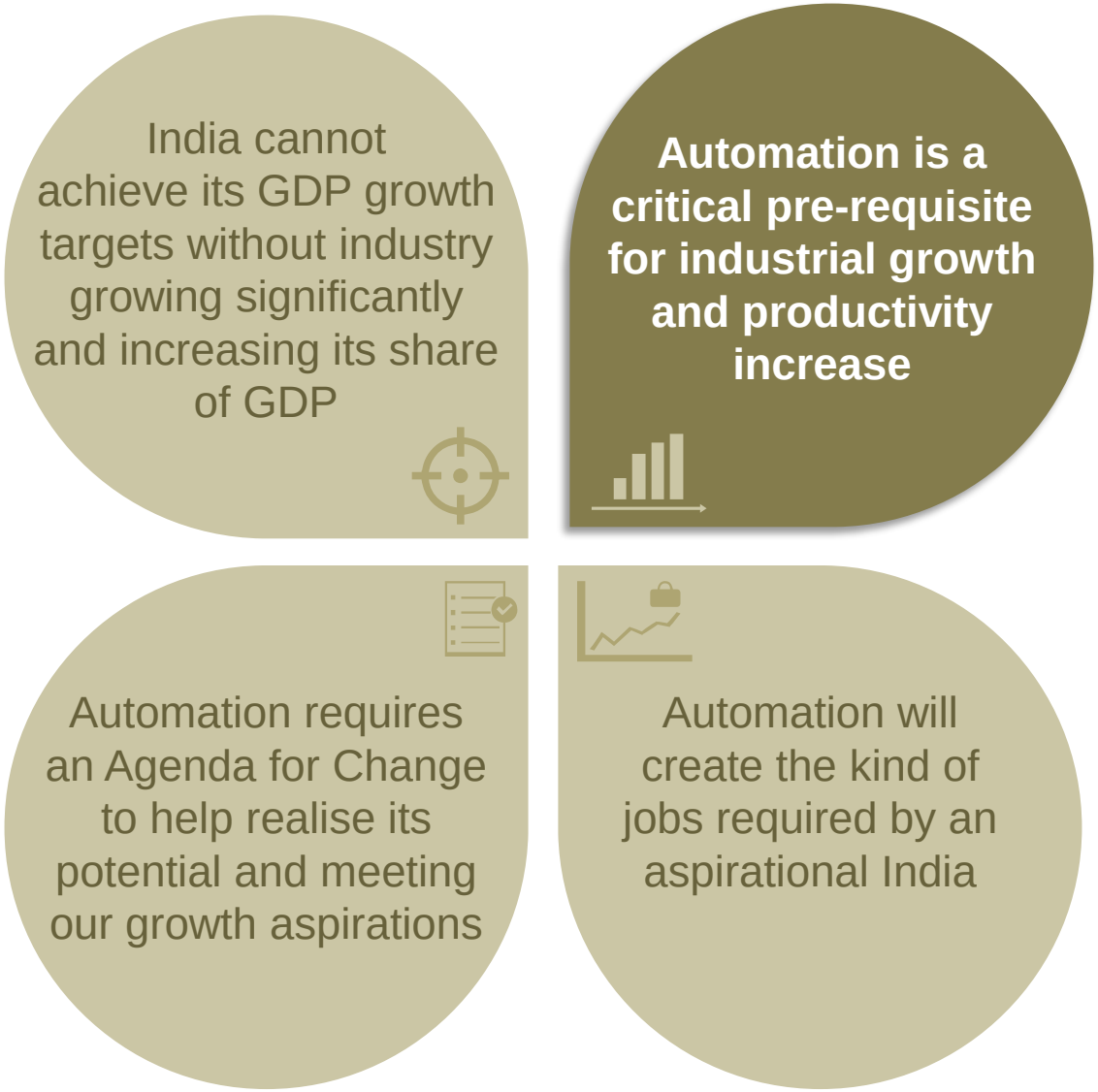

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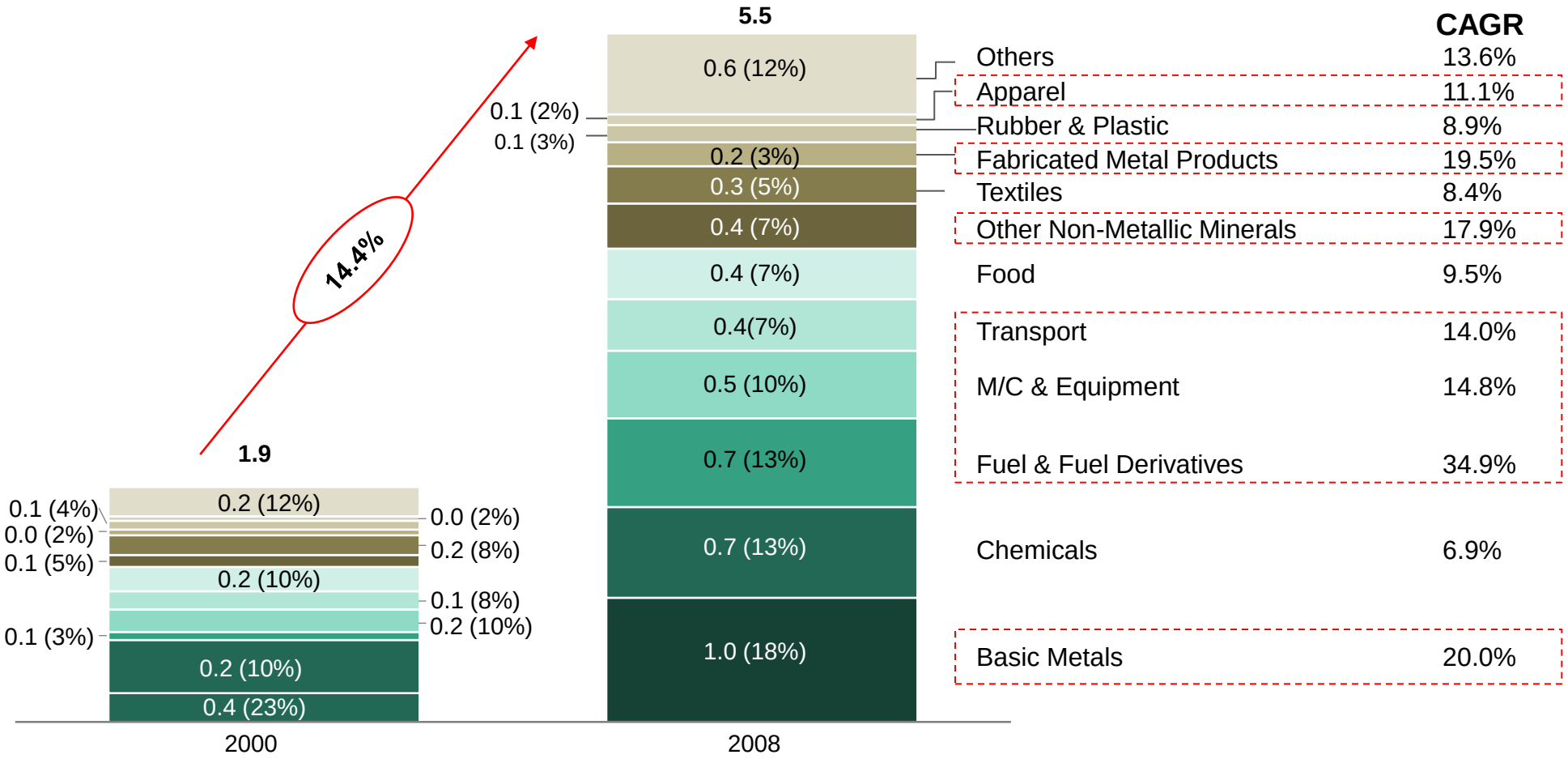
Industry growth in the past decade have been driven by several sub-sectors like mining, automobiles, basic metals, fuel derivatives etc. Consequently, some of these sectors have also increased their share within industry

Trends in Organized Industry Industry Gross Value Added (GVA), Rs. Tn



	CAGR
Others	13.6%
Apparel	11.1%
Rubber & Plastic	8.9%
Fabricated Metal Products	19.5%
Textiles	8.4%
Other Non-Metallic Minerals	17.9%
Food	9.5%
Transport	14.0%
M/C & Equipment	14.8%
Fuel & Fuel Derivatives	34.9%
Chemicals	6.9%
Basic Metals	20.0%

Source: ASI, DGFT, Avalon Consulting Research and Analysis

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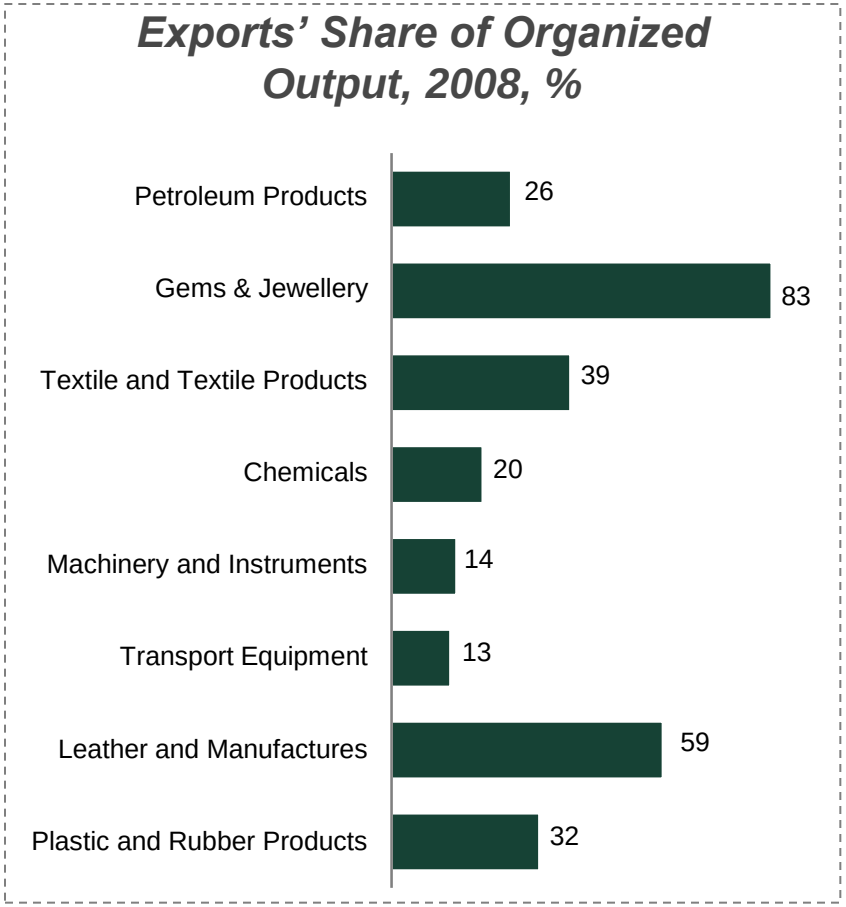
These sectors have also seen rapid growth in exports with global markets even accounting for a significant share of the Indian production in some sectors

India's Exports in Financial Year Ending on 31 March, USD Billion			
	2000	2012	CAGR 2000-2012
Petroleum Products	0.04	55.60	83%
Transport Equipment	0.81	20.91	31%
Machinery and Instruments	1.18	14.36	23%
Gems and Jewellery	7.50	46.90	17%
Basic Chemicals, Pharmaceuticals & Cosmetics	3.09	24.44	19%
Manufacture of Metals	1.23	9.62	19%
Plastic and Linoleum Products	0.60	6.36	22%
Ores and Minerals	0.92	8.15	20%
Rubber, Glass, Paints, Enamels and Products	0.69	4.77	17%
Iron & Steel	0.83	6.45	19%
Leather and Manufactures	1.59	4.79	10%
Textile and Textile Products	9.82	28.00	9%



Source: DGFT, ASI (MOSPI), Avalon Consulting Research and Analysis

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Many of these high growth sectors have seen a significant adoption of automation in the last decade

	Level of Automation	Illustrative Industries
Petroleum Products		Refineries, petrochemicals
Transport Equipment		Auto, Auto Component, Railways
Machinery and Instruments		Machinery, equipment, precision instruments
Gems and Jewellery		
Other Manufactured Goods		Furniture, paper, toys,
Basic Chemicals, Pharmaceuticals & Cosmetics		Chloralkali, base chemicals, pharma, cosmetics
Manufacture of Metals		Aluminium, copper etc.
Plastic and Linoleum Products		Plastic & plastic components
Rubber, Glass, Paints, Enamels and Products		
Iron & Steel		
Leather and Manufactures		Leather, hides, shoe etc
Textile and Textile Products		Textile, knitwear, apparel, carpets etc.

Source: Avalon Consulting Research and Analysis

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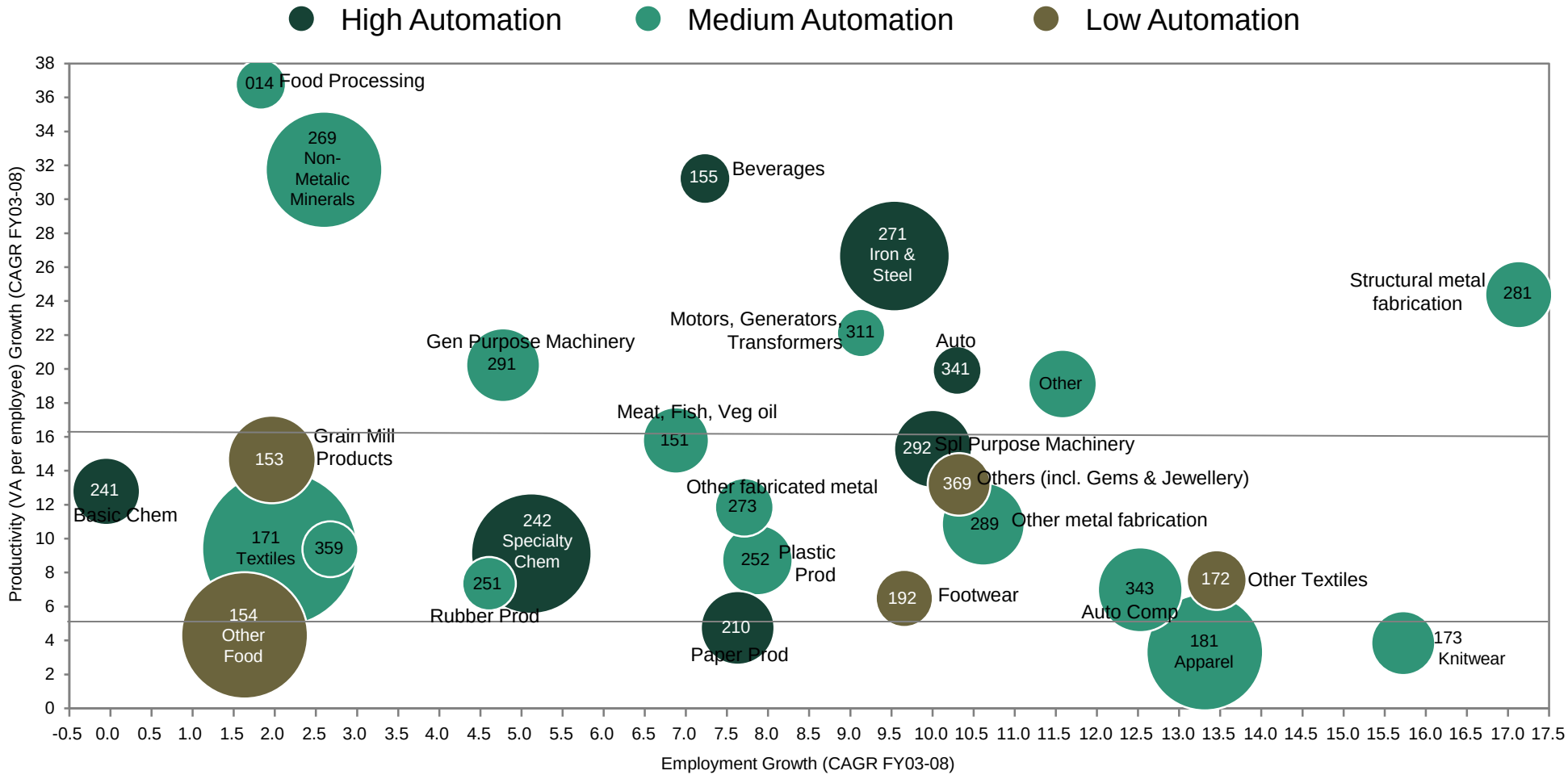
This is reflected in the employment and productivity growth seen in the constituents of these high growth sectors

Productivity Growth vs. Job Growth



Note: Showing only sectors of high growth with >100,000 employed, Organized sector (as covered in ASI)
Bubble size represents number of persons engaged
Source: NSSO, Avalon Consulting Research and Analysis

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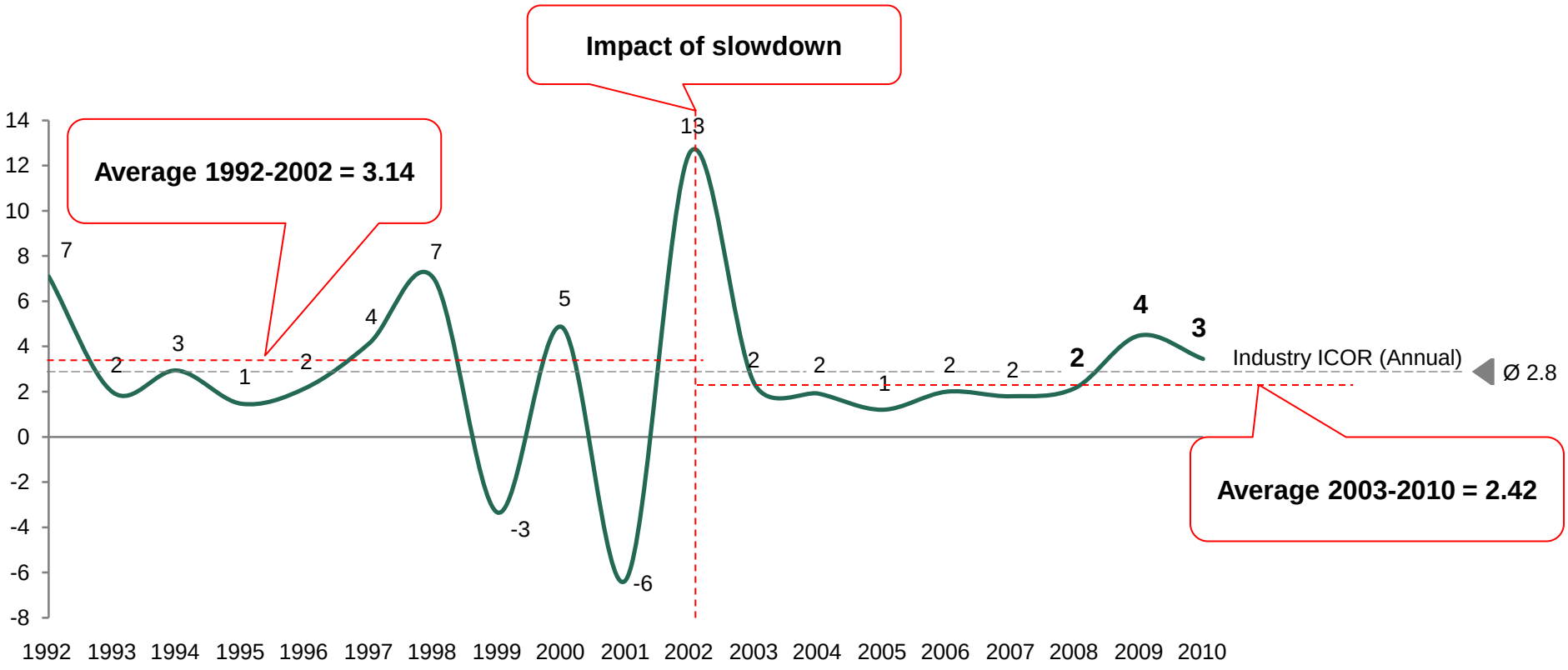
At a macro level, the increased adoption of automation is reflected in the changing Incremental Capital Output Ratio (ICOR) indicating that productivity enhancements has also been a key contributor to India's GDP growth in the past decade

Industry ICOR, as on Financial Year Ending 31 March



Source, RBI, NSSO, Avalon Consulting Research and Analysis

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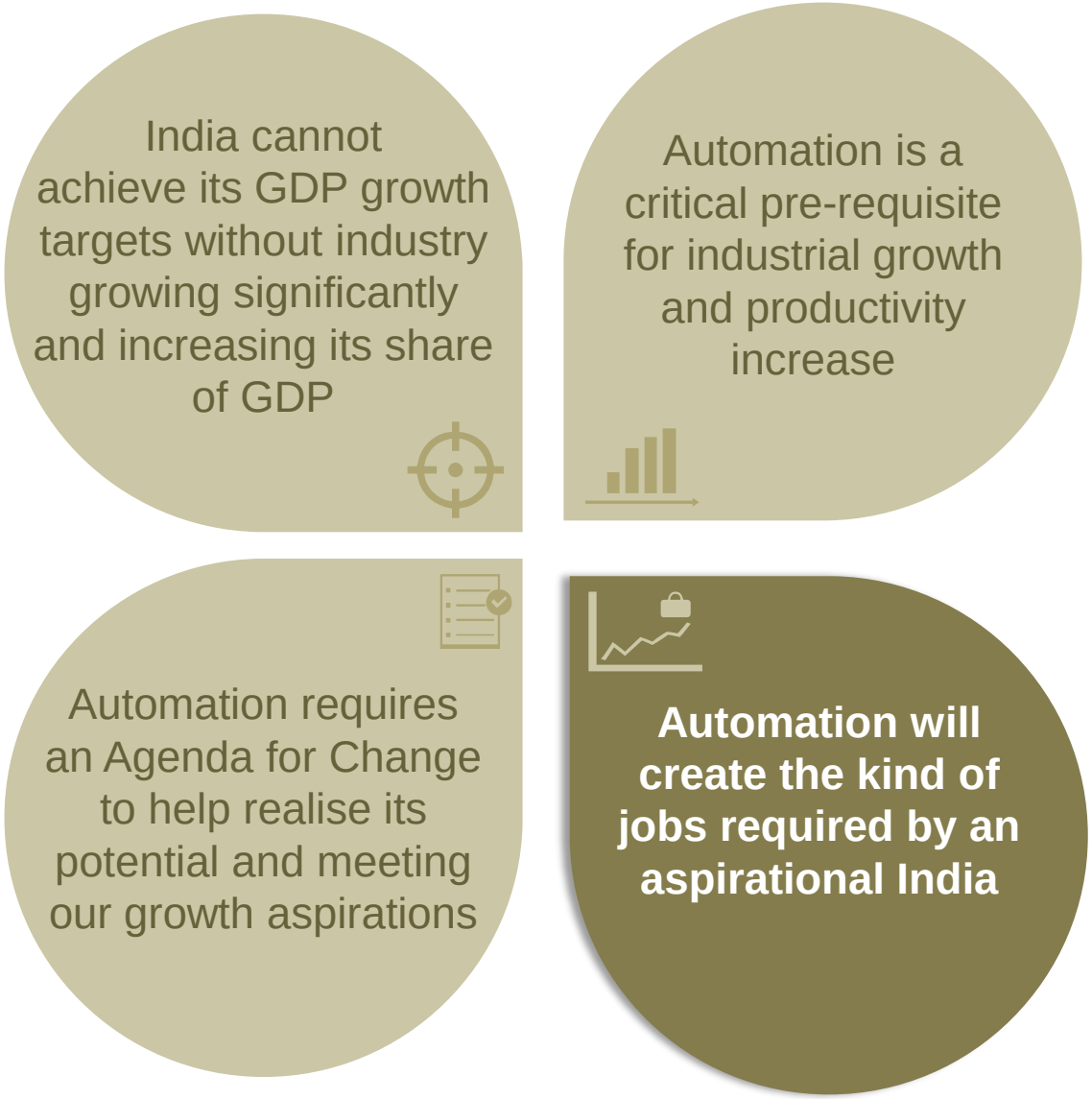

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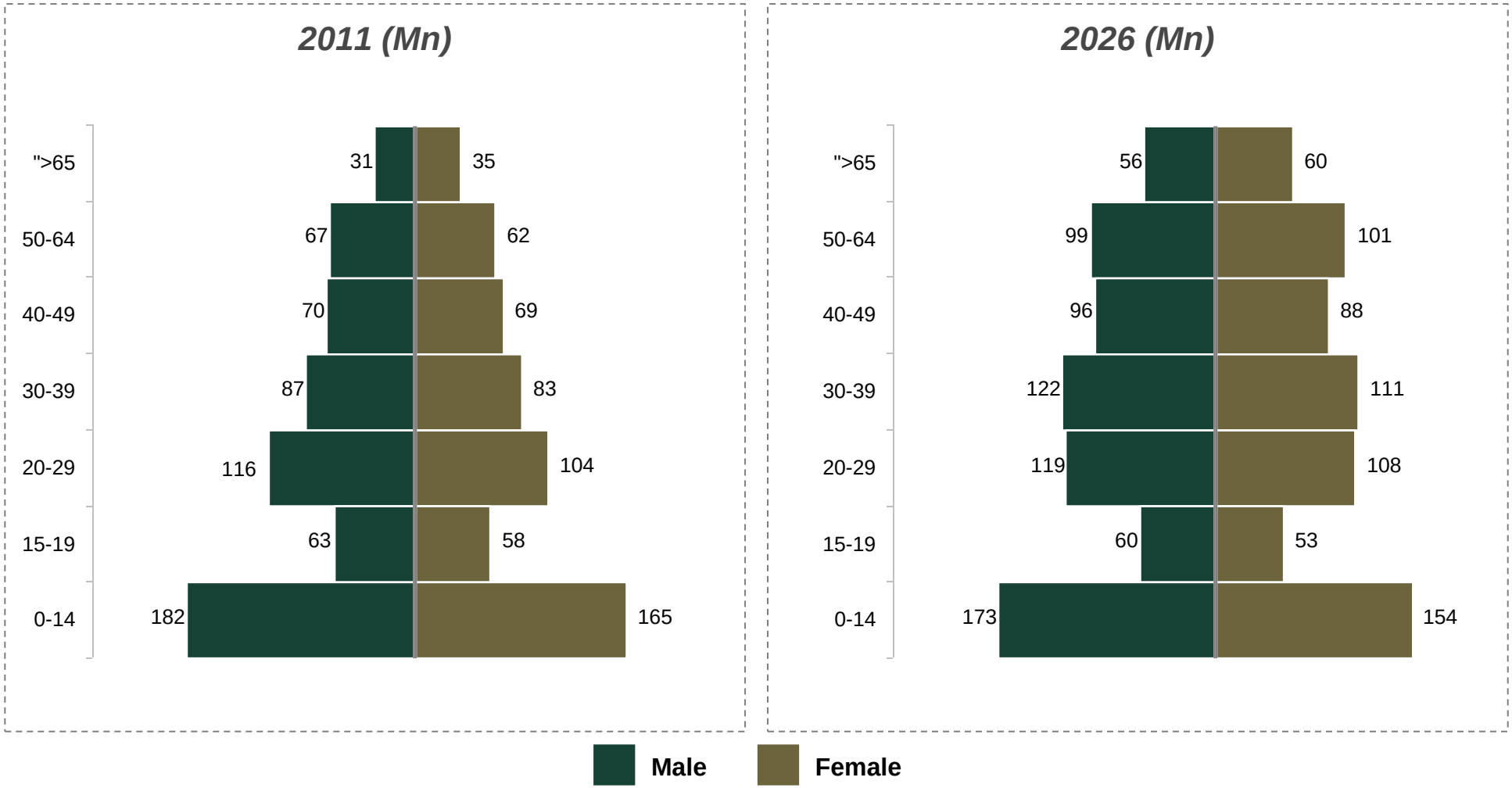
Given the demographics of India, finding gainful employment through appropriate job creation will be a key challenge for the youth in the coming decades

Population (Mn) by gender and age-group, 2011, 2026 (P)



Source: Census 2011, Avalon Consulting Research and Analysis

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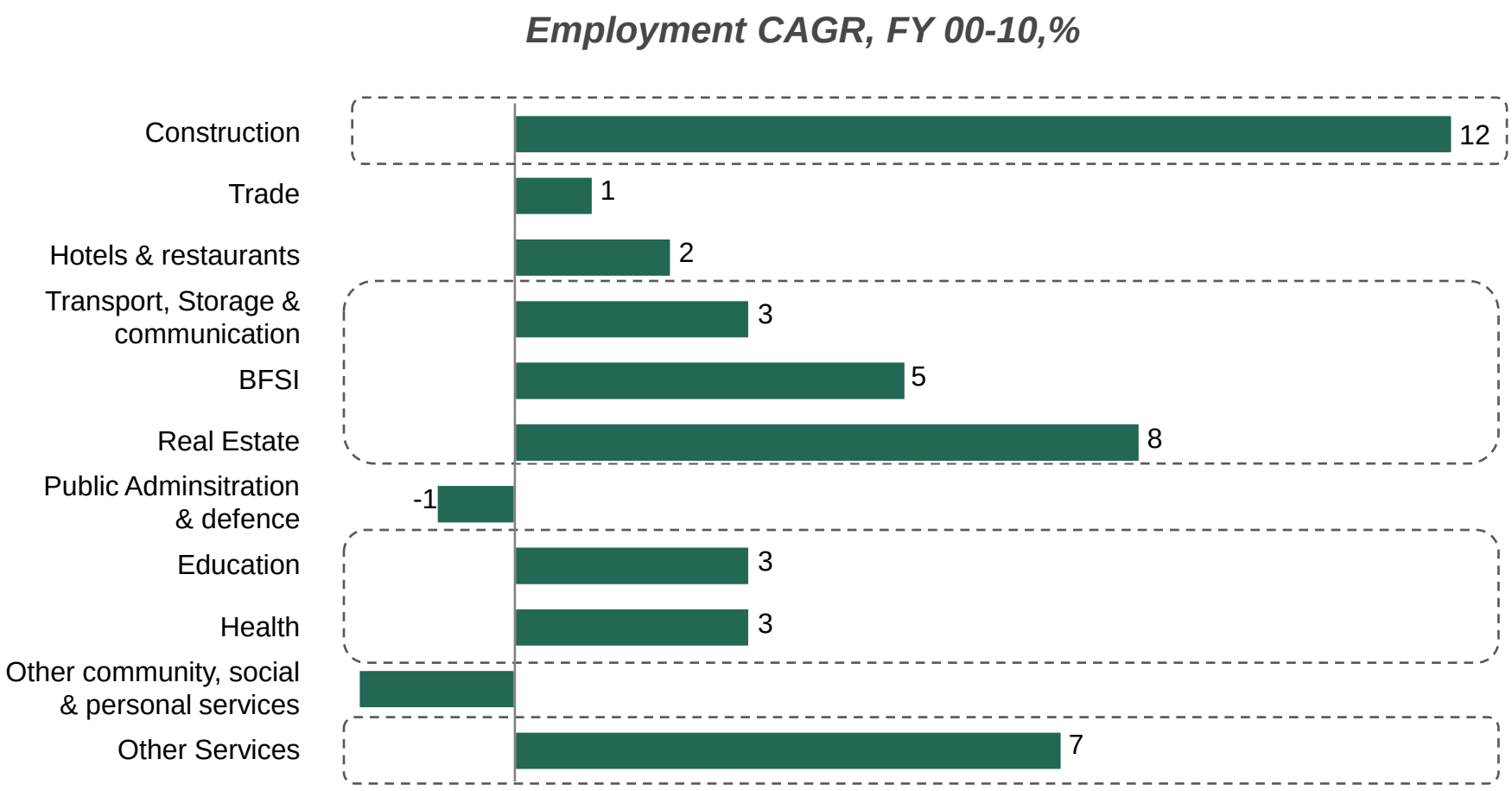
Several segments within the Services sector have played and will continue to play a significant role in job creation in the coming years



Source: RBI, NSSO, Avalon Consulting Research and Analysis

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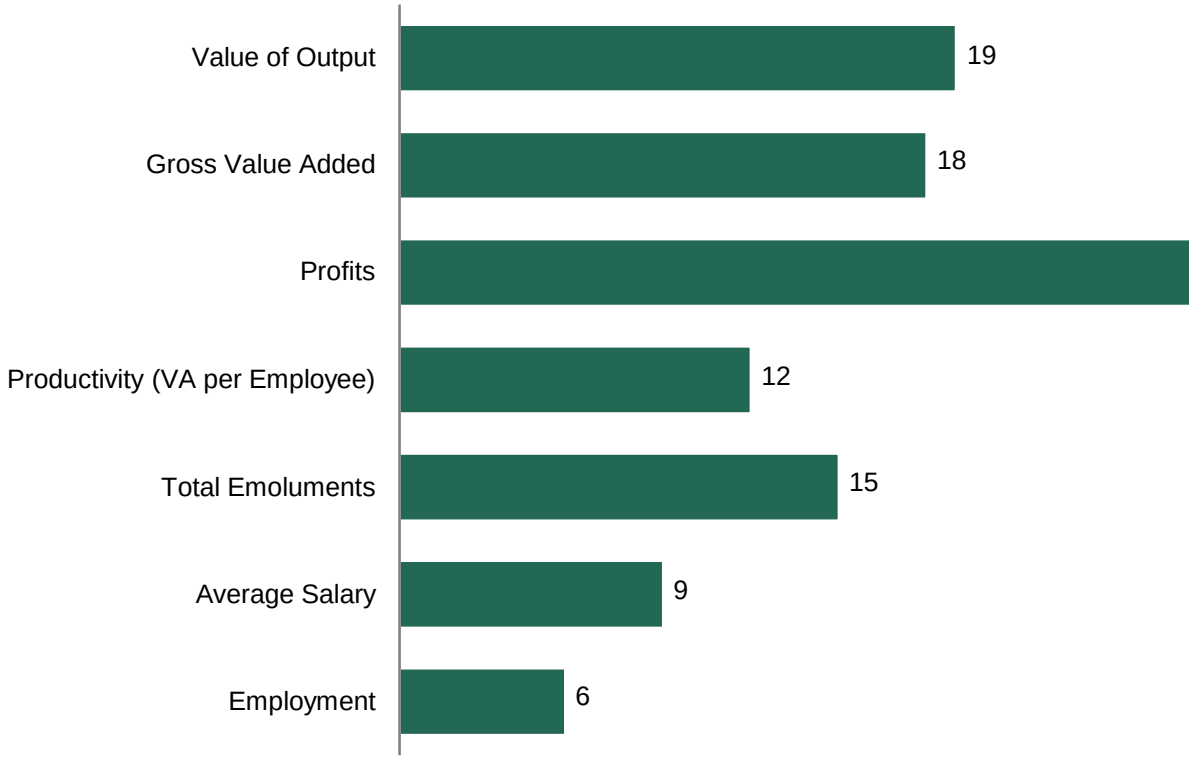
However, Industry will also need to pull its weight - high growth in industry will result in significant direct job creation – reflected in the boom years of FY03 to FY08

CAGR of Select Parameters in the Industry Sector, FY 03-10, %



3.85 million jobs created in this period in Industry

Source: NSSO, Avalon Consulting Research and Analysis

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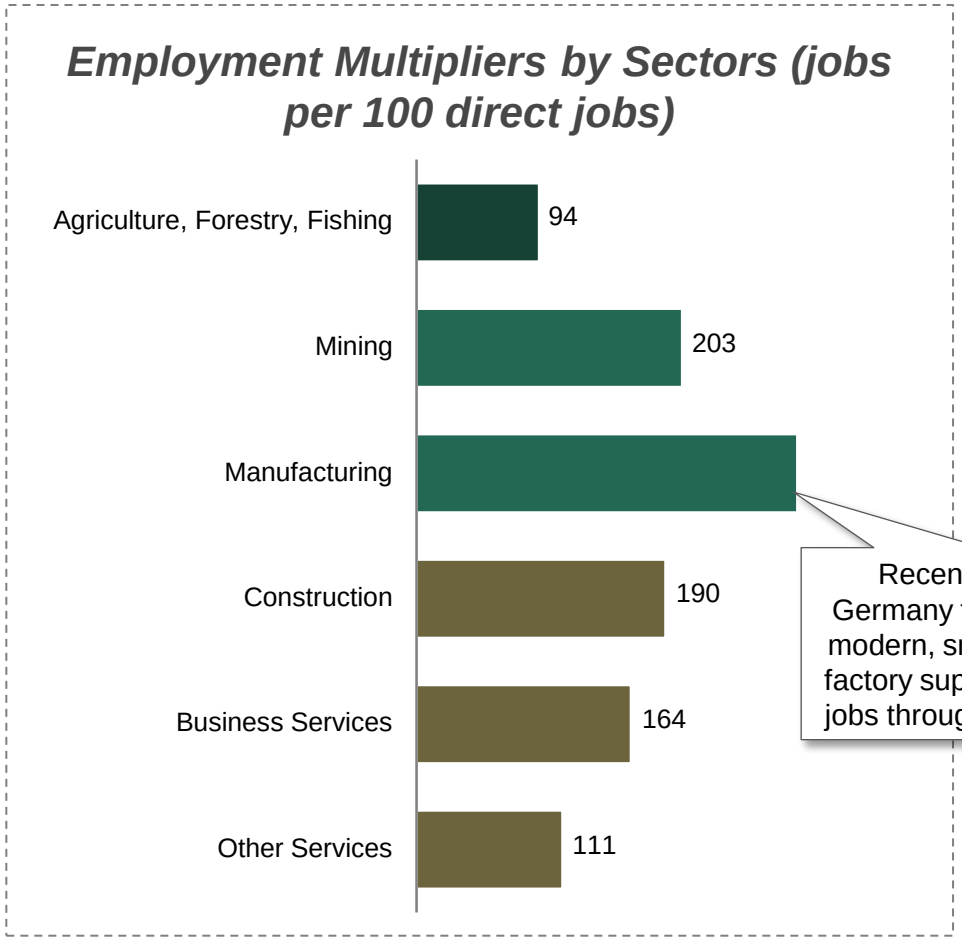
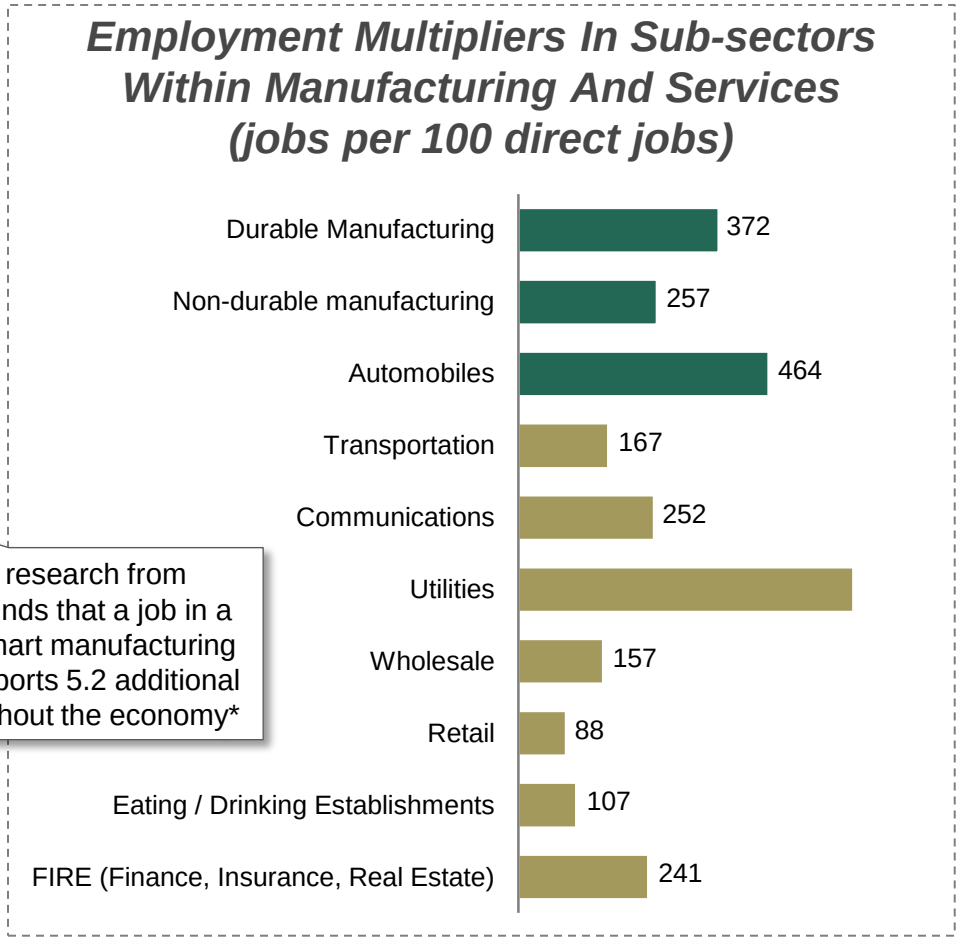
Industry also has a high employment multiplier - for each direct job, it creates ~2-3 other indirect jobs (in Manufacturing or Services). The multiplier effect is even higher for smart manufacturing





** The Case for a National Manufacturing Strategy, The Information Technology and Innovation Foundation, USA*

Source: Research by Economic Policy institute using US date (2003), Avalon Consulting Research and Analysis

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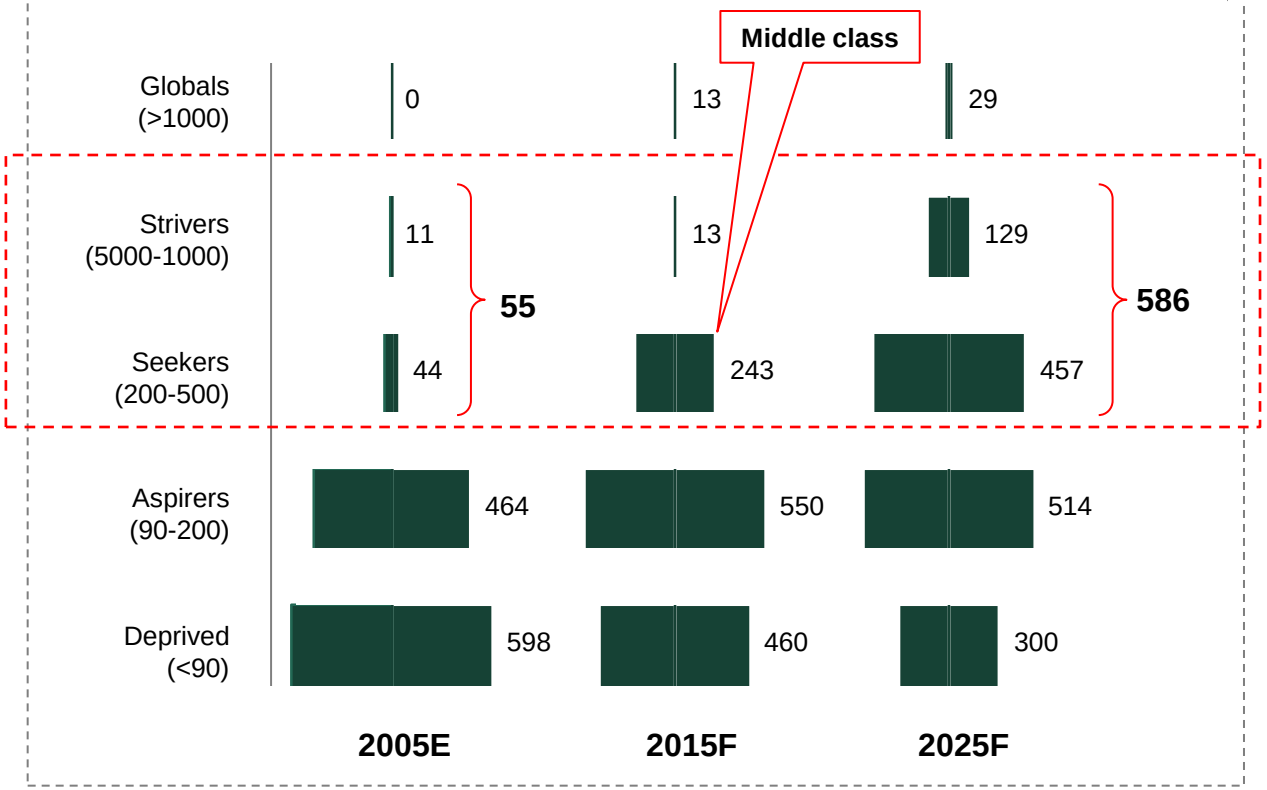
There will also be a need to focus on the quality of jobs being created given the expected changes in the aspirations of the Indian youth in the coming decades

Changing Aspirations of the Indian Youth

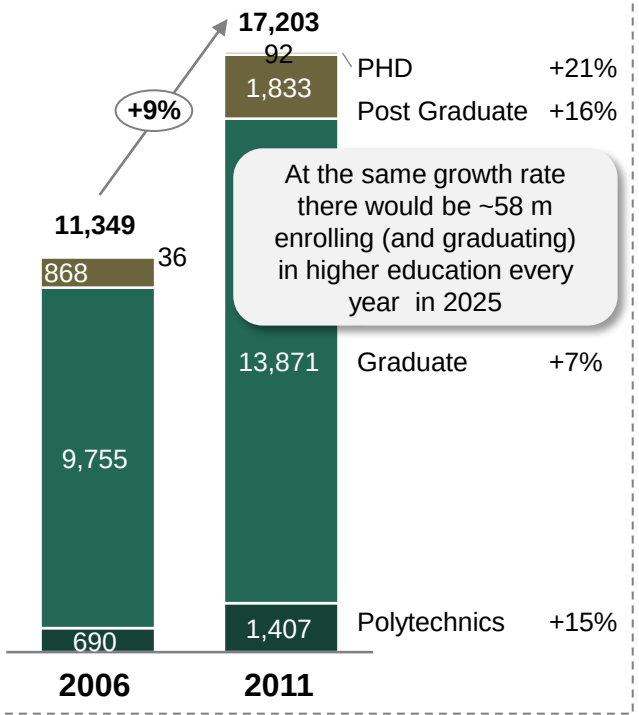
There will be a significant change in the composition of the middle class with rising incomes….

Share of Population in each Income Bracket, %, mn



….and educational levels given the opportunities in higher education

No. of Enrollment ('000)



Note : Figures are rounded to the nearest integer and may add up to 100%
Source: Mckinsey Global Institute, Ministry of HRD, Avalon Consulting Research and Analysis

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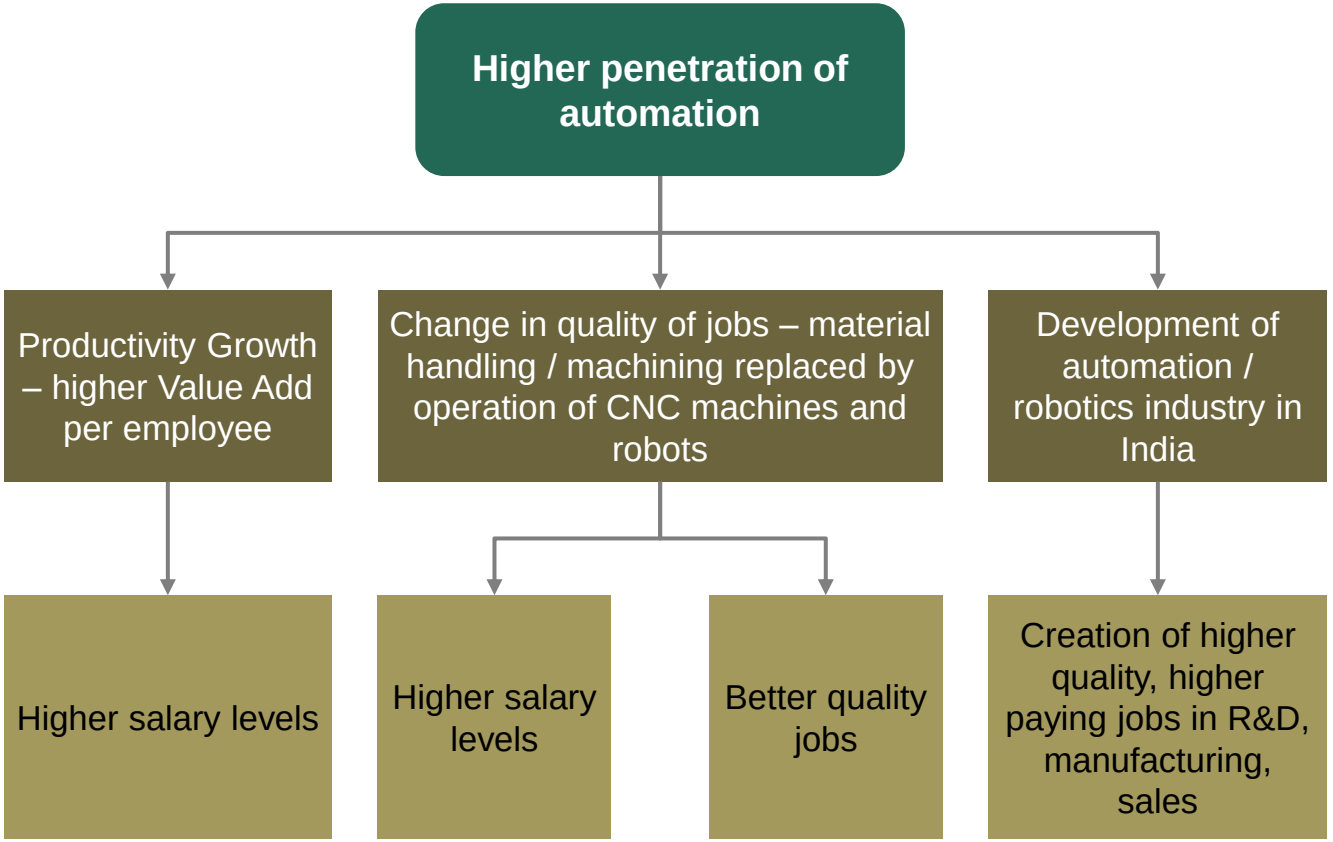
Increased adoption of automation (across Industry and Services) will meet the changing needs of job creation and consequently, the aspirations of the Indian youth in the coming decades



Source: Avalon Consulting Research and Analysis

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Automation will also drive competitiveness, improve quality of products and services and enhance safety in jobs

Factors Influencing Automation & Robotics growth

Enhanced Competitive-ness

- Less downtime / resting / changeover time
- Greater output per hour
- Higher output per worker

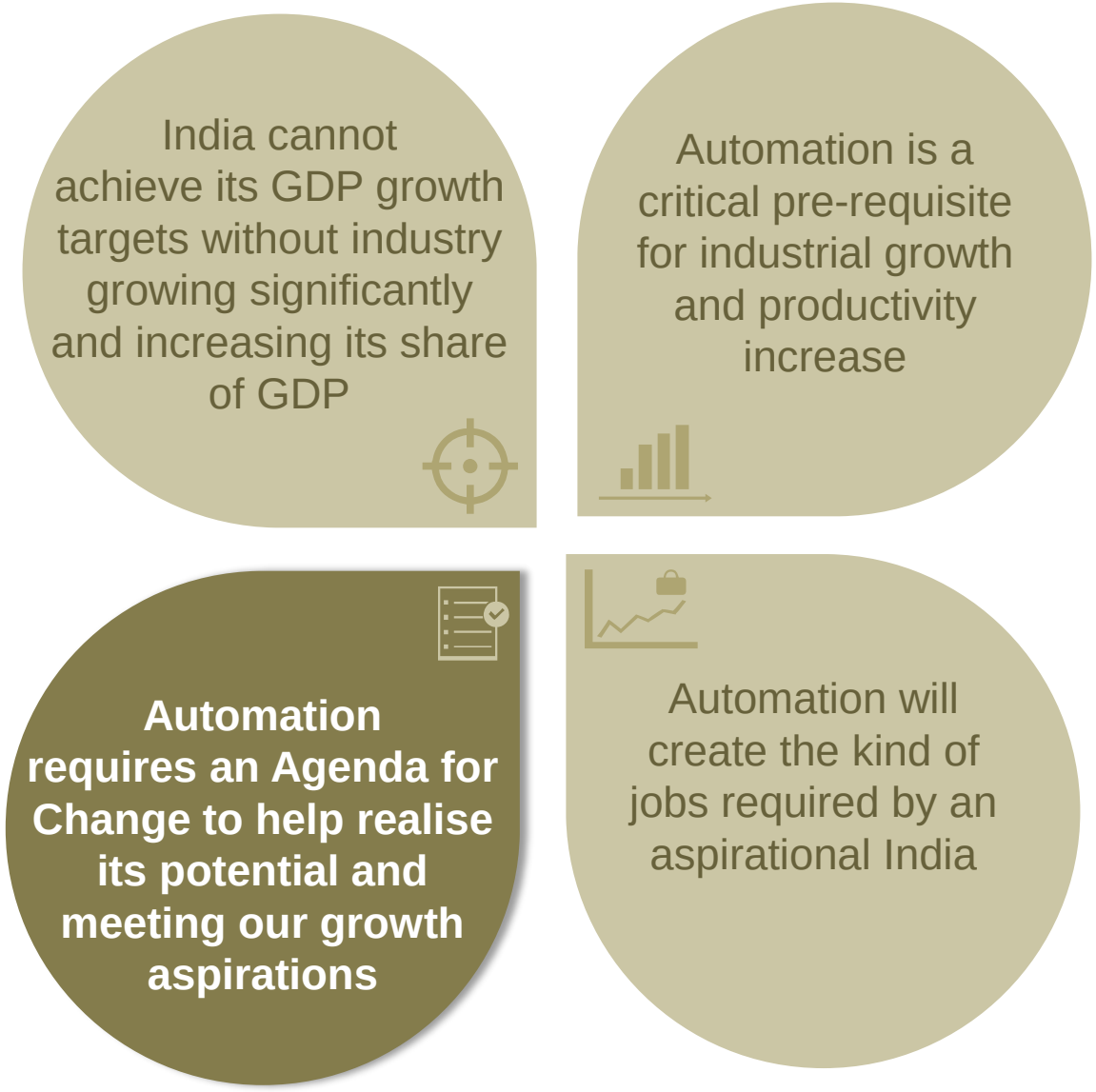
Improved Quality

- Ability to obtain higher precision
- Ability to obtain higher repeatability

Improved safety

- Ability to automate and use robots in hazardous work , e.g. furnaces, handling hazardous chemicals

Automation is thus an Imperative for improving Quality and Productivity while Sustaining Competitiveness



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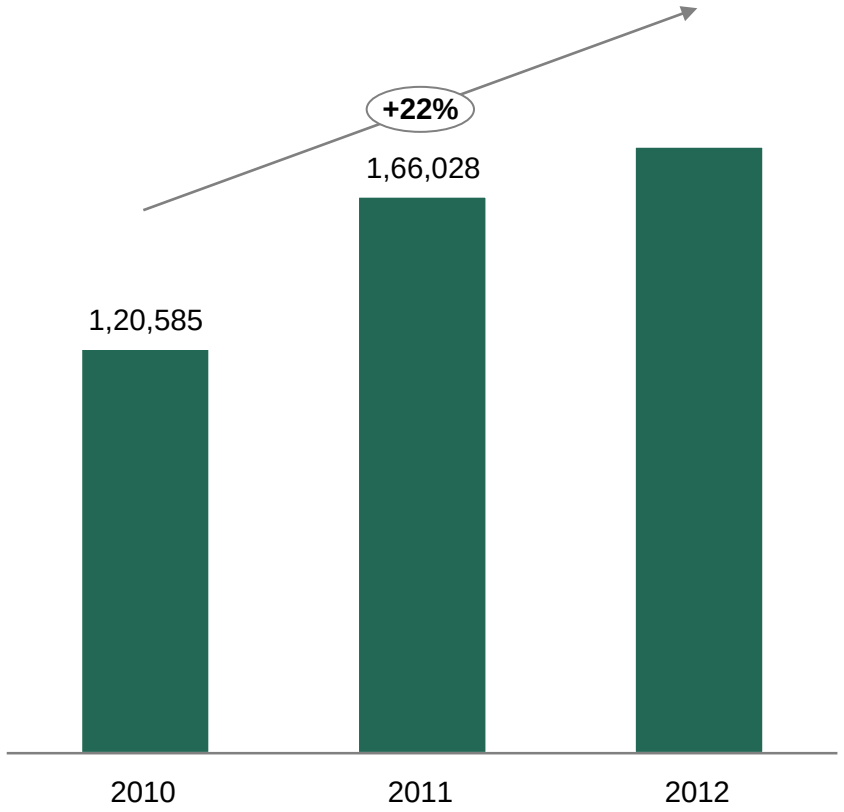
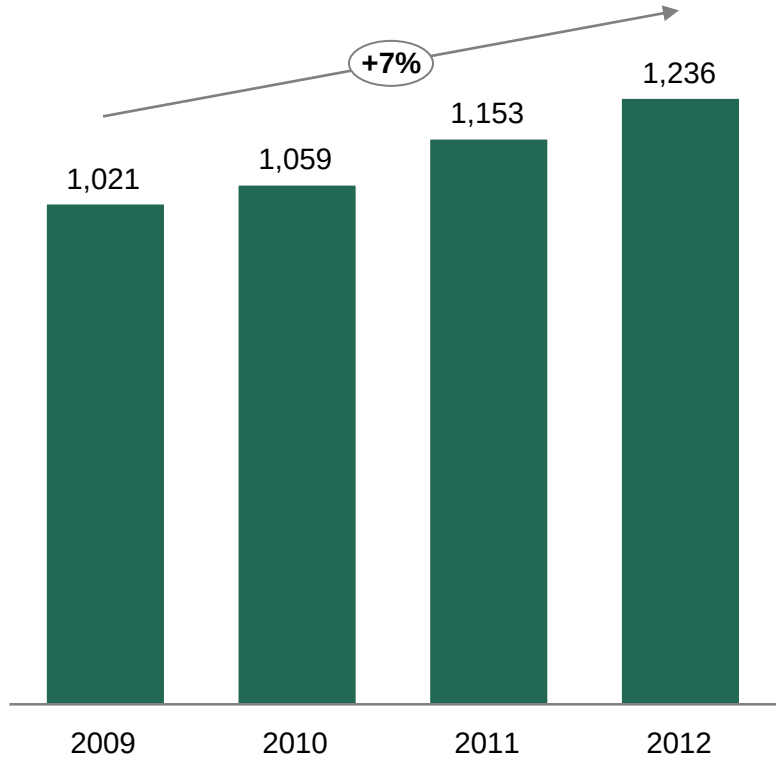
Globally, robotics is seeing an uptrend with rapid increase in volumes year on year

Robotics Trends

Annual shipments of multipurpose industrial robots, nos



Operational Stock of multipurpose industrial robots, '000



1. Numbers for 2012 are estd

Source: IFR, Avalon Consulting Research and Analysis

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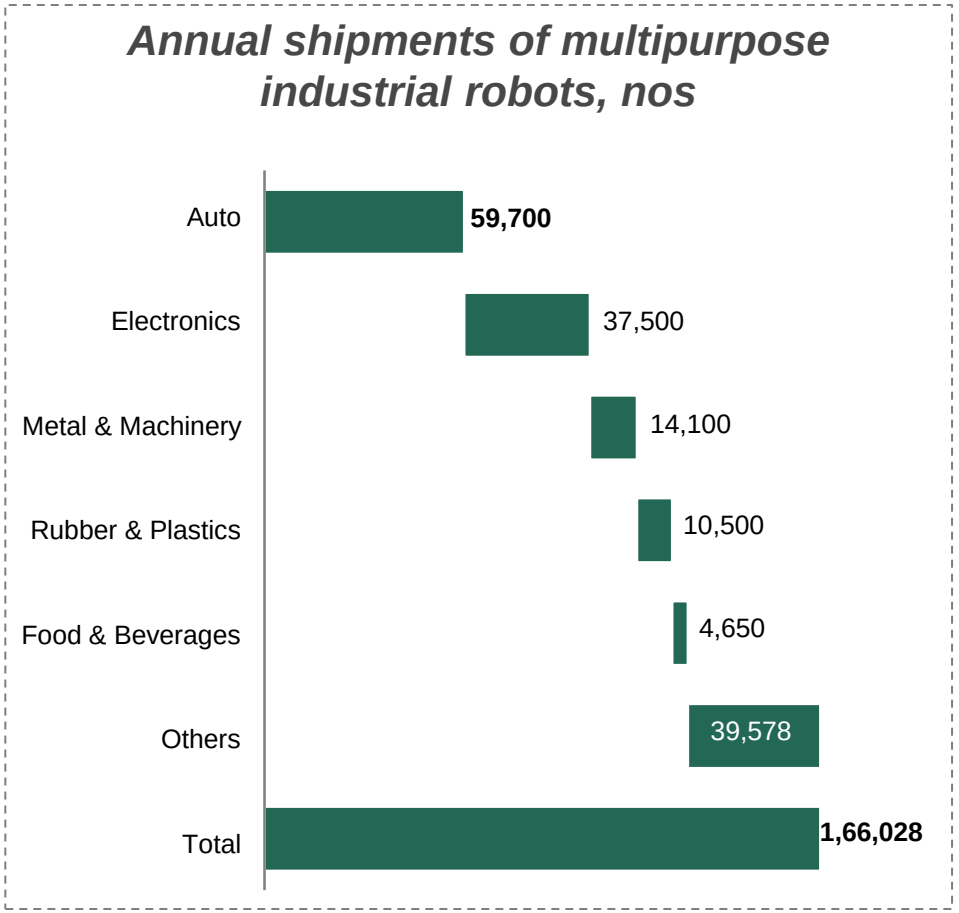
This growth is driven by certain specific sectors which are also critical for India's growth targets within industry



	Quality	Productivity	Safety	Importance to Economy	Importance to Employment
Auto / Transport	●	◕	◑	14%	6%
Electronics	●	●	◔	9%	5%
Metal & Machinery	◕	◕	◑	21%	18%
Rubber & Plastics	◔	◑	◕	9%	3%
Food & Beverages	◕	◕	◕	10%	14%

It stands to reason that in India too, such sectors would require automation

- *Importance to economy based on share of organized industry gross value added*
- *** Importance to employment based on share of total employment, ASI 2008*

Source: IFR, ASI, Avalon Consulting Research and Analysis

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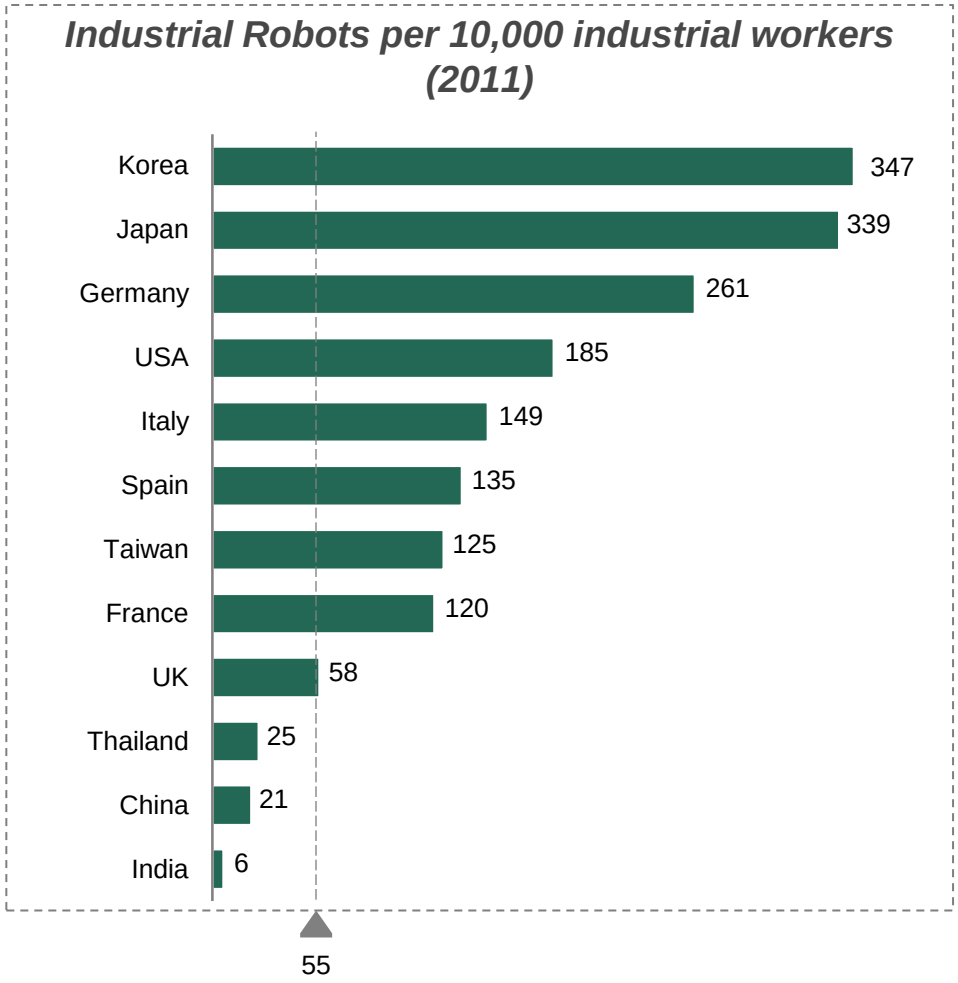
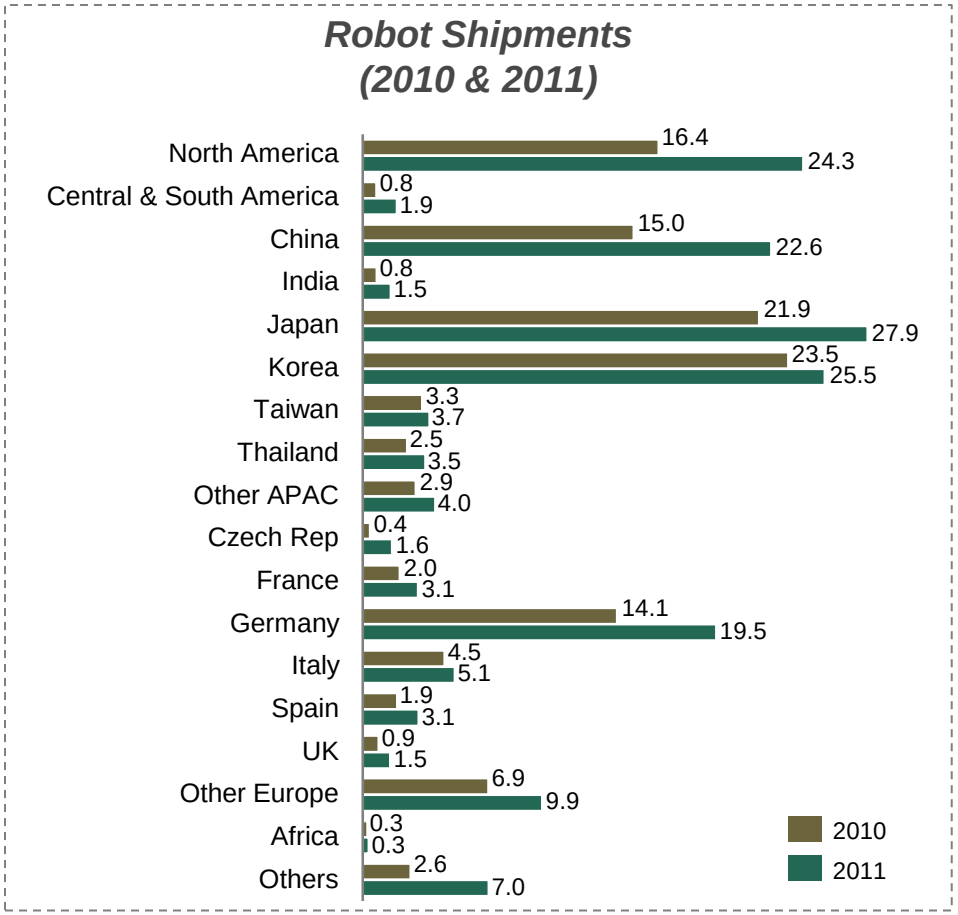
Despite a more rapid adoption of automation in the past decade, India's penetration of robots in industry lags way behind industrialized countries – and also Asian competitors





Source: Avalon Consulting Research and Analysis

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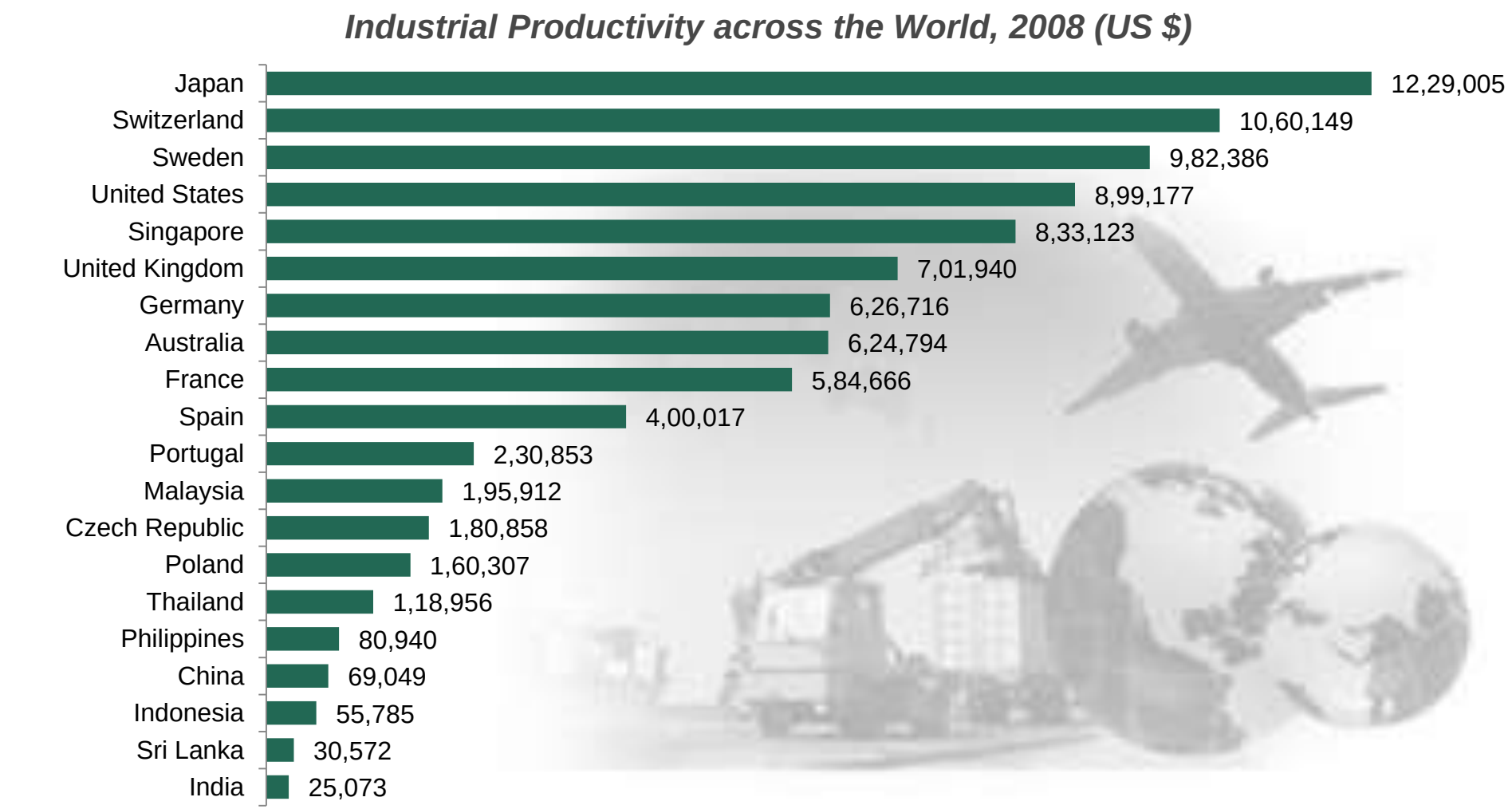
This is also reflected in productivity -- India lags developed countries and Asian peers in industrial productivity

Industrial Productivity



Source: World Bank, Avalon Consulting Research and Analysis

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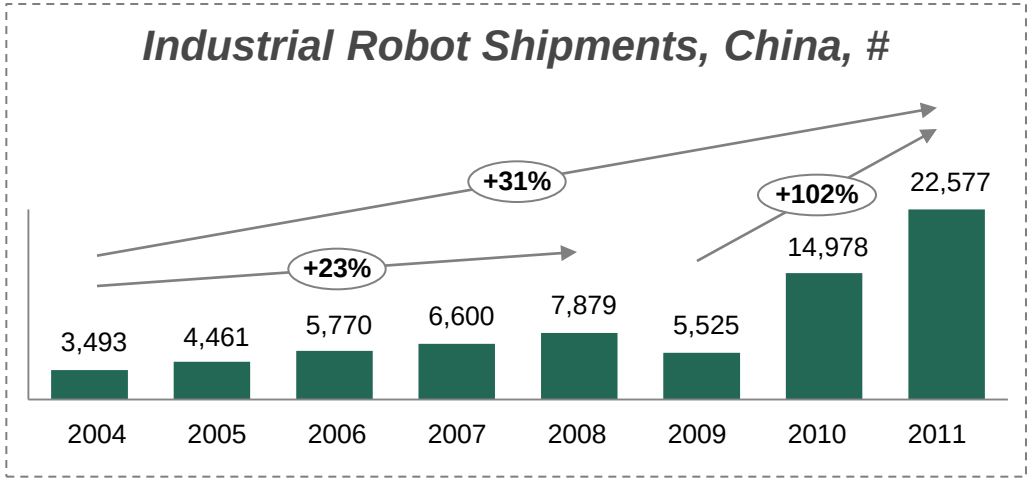
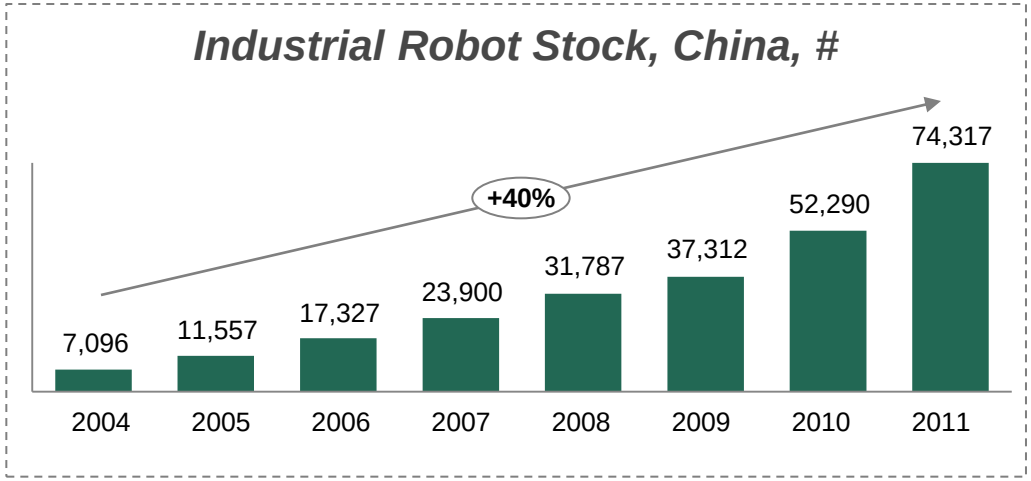
China has started the journey ~7 years back and is emerging as a global hub for automation and robotics. India needs to catch up to remain competitive





To retain competitiveness in manufacturing, beyond a certain time, automation is essential

China realized this and has been automating its factories rapidly. It is emerging as a global hub

It is seeing investments in robotics (Kuka, Kawasaki etc.) and is set to surpass Japan to become the largest market of industrial robots in the world by 2015

Source: Avalon Consulting Research and Analysis

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China has approached robotics in a structured manner at both central and regional levels, with robotics zones, indigenization plans and research grants

National Level Plans

- Industry and government sources tell ICS that over the past three years, local companies and universities have received $5Mn of funding for robot research and development, with another $7.5 Mn in 2013 to further support the local robot industry.
- The Chinese government supports the development of robots. The 12th Five-Year Plan (2011-15) outlined a plan for overall revenue in the intelligent equipment sector to surpass **1 trillion yuan ($160 Bn) by 2015**, a compound growth rate of 25 percent, said Wang Weiming, deputy director of the equipment industry department of the Ministry of Industry and Information Technology.
- The ambitious target also includes 30 percent of intelligent equipment with homegrown technologies. It further set out to localize production of robotics and relevant electrical machinery by the end of the plan, Wang said.
- Currently, there are at least six major **robotics zones** nationwide, largely centered in and around China's key economic bases such as Shanghai, Beijing, Guangzhou and Chengdu.

Regional Incentives

- The municipal government of Shanghai has listed robots as one of its major industries in the coming years, and it hopes the industry will generate as much as $3.2 Mn by 2015. In a long run by 2020, the Shanghai government will be making about half the country's industrial robots, and generate ~$12 Bn a year from it.
- So far, the city has garnered industry heavyweights such as Germany's Kuka AG, Switzerland's ABB Group, Japan's Fanuc Corp and China's top indigenous robot manufacturer, Siasun Robot and Automation Co.
- The local government is also encouraging such businesses to settle in the Shanghai Industrial Park of Robotics. The 3.09-square-kilometer zone aims to serve leading robot makers by producing state-of-the-art products and contributing to the internationalization of Chinese robotics standards.
- However, the government is yet to subsidize its own enterprises, Zhao noted Zhao Yong, chief operating officer of robot-china, an online information provider for the domestic industry. "It will probably take another five years to get those details right on track.

Source: Avalon Consulting Research and Analysis

India needs to adopt its own path as part of the Agenda for Change to ensure faster adoption of Automation to help realize its potential and meeting our growth aspirations

Growing and more educated population demanding quality jobs

- **Creation of an automation and robotics industry becomes essential**

Improvements required in productivity, quality and safety

- **Need for wider adoption of automation within industry**

India is lagging behind Asian competitors in automation

- **Fast track implementation of industrial automation**

India needs to define its own path to change which could include possible options like :

- Attracting investments in automation and robotics
  - Robot Parks
  - Incentives
- Incentives to develop indigenous IP in automation / robotics
- Nurturing enterprises capable in automation and robotics domain
- Improving institute-industry collaboration
- Encouraging fast track upgradation of manufacturing technology

Source: IFR, Avalon Consulting Research and Analysis

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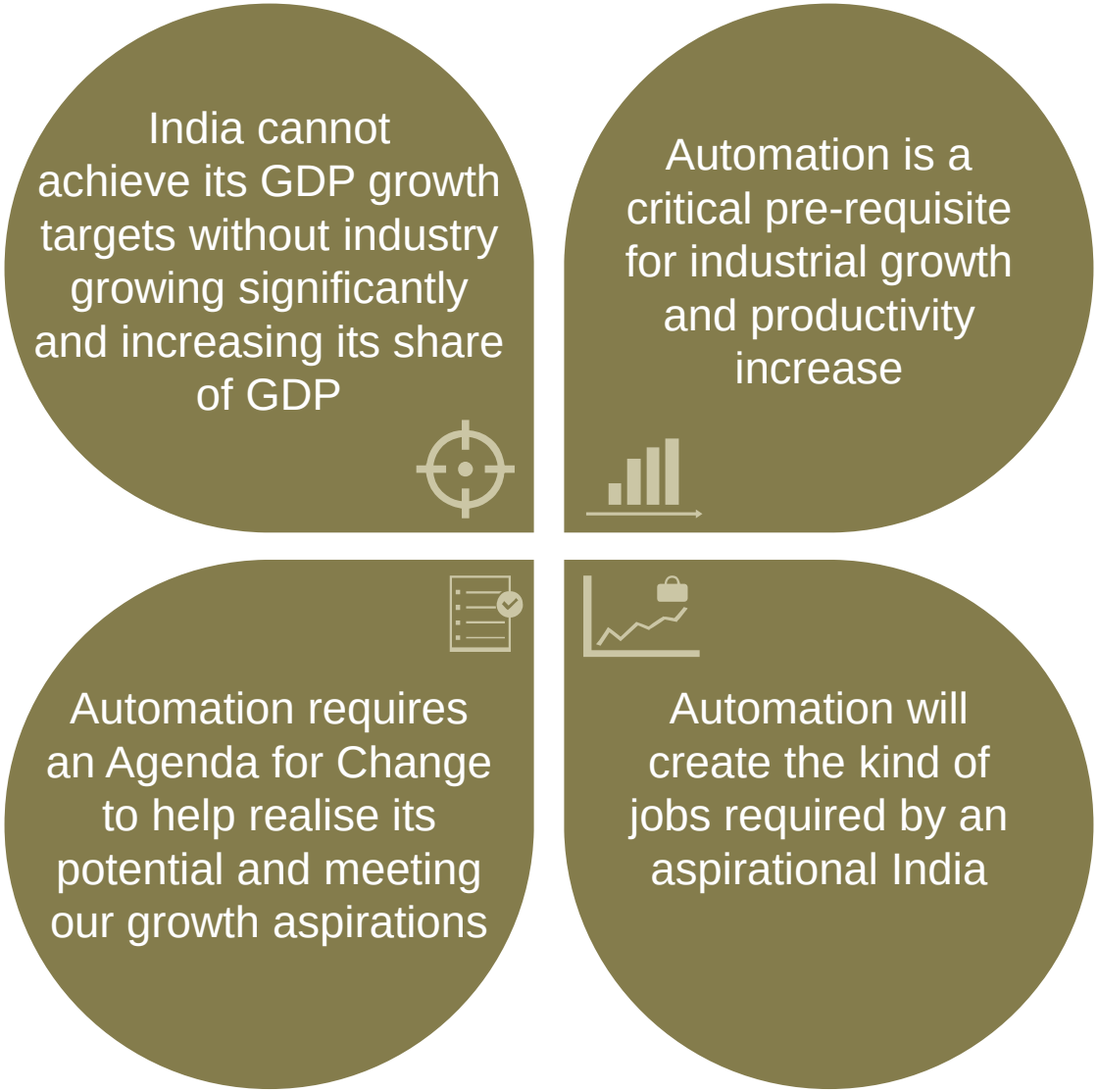

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Focus Sectors

	Agri Business		Auto
Chemicals		Consumer Goods & Services	
	Education		Infrastructure & Capital Goods
Metals & Mining		Healthcare & Pharma	

Service Capabilities

- **Strategy**
  - Corporate Strategy
  - Business Unit Strategy
  - Functional Strategy
- **Transformation**
  - Strategy Articulation
  - Organisation Design and Alignment
  - Process Re-engineering
  - Change & Performance Management
  - Post Merger Integration
- **Transactions**
  - Deal Origination
  - M&A Support
  - Value Enhancement
  - Exit Strategy

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