


# Future of jobs in India

A 2022 perspective

**NASSCOM**<sup>®</sup>







**“ If the rate of  
change on the  
outside exceeds  
the rate of change  
on the inside,  
the end is near.”**

**- Jack Welch\***

*Former Chairman and CEO of  
General Electric (1981-2001)*

\*Annual Report - 2000  
General Electric



# Foreword



Ever since the World Economic Forum came out with the report 'Future of Jobs' in 2016, highlighting the global trends on technological changes and their impact on the patterns of production, consumption and employment in the developed world, there have been speculative numbers floating around regarding the loss of jobs in India. The two key factors that challenge the nation today are, the 17 million new entrants into the workforce year on year against the 5.5 million jobs created; and the speed and scale at which the disruptions are occurring and will continue at the same or faster pace, impacting the way we work and live. Today the statement 'change is the only constant' holds true as never as change is accelerating.

The impact of technology on jobs in India has been evident for some time in the financial services and IT area and did not disrupt the way we worked or lived. The transition from type writers to computers and land lines to mobile phones has been spread over two decades.

However, as a policy thought leader, FICCI had studied the global megatrends that would impact India and had carried out a study in 2010 under the editorial supervision of futurist economist Prof Jeremy Rifkin and highlighted the impact of the third industrial revolution resulting in emergence of new business models, intelligent technology and future of work and collaborative education.

To understand the preparedness of BRICS nation in skill development to deal with Industry 4.0 needs, in 2016, FICCI and Roland Berger along with member BRICS countries carried out a study on "Skill Development for Industry 4.0". The report highlighted the "job polarization" with decline in the mid-level, repetitive and rule based jobs and increase in demand for creative, design oriented high order skills.

Since there is no India based empirical study which highlights the impact of advanced technologies on key manufacturing and services sectors that create the bulk of jobs and contributes majorly towards GDP, FICCI and NASSCOM initiated the study on 'Future of Jobs' with EY. The report examines the global megatrends, its impact on Indian economy and recommends the way forward. The report also covers an in-depth analysis of impact of technology, demography and globalization in five crucial sectors - automotive, textiles and apparel, BFSI, IT-BPM and retail. The report also assesses the changing nature of jobs in these sectors, skill requirements and policy recommendations.

India will have to prepare itself to fully realize the economic opportunities of the technological advancements and transform to create a nimble demand led education system integrated with skill development. A collaborative effort from Government, industry and academia can certainly turn the challenge of Industry 4.0 into an opportunity, but the time for action is 'NOW'.



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The fourth industrial revolution that we are currently witnessing is being defined as the new age of automation, driven by unprecedented technological advances. The pace of automation and its scope continues to grow exponentially. As entire families of work activities get increasingly automated, the implications on the global economy are manifold - changing nature of work, job roles being re-defined, a certain class of job roles becoming redundant leading to growth in new occupations and new roles. These changes are ushering in a new age of learning - continuous, agile and on-the-go, both urgent and imperative for the current workforce and the emerging pipeline of talent. It also raises a whole host of questions - What jobs are getting automated? What are the implications on the organization and the workforce? What new skills are needed in the future? How should individuals shape themselves for this future to remain relevant?

The information technology is one of the industries that is most impacted by digital and automation technologies. As part of a joint exercise to study the potential implications of these advancements, NASSCOM, FICCI and EY partnered to analyze the profile of jobs under threat, identify new emerging job roles, existing roles that will undergo change and those that won't. We have attempted to present a 2022 picture - a time when no one can afford to "rest on one's laurels" but needs a continuous learning culture. Another important fact being seen is the fact that non-tech firms are increasingly emerging as the source of information technology roles; for e.g., automotive, aerospace, BFSI, telecom, retail, healthcare, etc.

We would like to express our gratitude to the IT-BPM firms for taking part in this important initiative and openly sharing their inputs. The research was led by EY and NASSCOM facilitated the interviews. This report is part of NASSCOM's ongoing endeavor to identify emerging forces impacting the global economy and the technology industry and to put in place a roadmap for a future that works.

We look forward to your feedback on this report; please write in to [research@nasscom.in](mailto:research@nasscom.in).



**R. Chandrashekhar**  
President, NASSCOM

# Foreword



This "Future of Jobs" report provides a vision of change for the job market in India over the next few years. It offers corporations, students, policy makers and educationists a consolidated view of the impact that various primary forces such as globalization, demographics, and Industry 4.0, are expected to have on the key sectors of the economy. It also provides an overview of the projected job creation rates for the next five years, new jobs that will emerge and the skills and expertise that will be required for success in the emerging environment.

This report, the first such comprehensive research study on the future of jobs in India, examines five sectors in detail (IT/ITES, retail, financial services, textile & apparel and auto). It analyzes the impact of three primary forces - globalization, demographic changes and the adoption of exponential technologies by companies in India. It takes an informed view of the future based on hypotheses developed through secondary research and their validation by experts, industry leaders and academicians through primary interactions.

Despite the influence of globalization and the rapid adoption of exponential technologies, the majority of respondents still believe that demographic changes will have the most impact on the future of jobs. The combined effect of these primary forces on IT/ITES, retail and financial services will be disruptive. Business models will undergo a significant change and hence it will have a significant impact on the skills and capabilities required for success in these sectors. However, the effect on sectors such as apparel, textile and leather in the short term is expected to be relatively marginal.

India's job landscape is in transition with a slowdown in employment in core sectors and the concurrent emergence of new engines of job creation. Increased infrastructure and construction sector activity driven by Government spending; new self-employment models; and emerging technology aggregator models etc. are transforming the job landscape in the country. Over the next few years, many other factors such as the levels of FDI flow, impact of exponential technologies on offshoring, increase/decrease in overseas job opportunities for the Indian labor force, speed of adoption of emerging technologies, demands resulting from environmental sustainability, rising middle class and a high proportion of young population, would be some of the other key determinants of future of jobs in 2022.

The Government is already taking many proactive steps such as Skill India, investing in manpower intensive infrastructure and construction sectors, catalyzing micro entrepreneurship models and encouraging start-ups. It may need to focus more on sectors with higher employment elasticity to catalyze job creation, effect reforms in education and skills to create a large Industry 4.0 compliant workforce, and create enabling policies to drive rapid industry adoption of Industry 4.0 technologies. The industry needs to focus on rapidly restructuring their business models in light of these technologies to ensure competitiveness and also to drive large scale reskilling of the existing workforce.

While some may call it crystal gazing on what the future world may look like, but the views in this report are based on opinions of some of the leading industry leaders, industry associations and academicians in India. We feel this report will be useful for policy makers, corporations, as well as education and skilling institutes. This report should also be relevant for parents and students to help them better appreciate opportunities as well as challenges in the near future.

We hope you find the report useful and we look forward to your feedback, please write in to [anurag.malik@in.ey.com](mailto:anurag.malik@in.ey.com) and [arunkumar.pillai@in.ey.com](mailto:arunkumar.pillai@in.ey.com)



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# Executive summary



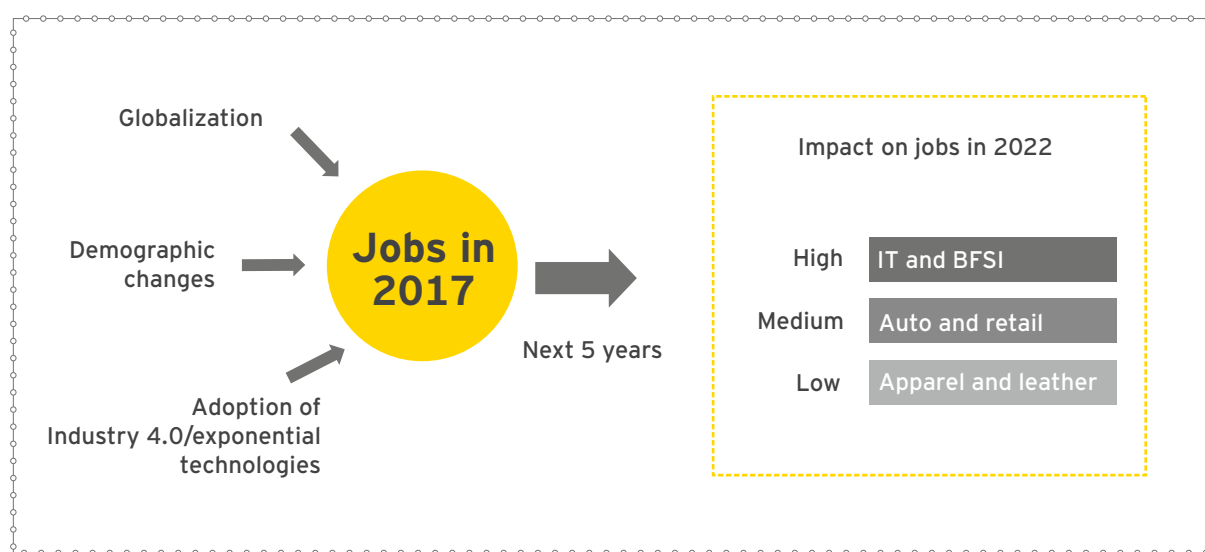




The overall job landscape in the country is evolving rapidly. Current job surveys that focus on employment in the traditional sectors no longer provide an accurate representation of job creation. Growth of e-commerce and technology-based sectors is leading to the creation of new job ecosystems, which are becoming a large source of employment. Informal employment in sectors such as infrastructure and retail is extremely large and continues to rise. Given the Government's large investments in highways, renewable energy, urban transport, shipping, affordable housing, smart cities, Swachh Bharat, rural roads program, national waterways, airports and industrial corridors, etc., infrastructure has become one of the largest creators of jobs in the country. The overall push for entrepreneurship through schemes such as Stand-Up India, Start-Up India is also beginning to positively impact jobs and opportunities for livelihood. Any discussion on the future of jobs in the country should be in the midst of this changing job landscape.

The future of jobs in 2022 in India will be determined by the country's response to the inevitable impact created by the interplay of three primary forces - globalization, demographic changes and the adoption of Industry 4.0 exponential technologies by Indian industries. The impact of these three primary forces is expected to be disruptive on sectors such as IT-BPM and BFSI and relatively lower on core manufacturing sectors such as apparel and leather.

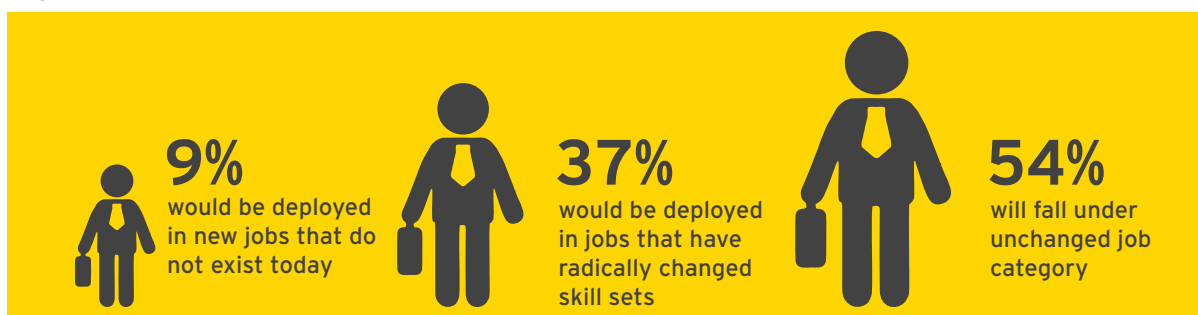
**Figure 1: Impact of primary forces on jobs - 2022**



Source: EY future of jobs respondent analysis

These primary forces will have a significant impact on jobs through a combination of new jobs that will be created, a section of jobs that will require significantly new skill sets, and a set of jobs that may cease to exist.

**Figure 2: Workforce mix - 2022**



Source: EY future of jobs respondent analysis

It is in the context of globalization, disruptions caused by exponential technologies, and the opportunities thrown up by a large demographic dividend, that this report aims to forecast the future of jobs in India.

We are in the midst of a reversal of globalization, which was earlier, one of the largest enablers of job creation in emerging markets. This is being de-accelerated by the increased adoption of exponential technologies by developed markets, and protectionist measures that are affecting the flow of goods, services, labor, and capital.





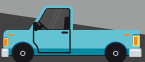










The adoption of exponential technologies is disrupting industries by creating new markets, as well as weakening or transforming existing product market categories and industries through product or business innovations. The rapid embracing of these exponential technologies by Indian companies has the potential to transform highly unorganized sectors, such as transportation, maintenance, food catering, and software development services, into organized ones. Its impact will be dual - the share of the organized sector will increase in the economy, and new jobs will be created. With their perceived inefficiencies, sectors such as education, healthcare and the farm & allied sectors also present enormous opportunities for deployment of exponential technologies.

In terms of demographics, the two faces of demand, size and sophistication, will drive the future of jobs in India. As long as a large section of the population remains below the poverty line, wages will be depressed and an increasing number of people will have stagnant per capita income. Both these impact consumption power. Millennials who form close to 30% of the population will continue to drive future sophistication of demand.

However, despite globalization and adoption of exponential technologies, majority of respondents still believe that demographic changes will have the most impact on the future of jobs in India by 2022.

The interplay of these three forces is leading to new business models in some sectors while redefining others, as a result driving creation of new jobs in the economy. Government infused investments in infrastructure creation, agriculture, health, education, tourism and hospitality are giving new impetus to job creation in these sectors. Start-up/E-commerce driven new business models are presenting themselves as the new driver of gainful employment generation. Start-up friendly policies and schemes like MUDRA, "Start-up India, Stand-up India" are helping in reshaping Indian economy by organizing some of the highly reorganized sectors as well as creating significant employment especially for low skilled workforce. In addition to these new avenues of job creation, traditional sectors such as textiles, apparel, leather, retail are also increasing their employment potential either through technology driven efficiency improvement, attracting FDI or strengthening position in export markets.

**Figure 3: A snapshot of the future of job in the organized sector - 2022**

	Workforce that			New job roles	
	would be deployed in new jobs that do not exist today (projected for 2022)	would be deployed in jobs that have radically changed skill sets (projected for 2022)	will face an existential threat to their jobs (for 2017)		
IT/BPM	<b>10%-20%</b> 	<b>60%-65%</b> 	<b>20%-35%</b> 	<ul style="list-style-type: none"> <li>VFX artist</li> <li>Computer vision engineer</li> <li>Wireless network specialist</li> <li>Embedded system programmer</li> <li>Data scientist</li> <li>Data architect</li> <li>AI research scientist</li> <li>RPA developer</li> <li>Language processing specialist</li> <li>Deployment engineer</li> <li>3D modeling engineer</li> <li>3D designer</li> <li>Cloud architect</li> <li>Migration engineer</li> <li>Android/iOS app developer</li> <li>Digital marketing</li> </ul>	
Automotive	<b>5%-10%</b> 	<b>50%-55%</b> 	<b>10%-15%</b> 	<ul style="list-style-type: none"> <li>Automobile analytics engineer</li> <li>3D printing technician</li> <li>Machine learning based vehicle cybersecurity expert</li> <li>Sustainability integration expert</li> </ul>	
Textiles and apparel	<b>5%-10%</b> 	<b>35%-40%</b> 	<b>15%-20%</b> 	<ul style="list-style-type: none"> <li>Apparel data analyst / scientist</li> <li>IT process engineer</li> <li>E-textiles specialist</li> <li>Environment specialist</li> <li>PLC maintenance specialist</li> </ul>	
BFSI	<b>15%-20%</b> 	<b>55%-60%</b> 	<b>20%-25%</b> 	<ul style="list-style-type: none"> <li>Cyber security specialist</li> <li>Credit analyst</li> <li>Robot programmer</li> <li>Blockchain architect</li> <li>Process modeler expert</li> </ul>	
Retail	<b>5%-10%</b> 	<b>20%-25%</b> 	<b>15%-20%</b> 	<ul style="list-style-type: none"> <li>Customer experience leader</li> <li>Digital imaging leader</li> <li>IT process modeler</li> <li>Digital marketing specialist</li> <li>Retail data analyst</li> </ul>	

Source: EY future of jobs respondent analysis



# Summary of recommendations for the Government

## Policy reform

- ▶ Support the competitiveness enhancing initiatives of corporates in the wake of exponential technologies
- ▶ Support labor-intensive industries to drive job creation
- ▶ Use the attractive size of the Indian consumer market to gain access to latest technologies through insistence of technology transfer during FDI deals in key sectors

## Skilling and reskilling initiatives

- ▶ Use the time window of the next 2-3 years to effect large scale reforms in the general, technical and vocational education system in mission mode
- ▶ Collaborate with and incentivize industry for skilling in exponential technologies
- ▶ Expand and upgrade the technology tool rooms across the country to enable the MSME sector to adopt exponential technologies
- ▶ Create a fund to promote joint new technology or business model proposals from industry and academia
- ▶ Perform economy and sector wide skills assessment for exponential technologies
- ▶ Formulate life-long learning strategies and drive behavioral change amongst citizens toward life-long learning

## Embracing technology and start-ups

- ▶ Establish centers of excellence in emerging exponential technologies
- ▶ Encourage start-ups that help to transform unorganized sectors to organized ones using technology
- ▶ Create a fund to support awareness creation and adoption of exponential technologies by the MSME sector
- ▶ Set-up career counseling centers that enable youth to be aware of the job market they would be stepping into

## Focus on priority employment-creating sectors

- ▶ Drive job creation in the agriculture sector through doubling farmer income schemes
- ▶ Drive job creation through Government investments in infrastructure
- ▶ Transform the public healthcare, education, tourism and hospitality and other development sectors through use of technology-assisted outreach workforce

# Summary of recommendations for the industry

## Formulate vision for Industry 4.0

- Create a "vision for exponential technologies" for your industry or company

## Embracing online economy

- Use the online economy approach to leverage the competencies of the laid off workforce
- Incorporate online economy resources as part of HR department manpower planning strategies

## Skilling and reskilling initiatives

- Create collaborative learning ecosystems for each industry
- Develop workforce re-training programs across organization levels

## Partnering with Government

- Work in close partnership with Government to ensure success of its efforts to take advantage of exponential technologies for Indian economy and society

# Summary of recommendations for academia

- Focus on judgment-driven skills
- Introduce tailored courses with flexible completion timings to enhance students' inclination towards learning

# Summary of recommendations for individuals

- Take responsibility for life-long learning
- Embrace the online economy



# 1

## Changing job landscape, EY framework and study methodology





# The changing job landscape in the country

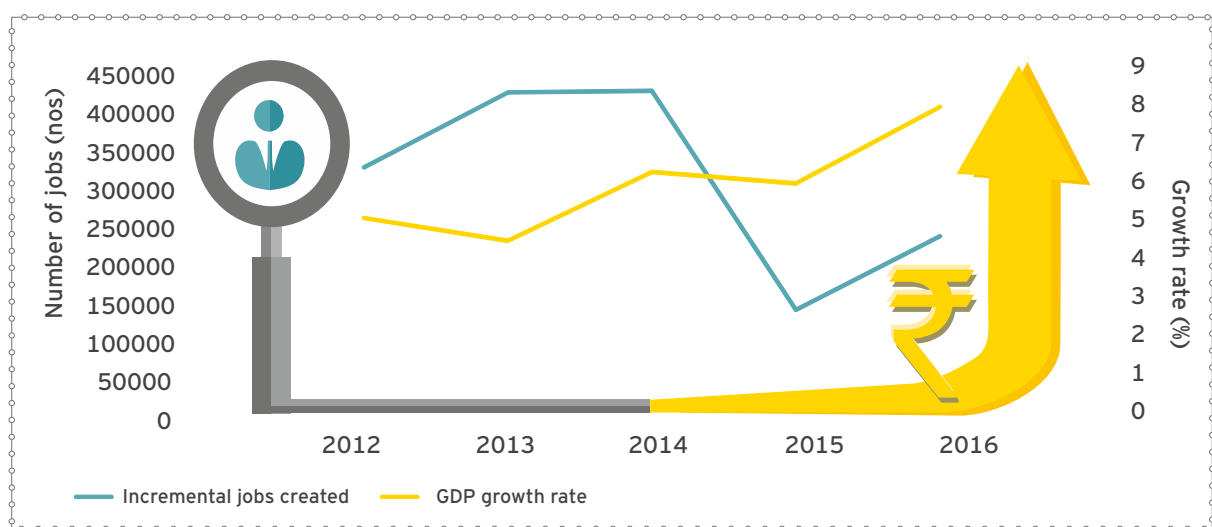
India's job landscape is in transition with a slowdown in employment in core sectors and the concurrent emergence of new engines of job creation

Over the last five years, with the Indian economy recording an average 6% GDP growth, per capita incomes have been rising<sup>1</sup> and poverty levels<sup>2</sup> dropping. These positive developments in the context of the slowdown in employment in core organized sectors, can be best explained by the three trends driving transition in the job landscape:

- ▶ Decoupling of growth and incremental job creation in core sectors.
- ▶ Increasing absorption of excess labor from farms into sectors other than organized ones (in contractual employment) and into self-employment/micro entrepreneurship opportunities.
- ▶ Emergence of new employment opportunities enabled by Internet and exponential technologies.

The decoupling of GDP growth and incremental jobs created in nine key sectors<sup>3</sup> is shown in the figure below.

**Figure 4: GDP growth rate and incremental jobs created in nine key sectors**



Sources: World Bank; Labour Bureau, Govt. of India

This decoupling is due to the fact that the employment elasticity to output has been declining across core sectors. Companies are squeezing out inefficiencies in their supply chains through redesign of business processes and their enablement by optimization technologies. During 1993-2012, for the aggregate employment estimates for India, the elasticity of labor to output was around 0.2<sup>4</sup> (point elasticity). This meant that for every 10% change in real GDP there was a 2.0% change in employment. This marked a significant decline from the 1980s (point elasticity 0.41<sup>4</sup>). The employment elasticity for some of the key sectors are shown in the table below:

**Table 1: Employment elasticity for various sectors (2012)**

S.no.	Sectors/sub - sectors	Employment elasticity (%)
1.	Overall manufacturing	0.29 to 0.33
	▸ Apparel	0.79
	▸ Leather and leather products	0.64
	▸ Motor vehicles and trailers	0.58
2.	Mining and quarrying	0.52
3.	Construction	1.13
4.	Utilities	0.04
5.	Trade and transport	0.19
6.	Finance and real estate	0.66
7.	Other services	0.08

Source: "Estimating employment elasticity of growth for the Indian economy." RBI working paper, Sangita Misra, Anoop Suresh, 2014; 12<sup>th</sup> 5-year plan, 2012-2017

The employment elasticity to output is further expected to decline in the coming years with the gradual adoption of exponential technologies by Indian companies.

The other indicator of development, which is the classical model of structural shift of labor from traditional sectors such as subsistence farming and petty trade into modern organized sectors, is slowing down. Agriculture in the year 2012 had a negative elasticity of 0.04<sup>4</sup>, i.e., for every 10% growth in agriculture GDP, employment declined by 0.4%. This surplus labor in addition to being deployed in organized sectors has also found significant employment in other sectors in contract or self-employment/entrepreneurship models.

This includes:

- ▶ Infrastructure and construction sector driven by Government spending: The Government is investing heavily in highways, renewable energy, urban transport, shipping, affordable housing (Pradhan Mantri Awas Yojana), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), smart cities, Swachh Bharat, rural roads program (PM Gram Sadak Yojana), national waterways, airports and industrial corridors. This spending on infrastructure is creating gainful employment opportunities in contract modes. Similarly, under the MNREGA, each beneficiary gets an average 46-50 man days of work. The Ministry of Rural Development (MoRD) reports that it created an additional 690 million<sup>5</sup> man days in 2017 compared to 2015. This translates to an additional 14 to 15 million beneficiaries whose incomes have grown<sup>5</sup>.
- ▶ Self-employment/Micro-entrepreneurship models: Over 90 million<sup>6</sup> borrowers have benefitted from the Prime Minister Mudra Yojana (PMMY) in the last three years. Banks have disbursed close to INR3.7 lakh crore as MUDRA loans<sup>6</sup>. This has created gainful employment opportunities for people who would otherwise have neither been able to grow their micro enterprises nor been able to set up their first ventures. In the absence of this funding support, many of them would have been rendered economically vulnerable due to the job slowdown in the organized sectors.

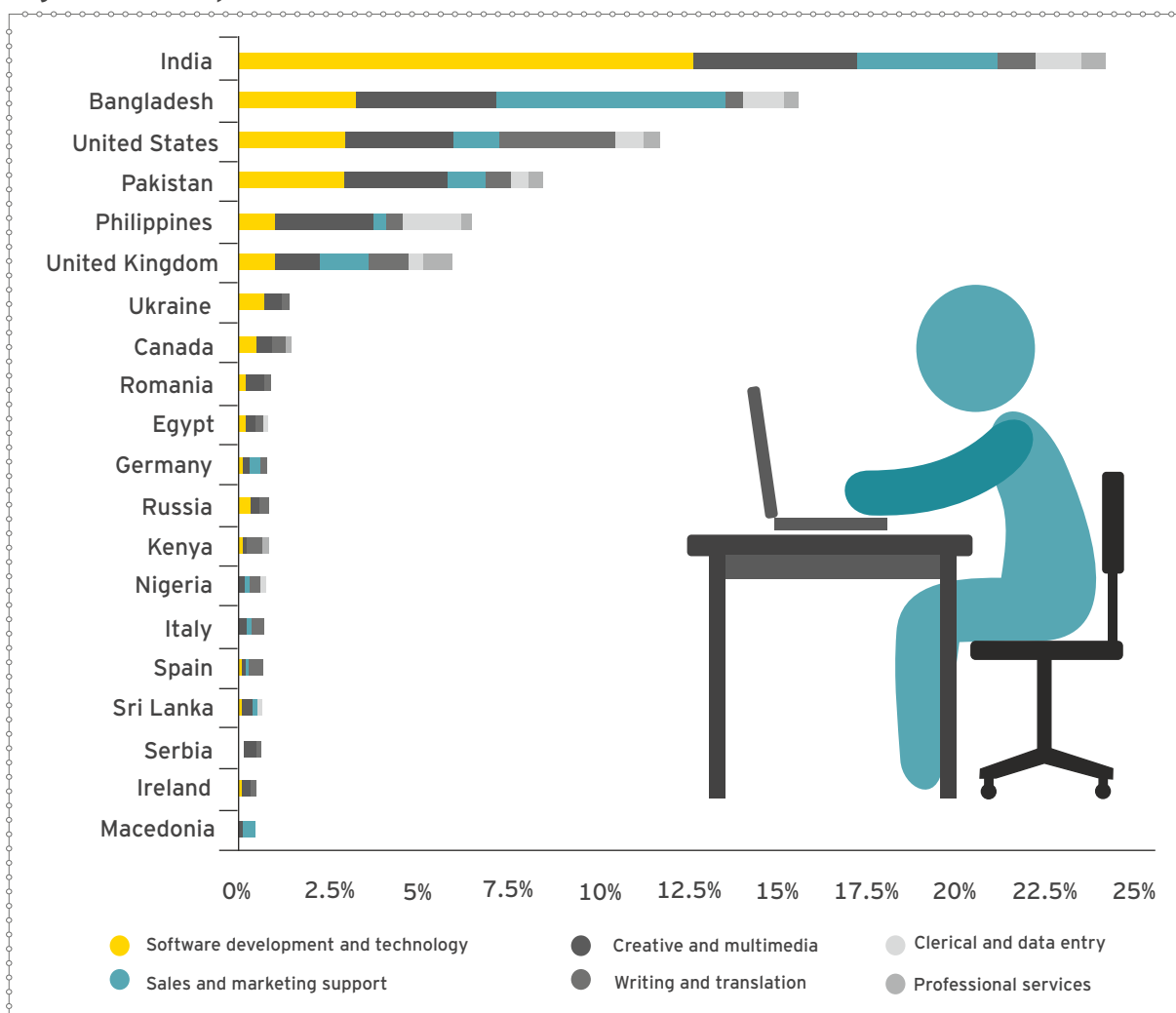
The internet and exponential technologies are creating an exciting space in which potentially numerous gainful employment opportunities are emerging. While the same technologies are responsible for a job slowdown in the organized sector, if nurtured and supported they have the potential to transform the job landscape in the country. The impact of these technologies are on both white collar and blue collar workspace.

- ▶ The first area of employment opportunities is the emergence of new ways of 'white-collar' working also known as the gig economy. Economists Otto Kässi and Vili Lehdonvirta of the Oxford University have created an Online Labour Index (OLI), which measures the utilization of online labor across countries and occupations by tracking the number of projects and tasks posted on platforms in near-real time. India is the leading country, with a 24% share of the online labor market as shown in Figure 5.

The gig economy is providing employment opportunities to Indian software developers, creative and multimedia professionals, online sales and marketing professionals, writers, translators and data entry operators. This employment model is expected to grow significantly in the coming years.



**Figure 5: The top 20 countries with online workers**



Source: "Online labour index: measuring the online gig economy for policy and research." Otto Kässi and Vili Lehdonvirta, Oxford Internet Institute, November, 2016.

- The second big area that is generating employment opportunities is the technology aggregator model that enables organizing highly inefficient markets. The 'Uber' model of technology aggregation of cab service providers on the one side and retail customers on the other, is being applied much beyond cab hailing services, in building maintenance, healthcare and other home services. The Indian unorganized/informal sector provides close to 50% of output, 92% of the jobs and encompasses at least 90% of the firms. Technology aggregation models that address the inefficiencies of the unorganized sector would be able to not only organize the market but also provide increased employment/income generation opportunities to many. The "Uber" model has organized the unorganized cab segment, resulting in increased market efficiency and higher incomes to cab drivers who are part of the network. The business architecture for the next 1,000 start-ups in the country could be an "Inefficient Market" + "Uber" like platform.



- ▶ The third area where potential employment opportunities are being created is in the ecommerce segment. India is seeing significant growth in the ecommerce retail segment. Ecommerce companies have been able to provide market linkage platforms to SME entrepreneurs and artisan entrepreneurs. Companies like Amazon, Flipkart and Paytm work with merchants and artisans on the supply side providing market linkages for their products. On the delivery side, these ecommerce firms have created a number of jobs in the logistics sector - drivers, delivery boys, warehouse assistants and managers. In addition to this, there are a number of service providers who find employment opportunities on their platforms, providing services on the supply side. These include content developers, web designers, digital photographers, sales and marketing professionals etc.

- ▶ Finally, we also see a large number of tech start-ups emerging focused on application of exponential technologies for creating new business models. Some of the features of the start-up ecosystem are as follows:

- ▶ India today has the 3<sup>rd</sup> largest start-up ecosystem with 4,750+ tech start-ups as of December 2016. Of these, 1,400+ new tech start-ups were set up in 2016 (~10%-12% YOY growth). B2B start-ups are gaining in prominence with a share of 36% to 40% of the market<sup>7</sup>.
- ▶ The start-up sector has been able to attract around US\$4 billion. Investors are looking at e-commerce, fintech, healthtech, edutech and agritech models. Cloud and big data/analytics were the key focus areas for new start-ups in 2016<sup>7</sup>.
- ▶ 140+ incubators and accelerators have been setup as of December 2016. A number of incubators and accelerators have also witnessed a 40% YOY growth in 2016, with 35 new additions under the "Start-up India, Stand-up India" initiative. Tier II/tier III cities are gaining traction, with 66% new incubators established<sup>7</sup>.

Some of these employment models today are not being captured as "jobs" and these "employee-entrepreneur" work arrangements do not fit the conventional definition of "jobs." So, while technology may be affecting jobs and skills in the traditional sectors in the short term, it is also creating new engines of employment creation.

Thus, the job landscape of 2022 is expected to have multiple categories of working persons:

- ▶ Employees in exponential technologies-impacted traditional sectors
- ▶ Contract employees in the infrastructure sector
- ▶ Micro entrepreneurs supported by MUDRA schemes
- ▶ Employer-entrepreneurs in technology enabled employment models:
  - Freelance workers-online platform models
  - "Uber" workers
  - SME and artisan entrepreneurs on e-commerce platforms
  - Delivery workers and service providers in the e-commerce ecosystem
  - Employees in tech start-ups

We have to be cognizant of the fact that any discussion on the future of jobs in the country is in the midst of this changing job landscape

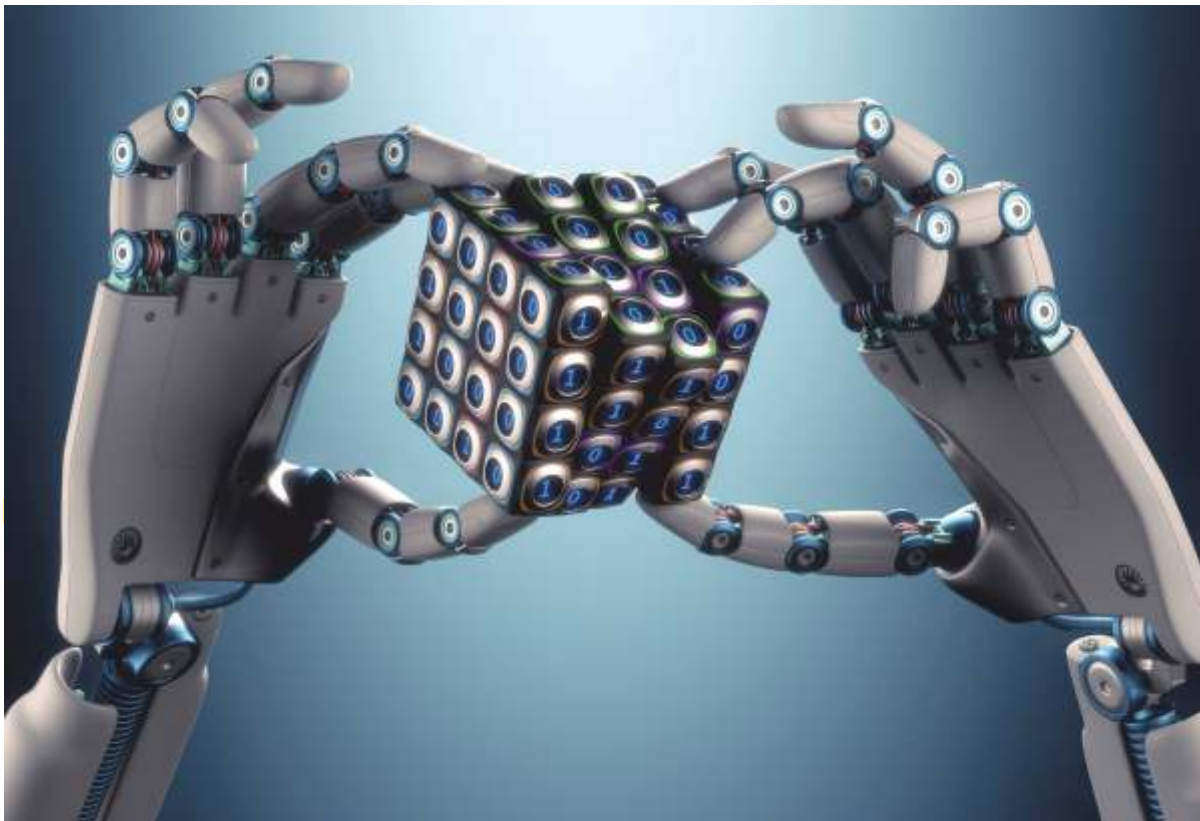
# EY framework

The future of jobs worldwide is being impacted by the interplay of the three inevitable primary forces globalization, demographic changes, and the adoption of exponential technologies by Indian industries

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**Globalization:** The future of jobs would be driven by globalization, i.e., those changes that affect positively or negatively the free movement of goods, services, capital and labor between countries. We are currently in a phase where globalization is being questioned by new regimes in US and UK and International institutions like WTO, World Bank and IMF are in the midst of redefining their roles.

**Adoption of exponential technologies:** The future of jobs would be affected by the adoption of exponential technologies by industries worldwide. These technologies are disrupting industries through the creation of new markets or are weakening or transforming an existing product market category/industry through either product or business innovation.



- ▶ Exponential technologies are those technologies whose performance improves by double or triple digit every year on the same cost basis, the best example being computing technology. During 1971-2011, computing technology followed Moore's Law, whereby for every dollar cost, the computing power doubled every two years. This has meant that over the decades, the improvement has been more than a billion times, making computing very cheap and disrupting a number of industries. However, now there are other exponential technologies too with their own laws, for example data storage (Kryder's Law), digital imaging (Hendy's Law), Network Capacity (Butler's Law) and DNA sequencing (Carlson's Law).
- ▶ When we get a convergence of several of these technologies, we come out with a product like the smartphone – a technological innovation that has enabled new business innovations such as Uber and Airbnb.

To demonstrate the exponential nature of these technologies, we take the example of sensor or IoT technology. The sensor technology has undergone a thousand times change in the last seven years, as shown in the table below:

**Table 2: Exponential nature of IoT/sensors technology**

S. no.	Unit	Change	Comments
1.	Number of sensors	Up 1,000X	From 10 million to 10 billion
2.	Cost	Down 1,000X	For example, from US\$250/axis for gyros to US\$0.75 for three axes
3.	Power consumption	Down 1,000X	From W to mW to microwatts
4.	Physical size	Down 1,000X	E.g., gyro from 2000 mm <sup>3</sup> to 2mm <sup>3</sup> /axis
5.	Number of transistors	Up 1,000X sensor	From 1,000/sensor to 1,000,000/sensor

Source: "Clean disruption of energy and transportation: How silicon valley will make oil, nuclear, natural gas, coal, electric utilities and conventional cars obsolete by 2030." Tony Seba, 2014.

- ▶ In the first decade of the 21<sup>st</sup> century, two of the primary forces, globalization and technology, were fellow travelers. In the second decade, while technology continues to support the globalization process, it has also readily provided tools in the form of automation and machine learning that can potentially slow down the process of globalization.



Demographic changes: Parts of the world are ageing while other parts are enjoying the demographic dividend. There is shortage of skilled labor in many of the advanced ageing economies such as Europe and Japan. Countries of Africa, Middle East and South Asia have young adults who form close to 30% of their population. Similarly, a significant part of this population was born in the 1980s, people commonly known as millennials. These millennials have grown up in a world with Internet and other technologies and their consumption behaviors are heavily influenced by them. Countries like India have a huge consumption market teeming with people from the middle-class, young people and millennials. These demographic changes would drive the future of jobs in tandem with the other two primary forces.

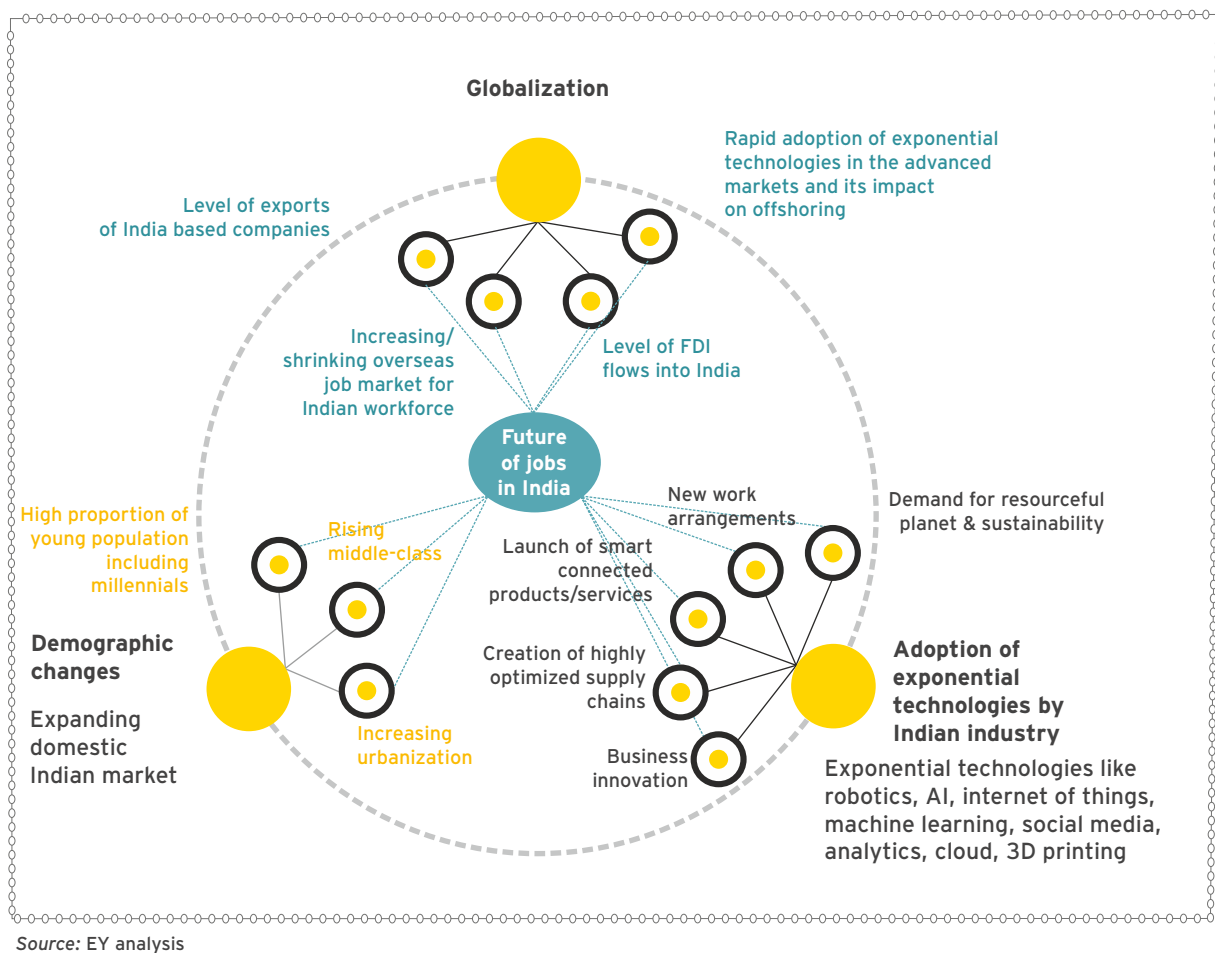
It is in this context of period of exponential technologies, new phase of globalization and the demographic dividend opportunity provided by a young population, that we are looking at the future of jobs in India



In India, the future of jobs in 2022 would be determined by the country's response to 12 trends created by the interplay of the three inevitable primary forces

Four of these trends are driven by globalization, five by adoption of exponential technologies by Indian companies and three by demographic changes. The EY framework capturing these 12 megatrends has been shown in the figure below:

**Figure 6: EY framework for the future of jobs study**



**Globalization:** Over the last two decades, the effect of globalization on the large demographically young domestic Indian market has been virtuous, with the creation of jobs and opportunities that lifted millions out of poverty and catalyzed the rise of the Indian middle-class. Within the changing landscape of international politics, we have identified four trends that would affect the future of jobs in the country.

- ▶ **The level of exports** of companies that have based their manufacturing operations in India would significantly impact jobs in the country
- ▶ **Rapid adoption of exponential technologies in advanced markets** would affect the offshoring of manufacturing and services to India. Technology, especially automation, is expected to reduce the number of offshored jobs in manufacturing industries where Indian companies are locked in vertically integrated global supply chains. Similarly, the Indian IT/BPM industry is being impacted by the adoption of these exponential technologies in their advanced markets
- ▶ **The increasing/shrinking overseas job market for Indian workforce** would impact the future of jobs in the domestic market, impacting the wage levels
- ▶ **Level of FDI flows into India:** India became the top FDI destination in 2016<sup>8</sup>. These FDI flows are expected to drive investments. However, the nature of FDI investments (greenfield or M&A) would determine whether there would be significant job creation, both direct and indirect



**Adoption of exponential technologies by Indian companies:** The adoption of these exponential technologies by Indian industry would be a factor of the rate of diffusion of these technologies from the advanced markets to India. This would depend on the following:

- ▶ The rate of falling cost curves of these technologies to levels that would make them economically viable in the Indian market
- ▶ The level of globalization of the Indian industry - Share of exports in total industry output, presence of offshoring opportunities and FDI
- ▶ The level of globalization of consumer trends in a sector
- ▶ The presence of start-up or disruptor firms in the sector

In the context of the above in a 2022 time frame, we will explore **five trends** with respect to the adoption of exponential technologies by Indian industries:

- ▶ Creation of highly optimized supply chains
- ▶ Launch of smart connected products/services
- ▶ Business innovation
- ▶ Demand for resourceful planet & sustainability
- ▶ New work arrangements

**Demographic changes:** The future of jobs in India would be determined by the quantum and sophistication of demand of the domestic Indian market.

- ▶ The quantum of demand would be driven by the rising size of the middle-class
- ▶ The sophistication of demand would be driven by the size of the affluent class and young population and increasing urbanization

The 12 trends are expected to significantly change the jobs landscape of the country by 2022

There are four possibilities in the job landscape for each sector in the year 2022:



# Study methodology

EY explored the relevance and importance of these 12 trends in the Indian context and their impact on the future of jobs by 2022 through extensive primary and secondary research and analysis. EY has sought to take an informed view of the future based on hypotheses developed through secondary research and their validation by experts and CXOs, through primary interactions. There was a great deal of iteration in the initial phases of the project, but gradually we were able to arrive at a reasonable set of views, which were then further tested and refined.

There is extensive literature available on the primary forces, exponential technologies and the trend that we have discussed as part of our framework for advanced markets, especially for the US and Europe. Our secondary research included perusal of industry reports, relevant articles and points of view to enable us to develop the base knowledge and hypothesis of our study. The inputs from these studies helped us to build the potential impact of the trends with respect to India as far as jobs/skills are concerned.

We then provided a quantitative and qualitative picture with respect to jobs (new jobs, threatened jobs, changed jobs and unchanged jobs) in the five sectors. The five sectors with their rationale for choice are as shown in the figure on the next page:





**Figure 7: Rationale for choice of sectors**

### **Automotive**

- ▶ India is one of the largest automotive markets in the world with production volumes of 23.96 million vehicles (2015-16)<sup>9</sup>
- ▶ It is one of the largest employers in the manufacturing sector, with close to 12.8 million<sup>10</sup> in employment
- ▶ It is a technology-intensive sector as many of the exponential technologies have had a huge impact on the sector in advanced markets
- ▶ Many automotive manufacturers use India as a base for offshoring

### **Textiles and apparel**

- ▶ It is one of the largest employment sectors, with ~22 million directly and ~54 million people indirectly<sup>11</sup>
- ▶ It is the largest employer of persons with low educational attainments
- ▶ It is one of the largest employer of women

### **BFSI**

- ▶ It is one of the highest technology-intensive sectors worldwide
- ▶ Indian financial services firms have been on the forefront of technology adoption
- ▶ The impact on jobs in terms of skill sets is expected to be significant in this sector

### **Retail**

- ▶ Retail is one of the largest employers in the services sector in the country
- ▶ Unorganized retail is gradually moving towards organized formats
- ▶ The higher productivity of organized retail through scale and technology is expected to have a huge impact on jobs in the sector

### **IT-BPM**

- ▶ This sector employs around 3.9 million<sup>12</sup> persons
- ▶ It has a significant share of exports, which is expected to be affected as companies in advanced markets begin to deploy automation technologies in their processes, affecting jobs in the sector

Source: EY analysis

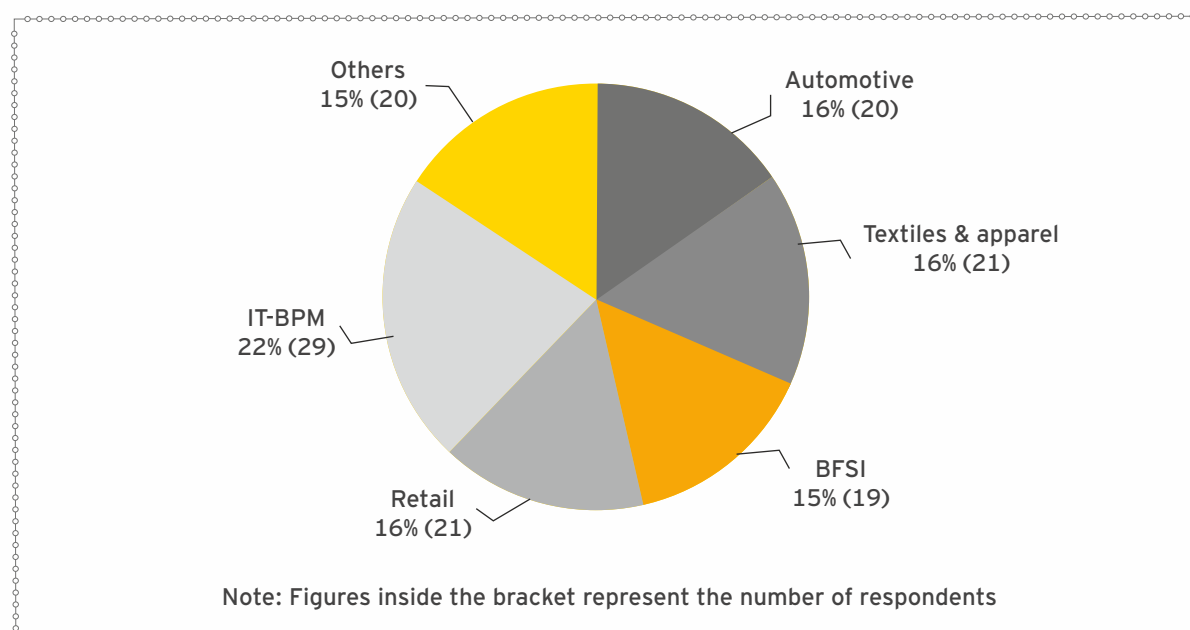
During our primary research, we interacted with more than 130 business leaders, academicians and representative of industry associations across the selected sectors. We shared a questionnaire with each of the respondents to ascertain their views on the trends and the future of jobs in their sectors by 2022. This was followed by an interview by phone or face to face.

The key questions were:

- ▶ Rate the key megatrends among the 12 trends in your sector
- ▶ Rate the top exponential technologies that would impact your sector
- ▶ Give a qualitative perspective on the relevant trends in your sector
- ▶ What percentage of current workforce (2017) would be working in threatened jobs by 2022?
- ▶ What percentage of the workforce in 2022 would be in new jobs?
- ▶ What percentage of the workforce in 2022 would be in jobs that would not undergo change?
- ▶ What are your recommendations for industry, educational institutions and the Government?

The breakup of 130 respondents by sector is given in the figure below.

**Figure 8: Breakup of the respondents by sector**



Source: EY future of jobs respondent analysis

A hand is shown interacting with a futuristic digital interface. The interface displays glowing blue and red lines, possibly representing data or network connections. The background is dark with some blurred light effects.

# 2

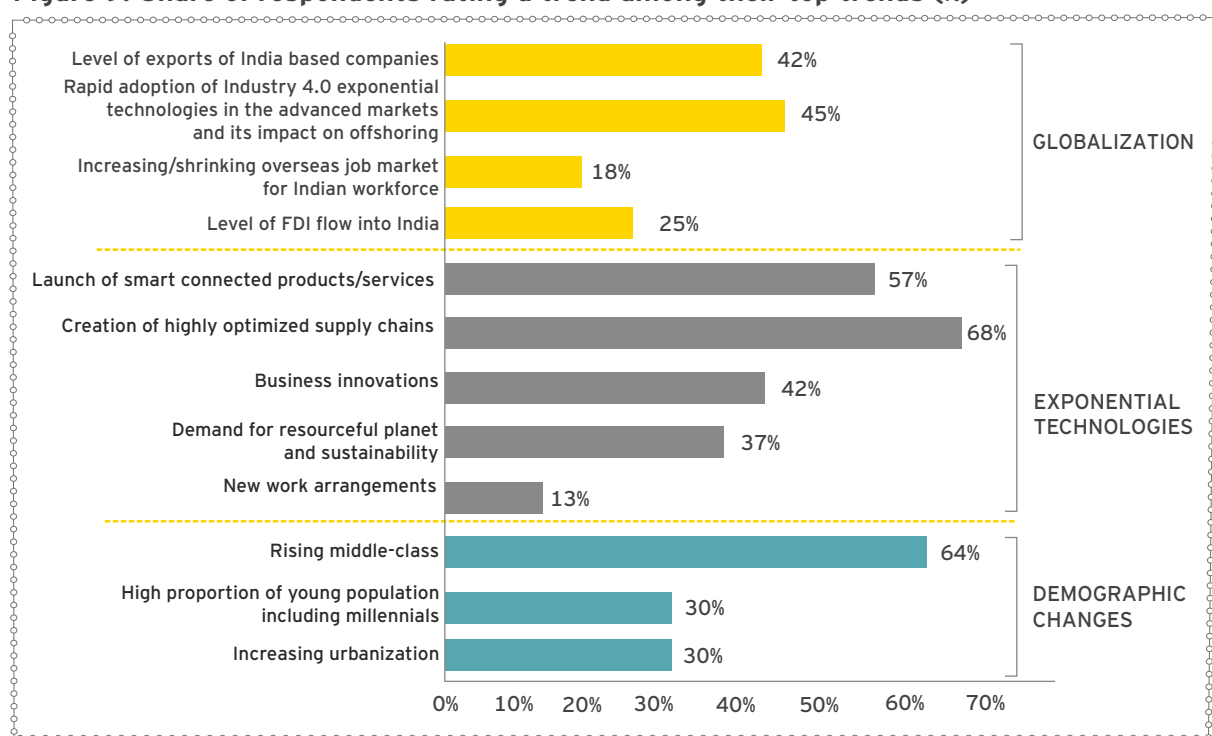
## Trends impacting future of jobs in India

# Trends impacting future of jobs in India

Despite globalization and adoption of exponential technologies, majority of the respondents still believe that demographic changes will have the highest impact on the future of jobs by 2022

The 12 trends affecting the future of jobs in India will have varying impacts. This was highlighted by the respondents on being asked to identify the key megatrends among the 12. The share of respondents rating a trend among his or her top trends is as shown in the figure below:

**Figure 9: Share of respondents rating a trend among their top trends (%)**



Source: EY future of jobs respondent analysis

The top three trends for each of the three forces as identified by the respondents by 2022 are as below:

- ▶ **Globalization:** offshoring impacted by adoption of exponential technologies by advanced nations
- ▶ **Exponential technologies:** creation of highly optimized supply chains
- ▶ **Demographic changes:** rising middle-class

# Globalization and the future of jobs in India

**The four key megatrends** that are driven by globalization are:

- ▶ Level of exports of India based companies
- ▶ Rapid adoption of Industry 4.0 exponential technologies in the advanced markets and its impact on offshoring
- ▶ Increasing/shrinking overseas job market for Indian workforce
- ▶ Level of FDI flow into India



## Level of exports of India based companies

Exports today generates 13%-15%<sup>13</sup> of the total employment in the country. The level of exports would be a key determinant of the future of jobs in 2022

The primary globalization related trend is the level of exports and its impact on the future of jobs. The total number of jobs supported by aggregate Indian exports (merchandise plus services) increased from about 34 million in 1999-2000 to 62.6 million in 2012-13 at a growth rate of 3.4% per annum<sup>13</sup>. The share of indirect job creation increased significantly in recent years to 50% in 2012-13<sup>13</sup>. Backward linkages, particularly from manufacturing to agriculture and services, have become an important source of export-related job creation in the country.

Employment by sector is as shown in the table below:

**Table 3: Export-led employment in key sectors**

S. no.	Sector	Total export-led employment (million) 2012-13	Direct export-led employment (%)
1.	Agriculture and allied activities	25.81	20%
2.	Mining, quarrying and petroleum products	0.86	48%
3.	Food processing, beverages and tobacco	1.57	95%
4.	Textiles and leather	10.80	87%
5.	Rubber, plastics and chemicals	0.84	70%
6.	Metal and metal products	1.23	39%
7.	Machinery	1.50	76%
8.	Transport equipment	1.14	85%
9.	Gems and jewelry	2.40	87%
10.	Other manufactured products	4.58	87%
11.	Services	11.87	48%
	Total	62.6	50%

Source: "Interlinkage between exports and employment in India." Export Import Bank of India, November 2016.

To target a 20% share of employment for exports in the total workforce, it is imperative to focus on sectors with a high employment coefficient

Estimates suggest that US\$1 million worth of exports supported 138 jobs in 2012-13 as compared to 191 jobs in 2007<sup>14</sup>. This is captured by the measure “employment coefficient” (number of workers employed per INR1 crore worth of export output). There has been a steady decline in the employment coefficient over the years as shown in the table below for key sectors:

**Table 4: Employment coefficient for key sectors**

S. no.	Sector	Employment coefficient (2007-08)	Employment coefficient (2011-12)
1.	Agriculture – cereals, pulses, fruits, Vegetables and other crops	282.8	143.0
2.	Petroleum products	0.3	0.2
3.	Cotton textiles and handlooms	28.9	16.5
4.	Readymade garments	31.5	78.5
5.	Leather footwear	67.3	34.3
6.	Leather and leather products	14.3	16.0
7.	Motor vehicles	12	11.5
8.	Motorcycles and scooters	24.2	9.7
9.	Gems and jewelry	17.3	14.2
10.	Computer and related services	6.7	5.3

Source: “Interlinkage between exports and employment in India.” Export Import Bank of India, November 2016.

However, two sectors ‘ready garments’ and ‘leather and leather products’ have reported increase in employment coefficient over the five year period.

The decline in the employment coefficient in other key sectors is a result of improvement in labor productivity, due to change in the composition of exports in favor of more skill and capital intensive products and introduction of labor-saving technology in each sector.

Viewed in this light, the Government's Make in India initiative is a move in the right direction to increase manufacturing. As a labor-abundant country, India can reap greater employment gains by specializing in labor-intensive sectors, such as apparel and leather, where it holds a comparative advantage. India could more proactively seek to negotiate bilateral Free Trade Agreements (FTAs) with the UK and Europe to support the exports of these sectors. Based on Economic Survey 2017 calculations for increased GDP due to FTAs, an additional US\$3 billion in GDP is possible in the apparel and leather and footwear sectors with an additional employment of 1.5 lakh people.



# Rapid adoption of Industry 4.0 exponential technologies in the advanced markets and its impact on offshoring

Adoption of exponential technologies in advanced markets is expected to improve productivity to the tune of 15%-20%<sup>15</sup> of the conversion costs in the next five years

The adoption of exponential technologies by companies in the US and Europe in product design and manufacturing is expected to improve the productivity and contribute to what is called as “renaissance of manufacturing”. The rising western activism to revive manufacturing is coming at a time when the average wages in traditional manufacturing offshoring locations have soared 15%-20%<sup>15</sup> per year. This will mean closing the gap of the cost advantage that those manufacturing offshoring locations had over the USA or Europe.

Recent studies by Federal Statistical Office of Germany indicate that adoption of exponential technologies will improve productivity to the tune of 15% to 20%<sup>16</sup> on the conversion costs. This increased productivity is expected to offset the cost disadvantages that companies face in Germany compared to low-cost destinations in the next five years. The ‘Reshoring Initiative’ resulted in 124,852 jobs and 818 companies being reshored back to the US during 2010-15. Of the reshored jobs, 60% were from China<sup>17</sup> and 55% were from India<sup>17</sup>. Around 2015 jobs and 24 companies were reshored from India in the same period. Eight industries are expected to reach the tipping point, wherein it becomes more competitive under total cost of ownership calculations to manufacture in the USA rather than, say, China.

India with its abundant and low cost labor, would continue to be a favorable manufacturing offshoring hub for the next 2-3 years. However, this may get affected by the increasing adoption of exponential technologies in the developed markets.

## By 2022, new business process offshoring opportunities in North America/European markets are expected to become insignificant

The impact of exponential technologies is also being felt by Indian companies in offshoring of services, where India is the leader with a 55% market share. In the case of offshoring of services, the challenge comes from robotic process automation (RPA), artificial intelligence, machine learning and IoT. This has clearly affected the business models of leading Indian IT companies.

The various reasons that contribute to the decline of the business process offshoring industries are as below:

- ▶ Jobs that might have been offshored by the western firms in the coming years are expected to get reduced on account of productivity improvements
- ▶ Exponential technologies such as RPA, machine learning and artificial intelligence are considerably declining the offshorable remaining jobs of North America/Europe region
- ▶ However, we are also seeing the emergence of offshoring of functions and the establishment of captive design and development in India

In summary, the adoption of exponential technologies by companies in advanced markets is affecting the future of jobs in the country. The software services offshoring story is entering a challenging phase with Indian companies reworking their business models and building new capabilities to address the emerging market. The offshoring manufacturing story is one in which India was a late entrant and hence the impact on existing jobs will be minimal.



# Increasing/shrinking overseas job market for Indian workforce

Migration of workers to overseas markets are expected to decline by 25%-30%<sup>18</sup>, in traditional overseas market while new market are expected to open up for Indian labor

There was a 33% dip in jobs for Indians in the Middle East in 2016 compared to the year earlier. Saudi Arabia itself accounted for a 50% drop in jobs last year<sup>19</sup>. According to World Bank estimates, remittances also saw an 8.9% drop in 2016, recording a contraction for the second straight year. The shrinking demand for Indian workforce in the Middle East market is due to:

- ▶ Pro-domestic worker policies in destination countries such as Saudi Arabia and UAE (Saudization and Emiratization)
- ▶ Slowdown in infrastructure and industrial projects due to depressed oil prices

There have been changes in visa rules in some of the advanced markets, which will affect Indians who intend to work in these countries.

- ▶ The number of US H-1B visas issued for Indian workers in the IT sector is expected to drop to 60% from the current 86%. A proposal to hike the minimum salaries in US postings from US\$60,000 to US\$100,000 will make deployment of Indian workers uneconomical<sup>19</sup>
- ▶ Australia has scrapped the 457 visa program and New Zealand has decided to institute the 'Kiwi First' program. Indians account for nearly a third of the visa holders under Australia's 457 category of visas for foreign skilled workers<sup>19</sup>
- ▶ The UK, where about 60% of visa recipients for foreign skilled workers were Indians during the period January-November 2016, has also tightened its entry rules by raising the salary thresholds for employing outsiders. It had already begun the process of making it difficult for Indian students to exceed their stay through jobs<sup>19</sup>
- ▶ Singapore, another popular destination for the upwardly mobile Indian middle-class, has ordered its companies to advertise any vacancy for two weeks domestically before seeking employment passes for job seekers from overseas<sup>19</sup>

Shrinking market will result in:

- ▶ Surplus labor for jobs within the domestic market, pushing wage levels down
- ▶ Drop in remittances to India, affecting the purchasing power in the domestic market in states such as Kerala, UP, Bihar and Punjab, etc. and thereby affecting jobs created through increased domestic demand

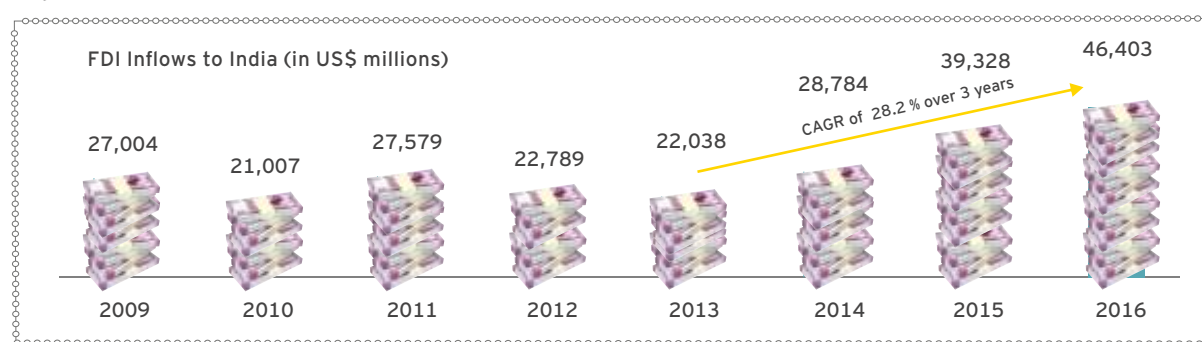
New markets could include aging economies of Europe and Japan.

## Level of FDI flow into India

India is emerging as the leading recipient of global FDI. With increasing green field FDI investments versus M&A FDI, level of FDI flows would be a key determinant of future of jobs

Year 2016 saw the FDI in India reaching an eight-year high level of US\$ 46.4 billion in 2016. In the last three years, FDI inflows have grown at an average CAGR of 28.2%<sup>20</sup>.

**Figure 10: FDI inflows**



Source: "Fact sheet on foreign direct investment (FDI)," Department of Industrial Policy and Promotion, Govt. of India, March 2017.

Service sector drew 60% of the total FDI flows. Some of the key sectors for FDI are given below:

**Table 5: Highest FDI inflow**

Sector	US\$ million (April 2015 - April 2016 )	Growth
Service sector	6,889	55.05%
Computer software and hardware	5,904	157.14%
Trading	3,845	40.95%
Automobiles	2,527	-7.3%
Chemicals	1,470	92.66%

Source: "Fact sheet on foreign direct investment (FDI)," Department of Industrial Policy and Promotion, Govt. of India, March 2017.

In order to create large-scale employment within the economy, it is critical to attract more FDI inflows toward labor-intensive manufacturing. This will help in significant job creation for unskilled labor. However, attempts to attract higher FDI inflows toward labor-intensive manufacturing is hindered by bottlenecks in critical areas such as infrastructure and labor laws. Policy initiatives have helped improve India's "Ease of Doing Business" ranking. However, imminent reforms are needed in labor laws, public contract dispute resolution, and insolvency and bankruptcy laws to attract long-term foreign investments in core sectors.

# Adoption of exponential technologies by Indian companies and future of jobs in India

**The five key megatrends** that are driven by exponential technologies are:

- ▶ Launch of smart connected products/services
- ▶ Creation of highly optimized supply chains
- ▶ Business innovations
- ▶ Demand for resourceful planet and sustainability
- ▶ New work arrangements

## Most of the exponential technologies in India are at a nascent stage of experimentation in the customer adoption cycle

Our study was focused on determining the stage at which the respondents, other than those from the IT/BPM industry, are with respect to each of the exponential technologies on the consumer adoption cycle – awareness, interest, evaluation, trial and adoption. The picture that emerged is as below (✓-Depicts the maturity level in each stage of consumer adoption cycle):

**Figure 11: Exponential technologies on consumer adoption cycle**

	AWARENESS	INTEREST	EVALUATION	TRIAL	EARLY ADOPTION
Sensors/internet of things	✓✓✓✓✓	✓✓✓	✓✓	✓	
AI/machine learning	✓✓✓	✓✓			
Robotics	✓✓✓✓✓	✓✓✓✓	✓✓✓	✓✓	✓
Energy storage	✓✓✓	✓✓	✓		
3D printing	✓✓✓✓	✓✓	✓✓	✓	
3D visualization	✓✓✓	✓✓			
Mobile, internet and cloud	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓
Big data	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓
Drones	✓✓				
Blockchains	✓✓✓	✓✓			

The driving exponential technologies of today in India

Source: EY future of jobs respondent analysis

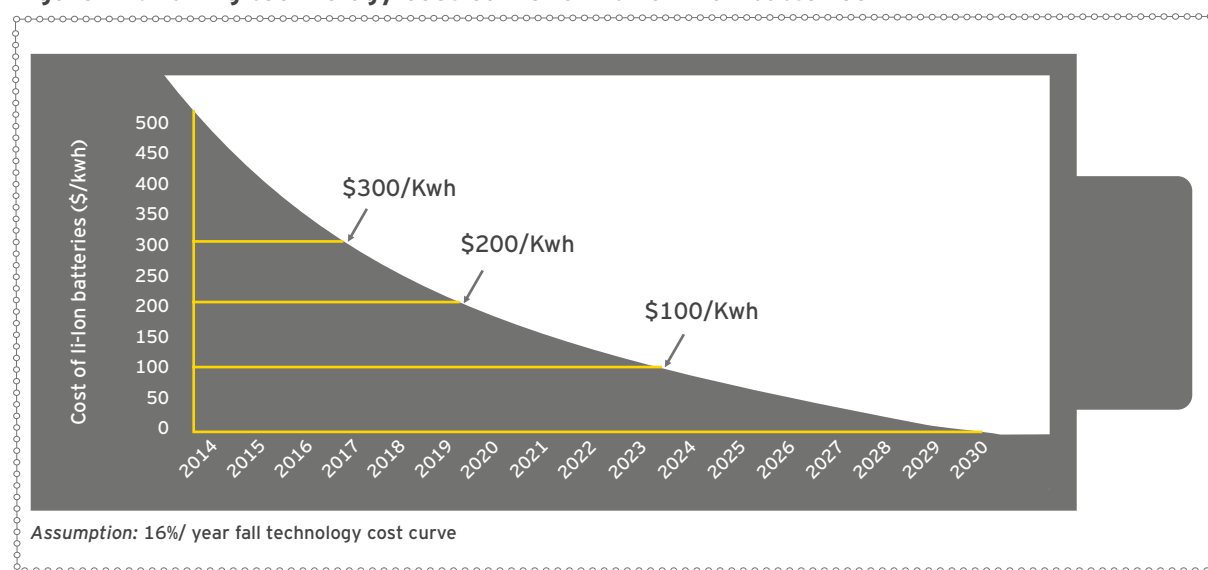
While the respondents were aware of these technologies and showed interest, not all technologies had been evaluated and experimented with, to merit adoption. Less than 20% of respondents had evaluated the use of technologies beyond mobile Internet, Cloud and Big Data.

In addition to the consumer pressure to adopt these technologies, the other factors that will drive adoption by Indian companies will include:

- ▶ Rate of falling cost curves of these technologies to levels that will make them economically viable in the Indian market
- ▶ Level of globalization of the Indian industry. Share of exports in total industry output, presence of offshoring opportunities and FDI
- ▶ The presence of start-up or disruptor firms in the sector
- ▶ Government regulation

A typical example of a fast falling cost curve as shown in the figure below is that of lithium ion batteries or storage technologies, which are expected to disrupt the automotive (think electric cars) and energy (think renewable energy) industries. The incumbent Indian auto and energy companies are expected to be disrupted with costs dropping at the rate of 16% YOY, some even to the extent of US\$100/-Kwh lithium-ion. An average Indian car today sells at US\$12,000. Today's electric car, whose major cost is that of the batteries, is retailing at US\$35,000 in the US<sup>21</sup>. With the falling technology cost curve, the figure of US\$12,000 will be reached by around 2020.

**Figure 12: Falling technology cost curve for lithium-ion batteries**



Source: "Clean disruption of energy and transportation: How silicon valley will make oil, nuclear, natural gas, coal, electric utilities and conventional cars obsolete by 2030." Tony Seba, 2014.

We also found in the survey that those industries which are globalized, i.e., high exports, significant FDI investments or high offshoring revenues, are more likely to adopt these technologies. This is true of Indian industries such as IT/BPM, automotive and BFSI.

The presence of disruptor firms in the sector quickens the pace of technology adoption by the industry, forcing many of the incumbent automakers to innovate. A leading global auto OEM recently announced that all new cars they would be manufacturing after 2020 would be electric cars. All other manufacturers in India seem to be in wait and watch mode. The expected entry of a leading global electric auto OEM into India and its subsequent movement into the mass-market segment would unleash the necessary competitive forces to uncork the technology genie from the bottle. However, in the case of the retail industry in the country, with the presence of e-commerce firms and a number of start-ups working on B2C models, the necessary innovative pressure exists forcing incumbents to adopt these technologies.

Finally, the role of the Government as a regulator is critical in widespread adoption of these technologies. Regulations that support green products and sustainability in the form of incentives or penalties can quicken the pace of adoption.



# Launch of smart connected products/services

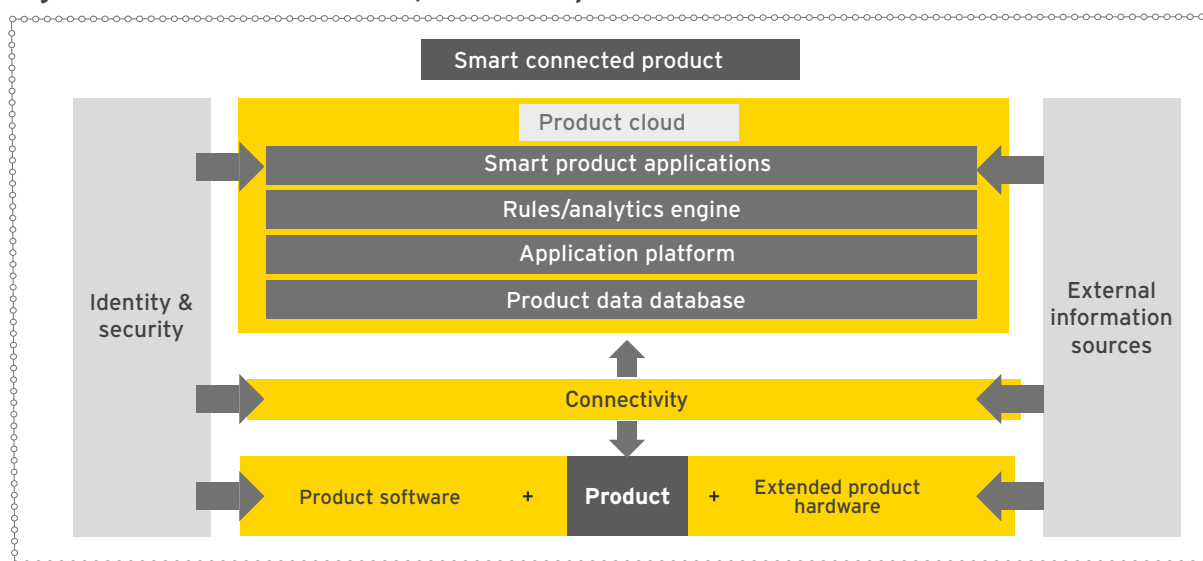
India is witnessing a rapid evolution of products and services into “smart connected products/services”. This will be a key driver for new and changed jobs by 2022

We are seeing the evolution of products and services into smart, connected products and services.

A smart, connected product has the following features:

- ▶ Product software which includes embedded operating system, on-board software applications, enhanced user interface and product control components
- ▶ Extended product hardware including embedded sensors, processors and connectivity port/antenna
- ▶ Connectivity to a product cloud
- ▶ Product cloud with smart product applications, rules/analytics engine, application platform and product data database
- ▶ Identity and security linkages to external information sources

**Figure 13: Features of a smart, connected product**



Source: "How smart, connected products are transforming competition." Michael E. Porter and James E. Heppelmann, Harvard Business Review, Nov 2014; EY analysis.

The following are some examples of smart, connected products adopted by Indian firms:

- ▶ An Indian auto major is trying to redefine the experience of its automobile users by enhancing in-car connectivity and efficiency for an enriched mobility experience. It is collaborating with an IT major to develop smart, connected vehicle technologies by bringing together artificial intelligence, machine learning and IoT capabilities. These new technologies are getting connected to a cloud platform and will provide a highly personalized, smart and safer driving experience to vehicle owners
- ▶ In a similar effort, general insurance providers in India are increasingly experimenting with 'connected insurance'. The connected insurance business model is primarily enabled by IoT technologies, allowing for real-time monitoring of vehicles. It also helps in establishing direct connection between customers and insurers
- ▶ With IoT, firms are able to monitor fulfilment rates, success at sales and employment movement. For example, logistics division of a leading ecommerce firm has developed algorithms that take incoming orders and develop commands to optimize worker movement around the warehouse. Now, warehouse workers are hired as required by the scripts

As can be seen from the survey, 57% of respondents selected this trend as one of the top trends. The emergence of smart, connected products will have a significant impact on the Indian labor market. The skill sets required to create a smart, connected product thus are new and multi-disciplinary - knowledge of systems engineering, software development, electronics and mechatronics in addition to basic mechanical and electrical engineering is necessary. The current workforce would need to embrace the new technologies to keep up with the pace of changing job roles. At the same time, new job roles might emerge to support further integration of connected technology into products/services.



## Creation of highly optimized supply chains

Our survey revealed that with the falling cost of exponential technologies, Indian companies are exploring their adoption for optimization of their value chain in the next 2-3 years. This will threaten many existing jobs while creating new ones

In the manufacturing sector, the deployment of mobile robotics, worldwide is rising fast. The IFR World Robotics 2016 report forecasts that the world annual supply of industrial robots would grow at 13% YOY to reach 4.14 lakh units by 2020. The two key industries where robots have been deployed are automotive and electronics. Both the industries have seen growth in robot deployment of more than 10% YOY. Mobile robotics in India, however, is in a nascent stage. The table below shows the robot density, i.e., the number of robots per 10,000 employees, for a few countries including India:

**Table 6: Density of robots by country**

S.no.	Country	Robo density (2014)	Growth rate (%)
1.	Korea	478	12.0%
2.	Japan	323	0.1%
3.	Germany	282	4.0%
4.	US	155	11.0%
5.	China	36	35.0%
6.	South Africa	22	22.0%
7.	India	2	NA

Source: "World robotics report 2016." International Federation of Robotics, 2016.

Indian auto companies during the survey attested to the deployment of robots on the shop floor. While paint and welding shops are expected to be completely automated by 2020, the use of robots in the assembly line is limited to 20% across companies. Indian companies are also exploring the deployment of robots in the logistics function. With intra-plant logistics getting automated, logistics costs are expected to reduce 10%-20% and inventories by 30%-50%<sup>22</sup>.

Digitization with automation is removing siloes between the various organizational functions and allowing symbiotic resource sharing between various functions such as sourcing, logistics, warehousing and inventory management. Many firms are collaborating with software service firms to develop customized robotics to enable different sections to be managed in tandem and drive value for the entire supply chain.

India's automotive industry showcases usage of increased automation. While the plant level automation at most OEMs remains at 30%, its level in the body shop is beyond 95%. Auto companies are increasingly deploying smart robots with artificial intelligence capabilities that are able to adapt, communicate and interact with each other and with humans.

The service sector also has seen rise in the deployment of exponential technologies like RPA over the last four years. The Indian market for robotic automation has grown over the last couple of years with many new cognitive and artificial intelligence enabled solution and product offerings being introduced.

Many Indian companies are deploying RPA tools and automating various functions, such as HR, finance and payroll. In EY's survey of 130 companies for this study, close to 40 mentioned that they had either deployed or experimented with RPA tools, resulting in replacing potential new human hires. However, the adoption of RPAs is also opening up new avenues of job creation for the skilled workforce involved in developing and implementing RPA technologies.

Many activities previously considered outside the realms of automation are getting automated. A useful way to look at jobs is to divide them into four categories:

- a. Routine Manual (RM)
- b. Routine Cognitive (RC)
- c. Non-Routine Manual (NRM)
- d. Non-Routine Cognitive (NRC)

Categories "a" and "b" are susceptible to automation. Oxford University technologists Frey and Osborne conducted a study on the probability of computerization of different occupations. The table provides us an estimate of the extent to which rule-based and predictive jobs are susceptible to accelerating computing technology.

**Table 7: Jobs and their susceptibility to computerization**

S. no.	Job	Probability
1.	Recreational therapists (NRC)	0.003
2.	Dentists (NRC)	0.004
3.	Athletic trainers (NRC)	0.007
4.	Clergy (NRC)	0.008
5.	Chemical engineers (NRC)	0.02
6.	Editors (NRC)	0.06
7.	Fire fighters (NRM)	0.17
8.	Actors (NRC)	0.37
9.	Health technologists (NRC)	0.40
10.	Economists (NRC)	0.43
11.	Commercial pilots (RC)	0.55
12.	Machinists (RM)	0.65
13.	Word processors and typists (RM)	0.81
14.	Real estate sales agents (RM)	0.86
15.	Technical writers (RM)	0.89
16.	Retail salespeople (RC)	0.92
17.	Accountants and auditors (RC)	0.94
18.	Tele-marketers (RC)	0.99

Source: "The future of employment, how susceptible are jobs to computerization?" Carl Benedikt Frey and Michael A. Osborne, 2013.

Frey and Osborne (2013), estimated that 47% of all present jobs have a 70% likelihood of being displaced by computerization over the next decade.

## Business innovations

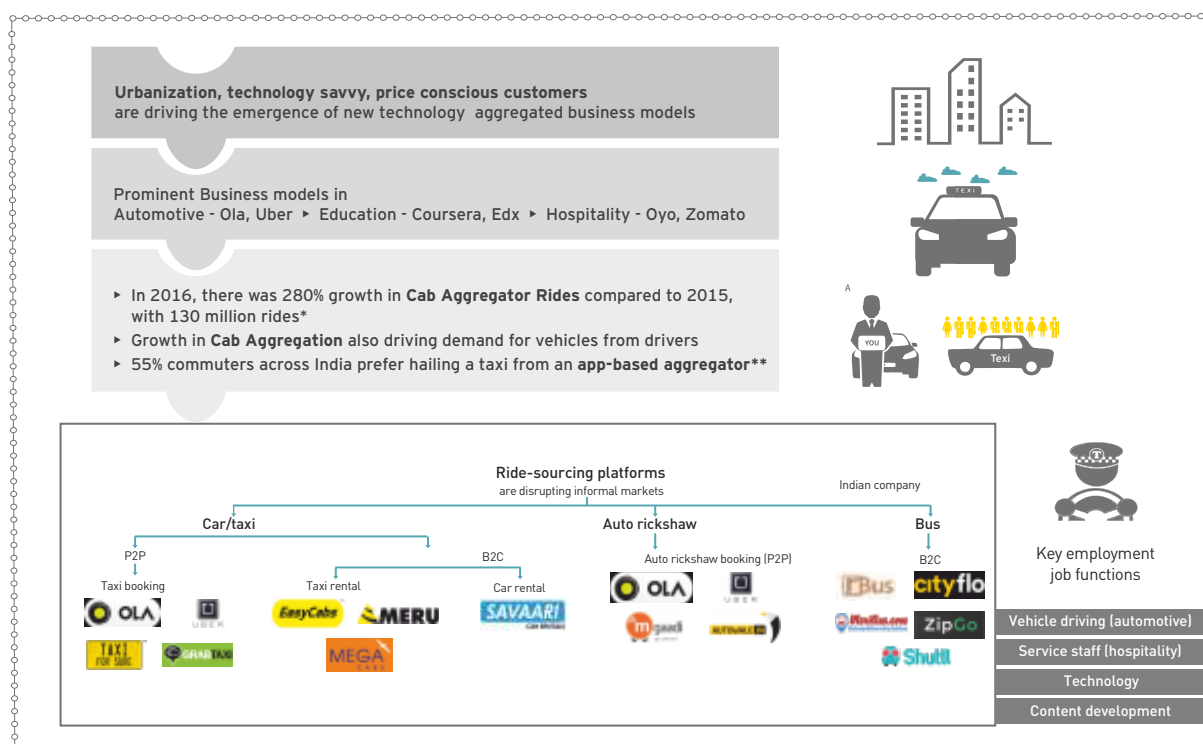
Over 5,000 tech start-ups set-up in the last five years are giving rise to new innovative business models, changing the structure of the economy (from unorganized to organized) and creating additional jobs

Every year over, 1,500 tech start-ups are emerging in the market place that have business models based on one or more of these innovation levers<sup>23</sup>:

► Personalization ► Asset sharing ► Usage-based pricing ► Collaborative ecosystem ► Agility

In the context of India, these business models have stimulated the overall growth of the economy. Business innovation backed by technology has not only led to growth in the retail and logistic sector, created employment opportunities but is also proving to be an important force in moving the economy towards the organized sector for example, for ecommerce and taxi aggregators (Uber/Ola).

**Figure 14: Emerging new economy sectors – engines of job creation**



Source: EY analysis

\*<http://timesofindia.indiatimes.com/companies/cab-aggregator-rides-surge-280-in-2016/articleshow/57217209.cms>

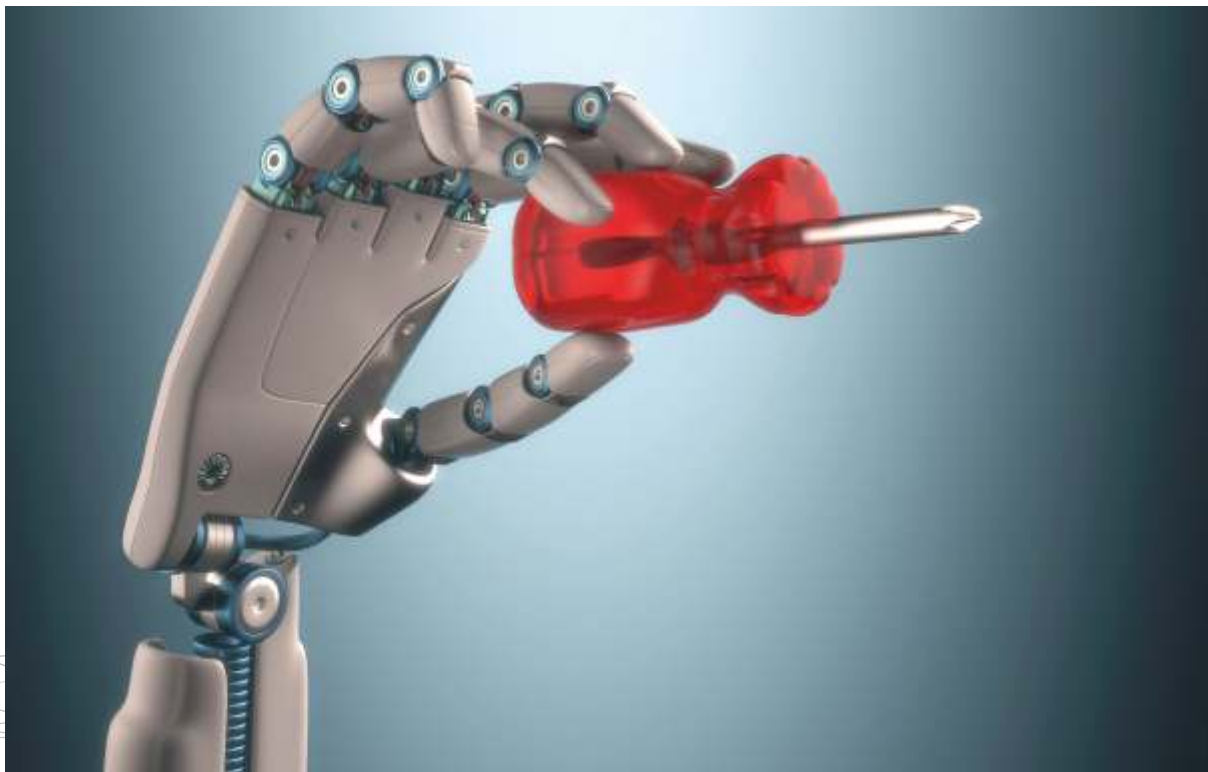
\*\*<http://bwdisrupt.businessworld.in/article/Socio-Economic-Impact-of-App-Based-Cab-aggregators-ABCA-in-India-and-Emerging-Policy-Issues/13-01-2017-111413/>



Leading online cab aggregators have reported a requirement of close to 3,500 drivers per month to meet their growth requirements. However, today they get fewer than 600 drivers per month through their hiring ecosystem<sup>24</sup>. The 'Uber' model of technology aggregation of services has also been taken up by other entrepreneurs in building maintenance, healthcare and other home services. Some of them are beginning to gain size and scale.

Ecommerce companies have developed a job ecosystem around them. It includes logistics firms, freelance web scriptwriters, web photographers etc., which support the entrepreneurs. There are also entrepreneurs who support local artisans in the design, manufacture and marketing of fashion and lifestyle products on the Internet. Some of the entrepreneurs are onboarding artisans onto B2B and B2C platforms. Such platforms, once developed, will make it possible to service an e-commerce company such as Amazon and Flipkart.

We are also seeing the emergence of technology-enabled knowledge service provision in development sectors - agriculture, health, financial services and education. In such models, a less educated worker (such as an ASHA worker in the healthcare space, a business correspondent in the financial services space, a para teacher in the education and skills space and a rural-technician in agriculture and allied spaces) is supported through technology tools such as information tablets connected to the cloud and diagnostic tools to deliver the much-needed developmental services in distant areas. This combination of a trained human being in collaboration with a technology tool is emerging as a gainful employment opportunity in rural areas in the country.



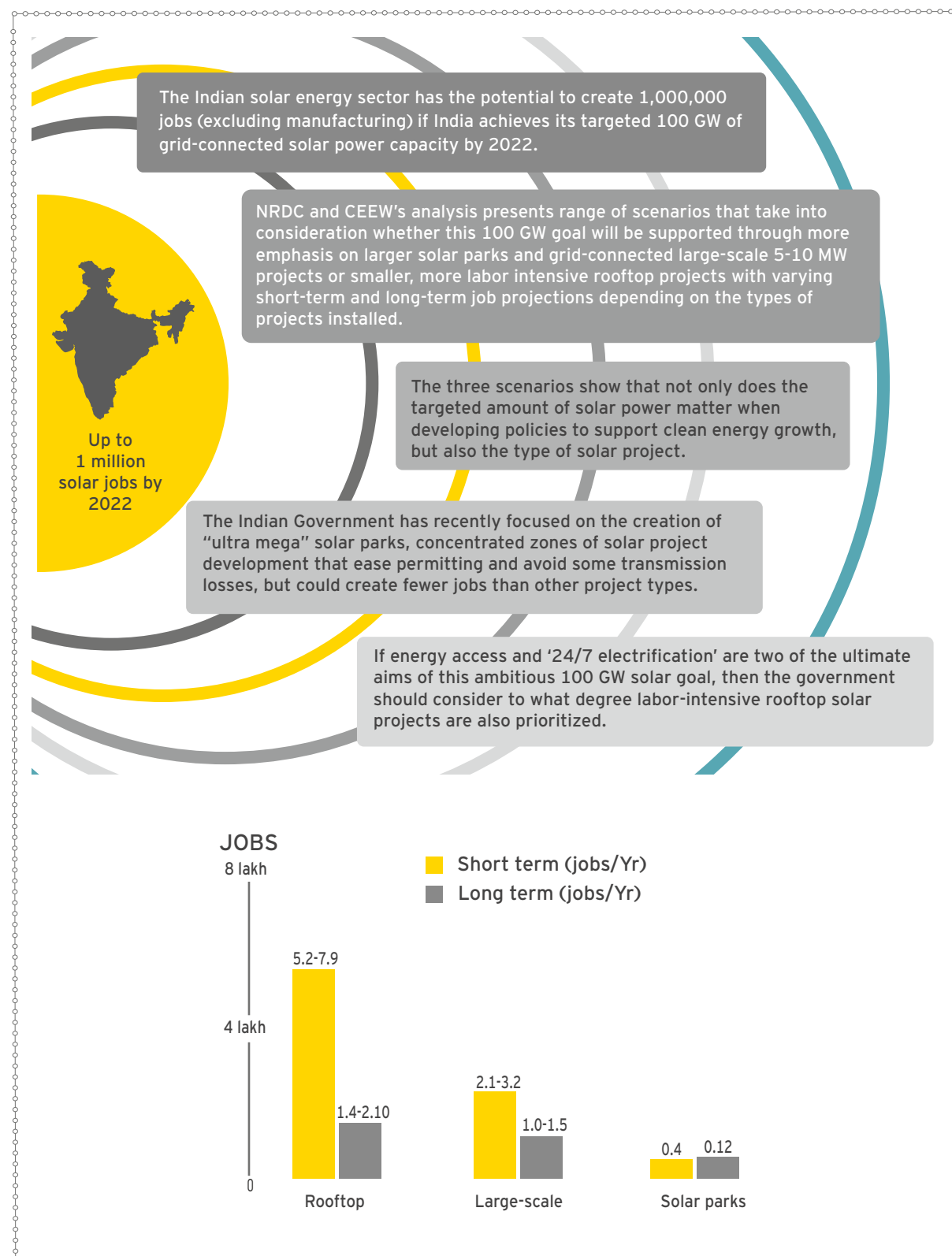
## Demand for a resourceful planet and sustainability

Environmental sustainability demand supported by regulations have the potential to create more than 1.5 million green jobs by 2022<sup>25</sup>

Regulation is a key driver for creating environmentally benign products and services. The recent Supreme Court ban on registration of large diesel vehicles in NCR has increased the demand for hybrid cars. Some Indian auto OEMs have witnessed a significant jump in the sales of their mid hybrid technology vehicles. This increased demand has prompted firms in not only automobile but also other industries to come up with environmentally sustainable offerings. Indian firms are coming up with a portfolio of sustainable products ranging from organic foods, electric cars, to new age air conditioning and lightening systems that are power efficient. Given the rising demand, the growth for green products is expected to remain strong in the coming years.

On the employment front, the growth of sustainable businesses is opening up new avenues for job creation. A recent study by Natural Resource Defence Council and Council on Energy, Environment and Water estimates that solar electrification projects created approximately 24,000 full-time jobs in India around 2011-14. Similarly, the wind power sector created an additional 45,000 jobs. Given India's ambitious target of generating 100 gigawatt of solar energy by 2022, estimates show as many as 1 million new jobs could be created. Also, another 183,500 full-time jobs would be created in the wind sector to meet the target of 60 gigawatt of wind energy generation by 2022<sup>25</sup>.

**Figure 15: Avenues of clean green jobs in India**



Source: "Clean energy powers local job growth in India." NRDC-CEEW, February, 2015.

## New work arrangements

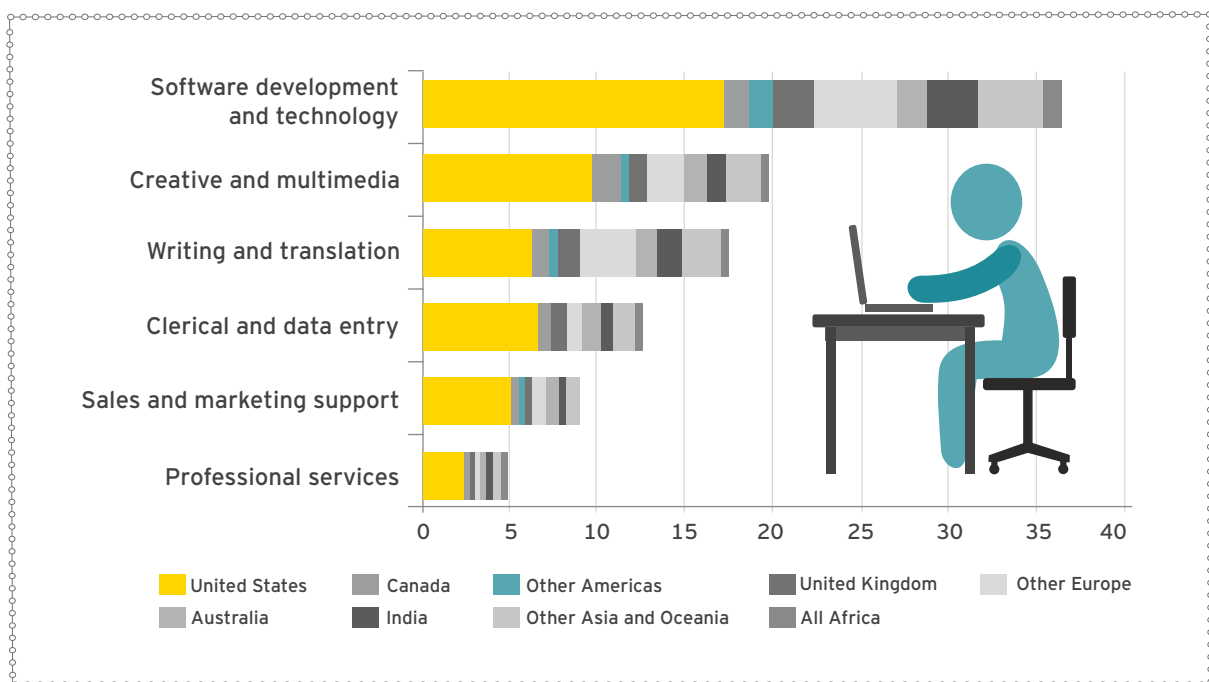
With 24%<sup>26</sup> share of the global online gig economy Indian freelance workers are charting new work arrangements

As mentioned earlier in the report, what constitutes a "job" will need to be re-defined in the future. Any gainful employment that provides income equal to or more than a standard office or factory-going job needs to be considered as a "job" in the future. Indians are embracing various kinds of employment in an on demand/gig economy:

- ▶ Freelancing
- ▶ "Uber" models
- ▶ Entrepreneur/self-employment models within a job ecosystem of an ecommerce company
- ▶ Technology-enabled knowledge service provision in development sectors

An analysis of online occupations measured by the online labour index projects reveals that software development and technology have the highest share, followed by the creative and media sector.

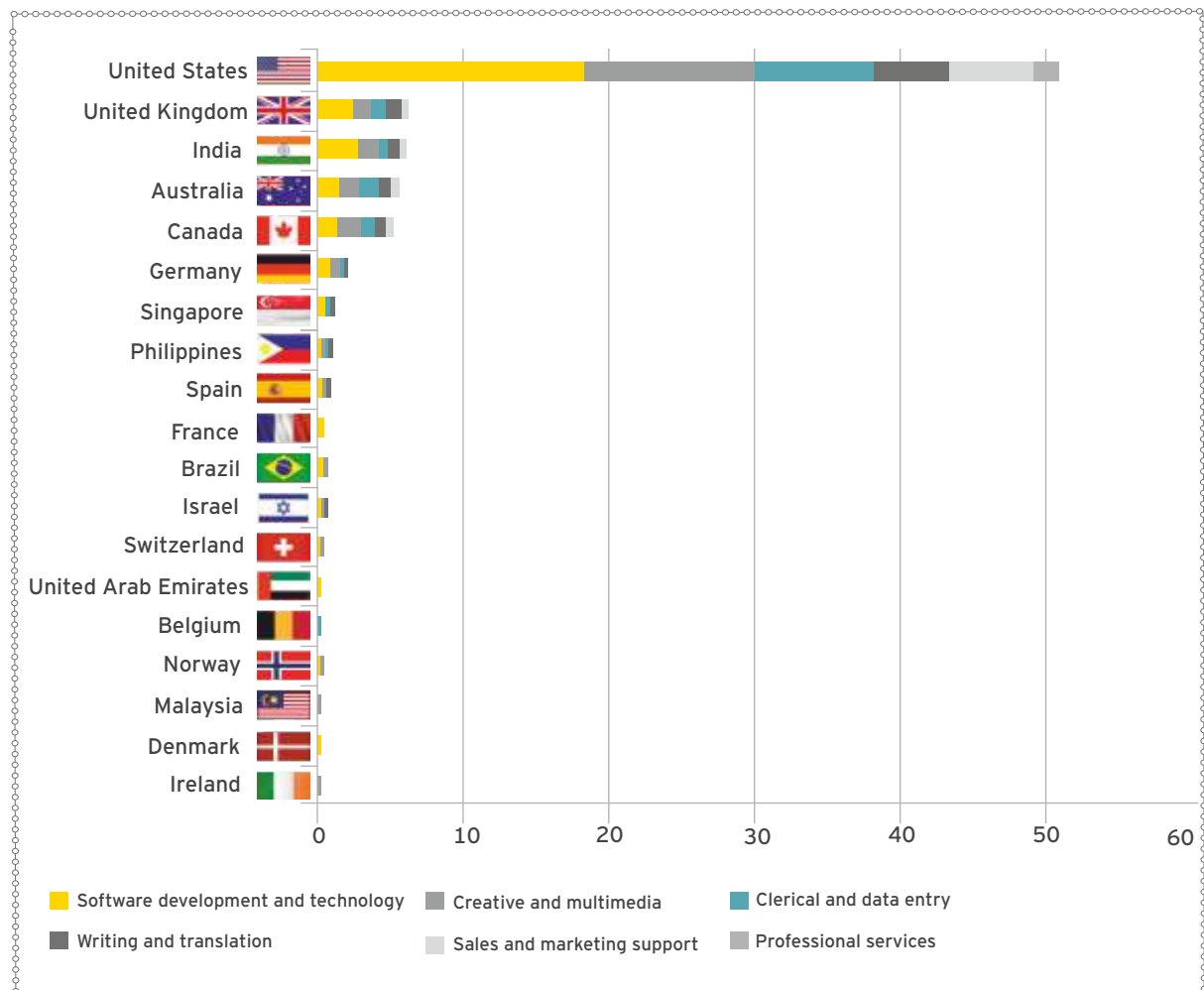
**Figure 16: The top online occupations - demand**



Source: "Online labour index: measuring the online gig economy for policy and research." Otto Kässi and Vili Lehdonvirta, Oxford Internet Institute, November, 2016.

India is also among the top three in demand countries for online work, led by the US as shown in the figure below:

**Figure 17: The top 20 countries with demand for online work**



Source: "Online labour index: measuring the online gig economy for policy and research." Otto Kässi and Vili Lehdonvirta, Oxford Internet Institute, November, 2016.

The new work arrangements include employee-entrepreneur combination and tech-assisted entrepreneurs

The "Uber" models in cab hailing, building maintenance, healthcare and other home services have work arrangements where the service delivery is done by persons who work in employee-entrepreneur models. Similarly ecommerce companies have helped create an ecosystem of entrepreneurs whom they support through market linkages and automated business processes. Finally, in the development sector various tech platforms are helping create a cadre of rural knowledge workers.

# Changing demographic trends and future of jobs in India

**The three key megatrends** that are driven by demographic change are:

- ▶ Rising middle-class
- ▶ High proportion of young population
- ▶ Increasing urbanization



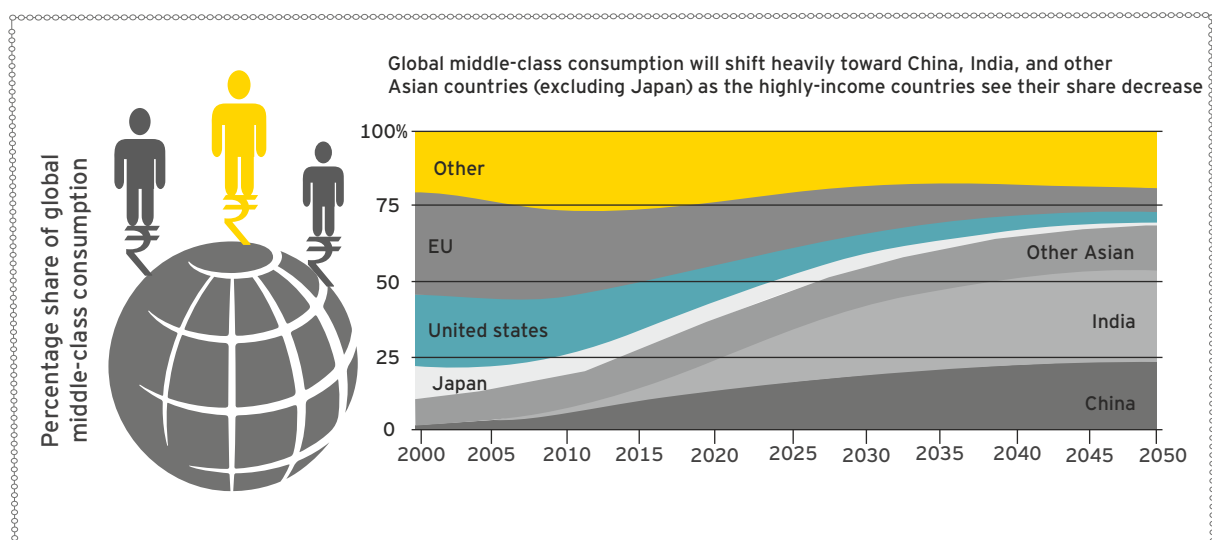
## Rising middle-class, high proportion of young population, increasing urbanization

Indian “global middle-class” which is expected to quadruple by 2020, will drive domestic consumption and thereby increase the quantum of jobs

While there are many definitions of “middle-class”, including the World Bank definition of lower middle-class (US\$2 to US\$10 earnings per day) and upper middle-class (US\$9 to US\$13 earnings per day), for most businesses a much more useful definition of middle-class is people earning between US\$10 and US\$100 per day. At this level, consumers start having the kind of disposable incomes that allows them to buy cars, televisions and other goods. People in this income bracket can be considered a “global middle-class” by the standards of any country.

India’s small “global middle-class” at around 50 million people in 2015, or 5% of its population, is expected to grow steadily over the next decade, reaching 200 million by 2020<sup>27</sup>. But by 2025, this “global middle-class” will become the largest, accounting for about 40% of all Indian consumption, up from about 26% in 2015<sup>28</sup>. The figure below shows the middle-class consumption trends of the leading global economies:

**Figure 18: The global middle-class wave**



Source: “The emerging middle-class in developing countries.” Homi Kharas, OECD development centre working paper No. 285, 2010.

When a significant numbers of people begin earning the equivalent of over US\$10 per day, and enter the global middle-class bracket, their purchasing habits attract the attention of companies accustomed to supplying to middle-class markets in the developed world. The power of the sweet spot also produces a “middle-class effect”, where the size of the middle-class is directly proportionate to the rate of economic growth. Hitting the sweet-spot level accelerates growth, which, in turn, adds more people to the middle-class, producing a virtuous circle. The Economic Intelligence Unit reckons that India will hit the sweet spot this year.

**Table 8: When will the emerging market countries hit their sweet spots (projected)**

Country	Year
Egypt	2011
Indonesia	2015
India	2017
Philippines	2019
Vietnam	2019
Pakistan	2024
Nigeria	2025
Bangladesh	2029

Source: “Hitting the sweet spot. The growth of the middle class in emerging markets.” Ernst & Young, 2013.

In the past 10 years, the consumption levels of Indians have increased by more than threefold and are expected to register an even stronger growth in the next decade. The consumption levels are expected to achieve a tenfold increase over the next 20 years. Consumers, are now increasingly spending on services like education, leisure, and telecommunications, especially from the emerging middle-class. Also, Indian consumers are shifting toward better, high-priced segments in categories like food, leisure, lifestyle and durables.

Schemes like Digital India are expected to have a profound impact on the consumption habits of Indians as they pave the way to connect Internet users to the online marketplace.

Ecommerce websites generate a surprisingly high share of their sales from tier-II and III towns, due to the access they provide to consumers in these locations. The Internet is also enabling Indians to gain access to global education and healthcare.

## Over 400 million millennials are creating a marketplace for digital products and services that demands newer skill sets

Indian millennials are the driving force behind the growing digital economy. As per a recent Morgan Stanley research report, millennials are expected to form over 36% of the Indian population, accounting for 61% of its Internet users and 78% of its online shoppers by 2020<sup>29</sup>. They are embracing online shopping through smartphones. The report describes Indian millennials as the largest disruptive force in India for years to come and currently this trend is still in the nascent stage<sup>30</sup>.

The rise of millennials is also redefining the workplace culture. The majority of millennials view innovation and flexibility as the key purpose of business and just as important as profitability.

The concept of urbanization is quite unique in the context of India whereby urbanization is not limited to metropolitan cities such as Delhi or Mumbai. Rapid urbanization is expected in the next decade as almost 40% of the population will be living in cities by 2025. This urban population is expected to drive 60% of the consumption levels in the country<sup>31</sup>. This urbanization trend would be fueled by the Government's drive to setup 100 smart cities by 2022. What is further interesting is that the increased consumption drive will come from the newly emerging tier II, III and IV cities and not from the mega-cosmopolitans cities like Delhi or Mumbai.

Today, nearly 70% of Indian households have a nuclear construct, representing a 13% increase over the past two decades. While this has many social implications, from a pure consumption point of view, it presents a unique opportunity – for the same income level, nuclear families spend 20%-30% higher per person than joint families<sup>32</sup>.

Clearly, this is an economy and society facing enormous changes and the demand created by such a dynamic society is a magnet for businesses to be set up and jobs created. It is no wonder that the rising middle-class has been ticked by the largest number of respondents as the key trend.

# The changed job landscape in 2022

Finally, we present a picture of the potential job market by 2022. In 2017, the total workforce is 473 million<sup>33</sup>. Of this, the organized manufacturing and services sectors have an 8% share, while the unorganized and informal economy's share is 92%<sup>34</sup>. By 2022, this workforce is estimated to be 600 million. However, there would be a structural change in the workforce.

One area, that has not been considered but could have a significant impact on the job landscape is new age farming. The Government's initiative of doubling farmers' income by 2022 is expected to shift a number of farmers or farmer producer companies from subsistence farming to commercial farming. This is proposed to be achieved through three action categories: development initiatives, technology generation and dissemination, and policy reforms. New technologies in agriculture are being introduced to push yields frontiers further, utilize inputs efficiently and diversify to more sustainable and higher value cropping patterns. New technologies coupled with additional allied activities like horticulture, poultry and dairying would help in increasing farmers' income. These would provide employment opportunities to rural youth. In addition to this, employment would be created by e-platforms like e-kisan mandi that allow large buyers – including exporters, caterers, hotels, and offline and online retail chains such as Big Bazaar, More, Grofers - to procure vegetables and fruits directly from farmer producer organizations rather than through middlemen.

In the organized manufacturing and service sector, the employment is expected to increase from the current 38 million to 46-48 million by 2022<sup>33</sup>. There would be job slowdown for the next two years as companies struggle to restructure their business models. By 2022, 9% would be deployed in new jobs that do not exist today, 37% would be in jobs that have radically changed skill sets, and jobs of 21% in 2017 would face existential threat<sup>33</sup>.

All the new forms of employment are expected to add a further 20% - 25% to the workforce of the current defined "organized" sector in 2022. This would increase the share of the organized sector in the overall economy to 10% from current level of 8%, i.e. approximately 60 million in a workforce of 600 million<sup>33</sup>. The new forms of employment would include

- ▶ Contract employees in infrastructure sector
- ▶ Micro entrepreneurs supported by MUDRA schemes
- ▶ Employer-entrepreneurs in technology enabled employment models
  - ▶ Freelance workers on online platform models
  - ▶ "Uber" workers
  - ▶ SME and artisan entrepreneurs on ecommerce platforms
  - ▶ Delivery workers and service providers in the ecommerce ecosystem
  - ▶ Employees in tech start-ups
- ▶ Employer-entrepreneur models in the agriculture sector





# 3 | Sector analysis





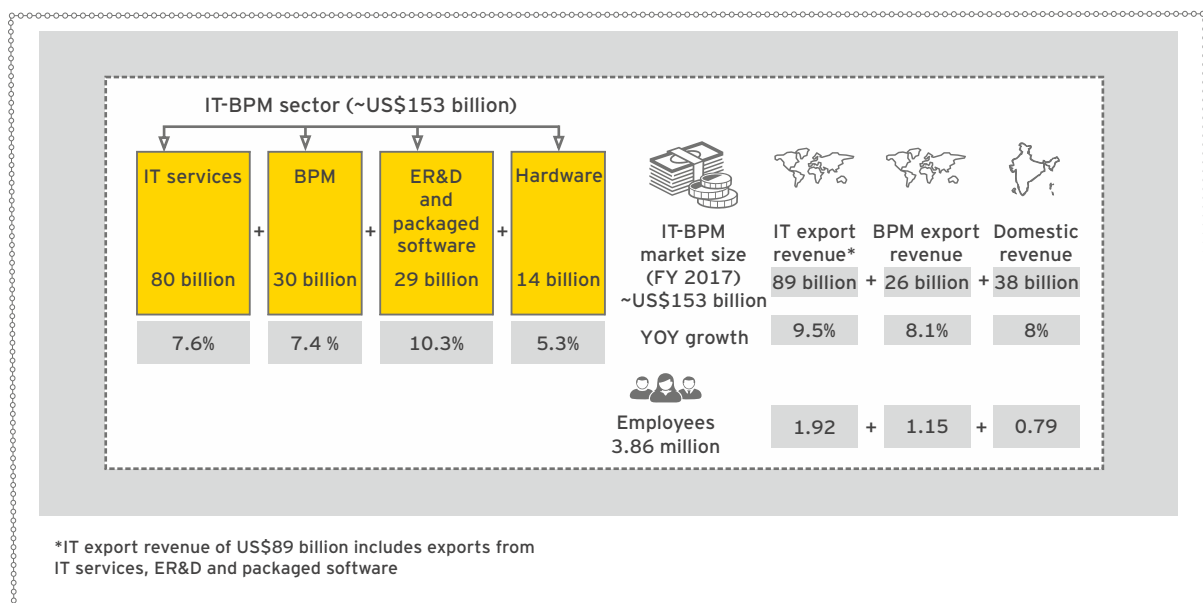
# IT-BPM sector

India continues to be world's number one sourcing destination for IT-BPM services, with a 55% market share (2016)

## Background

The Indian IT-BPM sector, which employs 3.86 million people directly and 13 million indirectly, earned a revenue of ~ US\$153 billion in FY 2017, up by 7.8% from FY 2016<sup>35</sup>. The breakup of the IT-BPM sector revenue for FY 2017 by sub-sectors, geographies and total employment is given in Figure 19.

**Figure 19: Sector overview**



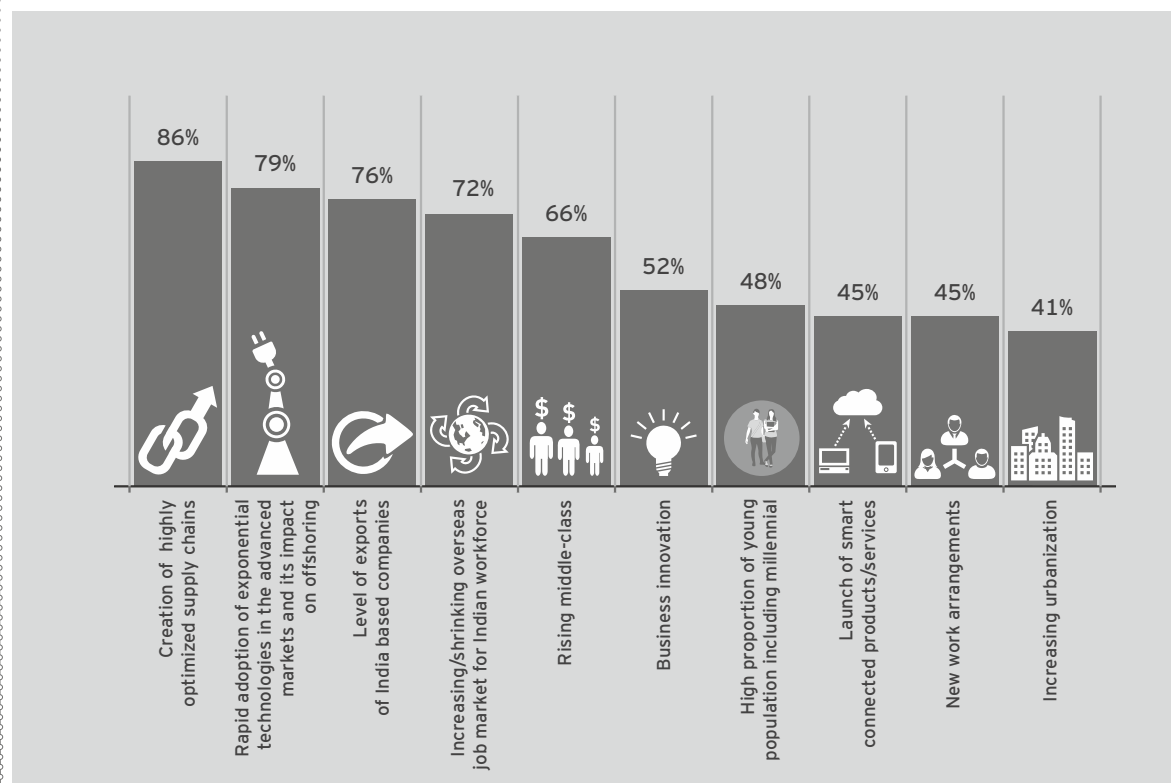
Source: Nasscom Strategic Review 2017

## Key megatrends impacting the IT-BPM sector

Close to 80% of the survey respondents believe that creation of highly optimized supply chains and rapid adoption of exponential technologies by global enterprises are the two primary trends that will redefine the sector

The IT-BPM industry is one sector where each megatrend was considered significant by the respondents. Over 40% of respondents voted for even the lowest impact trend - increasing urbanization. Five trends were voted as key megatrends by more than 65% of respondents, as seen in the figure below. This is in contrast with other sectors, where more than one trend was considered less significant by respondents. This is in line with the fact that the IT-BPM industry is at the center of the shifts being enabled by these exponential technologies.

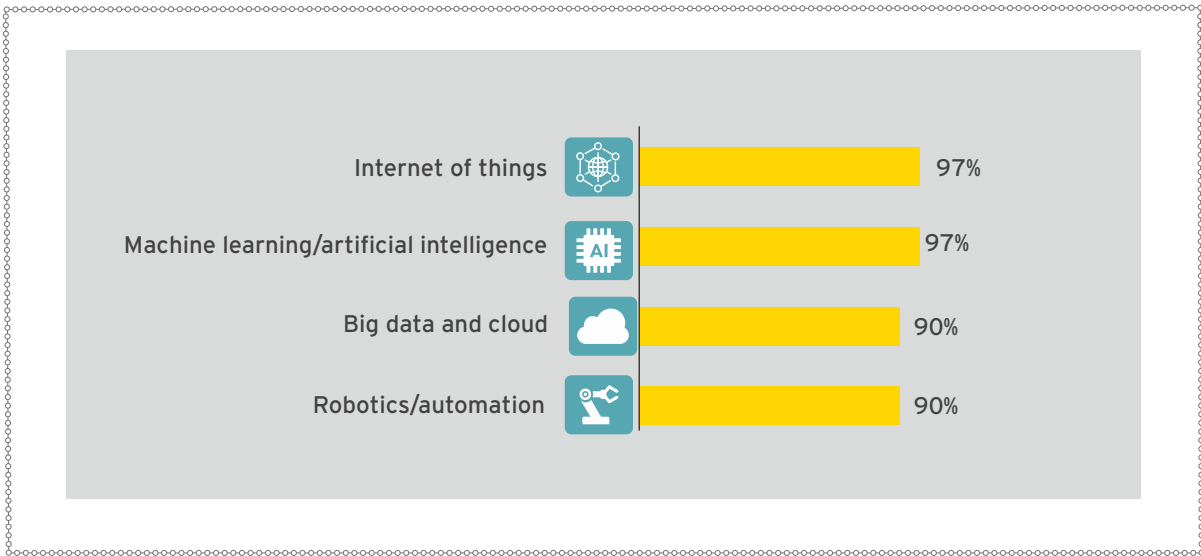
**Figure 20: Key megatrends IT-BPM sector**



Source: EY future of jobs respondent analysis

The high rating for the first two trends is not surprising. The falling cost curve of the exponential technologies is leading to their rapid adoption by firms in advanced markets to automate processes and enhance products offerings. The key technologies that would drive business for IT organizations in advanced markets as per the industry respondents are shown in Figure 21.

Figure 21: Technological trends



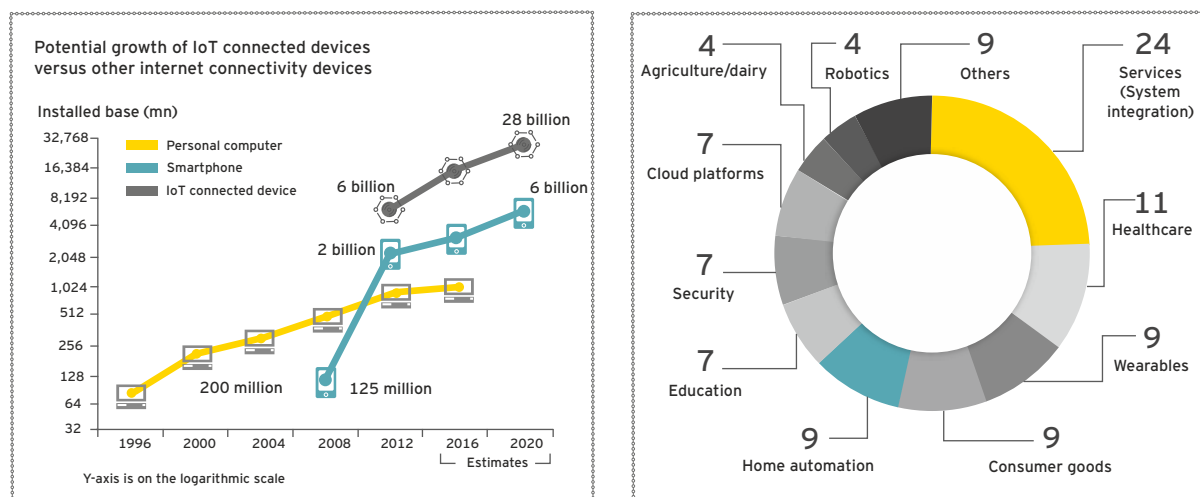
Source: EY future of jobs respondent analysis

The IoT has been rated as the top tech trend. This is because globally, the number of IoT connected devices is expected to reach 28 billion by 2020<sup>36</sup> as shown in figure on next page.



24% of the respondent companies are providing services around IT<sup>36</sup>. The percentage of firm providing IoT services sector wise is shown in figure below.

**Figure 22: Evolution of IoT**



Source: "Evolution of internet of things ecosystem - potential in India." Convergence Catalyst, November, 2014.

40% of the firms are focused on providing vertical-specific IT solutions (healthcare, consumer goods, home automation, education, agriculture, etc.)<sup>36</sup>. Artificial intelligence, the next rated trend is expected to generate US\$100-US\$120 billion business for IT-BPM industry globally<sup>37</sup>.

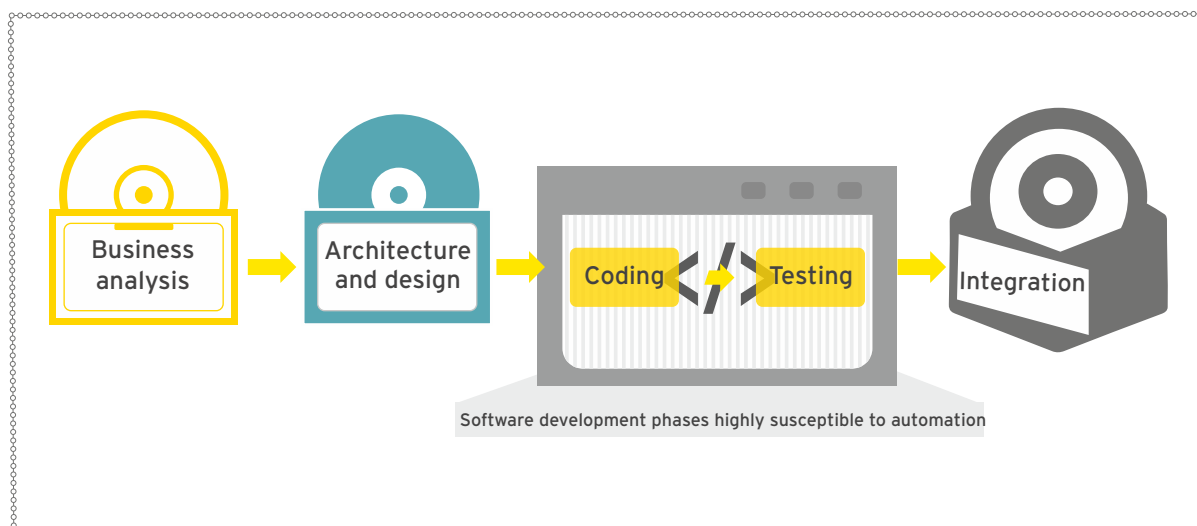
Changing demands of global customers are driving Indian IT-BPM players to develop relevant competencies around these technologies.

IT-BPM firms have already started rapid reskilling initiatives and are beginning to derive RoI for these efforts. An analysis of the skilling/reskilling programs of IT-BPM firms by NASSCOM in 2017 indicates that >50% of the workforce of large-sized firms (revenue >US\$1 billion) has already been trained in digital technologies; for medium firms, it is 33%-35% and for small firms, 38% of workforce has been reskilled<sup>35</sup>. The revenue share of the Indian IT-BPM industry from digital technologies as of FY2017 is estimated at >14%<sup>35</sup>.

Jobs that are based on routine processes like software testing are likely to be most impacted by automation in the software development value chain

Continuous advancements in exponential technologies such as artificial intelligence and robotics and adoption of newer models such as continuous delivery have already started to have an impact on the software development value chain mainly in the testing and coding functions. A typical software development value chain is shown in Figure 23. IT companies are increasingly leveraging software robots to automate repetitive task and testing for bugs.

**Figure 23: Typical software development value chain**



Source: EY analysis

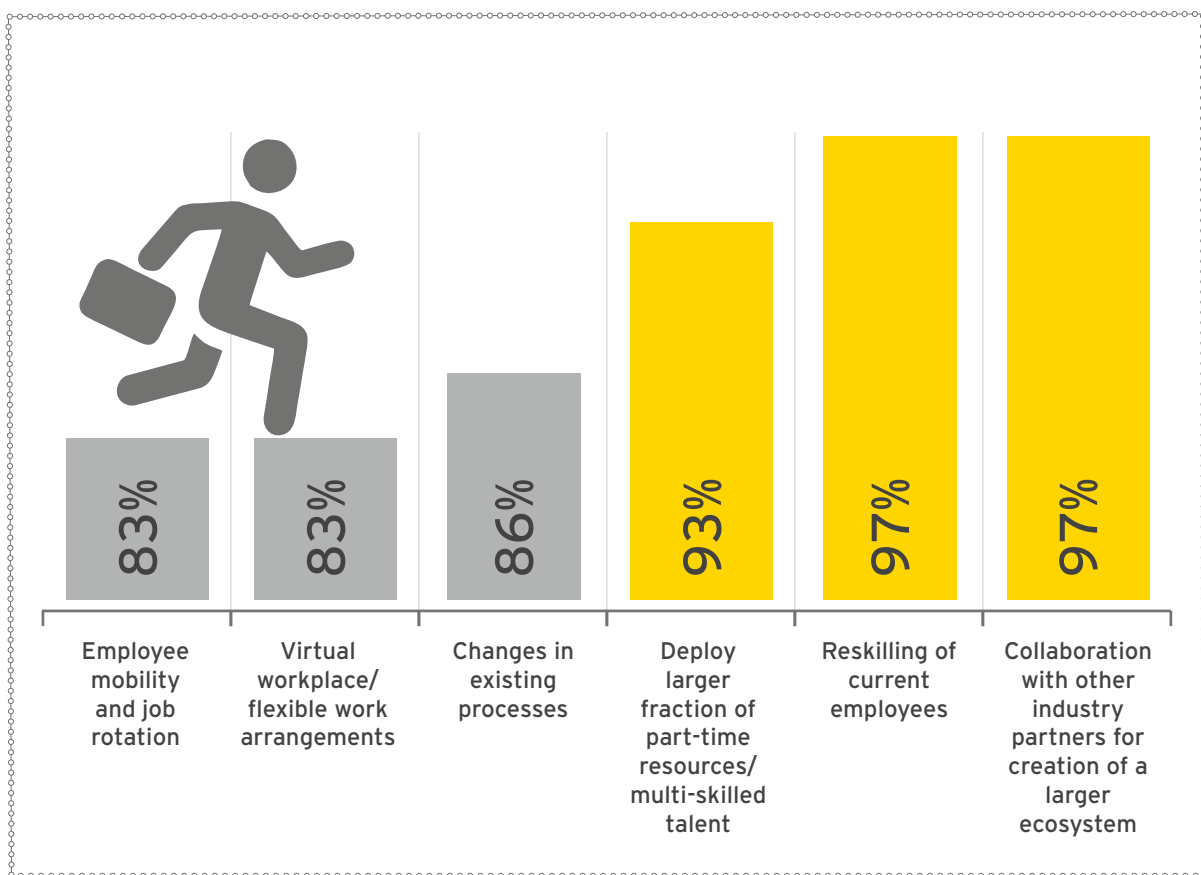
The BPM sector has been shifting gears, being driven by the three A's - automation, analytics and artificial intelligence. This sector is witnessing an increasing advent of RPA/chatbots especially in the BFSI industry. Typical examples of RPA are transaction processing, data entry in high volume, repeatable and computer-centric processes such as claim processing for the insurance sector and reward processing for the telecom sector. RPA is taking over not only rule-based jobs but also jobs that require knowledge-based activities. This has become possible because of the advances in cognitive computing, artificial intelligence, deep learning, gig data and natural user interface.

45% of our industry survey respondents view launch of smart connected product/services to be a major growth driver for the domestic IT-BPM industry. This demand is anticipated to be driven by both private and public sectors. Rising middle-class with increased digital penetration is creating huge demand for smart connected products/services. Businesses, in order to cater to this demand and on their quest for creating smart connected factories, are increasingly onboarding technology firms. On the other hand, Government spending on urban infrastructure creation such as smart cities and smart grids is further expected to increase business for the IT firms. The number of smart connected devices in India is expected to increase from the current level of 200 million to 2.7 billion by 2020<sup>38</sup> there by creating demand for new job roles such as IoT wireless network specialists.

97% of the industry respondents view reskilling the current workforce as a key initiative to be prepared for the change due to the impact of primary forces

In view of the above changes, IT players have initiated major reskilling programs in order to prepare the workforce for the future as can be seen from Figure 24.

**Figure 24: Key industry initiatives**

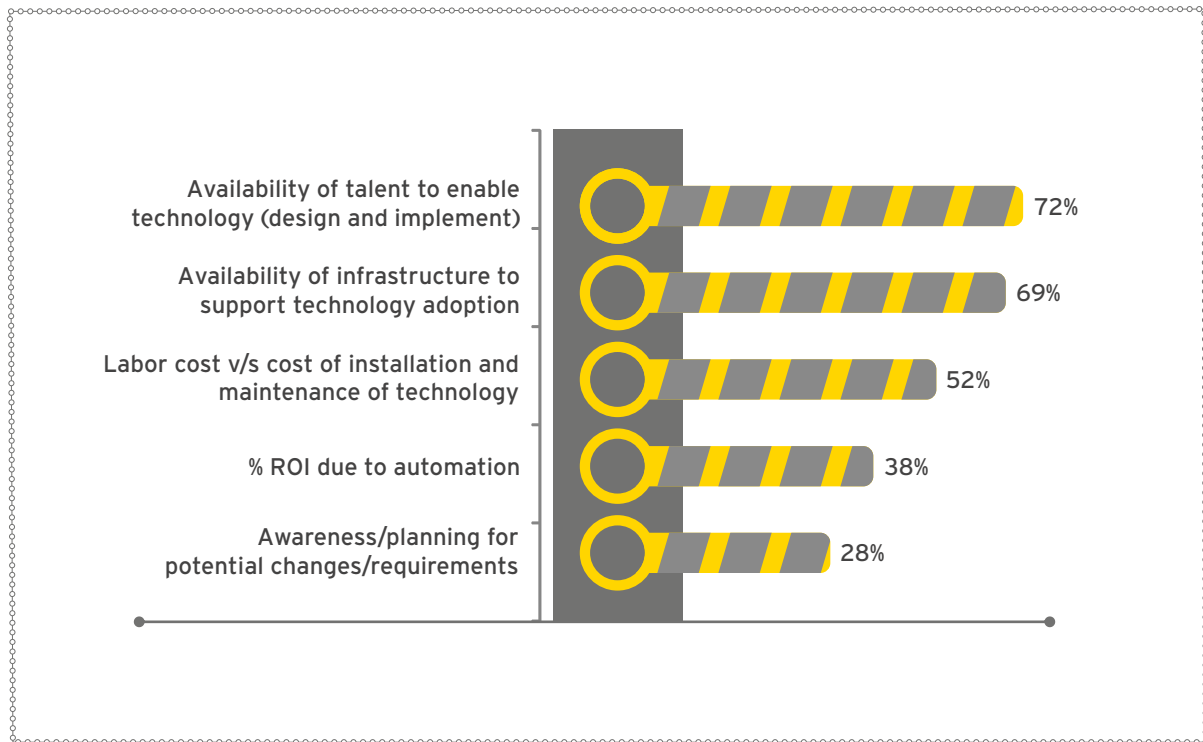


Source: EY future of jobs respondent analysis



However, the industry is grappling with a set of challenges that are hindering the rapid adoption/implementation of exponential technologies. (see Figure 25)

**Figure 25: Key barriers to automation**



Source: EY future of jobs respondent analysis

## India is seeing the emergence of gig economy with Indian companies beginning to use online labor

India is emerging as the third largest online labor market<sup>39</sup>. Online Labour Index survey 2016 shows that India-based employers represented 5.9% of all projects/tasks posting for online labor of which 45% were for software development and technology projects<sup>39</sup>. This trend suggests the changing nature of employment in the IT-BPM sector. This trend was reaffirmed as 45% of the survey respondents viewed new ways of working such as freelancing as an important megatrend shaping the industry.

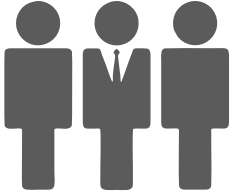


## Impact on jobs and skills

IT-BPM sector would continue to hire at a rate of 3%-3.5% year-on-year against a historical growth rate of 6%-6.5% to reach 4.5 million in 2022. 70%-75% of the jobs in 2022 would require new skill sets

The IT-BPM sector employed 3.9 million people in India in FY2017<sup>35</sup>. 80% of the workforce is involved in IT-BPM exports, mainly to the US and Europe (including the UK).

**Table 9: IT-BPM sector employment**



Employment figures 2015-2017		
IT sub sector	Employment in million	
	2015	2017
IT services and exports*	1.73	1.92
Domestic market	0.71	0.79
BPM exports	1.04	1.15
Overall sector	3.48	3.86

Source: NASSCOM Strategic Review 2017

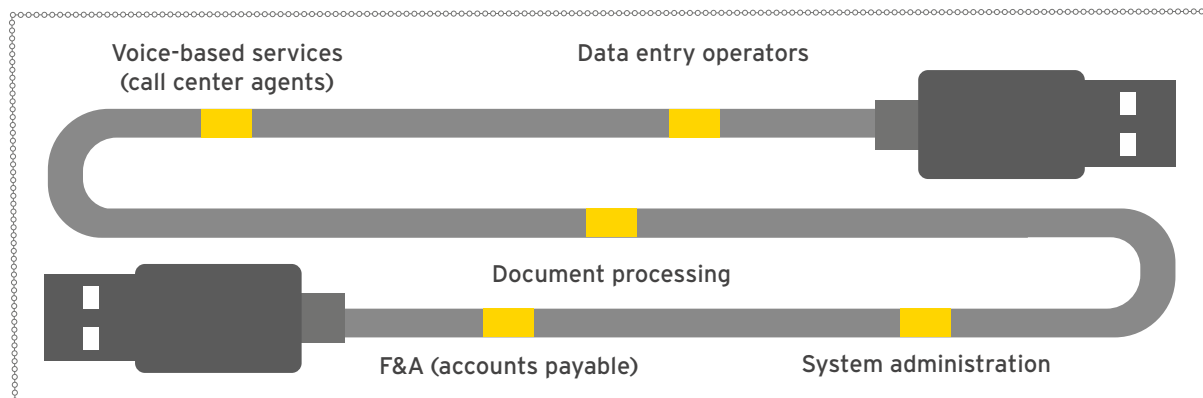
\*IT exports include IT services, software products and ER&D segments

**Table 10: Changed job scenarios in 2022 in IT-BPM sector**

Expected size of sector in 2022 (billions US\$)	Expected % growth in sector	Current jobs in sector (millions)	% of current sector jobs threatened	Incremental jobs created over 5 years (millions)	Total jobs in 2022 (millions)	% of 2022 jobs that will be new	% of 2022 jobs that will be changed
240	9	~3.9	20-35	0.7	4.5	10-20	60-65

Source: EY analysis and EY future of jobs respondent analysis

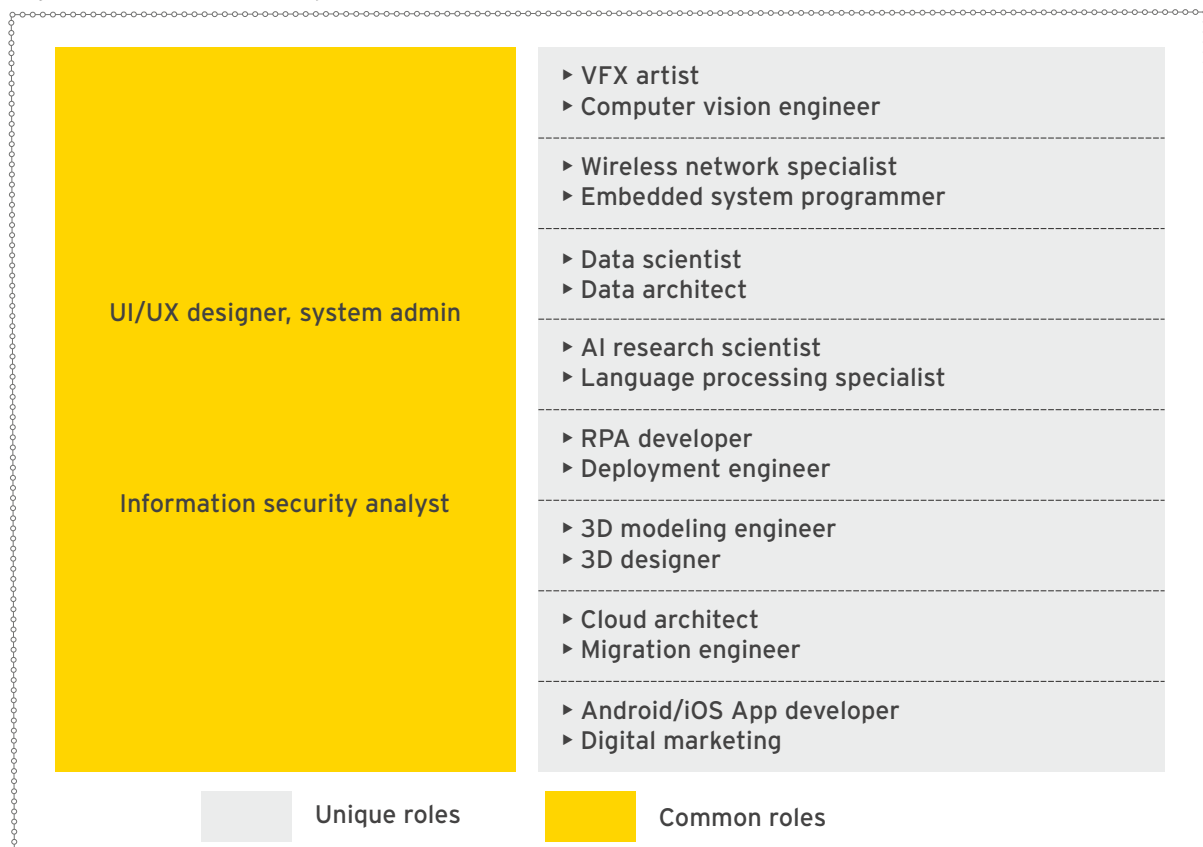
**Figure 26: Jobs likely to be highly automated**



Source: EY future of jobs respondent analysis

Of the 4.5 million jobs of 2022, 10-20% would be new jobs, some of the new jobs are shown below:

**Figure 27: IT-BPM new job roles**



Source: EY future of jobs respondent analysis

Figure 28: Skill set requirement for new job roles

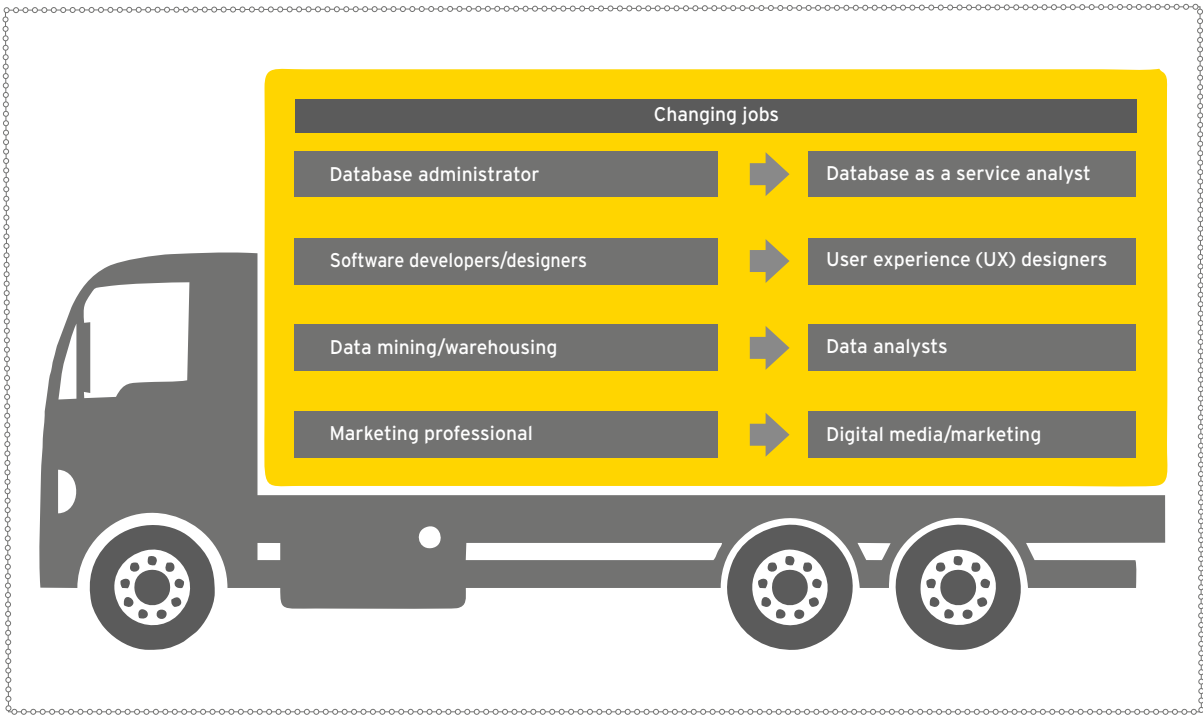
Key skills		Cognitive abilities	Physical abilities	Content skills	Process skills	Complex problem solving skills	Resource management skills	Social skills	System thinking	IT / Hardware skills	Environment conscious thinking
New jobs	VFX artist	✓		✓				✓		✓	
	Computer vision engineer	✓							✓	✓	
	Wireless network specialist	✓			✓				✓	✓	
	Embedded system programmer	✓			✓	✓				✓	
	Data scientist	✓			✓	✓			✓	✓	
	Data architect	✓			✓	✓			✓	✓	
	AI research scientist	✓		✓	✓	✓			✓	✓	
	Language processing specialist	✓		✓				✓		✓	
	RPA developer	✓		✓	✓		✓	✓		✓	
	Deployment engineer	✓			✓		✓	✓		✓	
	3D modelling engineer	✓	✓		✓					✓	✓
	3D designer	✓			✓					✓	✓
	Cloud architect	✓			✓	✓	✓		✓	✓	
	Migration engineer	✓			✓	✓			✓	✓	
	Android/iOS App developer	✓		✓		✓		✓	✓	✓	
	Digital marketing	✓		✓				✓		✓	✓

Source: EY future of jobs respondent analysis

It is evident from the figure that cognitive skills, process skills along IT/knowledge skills would be skillsets in demand in 2022.

Of the 4.5 million jobs in 2022, 60%-65% are expected to undergo change. Some of the changing jobs would be:

Figure 29: IT-BPM sector changing jobs



Source: EY future of jobs respondent analysis





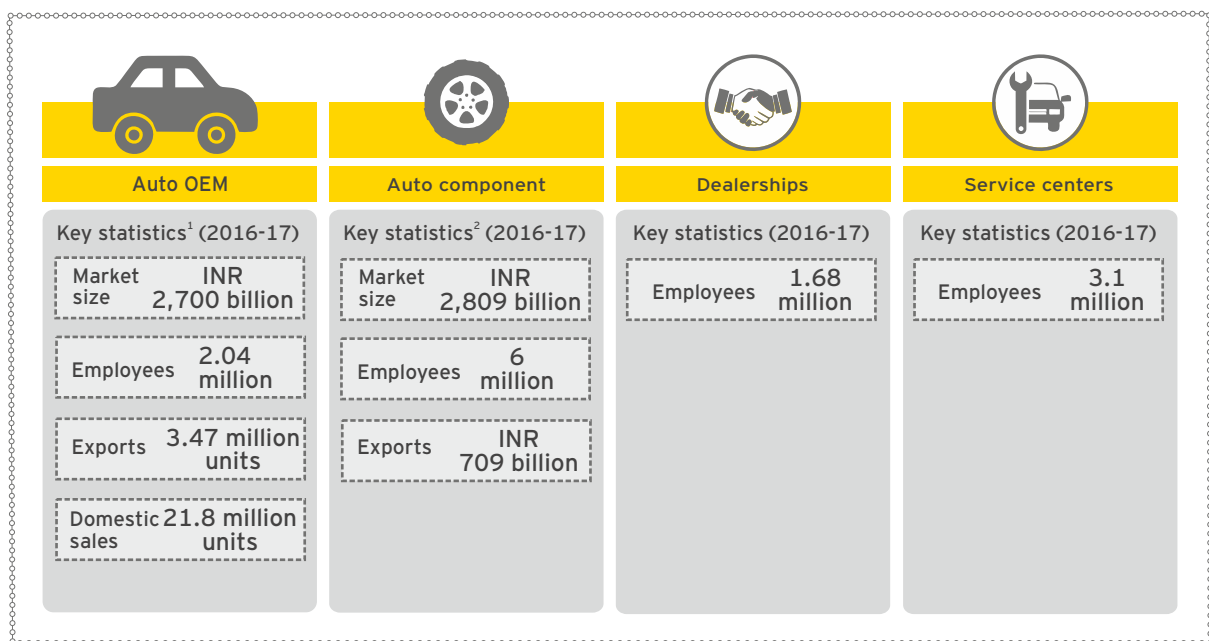
# Automotive sector

The automotive sector provides direct employment to 12.8<sup>40</sup> million people (FY 2017)

## Background

The automotive industry is major employer in the country. The employment picture across the four major sub-sector - auto OEM, auto component, dealerships, and service centers – is shown below:

**Figure 30: Sector overview**



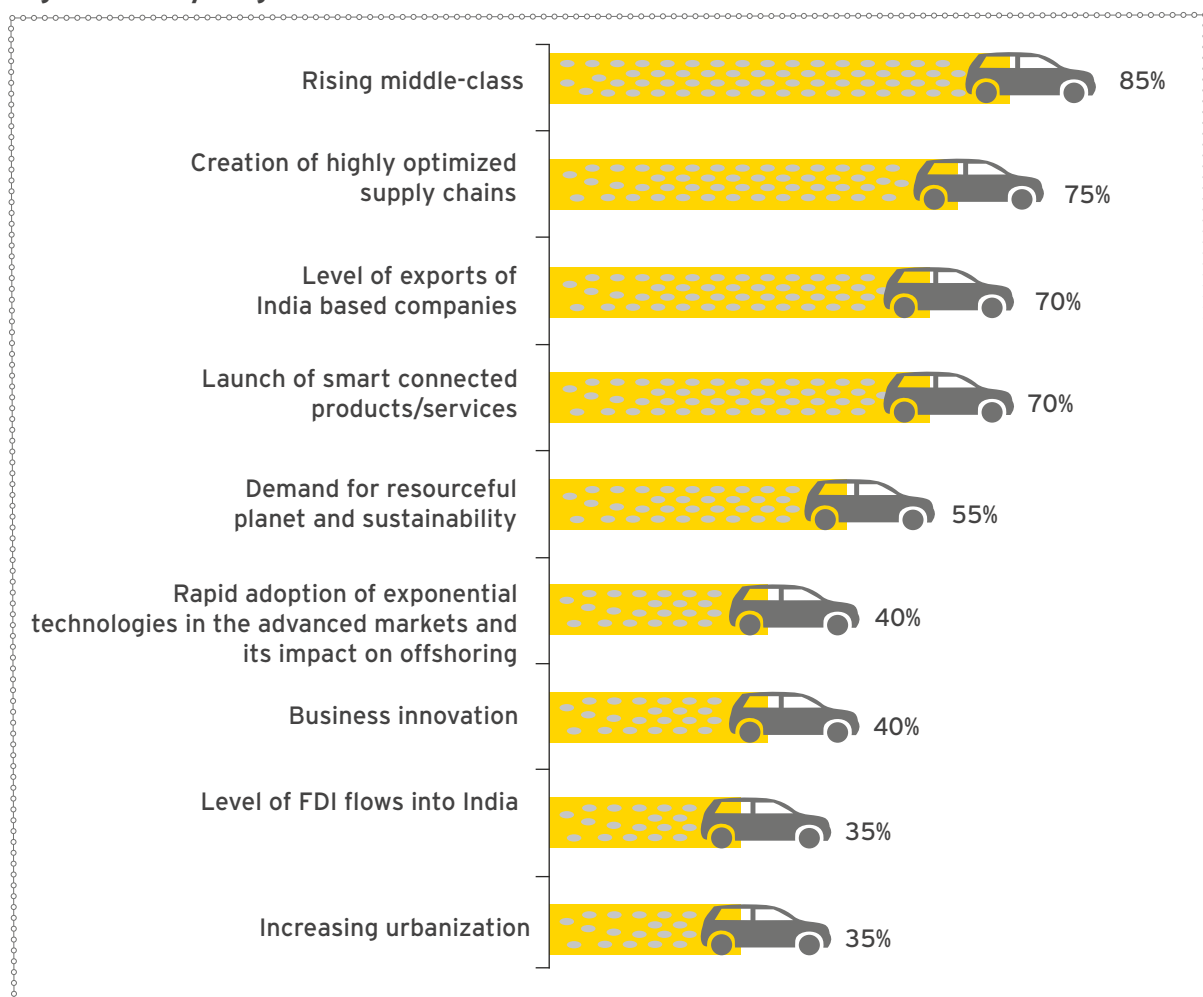
Source: "Human resource and skill requirements in the auto and auto components sector." National Skill Development Corporation, 2011; Automotive Mission Plan, 2016-26.

## Key megatrends impacting the automotive sector

More than 75% of the industry experts believe that the rising middle-class and creation of highly optimized supply chains are the two primary megatrends impacting the sector

The following trends were identified by respondents to have an impact on the sector in the next five years:

**Figure 31: Key megatrends automotive sector**



Source: EY future of jobs respondent analysis

## Abundant and low cost labor will continue to make India an attractive manufacturing hub at least for the next 2-3 years

Rising FDI and the entry of global automakers have helped India emerge as the third largest automotive manufacturing hub globally. Respondents from the industry mentioned that they are looking at India not only to increase production and sale in the country, but also as a manufacturing hub for exports. The favorable cost structure makes India an attractive location to set up manufacturing plants for parts or complete units for exports. Car exports from India rose 16% in FY 2017 compared to FY 2016 (from 6,53,053 to 7,58,830 units)<sup>41</sup>. Industry respondents view the adoption of exponential technologies such as 3D printing to have an impact on the level of exports from India in the long run. Abundant and low cost labor will continue to make India an competitive manufacturing hub at least for the next few years. The Indian automotive industry is likely to witness an increased demand for skilled labor in the coming years, as the economic environment improves and investments are made as part of the “Make in India” initiative.

Of the surveyed industry executives, 70% recognize the strategic importance of smart connected products for the industry. The advancements in IoT and big data/cloud computing are the building blocks to offering embedded smart connected cars with functionalities such as advanced navigation, predictive maintenance, vehicle-centric services, remote monitoring of car features, external mobile experiences and over the air updates. Technology further facilitated by urbanization and improvements in Internet infrastructure in the country is opening avenues of new offerings for OEM players in the form of smart connected cars. For example, an Indian auto major is providing smart analytical onboard dashboards to diagnose and prevent system malfunctions along with real-time tips on achieving better fuel efficiency as well as theft prevention. Similarly, another Indian auto major is partnering with a leading global software major to develop connected cars for Indian consumers<sup>42</sup>.

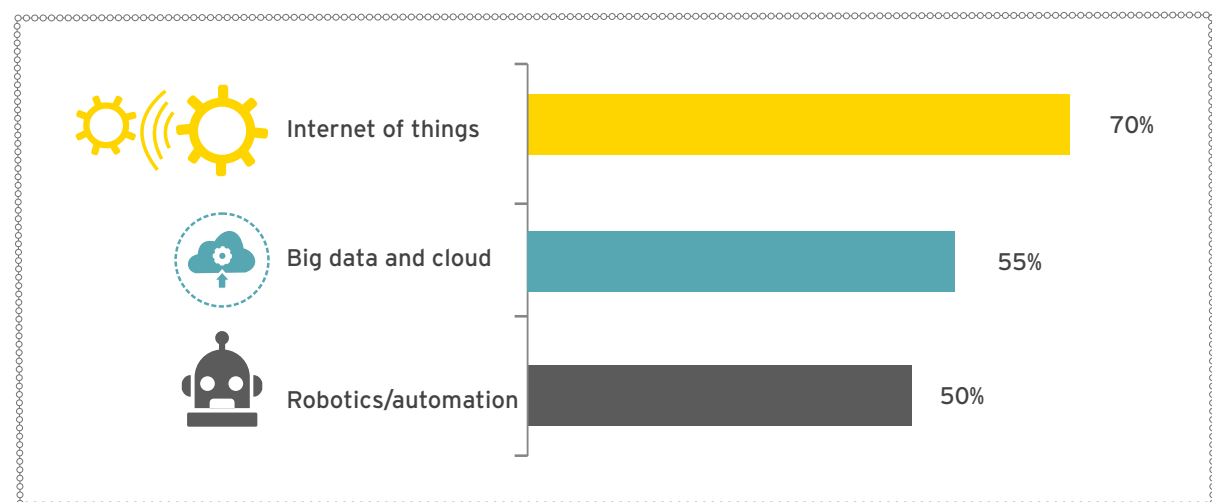
The partnership aims to bring together artificial intelligence, machine learning, IoT, and cloud to develop connected cars that present a highly personalized and safe driving experience. This emergence of connected cars, big data and cloud computing is demanding a new set of skills from the auto workforce.

## Rising middle-class with low auto ownership of 18 cars per 1,000 citizens will drive the demand for the domestic automotive industry

Despite having expanded enormously from a low base, auto ownership in India remains low, with only 18 cars per 1,000 citizens (China has nearly 69, while the US has 786)<sup>43</sup>. An expanding middle-class, rising urbanization, and one of the lowest car penetration ratios make India one of the most promising automobile markets globally. By 2021, India's emerging middle-class segment will comprise nearly 900 million people<sup>44</sup>, opening up new opportunities for the automotive industry. To serve this emerging class most global automobile players are ramping up their production activities in India and are expected to invest US\$8-10 billion over the next three years giving employment to 20,000-25,000 people<sup>45</sup>.

The automotive industry has been one of the top robot-buying industries for years, and this trend is expected to continue. Making its way through die-casting and welding, robots have enabled almost 70%-100% automation in weld shops, press shops, cast shops and paint shops. Robots are further penetrating into the assembly operations to enable higher degree of automation and lower costs for the manufacturer. 50% of the respondents described robotics/automation to be one of the most impactful technologies for the Indian automotive industry as can be seen from Figure 32. With Robotics being increasingly adopted in the sector, repetitive jobs roles such as painting and welding are being threatened. At the same time, job roles in robotics programming and maintenance will be more in demand.

**Figure 32: Top technological trends**

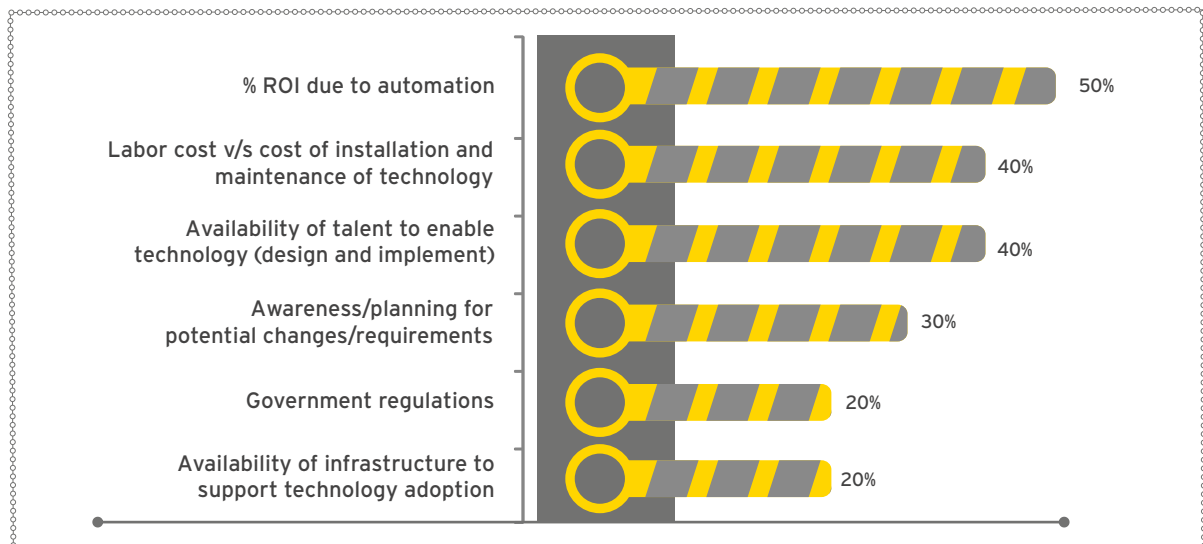


Source: EY future of jobs respondent analysis



Although the automotive sector has been a quick adopter of newer technologies, however, as per the respondents there have been certain barriers which are highlighted in Figure 33.

**Figure 33: Key barriers for adoption of automation**

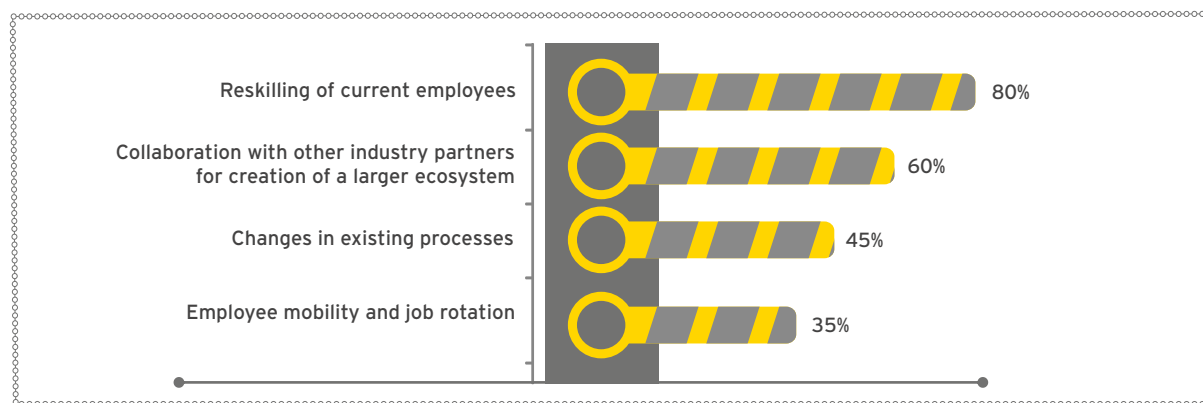


Source: EY future of jobs respondent analysis

With the introduction of connected cars, big data, and cloud computing, new skill sets will be required in design, operation as well as other elements of the auto value chain in the next five years

Reskilling has been rated as one of the top most initiatives by 80% of the industry players as shown in the figure below.

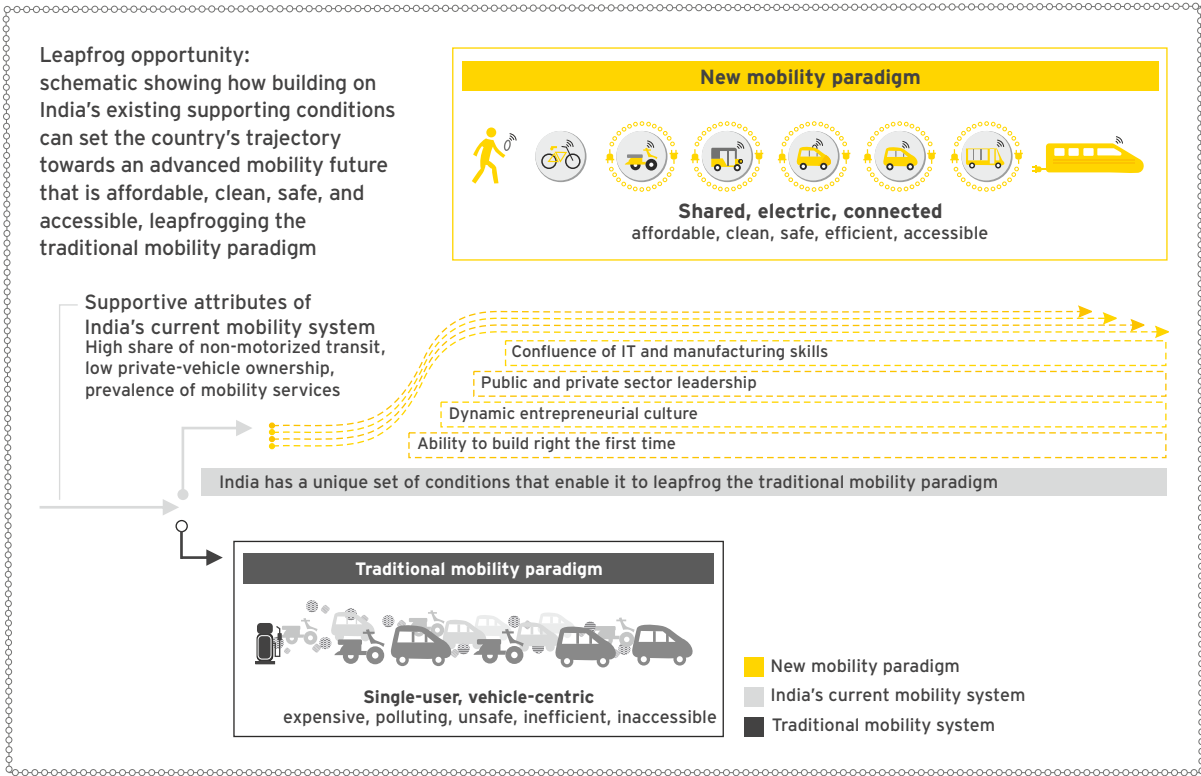
**Figure 34: Key initiatives by industry players**



Source: EY future of jobs respondent analysis

The convergence of low-cost sustainable technologies, smart design and integration, innovative business models, and supportive policies for sustainable mobility services has the potential to dramatically transform the automotive industry. Especially, the activism toward environmental sustainability is important to provide clean, cost effective mobility services, creating new green jobs. NITI Aayog estimates that 44% of the 538 million vehicles on Indian roads will be electrified by 2030 to trim the country’s projected oil demand<sup>43</sup>.

**Figure 35: Leapfrog opportunity for India**



Source: "India leaps ahead: transformative mobility solutions for all." NITI Aayog, May 2017.

Government initiatives such as "Make-in-India," Green Mobility Fund with a projected investment of INR80,000 crore and 100 smart cities development are providing India the opportunity to make a leapfrog transition toward creating a greener mobility ecosystem<sup>43</sup>. These projects are not only opening up employment opportunities but also creating businesses for the automotive industry. For example, many respondents view the Government's' electric and hybrid vehicle program as the key to the growth of modern passenger vehicle industry. This and other such businesses will help in creating significant jobs in the automotive industry.



## Impact on jobs and skills

The automotive sector would continue to hire at a rate of 2%-2.5% year-on-year against a historical growth rate of 3%-3.5% to reach 14.3 million in 2022. 60%-65% of the jobs in 2022 would require new skill sets

The Automotive sector over the past two decades has been a major contributor to employment in the country, providing a source of income to around 7%-8% of the total Indian workforce<sup>46</sup>.

The breakup of the employment figures across the four sub sectors is shown below across a four year period:

**Table 11: Automotive sector employment-2013-17**

Automotive sub sector	Employment in millions	
	2013	2017
OEM	1.87	2.04
Auto component manufacturers	4.81	5.99
Service centers	2.80	3.10
Dealerships	1.50	1.68
Overall sector	10.98	12.81

Source: "Human resource and skill requirements in the auto and auto components sector." National Skill Development Corporation, 2011.

A snapshot of the jobs scenario in 2022 in the automotive sector is shown in the table below:

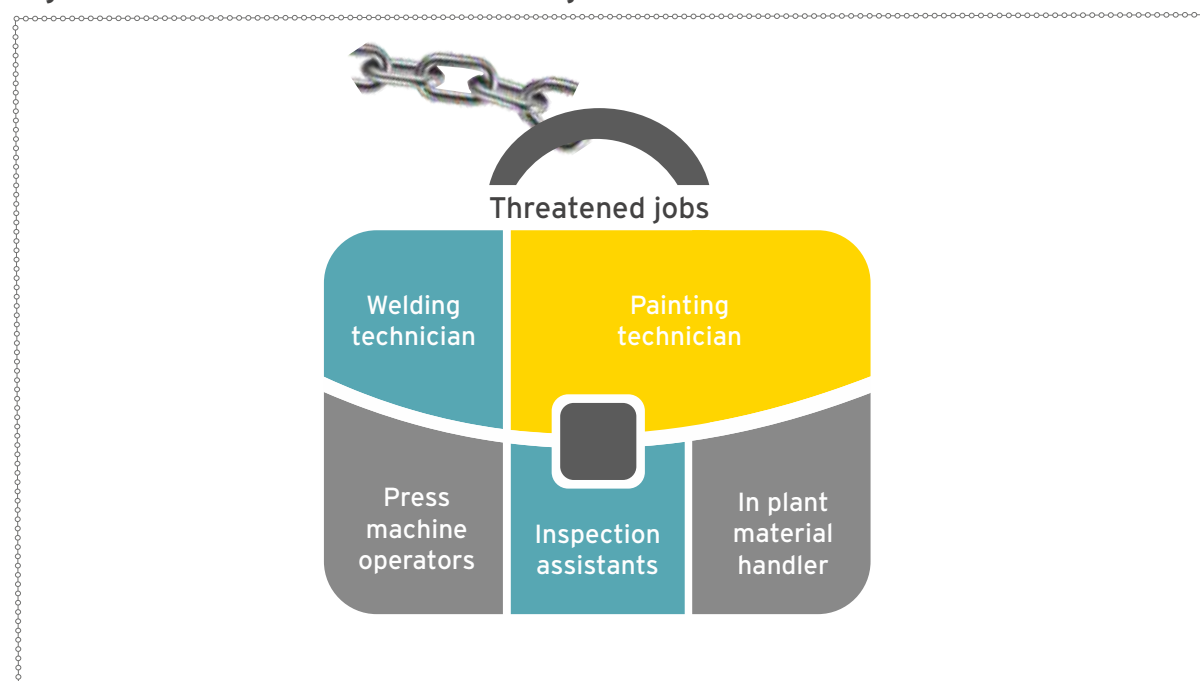
**Table 12: Changed job scenarios in 2022 in automotive sector**

Sub-Sector	Expected size of sector in 2022 (billions INR)	Expected % growth in sector	Current jobs in sector (millions)	% of current sector jobs threatened	Incremental jobs created over 5 years (millions)	Total jobs in 2022 (millions)	% of 2022 jobs that will be new	% of 2022 jobs that will be changed
Automotive OEM	4,032	8-8.5	2.04	15-20	0.17	2.2	10-15	55-60
Automotive component	4,500	9.5-10	5.99	15-20	0.93	6.92	10-15	55-60
Service centers	NA	NA	3.10	5-10	0.04	3.14	5-10	45-50
Dealership	NA	NA	1.68	<5	0.40	2.05	5-10	45-50
Overall sector			12.81		1.54	14.30		

Source: EY analysis and EY future of jobs respondent analysis

Some of the threatened jobs in the automotive sector are highlighted below:

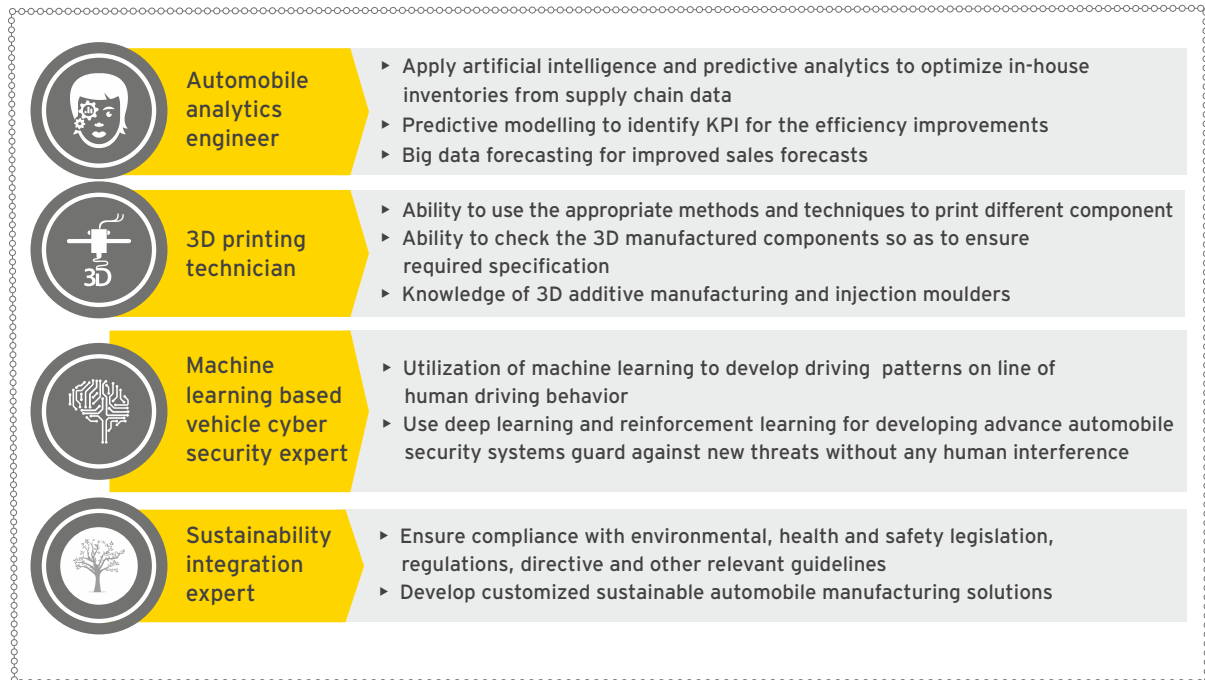
**Figure 36: Automotive sector threatened jobs**



Source: EY future of jobs respondent analysis

Some of the new jobs in the automotive sector are highlighted below:

**Figure 37: Automotive - new job roles**



Source: EY future of jobs respondent analysis

The skill sets required for the new job roles have been shown in the figure below:

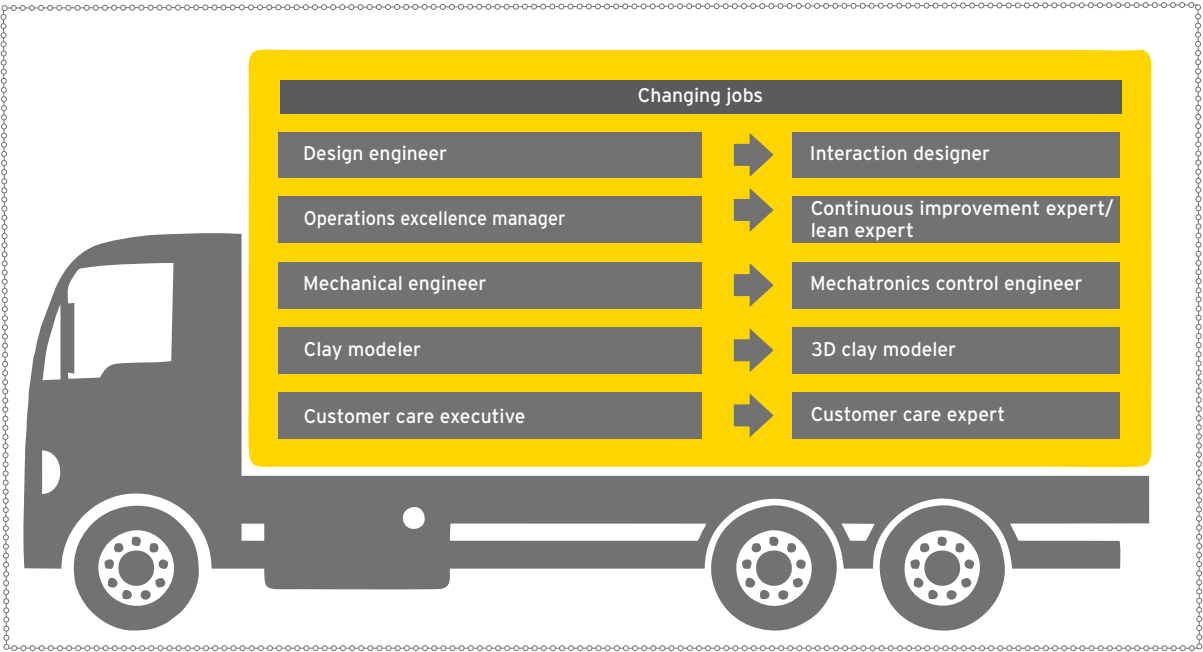
**Figure 38: Skill set requirement for new job roles**

	Key skills									
		Cognitive abilities	Physical abilities	Content skills	Process skills	Complex problem solving skills	Resource management skills	Social skills	System thinking	IT / hardware skills
New jobs	Automobile analytics engineer	✓			✓	✓			✓	✓
	3D printing technician	✓	✓		✓					✓
	Machine learning based vehicle cyber security expert	✓			✓	✓			✓	✓
	Sustainability integration expert	✓		✓	✓				✓	✓

Source: EY future of jobs respondent analysis

The changed jobs in the automotive sector are highlighted below:

**Figure 39: Automotive sector changing jobs**



Source: EY future of jobs respondent analysis

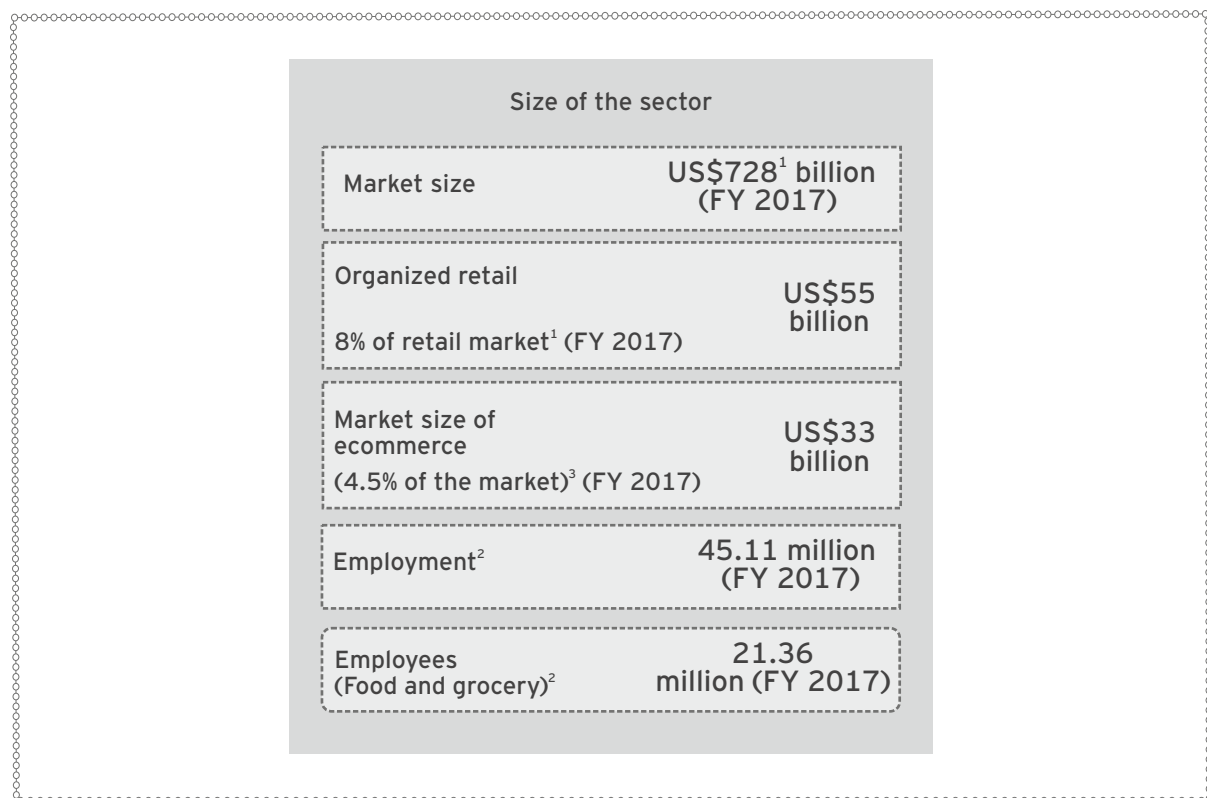
# Retail sector

The retail sector accounts for approximately 8% of the country's employment and 10% of its GDP

## Background

The retail sector accounted for a market size of US\$728 billion in 2017<sup>47</sup>. The share of ecommerce and organized retail sector is 8% and 4.5% of the retail market. Food and grocery is the largest sub-sector.

**Figure 40: Sector overview**



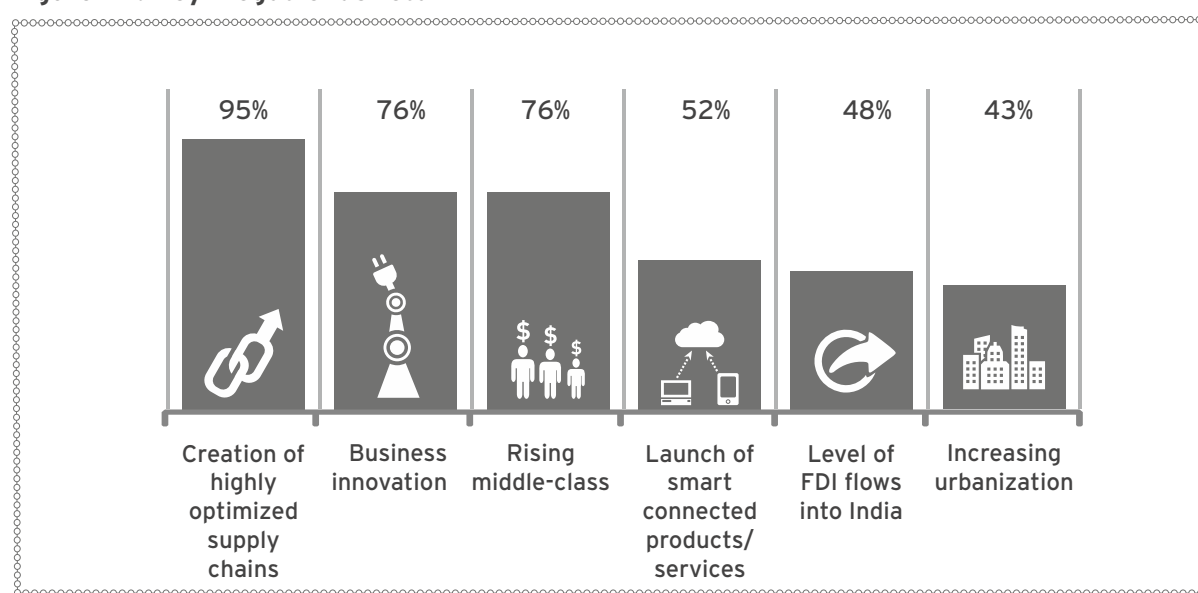
Source: <sup>1</sup>EY analysis; <sup>2</sup>"Human resource and skill requirement in retail sector." National Skill Development Corporation; <sup>3</sup>NASSCOM Strategic Review 2017

## Key megatrends impacting the retail sector

More than 76% of the industry experts believe that creation of highly optimized supply chains, rising middle-class and business innovation are the three primary megatrends that would drive growth in the sector

The following trends were identified by respondents to have an impact on the sector in the next five years:

**Figure 41: Key megatrends retail**

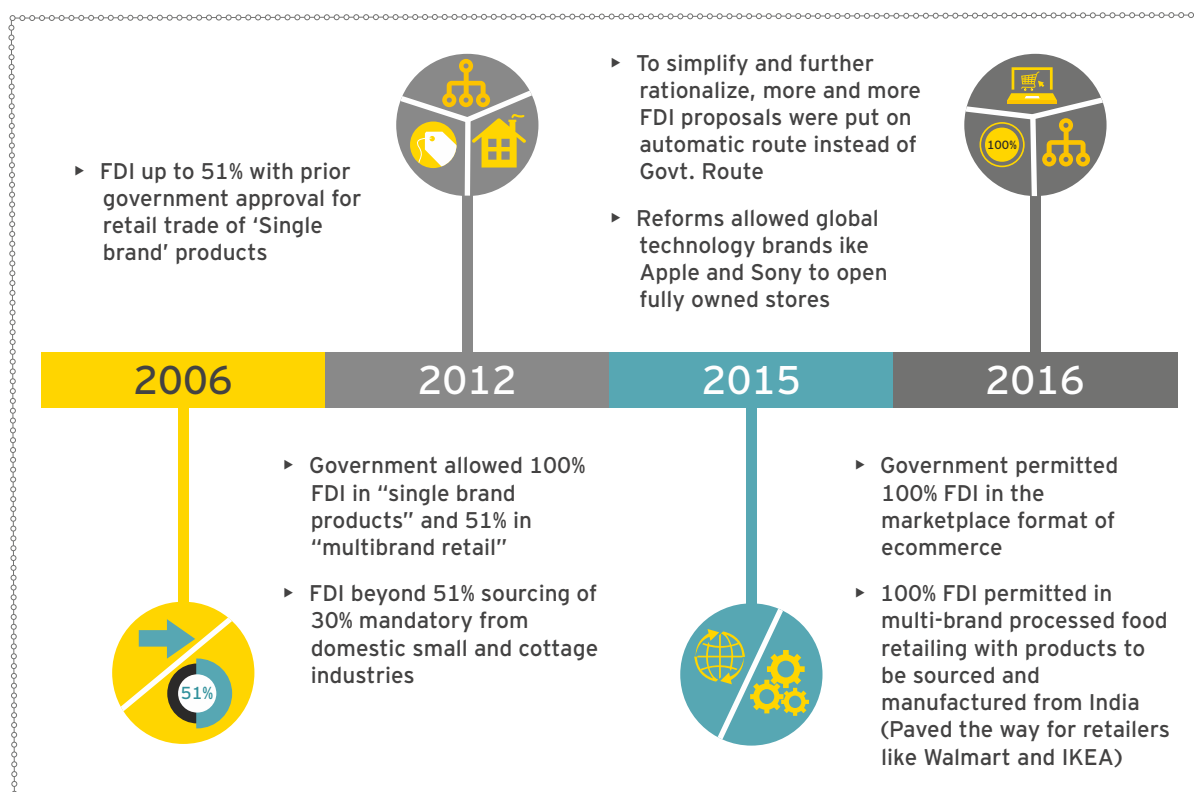


Source: EY future of jobs respondent analysis

Policy reforms allowing 100% FDI in single brand retail and 51% in multi-brand retail have set the momentum for long-term growth of the retail sector in India. In 2016, the Government approved 100% FDI in the marketplace format of ecommerce. In the apparel sector, global brands such as Zara, Mango, Calvin Klein and Aldo have set up stores in the country, and are looking at the omni channel model for future growth. The retail sector today is among the top three employers in the country. The growing FDI in the sector is expected to create more jobs in coming years. FDI regulation in multi-brand retail stipulating 50% investment in creating back-end infrastructure such as warehouses, logistics, accounting, customer services etc. is expected to create significant jobs in allied sectors<sup>48</sup>.



**Figure 42: Changing FDI regulations**



Source: EY analysis

Ecommerce which is expected to grow at a CAGR of 35%, will catalyze job creation in the retail and allied sectors

EY survey indicates 76% of the industry leaders expect business innovation will have a transformational effect on the retail sector in the coming years. This is especially important given the largely unorganized nature of the sector. The new business models such as ecommerce are opening the doors for organized retail to reach tier-II and III cities, where the brick and mortar format retail has limited presence. Mobile based e-tailing is increasingly becoming popular for both grocery and non-grocery items.

The impact of the growth of e-tailing is already visible on the job market. **Ecommerce companies are creating new job profiles in logistics, warehousing, web and app design, system integration, customer service, big data and machine learning.** Ecommerce companies at the same time are leveraging automated warehouse facilities to streamline their back-end processes, and are using big data and artificial intelligence when it comes to understanding customer preferences.

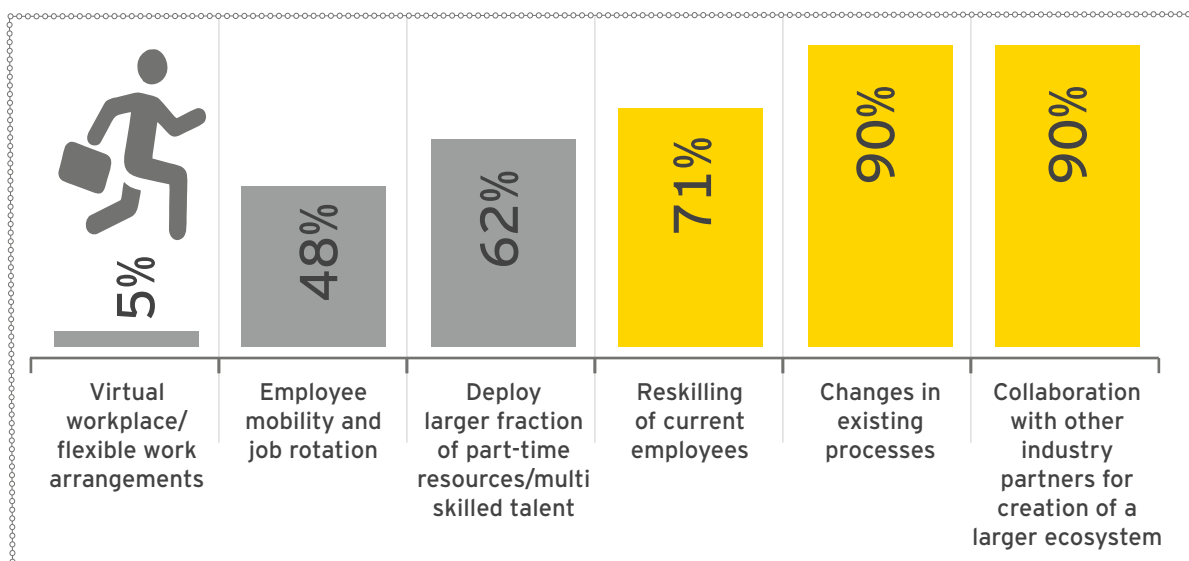
With a 40% share of the country's consumption by 2025, the middle-class will drive the growth and employment in the retail sector

Increasing urbanization and rising middle-class are driving the growth of retail in India. 76% of the respondents surveyed viewed the rise of middle-class as one of the key megatrends shaping the sector. It is estimated that by 2025, the middle-class will be the largest income segment in the country, and will account for 40% of the country's consumption, up from 26% in 2015<sup>49</sup>. The new middle-class, with higher disposable income, is shifting from buying just the essential commodities, to purchasing goods that can be described as luxury products. **The increasing quantum of demand by the rising middle-class is going to be the key driver of employment generation in the retail sector.**

The rapid urbanization of smaller towns is leading to an increased number of malls and retail stores coming-up in tier II and III cities across the country. The urbanization in the country is not just driving growth in the organized retail sector, but also increasing the number of unorganized retail and kirana stores opening up to cater to this growing population. By 2025, it is estimated that about 40% of the population will be living in urban areas and accounting for more than 60% of the country's consumption<sup>49</sup>. Many permanent brands are opening stores and outlets in tier II and III cities.

This growth of retailing especially in tier II and III cities is helping boost employment in the sector with more stores getting opened. Also many of these new stores are planning to provide experiential shopping experience to their consumers. This shift in focus driven by technology will require significant reskilling of current employees in soft skills and IT skills. This is evident from Figure 43, as reskilling of employees was rated as a key initiative by 71% of the industry players.

**Figure 43: Key initiatives by industry players**

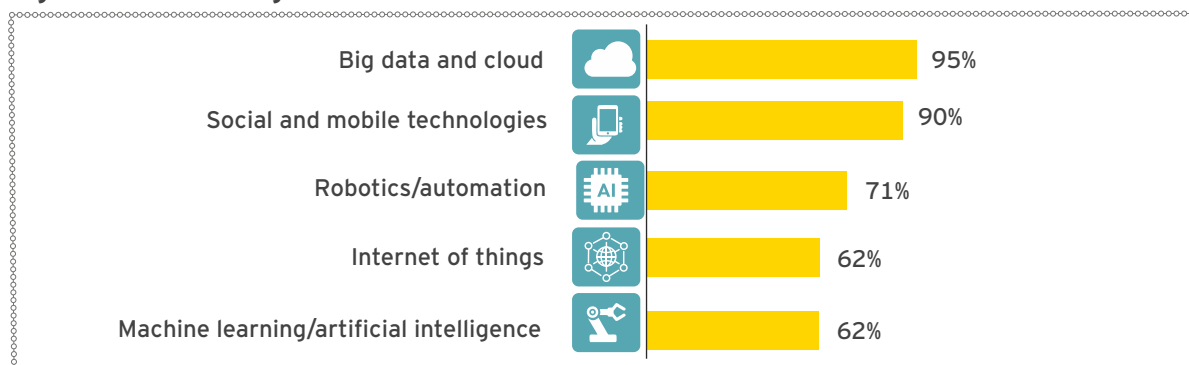


Source: EY future of jobs respondent analysis

The maximum impact of adoption of technology on jobs will be felt in warehouse management

95% of the industry experts in our survey believe highly optimized supply chains will be the biggest megatrend impacting the industry. This can be seen as retail players are making huge investments in new technologies such as big data, robotics, SMAC, IoT and RFID. These systems are supporting warehouse management and optimizing daily operational activities such as daily planning, organizing, staffing, directing and controlling utilization of resources. Companies are installing automated sortation systems in their warehouses. The key technologies that will facilitate in shaping the sector as per the industry leaders are provided in Figure 44.

**Figure 44: Technological trends**



Source: EY future of jobs respondent analysis

Companies adopting highly optimized supply chain products will require their employees to be able to adapt to the new technologies. Some job roles will be merged to be able to better work with the robots. Some manual and repetitive tasks may be threatened by the incoming technologies such as those working in sorting and organizing functions. A lot of jobs in inventory management and logistics will be automated to achieve higher efficiency.

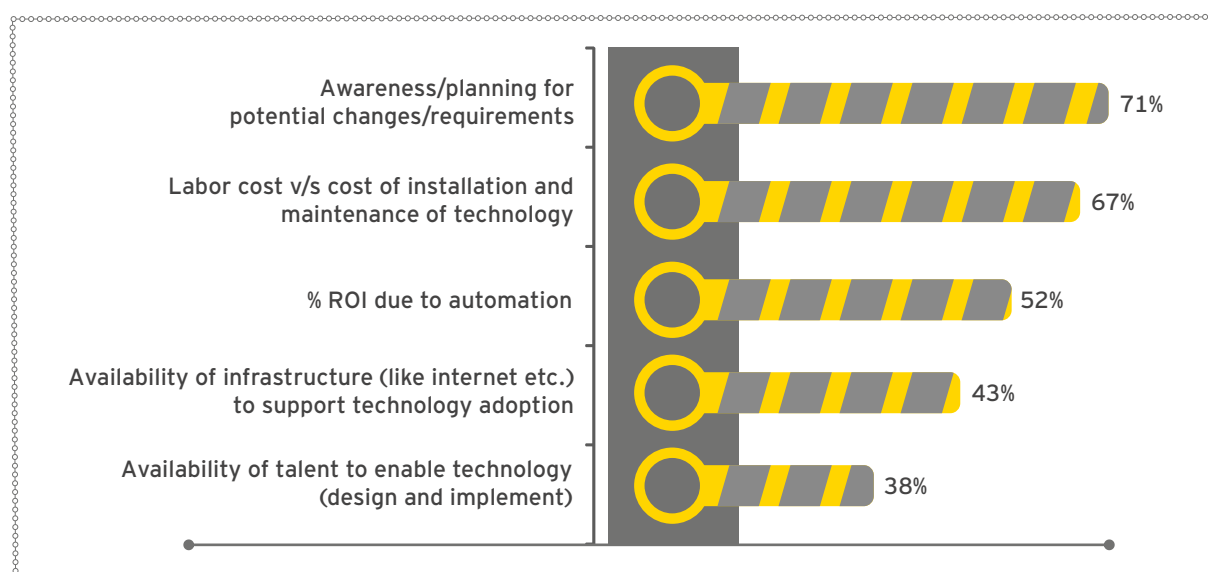
The new and changed jobs that include working with new technologies such as big data and blockchain, will increase with introduction of smart connected products/services

As per our survey, 52% of the respondents view smart connected products/services as a megatrend that is materializing as Indian retailers adopt them in their operations. This adoption is further getting propelled with the increase in the number of smartphones. Retailers can now leverage the data collected online to better understand customer needs. Many leading retail companies are working with FinTech companies that provides self-checkout software to retailers. The apps also allow these retailers to engage with regular customers, and track and understand customer purchase behavior.

With the growth of smart connected experiences, the sector will see an increase in new and changed jobs that include working with new technologies such as data analytics and blockchain. Jobs will increase for profiles such as IoT architects, system integrators and data analysts.

The adoption of exponential technologies is visible; however industry experts view certain barriers limiting the adoption to its full potential in Figure 45:

**Figure 45: Key barriers for adoption of automation**



Source: EY future of jobs respondent analysis

## Impact on jobs and skills

The food and grocery sub sector would continue to hire at a rate of 0.5%-1% year-on-year against a historical growth rate of 2%-2.5% to reach 22 million in 2022. 25%-35% of the jobs in 2022 would require new skill sets

The retail sector in the country employs 45.11 million people across sub-sectors, accounting for 8% of the country's employment<sup>50</sup>. The food and grocery sub-sector accounts for approximately 47% of the sector's employment<sup>50</sup>. More supermarkets are opening up across the country to cater to the diversity of preferences of the Indian consumers, making this the fastest growing sub-sector in retail. Food service, lifestyle and home improvement are the next biggest sub-sectors, together accounting for 38% of the sector<sup>50</sup>. The sub-sector wise employment numbers are given in Table 13:

**Table 13: Retail sector employment (2013-2017)**

Retail Sector	Employment in millions	
	2013	2017
Food and grocery	19.6	21.36
Food services	4.6	7.05
Lifestyle	4.5	5.17
Home improvements	4.4	5.11
Jewellery retail	1.5	2.04
Health and personal care	1.7	1.86
Auto sales	1.5	1.68
Leisure	0.8	0.84
Overall sector	38.6	45.11

Source: "Human resource and skill requirement in retail sector." National Skill Development Corporation, 2011.

We are providing a snapshot on jobs in food and grocery sub sector in 2022, based on the survey. The data for the other sub sectors was less forthcoming and hence have not been included in the EY 2022 perspective.

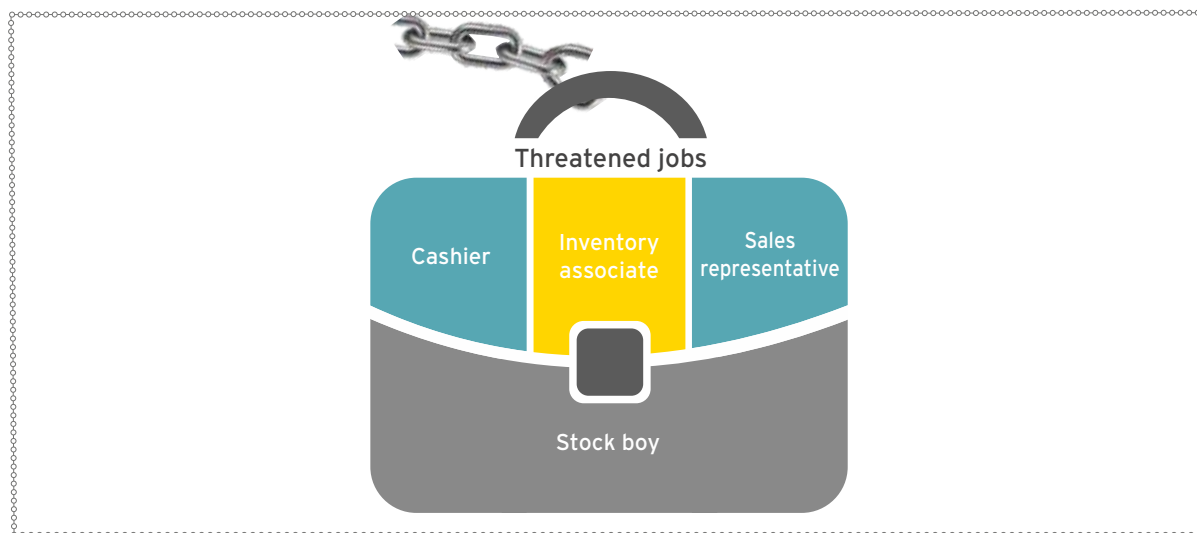
**Table 14: Changed job scenarios in 2022 in food and grocery sub sector**

Sub-Sector	Expected size of sector in 2022 (billions US\$)	Expected % growth in sector	Current jobs in sector (millions)	% of current sector jobs threatened	Incremental jobs created over 5 years (millions)	Total jobs in 2022 (millions)	% of 2022 jobs that will be new	% of 2022 jobs that will be changed
Food and grocery	865	11-11.5	21.4	15-20	0.52	22	5-10	20-25

Source: EY analysis and EY future of jobs respondent analysis

Some of the threatened jobs in the sector are:

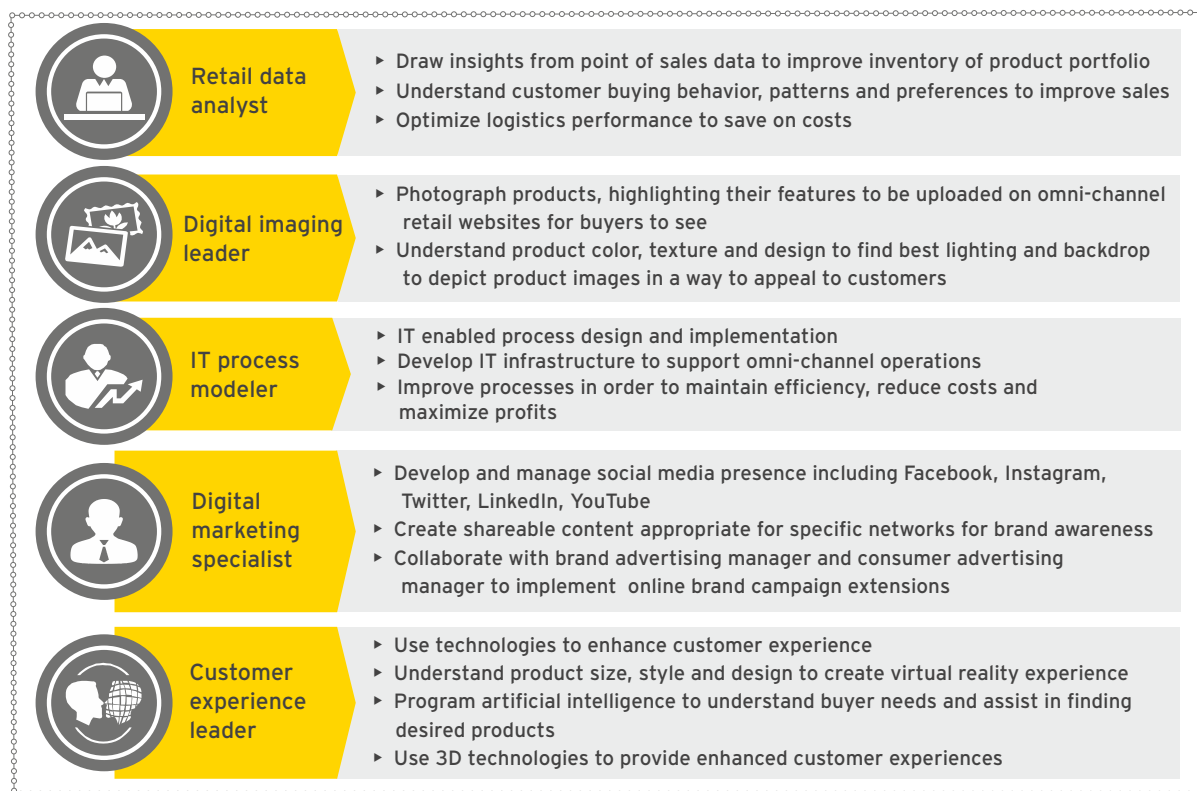
**Figure 46: Threatened job roles in the retail sector**



Source: EY future of jobs respondent analysis

Some of the potential new job roles that the retail industry respondents have listed are shown in the figure below:

**Figure 47: New job roles in the retail sector**



Source: EY future of jobs respondent analysis



The skill sets required for the new job roles have been shown in the figure below:

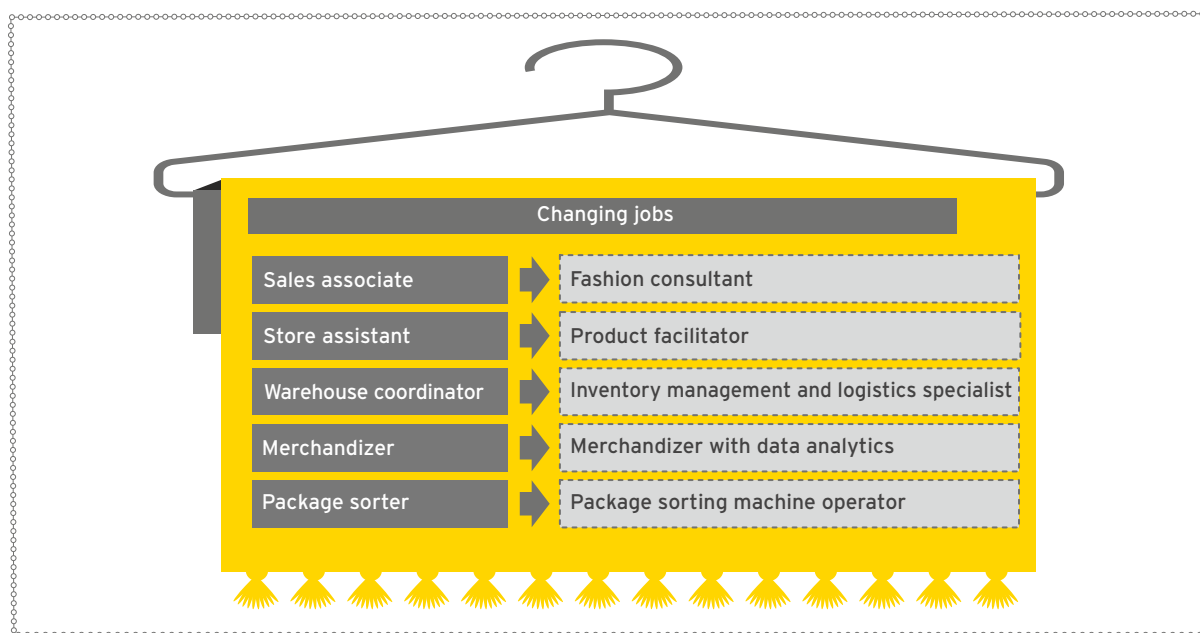
**Figure 48: Skill set requirement for new job roles**

Key skills		Cognitive abilities	Physical abilities	Content skills	Process skills	Complex problem solving skills	Resource management skills	Social skills	System thinking	IT / Hardware skills	Environment conscious thinking
New jobs	Retail data analyst	✓			✓	✓			✓	✓	
	Digital imaging leader	✓		✓				✓			
	IT process modeler	✓			✓	✓			✓	✓	
	Digital marketing specialist	✓		✓				✓		✓	✓
	Customer experience leader	✓		✓	✓	✓	✓	✓			✓

Source: EY future of jobs respondent analysis

Some of the changing jobs in the sector are:

**Figure 49: Changing job roles in the retail sector**



Source: EY future of jobs respondent analysis

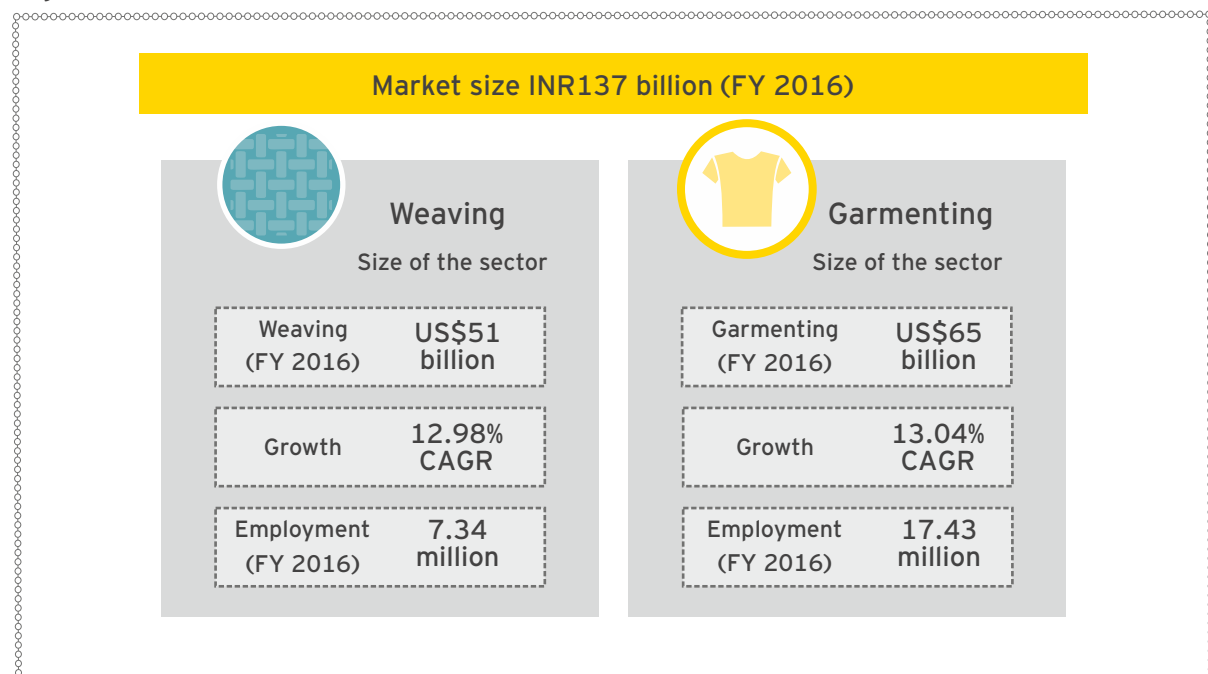
# Textiles and apparel sector

The textiles and apparel sector is among the oldest sectors in the Indian economy; highly labor-intensive and employing person with less educational qualification and more women on average than any other manufacturing sector

## Background

The industry is the second largest employer in the country after agriculture, employing approximately 80 million people across sub-sectors and allied sectors, with approximately 30 million people employed directly in the year 2016<sup>51</sup>. We have given an overview of the two larger sub sectors of the textiles and apparel sector - weaving and garmenting in below figure:

**Figure 50: Sector overview**



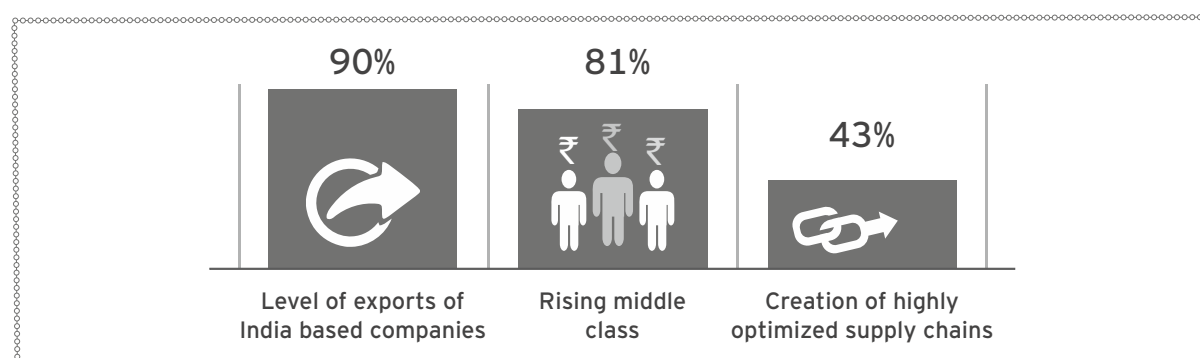
Source: EY analysis; "Human resource and skill requirements in textiles and clothing sector." National Skill Development Corporation; IBEF textiles and apparel report, March 2017.

## Key megatrends impacting the textiles and apparel sector

Rising middle-class and increasing exports of Indian companies are the two primary megatrends that will drive growth in the sector

The following trends were identified by respondents to have an impact on the sector in the next five year:

**Figure 51: Key megatrends textiles and apparel**



Source: EY future of jobs respondent analysis

Free trade agreements with the US and Europe have the potential to boost export-based employment by 2.81 million

With a 5.2% share of the global textiles trade, India is the second largest textiles exporter. India exported US\$9.4 billion worth of textiles and clothing in FY 2016<sup>52</sup>. India is also among the top 5 apparel exporting countries accounting for 3.7% of the global readymade garment exports<sup>52</sup>. Exports from the industry is a major job creator in the economy. In FY 2013, the readymade garment, cotton textiles and miscellaneous textiles segment related to export alone employed 5.2 million people<sup>53</sup>. Higher exports in the sector have significant employment potential especially for the large low-skilled workforce and women.

However, the exports from India face stiff competition in the global export market from countries such as Bangladesh, Philippines, Cambodia, Malaysia and Vietnam. Among Asian exporters, Bangladesh has emerged as the preferred low-cost garment exporter. The proposed FTA with European Union under the Broad-based Trade and Investment Agreement (BTIA) will significantly boost India's textiles and apparel exports. India currently has a 7% share in textiles and apparel exports to the EU. BTIA in textiles and apparel will further boost this share by providing preferential market access to Indian exports in the EU. A Government of India commissioned study estimates that textiles and apparel exports will increase by 25%-35% as a result of the BTIA<sup>54</sup>. Indian textiles and apparel exports to the US increased at a CAGR of 5.5% during 2011-15 in absence of any FTAs<sup>54</sup>. Government estimates suggest that signing an FTA with the US will increase India's share in US textiles imports from the current 7% to 19% by 2025<sup>54</sup>.

On the domestic front, 81% of the industry leaders view the increased spending of the middle-class on apparel to be the major employment creator in the next five years

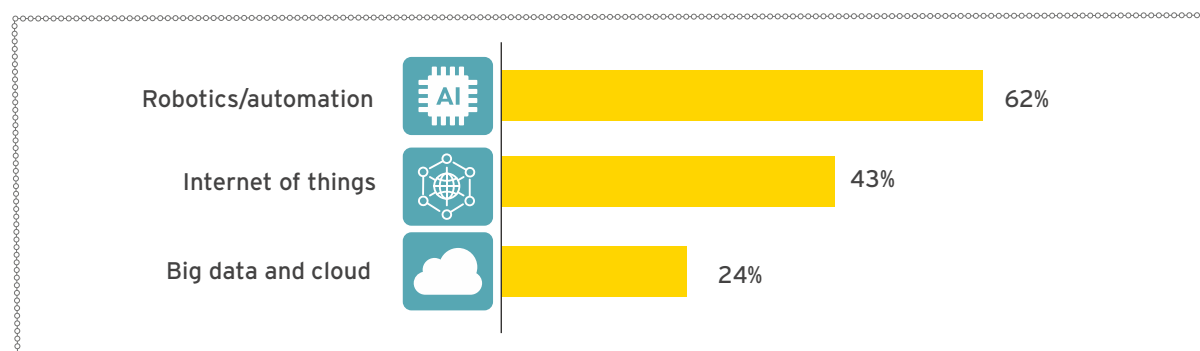
The domestic apparel market has seen a healthy growth on account of the rising middle-class, higher spending on apparel, and increased penetration of retail and e-tailing. The per capita spending on apparel and textiles in the country stood at US\$45 in 2015 and is expected to grow to US\$123 by 2025<sup>55</sup>. The textiles and apparel industry witnessed a 58% sales volume and 97% sales value growth between 2011 and 2016<sup>55</sup>.

The increasing access to Internet and spread of organized retail is helping this rising middle-class to adopt branded apparel in tier II and III cities. The middle-class is shifting from unbranded and unorganized apparel to organized branded apparel. This is driving the growth of the industry. This shift is expected to drive the growth of the domestic apparel and textiles sector currently estimated at US\$85 billion to reach US\$160 billion by 2025<sup>56</sup>. The growth of the industry will provide significant employment opportunities. The rising middle-class with a simultaneous increase in their spending levels will help in creating a demand driven employment in the sector.

Various processes so far within the sector already use automation but its maximum impact in the value chain has been felt across sub-sectors ahead of garmenting in the value chain, i.e., spinning and weaving. The next wave of automation is expected to impact the garmenting sub-sector where technologies such as intelligent transportation systems, robotic handling devices, automatic folding machines and 3D garment design are leading to reduction in workforce especially in job roles such as helper, fabric cutter, packer, presser and finisher. The sewing machine operator, the workhorse of the apparel sector may continue to escape automation

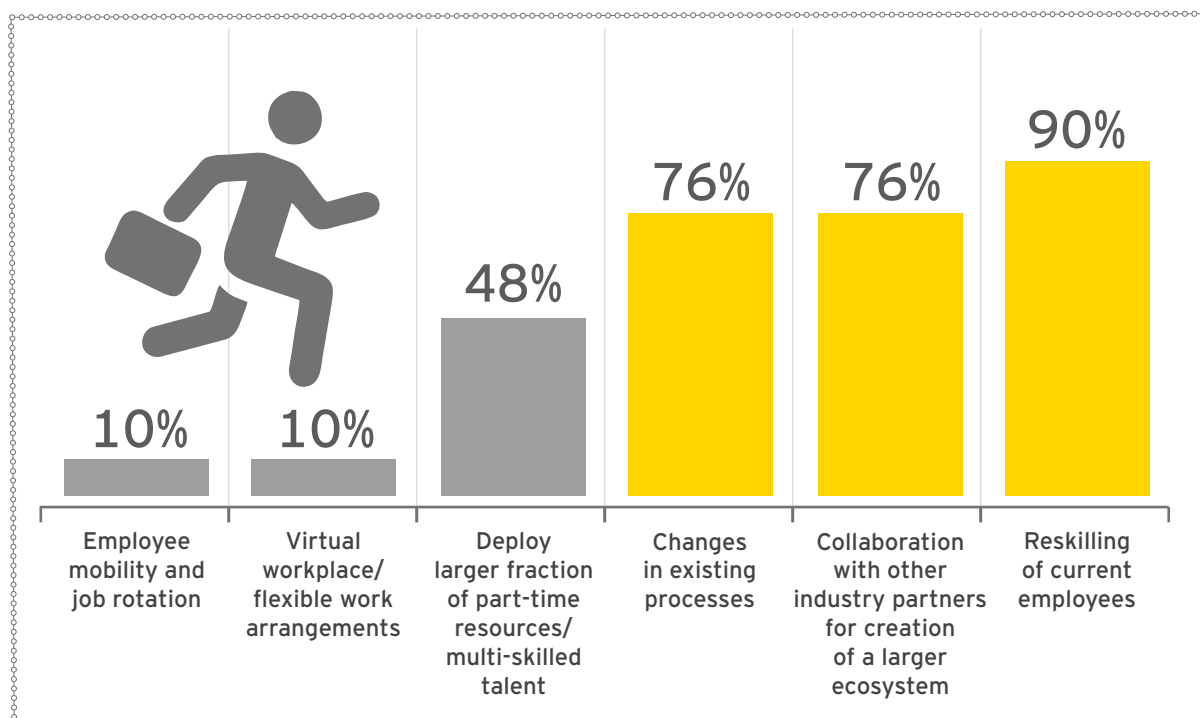
trends in the next five years. Automatic sewing bots are currently in experimentation stage in the US apparel companies. Industry experts suggest one robot has the potential to replace around 100 workers in a typical Indian textiles plant. The key technological megatrends and the initiatives taken by the industry players to cater to the changes in the industry are shown in Figure 52 and Figure 53 respectively. Figure 54 sheds light on the key barriers to adoption of technology in the sector as indicated by the industry players.

**Figure 52: Technological trends**



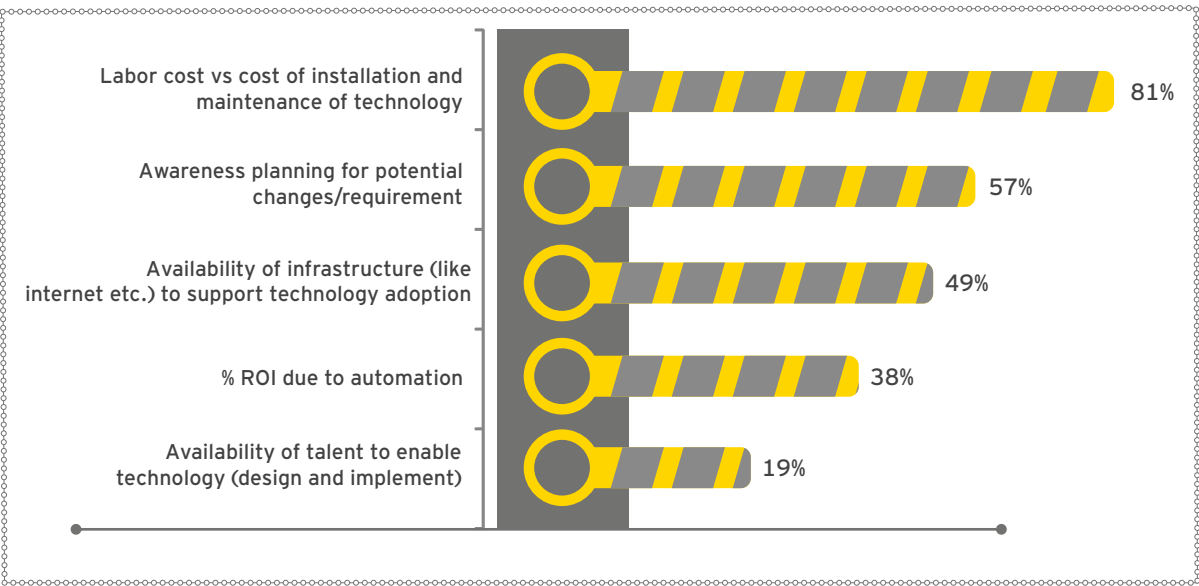
Source: EY future of jobs respondent analysis

**Figure 53: Key initiatives by industry players**



Source: EY future of jobs respondent analysis

**Figure 54: Key barriers to adoption of technology**



Source: EY future of jobs respondent analysis



## Impact on jobs and skills

The weaving and garmenting sub sector would continue to hire at a rate of 8%-8.5% year-on-year against a historical growth rate of 9%-9.5% to reach 40.7 million in 2022. 45%-55% of the jobs in 2022 would require new skill sets

The apparel and textiles sector provided direct employment to 21.7 million people in 2013<sup>52</sup>, of which 89% were deployed in the fabric manufacturing and garmenting sub-sectors. As a result, we have focused our study to understand the quantitative impact of megatrends on the weaving and garmenting sub-sectors. The employment numbers within each sub-sector are shown in table 15:

**Table 15: Textiles and apparel sector employment**

Sub-sector	Employment in millions	
	2013	2017
Spinning	1.89	–
Weaving	6.36	7.70
Processing	0.51	–
Garmenting	12.90	19.27
Overall sector	21.66	–

Source: EY analysis; "Textile industry as a vehicle of job creation for inclusive growth: TEXPROCIL-EY", 2016.

**Table 16: Changed job scenario in 2022 in textiles and apparel sector**

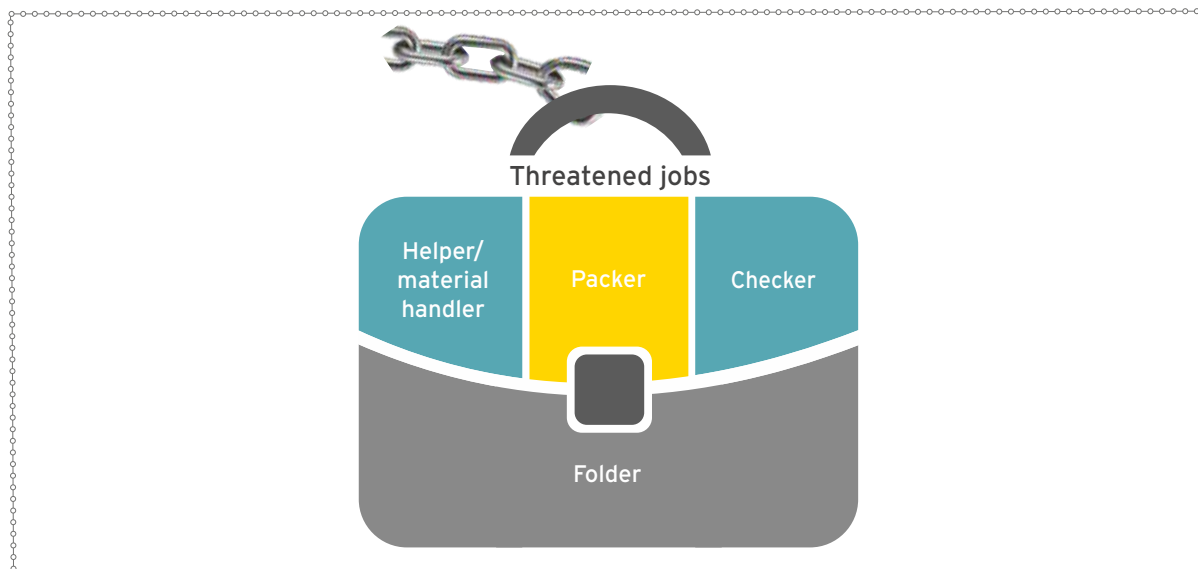
Sub-sector	Expected size of sector in 2022 (billions INR)	Expected % growth in sector	Current jobs in sector (millions)	% of current sector jobs threatened	Incremental jobs created over 5 years (millions)	Total jobs in 2022 (millions)	% of 2022 jobs that will be new	% of 2022 jobs that will be changed
Weaving	105	12-12.5	7.7	10-15	1.6	9.3	5-10	30-35
Garmenting	136	12.5-13	19.3	15-20	12.1	31.4	10-15	35-40

Source: EY analysis and EY future of jobs respondent analysis



Some of the threatened jobs in the sector are:

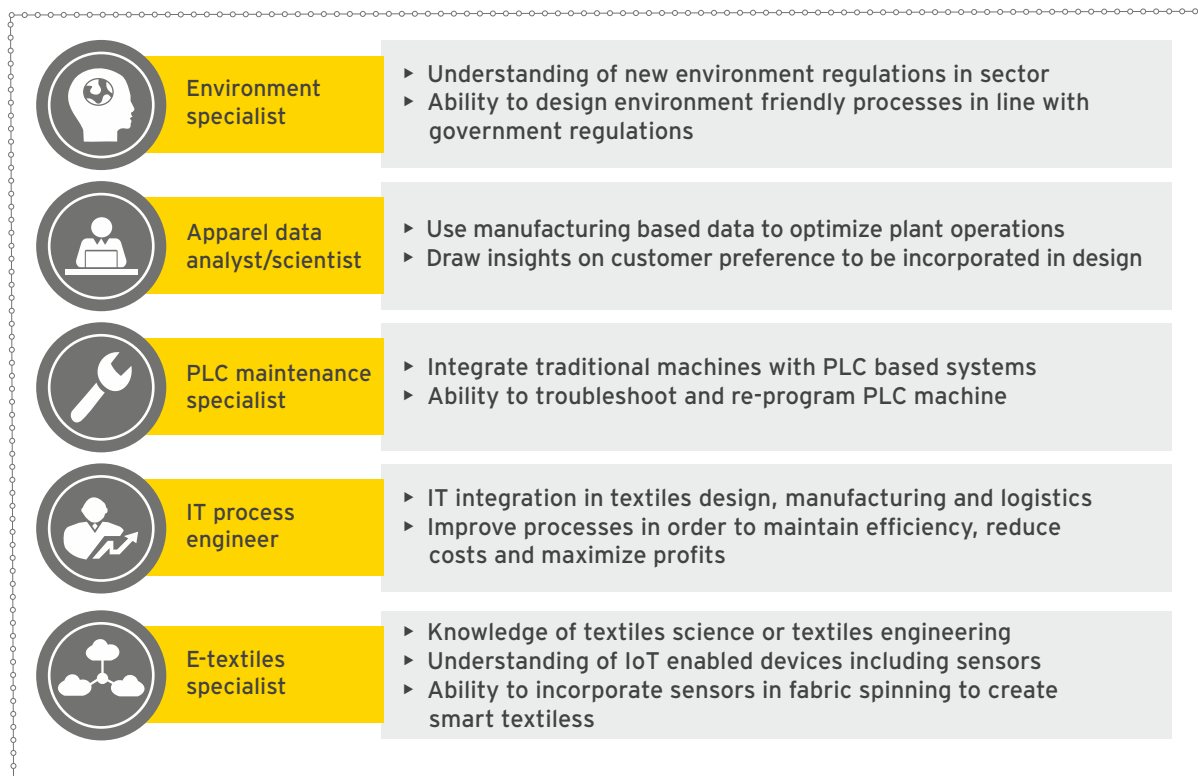
**Figure 55: Threatened job roles in the textiles and apparel sector**



Source: EY future of jobs respondent analysis

Some of the new jobs will be as shown below:

**Figure 56: New job roles in the textiles and apparel sector**



Source: EY future of jobs respondent analysis

The skill sets required for the new job roles have been shown in the figure below:

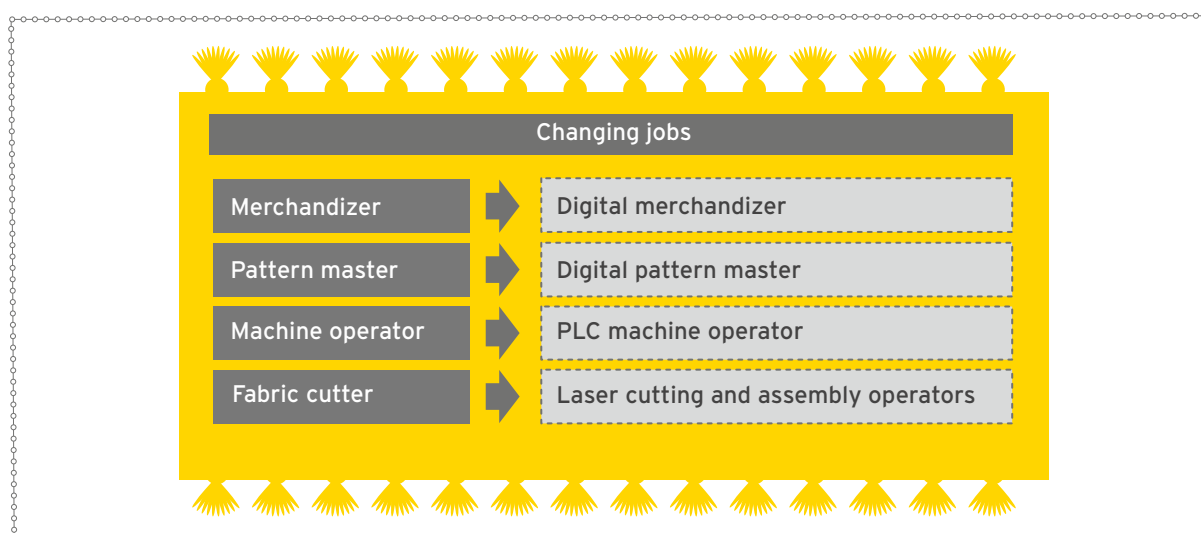
**Figure 57: Skill set requirement in new job roles**

Key skills		Cognitive abilities	Physical abilities	Content skills	Process skills	Complex problem solving skills	Resource management skills	Social skills	System thinking	IT / Hardware skills	Environment conscious thinking
New jobs	Environment specialist	✓			✓	✓					✓
	Apparel data analyst/scientist	✓			✓	✓			✓	✓	
	PLC maintenance specialist	✓			✓	✓			✓	✓	
	IT process engineer	✓			✓	✓			✓	✓	
	E-textiles specialist	✓		✓	✓				✓	✓	

Source: EY future of jobs respondent analysis

Some of the changing jobs in the sector are:

**Figure 58: Changing job roles in the textiles and apparel sector**



Source: EY future of jobs respondent analysis

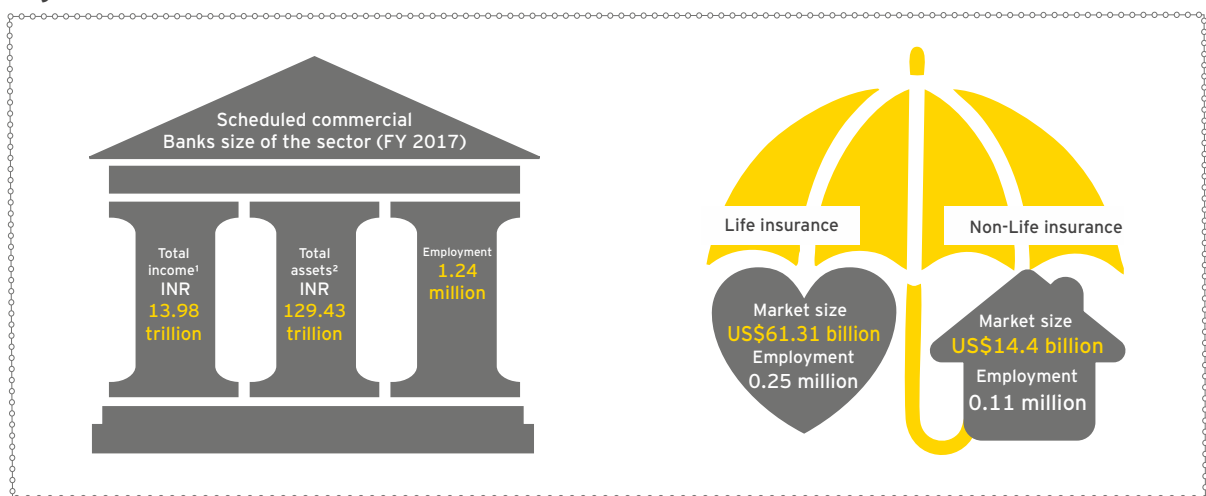
# Banking, financial services and insurance (BFSI) sector

Rapidly emerging innovations have already started disrupting the Indian BFSI sector

## Background

The BFSI sector is going through a transformation with the emergence of new technological banking solutions not only within the field but also from other business functions. The banking and insurance sub-sectors' overview in terms of market size and employment is given in the figure below:

**Figure 59: BFSI sector overview**



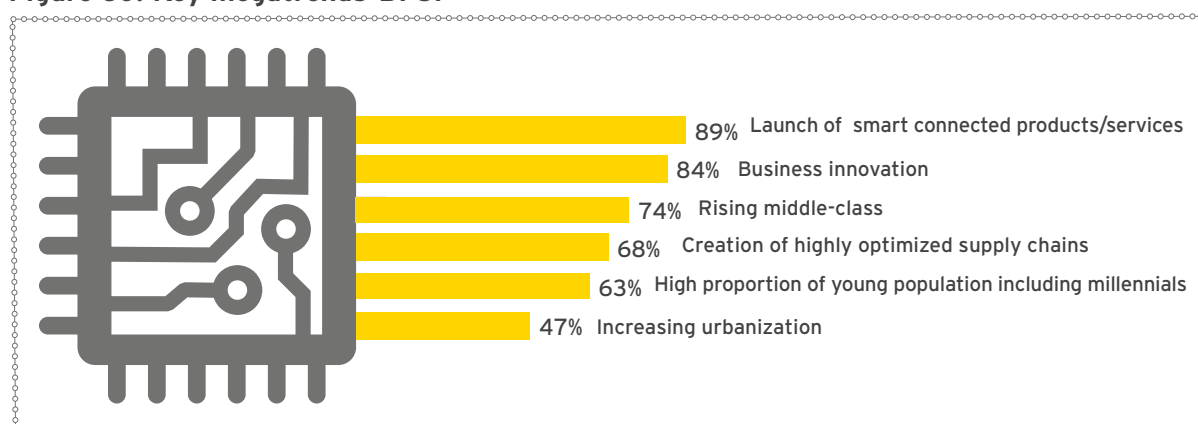
Source: EY analysis; "Human resource and skill requirements in BFSI sector." National Skill Development Corporation; IBEF BFSI report, May 2017.

## Key megatrends impacting the BFSI sector

Launch of smart connected products/services and business innovation are the two primary megatrends that will drive growth in the sector

The following trends were identified by the respondents to have an impact on the sector in the next five years:

**Figure 60: Key megatrends-BFSI**



Source: EY future of jobs respondent analysis

Launch of smart connected products/services and business innovation are the two primary megatrends that will drive the sector

The middle-class is emerging as the new growth engine of the BFSI industry. 74% of the industry leaders surveyed believe that rising aspirations, as well as their growing income levels is making the middle-class a major growth driver for the BFSI industry. The BFSI industry is looking toward the retail banking sector as the new growth avenue with corporate non-performing assets crossing US\$147 billion in FY 2016<sup>57</sup>.

In recent years, retail loans across the banks have seen a healthy growth driven by home loans, car loans, personal loans and credit cards. The sector, particularly the home loan segment, has seen increased focus from banks that have been looking for avenues to reduce their corporate lending risk exposure. Over the last 5 years, the home loans segment has recorded a 16% CAGR for 12% of all bank credits<sup>58</sup>.

## With the rapid growth of FinTechs, industry experts anticipate atleast a 15% increase in hiring

Mobile payments and digital wallets have witnessed an exponential growth in the past year. During FY 2016, total mobile payment transaction volume in India reached 2.9 billion<sup>59</sup>. One of the industry bodies expects mobile payments to reach around INR460 billion by 2022 at a CAGR of 132%. Government-backed “Digital India” has further aided the prospects of payment FinTechs in India<sup>59</sup>.

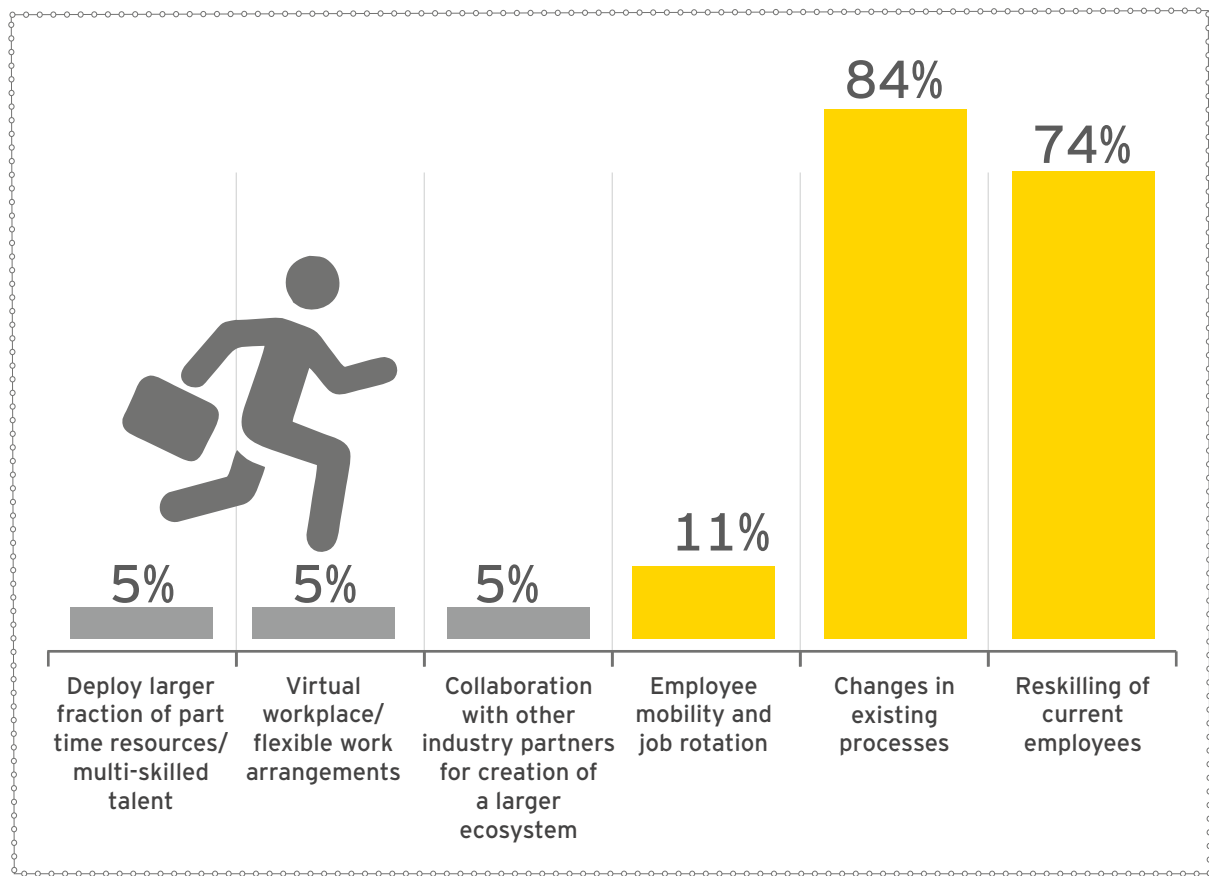
The P2P lending platform - a new business model backed by technology has gained traction in the last five years. Many P2P lending platforms have been launched in the last 5 years. In 2016 alone, Indian FinTech companies received INR3,294 crore (US\$512 million) in funding<sup>60</sup>. Indian P2P lending market is expected to reach INR25,744 crore - INR32,180 crore (US\$4 billion–US\$5billion) within 4 - 5 years<sup>61</sup>.

As these FinTechs are witnessing an exponential growth, they are on a hiring spree. As the sector evolves, industry experts anticipate at least a 15% increase in hiring due to e-wallets and payment banks<sup>62</sup>. Also, the sector is seeing an increased demand for talented IT professionals with understanding of finance. Similarly, the sector is also witnessing an increase in the hiring in other business operations too.

As per our survey, 68% of the respondents surveyed said that supply chain optimization through exponential technologies such as chatbots and blockchain is transforming the Indian BFSI sector. Indian banks are looking to bring in robotics into their branches as digital assistants to interact with and assist customers in day-to-day activities. These robots will have an impact on the POS and retail industry.

A leading bank has introduced artificial intelligence powered robot in one of its branches. The robot combines advanced robotics and artificial intelligence to interact with customers and assist them with information on account opening or using ATMs. Another leading bank has also deployed a customer-facing robot in its retail locations. These robots will help reduce the waiting time by providing information and services to customers. If successful, these robots might start replacing front desk job roles at bank branches in the next 3 to 5 years. As technology is being embedded in each and every function of the BFSI value chain, firms have already started the reskilling of the current workforce to align them with more value added services as can be seen from Figure 61.

**Figure 61: Key initiatives by the industry players**

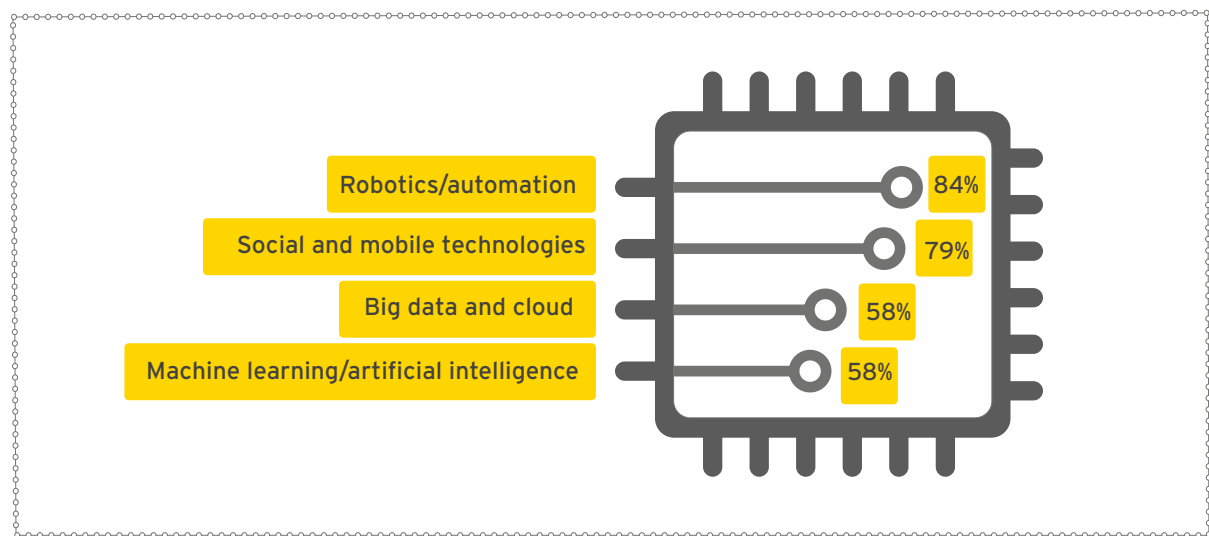


Source: EY future of jobs respondent analysis

Blockchain technology, based on cryptocurrencies like bitcoin, is fast gaining pace in India. Reserve Bank of India (RBI) in its statements expects blockchain to bring cost savings, efficiency, and most importantly transparency to the Indian banking industry. In FY 2016, close to 32 blockchain firms were formed in India<sup>63</sup>. Indian BFSI players are fast planning to incorporate blockchain in daily operations. Many traditional banks are using blockchain for vendor financing and international trade financing.

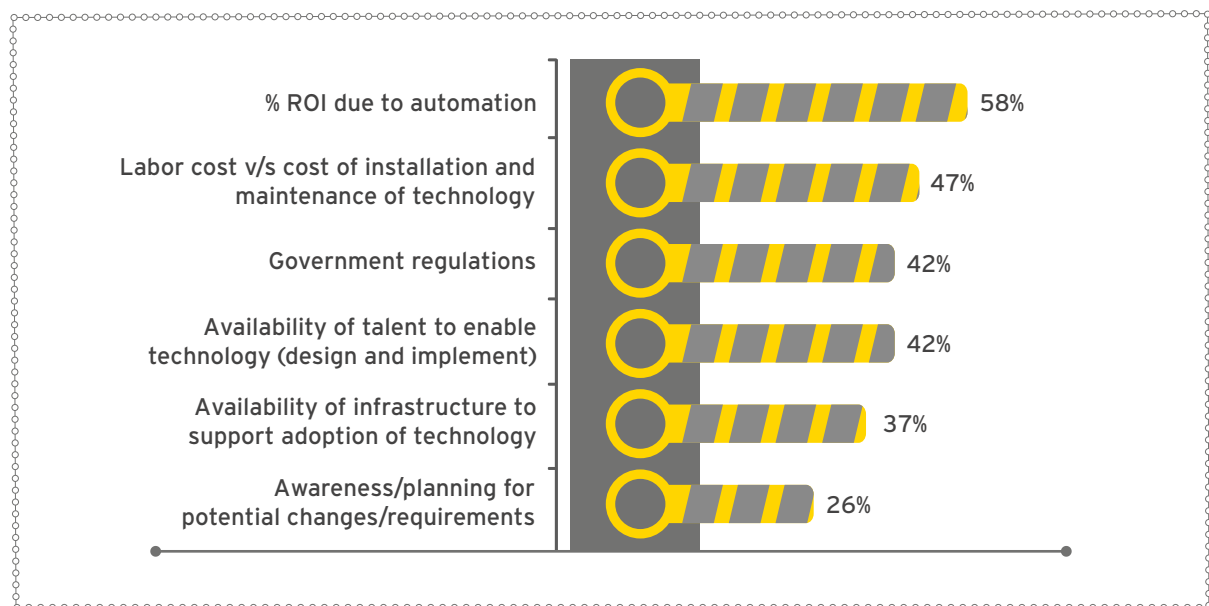
Key technological trends that are facilitating BFSI industry in business innovation and optimization of supply chain are given in Figure 62. However, there have been certain challenges too in deployment of these technologies as indicated in Figure 63.

**Figure 62: Technologic trends**



Source: EY future of jobs respondent analysis

**Figure 63: Key barriers to automation**



Source: EY future of jobs respondent analysis



## Impact on jobs and skills

The banking and insurance sub sector would continue to hire at a rate of 3.5%-4% year-on-year against a historical growth rate of 4%-4.5% to reach 2 million in 2022. 70%-75% of the jobs in 2022 would require new skill sets

The current employment in the banking and insurance sub-sector is given below:

**Table 17: BFSI employment 2017**

Sub sector	Employment in millions
	2017
Banking	1.24
Insurance	0.36
Overall sector	1.60

Source: EY analysis

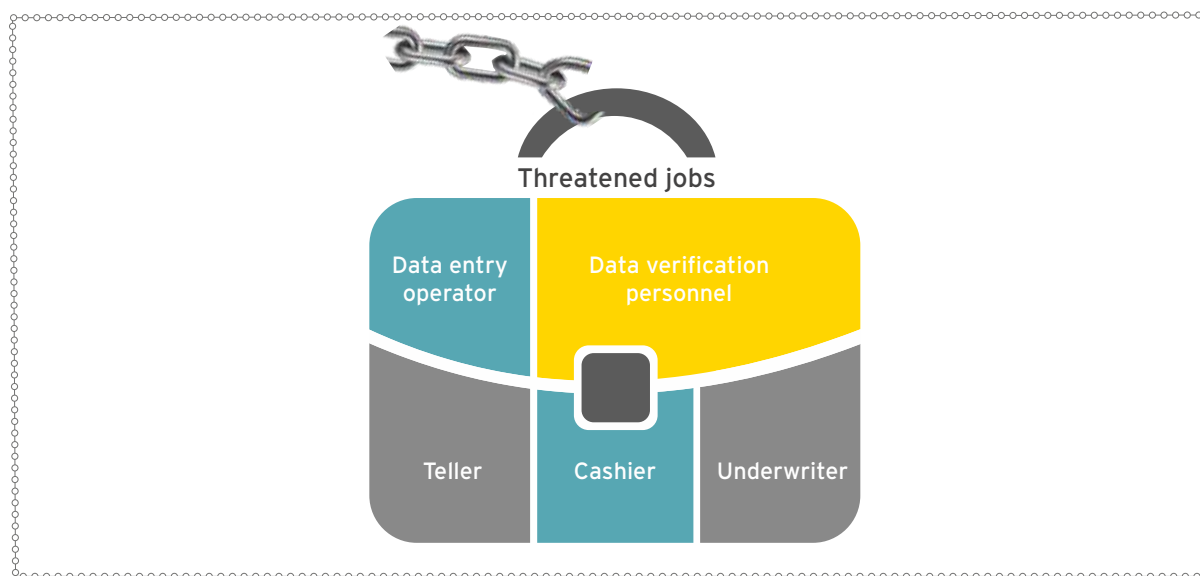
**Table 18: Changed job scenario in 2022 in BFSI sector**

Sub-sector	Expected size of sector in 2022 (billions INR)	Expected % growth in sector	Current jobs in sector (millions)	% of current sector jobs threatened	Incremental jobs created over 5 years (millions)	Total jobs in 2022 (millions)	% of 2022 jobs that will be new	% of 2022 jobs that will be changed
Banking		12.5-13	1.24	20-25	0.22	1.46	15-20	55-60
Life Insurance	110	12-12.5	0.25	25-30	0.05	0.30	15-20	55-60
Non-Life Insurance	24	11-11.5	0.11	25-30	0.04	0.15	15-20	55-60

Source: EY analysis and EY future of jobs respondent analysis

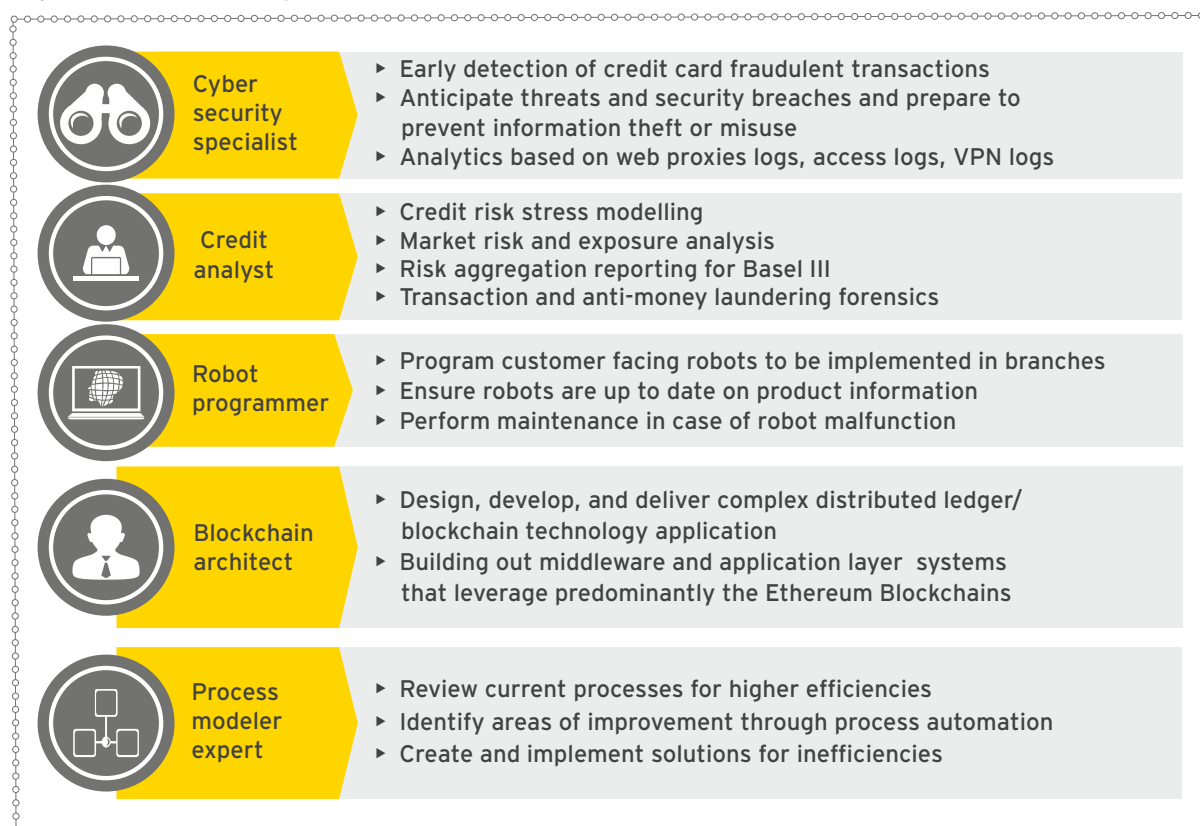
Some of the threatened jobs in the BFSI sector are shown below:

**Figure 64: BFSI sector threatened jobs**



Source: EY future of jobs respondent analysis

**Figure 65: BFSI new job roles**



Source: EY future of jobs respondent analysis

The skillsets required for the new job roles have been shown in the figure below:

**Figure 66: Skillset requirement for new job roles**

Key skills		Cognitive abilities	Physical abilities	Content skills	Process skills	Complex problem solving skills	Resource management skills	Social skills	System thinking	IT / hardware skills	Environment conscious thinking
New jobs	Cyber security specialist	✓			✓	✓			✓	✓	
	Credit analyst	✓		✓	✓	✓			✓	✓	
	Robot programmer	✓			✓	✓				✓	
	Blockchain architect	✓				✓				✓	
	Process modeler expert	✓			✓	✓			✓	✓	

Source: EY future of jobs respondent analysis

The changing job roles in the BFSI sector have been shown in the figure below:

**Figure 67: Changing job roles in the BFSI sector**



Source: EY future of jobs respondent analysis

# 4

## Recommendations



# Recommendations for the Government

## Policy reforms

Support the competitiveness-enhancing initiatives of corporates in the wake of exponential technologies: It is imperative that the organized sector be supported in its effort to stay competitive and survive in the face of these disruptive forces. The Government should avoid any formal regulations for stemming job losses. The focus should be to support these sectors in staying competitive. This is also critical in light of the fact that not only does the organized sector create direct employment, but it also supports a significantly high number of indirect employment opportunities in the organized and unorganized sectors. Thus, decline in competitiveness of the organized sector businesses could create serious ripple effects across the economy, reducing direct and indirect jobs in their operating ecosystem. In the current battle to stay competitive viz-a-viz job creation in the organized sector, the Government should support competitiveness. Once companies restructure and emerge competitive, the focus will shift to job creation.



**Support labor-intensive industries to drive job creation:** The Government must support companies whose competitiveness is largely dependent on low cost high productivity labor (apparel and leather sectors), in improving their competitiveness and thereby driving job creation. To promote large-scale job creation in the formal sector, the Government needs to focus more towards the labor-intensive sectors such as textiles, apparel, leather etc. through policy catalysts such as easing FDI regulations, FTAs with major trade partners, and industry-friendly labor reforms. For example, in the apparel and textile sector, FTAs with EU and US can become a major initiative to boost employment potential of the sector. The Economic Survey (2016-17) estimates indicate FTAs with EU and UK can contribute an additional US\$3billion in GDP and 1.5 lakh additional employment in the apparel and leather and footwear sectors.

**Leverage the attractive size of the Indian consumer market to gain access to latest technologies through insistence of technology transfer during FDI deals in key sectors:**

The Government could use technology transfer as a precondition for granting market access to the vast Indian consumer market to global firms. Global firms should be encouraged to transfer technology, create joint ventures and aid Indian firms. This will help in preparing Indian companies to compete in core areas of exponential technologies like artificial intelligence, aerospace, semiconductors, robotics. China's quid pro quo policy requiring foreign firms to transfer technology to China in return for access to its market is a useful example.





## Skilling and reskilling initiatives

**Use the time window of 2 to 3 years to effect large-scale reforms in the general, technical and vocational education system in mission mode:** As discussed in the report, India has a time window of 2 to 3 years before the effects of these disruptive technologies begin to have an impact on business and society. The current education system is clearly believed to be providing an output of low-employable students. The skill gap between the products of the education system and the requirements at the workplace is high, forcing companies to set up large training units. With the adoption of exponential technologies by industry in response to competitive pressures, this skill gap is expected to widen further. This immense gap looks unbridgeable by small scale tinkering of the education system. The formal sector may soon have jobs solely for people who study beyond class 10<sup>th</sup>. There is an urgent need to focus on institutional upgrades and teaching of new technologies. There need to be complete review of the curriculum, teacher training and training infrastructure requirements in light of these new technologies. Our survey of industry respondents reveals that an individual operating in area of assisting technologies requires a high level of cognitive skills, which our current education and training systems are not geared for. This window of 2 to 3 years provides us with the opportunity to strategize, benchmark our schools and colleges to global benchmark standards and create working models of how a new age engineering college, Polytechnic, ITI, graduate college and medical college should be. Once the models are validated, rollout plans can be formulated by the third year, which will help our education system to transition and meet global benchmarks of quality and effectiveness.

Further, a long-term perspective is needed to successfully meet the objectives of Skill India. It is necessary to develop a national skills repository that will help in the formulation of strategy for skilling related initiatives of the central and state governments. Aadhaar can help in outreach programs such as linking skilling initiatives with trainees, and to bring about much-needed transparency in the current system.



**Collaborate with and incentivize industry for skilling in exponential technologies:** The role of the industry in skilling is critical. Participation of corporate India will help in ensuring the mobilization of the much-needed funds, infrastructure and technology knowhow for countrywide skilling for the future job roles. To enable corporates as a part of the Skill India initiative, it would be useful to create joint engagement platforms and provide them with incentives. The current Sector Skills Councils (SSCs) are available platforms whose role and responsibilities need to be redefined to make them the agents to drive skilling in Industry 4.0 technologies. The Government should make provisions for tax incentives for those businesses that engage in skill development. Other industry incentive models beyond financials to create an Industry 4.0 ready workforce should be explored.

**Expand and upgrade the technology tool rooms across the country to enable the MSME sector to adopt exponential technologies:** Given the importance of the MSME sector to India's economy (around 36 million units, creating employment of about 117 million and contributing about 45% to manufacturing output and about 40% of exports)<sup>64</sup>, it is a point of concern that a mere 10% of the MSME workforce is reported to have received any form of structured skill training<sup>65</sup>. Given the high correlation of employee skilling and business productivity, any initiative to improve efficiency of MSME to remain competitive in the midst of primary force disruption will not be achieved until the workforce is skilled on latest technologies. The current effort by MSME Ministry to set up new high-tech technology tool rooms and upgrade existing ones under the World Bank funded project in some of the key industrial clusters needs to be expanded geographically. It also needs to be strengthened through introduction of the latest technologies in engineering design and manufacturing, including additive manufacturing techniques.

**Create fund to promote joint new technology or business model proposals from industry and academia:** There is a requirement for the triple helix model of academia, industry and Government working together to drive innovation and research to create the new generation jobs. However, in reality, getting this partnership going has been challenging. The Government can take the lead to drive this behavioral change among the stakeholders. The Government can create a fund that could part fund (up to 50%) any joint proposal of a university/academic institution and industry/company to create new technologies and business models. There are emerging models that need to be recognized for promoting this collaboration – for example, initiatives like FICCI-RAEng (Royal Academy of Engineering UK) Newton-Bhabha Innovation Fund for research in science and technology that encourages tripartite industry academia research through a fund of GBP 75,000 for 22 institutions. FICCI is also in the process of setting up a National Knowledge Function Hub in SV University Tirupati to institutionalize the industry-academia engagement that will facilitate applied research among other things.

**Undertake economy and sector wide skills assessment for exponential technologies:**

The Government and businesses recognize the need to close this skill gap and the urgent requirement to prepare the labor market for a future dominated by artificial intelligence, big-data, bots etc. To prepare the labor market for the future, it is necessary for the Government to periodically undertake an economy-wide skill gap analysis. It will help policy makers in preparing for the future by analyzing the current capabilities of the labor market and the skills it will need to achieve to survive the impact of technology. This exercise should go beyond the present piecemeal exercise of identifying the current skill scenario of the workforce, to identifying how technology will be changing the very nature of the jobs being performed today.

**Formulate life-long learning strategies and drive behavioral change among citizens toward life-long learning:**

The dominant mindset of most Indians is that formal learning is till the age of 20 to 25 years and the focus of rest of the life is on experiential learning, typically at workplace. This has been bolstered by the structure of the current education system. In the era of disruptive technologies no learning is current for long as new knowledge and technologies are being created, amended and replaced at fast pace. It becomes critical at the individual level that people embrace life-long learning to stay relevant, while the Government creates the enabling ecosystem for it. Many of the progressive governments across the world are realizing the importance of reskilling and life-long learning for their workforce. The Singapore Government has introduced the SkillsFuture program to support life-long learning among its citizens. This is supported by subsidies, scholarships and sponsorships. The Indian Government also needs to formulate and implement a skills future strategy for its citizens through its agencies like the National Skill Development Corporation while carrying out a behavioral change communication campaign for life-long learning. The responsibility for skilling in the future needs to be shared by all the three stakeholders - industry, Government and the individual.

**Set-up career counseling centers that enable youth to be aware of the job market they would be stepping into:**

One of the biggest challenges is the lack of awareness amongst youth about the possibilities in the job market for the educated and skilled. There is urgent need to set-up high quality counseling centers across the country.

## Embracing technology and start-ups

### **Establish centers of excellence (CoEs) in emerging exponential technologies:**

Exponential technologies and their combinations are expected to radically change the world we live in. We are seeing the establishment of CoEs dedicated to these technologies across the world. Some of the largest innovation labs in robotics are in China<sup>66</sup>, which is also the nation whose labor force would be most affected by deployment of robots on the manufacturing shop floor. This has not deterred the Chinese Government from setting up these innovation labs. In India, governments, industry associations and corporates are closely coordinating to embrace the changing dynamics of technology and entrepreneurship. For example, FICCI along with Samsung under the aegis of the Ministry of Labour & Employment, Government of India, is setting up India's first CoE on career counselling. The CoE will use technology tools to develop standards and conduct counselling of youths on emerging jobs of future and changing workplace readiness for informed decisions. Such centers should be set up in every university and state to begin with. Similarly, NASSCOM, along with the Ministry of Electronics & Information Technology (MeiTY), Government of India, Government of Karnataka and ERNET, has set-up the Centre of Excellence of IoT; CoE-IoT in Bengaluru. The CoE-IoT is an IoT start-up accelerator that is attempting to build an IoT ecosystem, connecting various entities such as start-ups, enterprises, venture capitalists, Government and academia. The CoE-IoT is enabling start-ups in areas of IoT, big data, AR/VR, artificial intelligence and robotics. Similar CoEs for all exponential technologies to do both basic research in these technologies and also develop "application models" that help in moving the technology to application. These horizontal technology CoEs would work with various industry verticals to develop new technologies and apply them to create new business models. There is a need for a second wave of institution building (setting up CoEs for various exponential technologies) similar to the one Government embarked on in the period after independence (when CSIR labs were set up).

**Encourage startups that help to transform unorganized sectors to organized ones using technology:**

The unorganized and informal sector in India is large, accounting for roughly 50% of the GDP and employing 92% of the workforce. This highly inefficient sector provides immense opportunities for startups to build business models, addressing the inefficiencies in various sub-sectors. This has the potential to create enormous number of jobs. The Government is aware of this opportunity and has launched the Startup India scheme to support startups. The goal would be to make India a startup nation. This would have dual impact: one of leapfrogging the intermediate technology levels and thereby organizing the unorganized sector and taking it to a much higher level of efficiency comparable to that of its advanced country counterparts. This would call for creation of a countrywide network of incubation centers and venture labs. These incubation centers need to play the role of providing a support ecosystem that accelerate the successful development of startup and fledgling companies. Strengthening its commitment to foster innovation and entrepreneurship, the Department of Science and Technology with FICCI, Lockheed Martin Corporation and Indo-US Science and Technology Forum has been running the India Innovation Growth Program since 2007 and has supported close to 500 innovators and startups, creating value of ~ US\$900 millions<sup>67</sup>. Through a wide outreach campaign undertaken by FICCI over the last 10 years, spreading over 100 cities across India, the program has received and evaluated over 7,000 ideas so far. Initiative like FICCI IIGP FICCI - AP XLR8 set up in Tirupati to mentor start-ups to pitch for next level of funding and hand hold Innovators to commercialize their products should be scaled up across all states. The Incubator in its 9-month operation has mentored 100 plus startups, incubated 40 companies and set up 4 manufacturing units employing 100 persons each.

**Create fund to support awareness creation and adoption of exponential technologies by the MSME sector:**

It is imperative to expose and prepare the MSME sector to embrace exponential technologies. A fund similar to the Technology Upgradation Fund (TUF) in the textile sector can be set up to promote awareness and adoption of exponential technologies by the MSME sector.

## Focus on priority employment creating sectors

**Drive job creation in the agri-sector through the DFI scheme:** The Government's target to double farmers' income by 2022 can be achieved by large-scale deployment of technologies developed in labs on fields. Similarly monitoring of the impact of proposed initiatives also requires monitoring technologies and big data analytics. Farming advancements such as precision farming, biotechnology, nanotechnology, protected cultivation can help in supporting productivity improvements of small and marginal farmers. Also, encouraging AgriTech startups can play a major role in bringing affordable technological solutions to boost farm productivity in India. AgriTech startups can help in increasing crop nutritional values, reducing the cost of farming, driving efficiency of agri supply chains through technology intervention, reducing storage wastes, developing smart warehousing solutions, deploying customized farm mechanization and enabling farm-market connectivity. Till 2016, India had 53 AgriTech startup working in the agri and allied sector. AgriStartups such as Thellawalas, Earth Food, SatSure and Gramophone are working to improve efficiencies in the agri sector through deployment of data capturing devices and farm software management. The deployment of these technologies would radically change the skills sets required by farmers and fuel the requirement for a new age farming outreach workforce. This could help create gainful employment for lakhs of youth, who otherwise would have migrated to urban areas or become a part of the disguised unemployed rural workforce.

**Drive job creation through Government investments in infrastructure:** The Government itself will need to act as a major source of employment generation in the economy. The Government through increased investments in building railways, roads, bridges, dams and other basic infrastructural amenities can create millions of jobs. This infrastructure investment will not only help in creating direct employment but also pave the way for indirect job creation in allied business sectors, including jobs for tradesmen, construction workers, and material moving and transportation workers, retail services etc. Further, investments in infrastructure will also enhance the efficiency of the economy, increasing its competitiveness. It is also important to improve data capture and analytical capabilities in this sector with respect to geographies and sub sectors of focus, to enable strategizing job creation and decision making.

Government investments in infrastructure projects can provide a new opportunity for meeting the objective of Skill India. Government can link skilling as a necessary provision with the development projects. In this direction, special attention should be given to the infrastructure and construction sector. Past decade has seen increased participation of private sector in the government's infrastructure development initiative under the Public-Private mode. This partnership can be utilised to further the skilling objective by linking the infrastructure contracts with provision of skilling certain percentage of the workers involved.

**Transform the public healthcare, education, tourism and hospitality and other development sectors through use of technology-assisted outreach workforce:** The Government can play the role of an innovator and integrator, strategic partner, technology proponent and capability builder to promote the development of sectors such as public education and healthcare. The last mile delivery in these sectors has been a challenge. A number of technology-assisted outreach workforce models where the capabilities of an outreach healthcare worker like ASHA can be enhanced with training and provision of simple technology tools like a diagnostic kit connected to a cloud that can provide knowledge support, are being piloted. This is equally possible in the other development sectors too. This will not only improve the reach and quality of the service, but also provide gainful employment opportunities to rural youth, especially females.

In the recent years tourism and hospitality sector has been rising at a phenomenal growth rate driven by the rising purchasing power of the new global middle class and the influx of foreign tourists to India. The rise is also strengthened by the rising FDI inflow in the sector. Given these positive market scenario, there is a need to strategically rejuvenate the skilling initiatives in the tourism and hospitality sector.

# Recommendations for industry

## Formulate vision for Industry 4.0

Create a vision for exponential technologies for your industry or company: Our interactions with the CXOs revealed that most organizations are either not aware, are indifferent or are still struggling with a concrete strategy when it comes to adoption of newer technologies and their impact on the jobs landscape in their sectors. As this report indicates, with most industries having a window of 2 to 3 years before a tangible impact of the exponential technologies is felt, it is necessary for industry associations and firms to develop a vision for exponential technologies for their industry or sector. The efforts of NASSCOM and the leading companies in the IT/ BPM sector are an example in point. The IT/ BPM sector has been the most affected by exponential technologies and hence there is enormous focus and drive within the sector for adoption of these technologies and revamping business models. Other sectors need not wait till they are impacted by the inevitable forces. They can begin planning their strategies starting with creating the vision for exponential technologies. Any efforts towards reskilling and skilling should not be aligned for short-term delivery but for achieving competitive advantage in the long-term horizon of 3 to 5 years. Further, continuous reskilling/upskilling in terms of newer technologies as well as processes is expected to be the norm. Companies need to begin planning for these changes.





## Embracing online economy

**Use the online economy approach to leverage the competencies of the potential laid off workforce:** As the industries deploy exponential technologies to address their inefficiencies and build more competitive business models, it is bound to slow down their hiring and lead to layoffs. Companies can set up counselling, mentoring and reskilling mechanisms to support the laid off workforce to develop them as gig/online workforce or entrepreneurs. Their existing competencies can be leveraged in servicing legacy systems. Their individual reskilling efforts can be supported through providing access to company training modules and their newly acquired capabilities used to support the companies resource capacity ramping and utilization strategies

**Incorporate online economy resources as part of HR department manpower planning strategies:** The online economy is growing fast with many skilled persons increasingly adopting flexible work arrangements either due to increased incomes in the new arrangements or because it gives them time to pursue other equally important commitments. Another important trend is that people, especially women who often take time off for family reasons, are using the flexible gig working models<sup>68</sup> to keep them engaged during the phase before returning back fully or partially to the workforce once the commitments are over. Companies should create the necessary platforms/tools to embrace the new ways of working and reach out to this workforce of tomorrow. For instance, EY, in order to source, match and engage contractors, has built an innovative platform namely GigNow. The platform not only allows engagement teams to tap into more sources of talent pools, quickens the process to deploy and lower the indirect costs, but also provide the gig workforce to view the various contractual employment opportunities at EY. Facilitating embracing of the gig economy would also open new doors for more women to enter the workforce. Educated skilled women who are unable to continue a full time employment within the corporate world could leverage new ways of working to achieve relevant sources of income. This could also mark an important means to improve India's GDP.

## Skilling and reskilling initiatives

**Create collaborative learning ecosystems for each industry:** Industry associations and individual companies can work toward creating a collaborative learning ecosystem in their respective sectors to skill workforce/students on the next generation of technologies. Standardized curriculum could be developed with the support from educational institutes and can be made available through MOOCs, universities and traditional training mechanism. For example, NASSCOM is working with IT/BPM companies (such as TCS, Infosys and Accenture) and academia to create a NASSCOM branded learning platform to reskill/skill 1.5-2 million people on next-gen technologies within 4-5 years. Similar, FICCI has developed a technology platform Resource Integration of Sustainable Employment (RISE) to strengthen the process mechanism of the skill development ecosystem using big data analytics which will help policy makers and industry to strategize for the future requirements of skilled manpower. This application could also be used by NITI Aayog, Central Ministries and state governments to effectively monitor and benchmark performances of various skill programs.

**Develop workforce re-training programs across organization levels:** For the existing workforce, there needs to be large-scale re-skilling on exponential technologies and their potential applications. Companies are working on improving the digital quotient of their enterprise. We are beginning to see this in sectors beyond service sectors, such as traditional manufacturing sectors. One of the largest steel producers has announced plans to train close to 10,000 of its workforce on these technologies. The expectation is that even shop floor workers with their experience would be able to suggest innovative process improvement solutions if they are aware of the technology possibilities. At the supervisory and mid management levels, the training focus is on awareness and process improvement programs using these technologies. Finally, at the senior management levels, the focus is on strategic implications, new products and business models.

## Partnering with Government

**Work in close partnership with the Government to ensure success of its efforts to take advantage of Industry 4.0 technologies:** The need for a partnership between industry and Government has never been more important than today, when disruptive forces are expected to have large-scale impact. Industry associations and leading companies need to support the Government by providing inputs on how the Indian society, workforce and education systems should be and look like going forward, enthusiastically participate in all engagement platforms and support the implementation efforts (typical weak link in large scale Government initiatives) through resources, knowhow and well-designed PPP models.

# Recommendations for academia

**Focus on cognitive/judgment-driven skills:** The rapid pace of change in jobs and skills is creating a growing demand for updated skills. There is an opportunity for educational institutes to transform their offerings from employability-enhancement skills to those related to the thinking, complex problem solving, and decision making among others. Educational institutions must keep pace with rapidly evolving technology, to enable individuals to be future ready and reduce their rate of obsolescence.

**Tailored courses with flexible completion timings will enhance students' inclination towards learning:** Changing aspirations, growing awareness about global trends and easy access to quality content has inclined individuals towards skill oriented courses, which allow flexible time frames for completing credits. Universities of the future need to transition towards a learner-centered education model where learning and work go hand in hand. Due credit needs to be given to experiential learning along with development of interactive learning modules. Customized learning modules focused on imparting competency-based knowledge, and the creation of adaptive, dynamic and agile life-long learners, should be the focus of the universities.

# Recommendations for individuals

**Take responsibility for life-long learning:** Individuals have to realize that the current model of formal learning up to the age of 20 - 25 years and then working and experiential learning for the rest of our lives is gradually being upended. They need to take responsibility for making their own lives relevant and enriching in the new economy. They need to take advantage of the enabling ecosystem that the Government and the companies they work for are providing in terms of learning opportunities.

**Embrace the online economy:** It is imperative for individuals to realize that the age of working a quarter of a century in a company or a number of companies may be coming to an end. Tomorrow's work arrangement could be a combination of employee arrangements interspersed with gig working models. They need to understand the importance and evaluate the benefits of contractual labor/project based work arrangements. These new ways of working should be considered as relevant as any other type of employment and considered as the primary source of income. This would also have its impact on society, which values stability in work.

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<sup>1</sup>Per capita incomes in India increased from US\$1,475 in 2012 to US\$1,861 in 2016 - Source: World Bank

<sup>2</sup>Poverty ratio in 2011 was 21.9% using the Uniform Reference Period (URP) consumption method (30-day recall period for calculating consumption expenditures). Poverty ratio in 2015 was 12.4% using the Modified Mixed Reference Period (MMRP) consumption method (7-day recall period for calculating consumption expenditures). Although not comparable fully, there is evidence that there has been a steady decline in poverty ratios.

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# Glossary of terms

AI	Artificial Intelligence
ATM	Automated Teller Machine
ASHA	Accredited Social Health Activist
B2C	Business to Consumer
BFSI	Banking, Financial Services and Insurance
BPM	Business Process Management
BTIA	Broad-based Trade and Investment Agreement
CAGR	Compound Annual Growth Rate
CXO	Chief Executive Officer
CoE	Centre of Excellence
CSIR	Council of Scientific and Industrial Research
DNA	Deoxyribonucleic Acid
ER&D	Engineering Research and Development
EY	Ernst and Young
EU	European Union
FDI	Foreign Direct Investment
FICCI	Federation of Indian Chambers of Commerce and Industry
FTA	Free Trade Agreement
GDP	Gross Domestic Production
HR	Human Resources
IBEF	India Brand Equity Foundation
IFR	International Federation of Robotics
IMF	International Monetary Fund
INR	Indian National Rupee
IoT	Internet of Thing

IT	Information Technology
ITI	Industrial Training Institute
M&A	Merger and Acquisition
MOOC	Massive Open Online Courses
MSME	Micro, Small, and Medium Enterprise
MUDRA	Micro Units Development and Refinance Agency
NASSCOM	National Association of Software and Services Companies
NCR	National Capital Region
NITI	National Institute for Transforming India
NSDC	National Skill Development Corporation
OEM	Original Equipment Manufacturer
P2P	Peer-2-Peer
PLC	Programmable Logic Controller
RBI	Reserve Bank of India
RFID	Radio-Frequency Identification
ROI	Return on Investment
RPA	Robotic Process Automation
SMAC	Social, Mobile, Analytics, and Cloud
UAE	United Arab Emirates
UK	United Kingdom
US	United States
VFX	Visual Effects
WTO	World Trade Organization

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### About FICCI

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### About NASSCOM

NASSCOM, a not-for-profit industry association, is the apex body for the USD 154 billion IT BPM industry in India, an industry that had made a phenomenal contribution to India's GDP, exports, employment, infrastructure and global visibility.

Established in 1988 and ever since, NASSCOM's relentless pursuit has been to constantly support the IT BPM industry, in the latter's continued journey towards seeking trust and respect from varied stakeholders, even as it reorients itself time and again to remain innovative, without ever losing its humane and friendly touch.

NASSCOM is focused on building the architecture integral to the development of the IT BPM sector through policy advocacy, and help in setting up the strategic direction for the sector to unleash its potential and dominate newer frontiers.

NASSCOM's members, 2200+, constitute 90% of the industry's revenue and have enabled the association to spearhead initiatives at local, national and global levels. In turn, the IT BPM industry has gained recognition as a global powerhouse. In India, this industry provides the highest employment in the private sector.

