

16th National Conference

on

Use of Emerging Technologies by Engineers for Economic Development

November 26, 2018



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Engineering Council of India

16th National Conference

on

Use of Emerging Technologies by Engineers for Economic Development

November 26, 2018 • New Delhi

Souvenir

Engineering Council of India

1304, Hemkunt Chamber, 89, Nehru Place, New Delhi-110019 Tel. : +91-11-41783281, 41783282, 26283281 Telefax : +91-11-26283282, E-mail : eci@ecindia.org **Website : www.ecindia.org** 16th National Conference on "Use of Emerging Technologies by Engineers for Economic Development"



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अखिल भारतीय तकनीकी शिक्षा परिषद् भारत सरकार का सविषिक निकाय मानव संराधन विकास मंत्रनाव, भारकार नेल्लन मंद्रेला पार्ग, क्संत कुंज, नई दिल्ली-19067 ALL INDIA COUNCIL FOR TECHNICAL EDUCATION (A STATUTORY BODY OF THE GOVT. OF INDIA) Ministry of Human Resource Development, Govt. of India Nelson Mandela Marg, Vasant Kunj, New Delhi 110067

November 24, 2018



Message

It gives me immense pleasure to learn that Engineering Council of India (ECI) is organizing its 16th National Conference on 26th November 2018 at New Delhi.

The Topic "Use of Emerging Technologies by Engineers for Economic Development" is quite relevant in today's context.

I am confident that the deliberations would result in ways to increase the employment opportunities of our young engineers.

I wish the conference all success.

(Prof. M. P. Poonia) (Vice Chairman-AICTE)

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Andhra Pradesh Real Estate Regulatory Authority





Message

I am pleased to know that Engineering Council of India is organising the 16th National Conference on the Theme "Use of Emerging Technologies by Engineers for Economic Development" on November 26, 2018 at New Delhi.

Andhra Pradesh Real Estate Regulatory Authority has been developed under section 4.3 of the Real Estate (Regulation & Development) Act, 2016. The department of Municipal Administration & Urban Development, Government of Andhra Pradesh is the nodal department for the implementation of RERA Act in the state of Andhra Pradesh. Its objective is to reform the real estate sector in India, encouraging greater transparency, citizen centricity, accountability and financial discipline

The newly formed Andhra Pradesh State is aiming at revival of National Economy through upliftment of Real Estate Sector. APRERA is the leading nodal agency for implementation of this vision of SUNRISE State through the following:

- 1. Creating an incentivized system rather than regulated & governed systems.
- 2. Creating a conclusive environment & eco system for professionalism in Engineers to grow.
- 3. Harmonizing operating systems.

In line with the same, AP RERA has signed an MoC with Construction Industry Development Council and look forward to bringing in the qualitative change.

I am sure that this great initiative will add value to the knowledge and capability and facilitate in increasing employability of our engineering graduates.

I take this opportunity to congratulate Engineering Council of India and wish the Conference a grand success.

Tecourole

(Velamati Ramnath) Chairperson

Place: Hyderabad / Vijayawada

Date: 23rd November, 2018

2^{ed} Floor, Vasu Estate, Beside Hotel Manorama, M.G Road, Vijayawada - 520 002 Andhra Pradesh

16th National Conference on "Use of Emerging Technologies by Engineers for Economic Development"

Dr. Uddesh Kohli

Chairman

Chairman Emeritus : Construction Industry Development Council Former : Chairman, Consultancy Development Centre : CMD, Power Finance Corporation; Adviser, Planning Commission



Engineering Council of India

Message

Engineering Council of India, which was formed by coming together of a large number of professional associations/institutions of engineers, has been organizing a National Conference every year on a theme which is relevant to the engineering profession, society and country. The theme chosen for the 16th Conference, namely, 'Use of Emerging Technologies by Engineers for Economic Development' is very apt and timely. The engineering profession today needs to explore, develop, adopt use new and emerging technologies so that the engineers can make maximum contribution in the pursuit of rapid economic development. Many of these technologies are in the nascent stage and may require further research, development, experimentation and further effort in implementation. This is a Challenge for our engineers.

I hope the deliberations at the Conference will be of great help conceptually and practically to pursue the emerging technologies. I wish the Conference all success

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(Uddesh Kohli)

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Dr. P.R. Swarup

Member Secretary



Engineering Council of India



Message

Engineering Council of India is organising the 16th National Conference with the theme 'Use of Emerging Technologies by Engineers for Economic Development with the support of All India Council for Technical Education (AICTE) on November 26, 2018 at New Delhi.

Technology is perhaps the greatest agent of change in the modern world. While never without risk, technological breakthroughs promise innovative solutions to the most pressing challenges of our time. Technology is changing at an ever accelerating pace and there is need to not only keep abreast with latest technologies, but also develop innovative technologies which may reduce costs, save natural resources, enhance the value of the products and processes, protect environment and help improve quality of life.

The emerging technologies include Drone Technology, Erection of Aquifer Storage and Retrieval Innovation System, Blockchain Technology, Robotics, Artificial Intelligence etc. These emerging technologies embrace all sectors of economy. Many of these technologies are being driven by very young people, some hardly out of college. This makes it essential for us to nurture our next generations at school and college levels in ways which bring out their creativity and quest for knowledge and techniques.

I am confident that the Conference will provide a forum for engineers, technologists, service providers, industry and other stakeholders to exchange knowledge and information which will benefit in employability of engineers.

We at ECI are looking forward to compile and implement the recommendations arising out of this Conference and provide a road map for future economy and establishing India as global leader.

(Dr. PR Swarup)

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B.R. Jain Director

Mobile : +91-8750065714



Engineering Council of India

B

Message

I am delighted to share the information that Engineering Council of India (ECI), with its member associations, are jointly organizing the 16th National Conference on the theme 'Use of Emerging Technologies by Engineers for Economic Development" on 26th November, 2018 at CSIO, Vinay Marg, Chanakyapuri, New Delhi.

Five/ Six technologies would be showcased in this Conference-Robotics, Artificial Intelligence/ IoT, Aquifer, Blockchain, 3D Printing and Drones. These are niche technologies which have the capacity to transform the economic scenario and be the frontrunners for the 4th Industrial Revolution. Adoption of these technologies would definitely result in enhancing the employment opportunities of our young/ aspiring engineers.

ECI, being the apex body of the engineering profession in India, has the responsibility to encourage and further the development of technologies which would catapult India to the forefront of advanced economies of the world.

I appreciate and feel proud to be a part of the Engineering Council of India that has always been proactive in in making the engineering profession responsive to the needs of the Indian society.

(B.R. Jain)

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Compiled by **Er. B R Jain** Director, ECI



Emerging Technologies and their impact on India

Expectations of Indian Economy:

In its seventh decade of independence, India stands on the cusp of major change : a transformation that could lead to unprecedented economic growth paired with radical improvements in the nation's Human Development Index (HDI). We have to understand what it would take for India to increase its GDP by 9% per year to become a US\$10tr economy over the coming two decades. Anything less than US\$10tr would not secure India's future. The nation needs to create 10-12m jobs every year in the coming decades to provide quality of life for its growing population. Young Indians, particularly members of the emerging middle and the middle class – a billion strong by 2034 - have rising aspirations. They are also more empowered to demand change, thanks to evergreater access to the internet and mobile connectivity. A 9% GDP growth rate with a per capita income rising from US\$1,500 to just under US\$7,000 per year will boost quality of life for more than 1.25bn citizens. This would be the largest national development effort any democracy has ever attempted. Reaching this goal will call for a concerted effort-from businesses, entrepreneurs, investors, and government leaders. It will also require new solutions. India needs to focus on creating new solutions that will radically improve its economic and human development performance. Each economic sector faces challenges whose resolution will require new solutions that are scalable, resource efficient, and environmentally sustainable. For example, the education sector will have to deliver high-quality, formal education to 7m additional children every year over the next two decades. Yet with current

education investments estimated at just 3% of India's GDP, achieving this target won't be easy using traditional strategies. Other sectors such as healthcare, agriculture, retail, utilities, manufacturing, financial services, urban infrastructure—all throw similar challenges. Each has to grow, despite resource constraints. Managing and achieving the requires growth will require significant new investment and innovative approaches. India will have to invest more in research and development (R&D), particularly for solutions to challenges facing emerging markets, where India has already established a leadership position.

All of the Industrialized Economies in the world, without any exception, basically have reached that stage purely on the strength of their own Research and Development, their own entrepreneurs and own industry. USA excels in innovations, Europe, particularly Germany, for Engineering acumen, Japan/Korea in applications and China for its manufacturing prowess. The rest of the world, including India, are markets for their produce. If India wants to become an industrialized nation, then it has to gear up on all fronts, be it Education, Research and Development, Industry, Government or Financial Institutions.

Indian Economy Today

The Indian Economy can be divided into three basic sectors, 1) Agriculture, 2) Service, 3) Manufacturing.

The structural transformation of the Indian economy over the last three decades has been spectacular growth of the services sector, which now accounts for about 50 per cent of the GDP.

However, the rapid growth of the services sector much before the manufacturing industry attaining maturity is not a healthy sign. A knowledge -based economy cannot be sustained in the long run unless it is adequately supported by a growing manufacturing economy. Moreover, a service economy cannot continue to thrive on a long-term basis in a country where over 80 per cent of the population is education below the middle-school level.

The IT industry in India, which grew by as much as 30% up till five years back, has slowed down to a 10.2% growth rate at present. The demand for traditionally qualified professionals in the field has understandably gone down too. Some sectors, such as IT, ITES and pharmaceuticals, will compete globally, employing perhaps 2% of the population and bringing wealth to many parts of India. At the same time, around 60% of the population will remain dependent on the agricultural sector, sharing less than one-quarter of India's GDP. Without reform, the agriculture will continue to suffer from endemic underemployment, low wages and monsoon dependency. This will result in continued urban migration, but without the development of an industrial sector this will lead to rising unemployment in the cities. Recognition that this pattern is unsustainable is growing.

The Third Industrial Revolution (3IR), linked to the invention of computing, telecommunications, and electronics, is still unfolding in India. Approximately 300 million Indians live without electricity and only 35 per cent of the population has access to the internet. The two distinctive features of India's structural transformation have been disconnecting between the gross domestic product (GDP) and employment growth and a shift straight from agriculture to service-led growth, without an expansion in manufacturing. This is reflected in the overwhelming contribution of the services sector to GDP growth (63 per cent) over the last decade, but a significantly smaller share in employment (about 25 per cent) during the same period. Over 80 per cent of the workforce is engaged in the unorganized sector. Fewer than two million jobs are being created annually, even while the number of people joining the workforce exceeds 8 million every year. India is also one of the few countries in the world where women's participation in the labour force is declining. It is therefore imminently clear that the future of work in India will be shaped by the interactions that exist between technological trajectories and such socio-economic trends.

Future Scenario

It is estimated that India needs to create 7-8 million new jobs each year outside agriculture to stay at its current unemployment level of 7 percent. Manufacturing jobs are ideal for workers transitioning out of agriculture as service jobs require high level of education and professionalism. The revival of manufacturing sector can create close to 2.5 Million new jobs every year. With the removal of all quantitative restrictions on imports and the falling import tariffs under the WTO regime, it is all the more important for the Indian industry to improve its competitive edge. The sheer volume of international trade with over 70 per cent of the seven trillion-dollar market being in processed manufacturing, strongly indicates the necessity of developing global competitiveness in this sector.

The Fourth Industrial Revolution (4IR), characterized by the convergence of a cluster of technologies cutting across the physical, digital, and biological worlds - machine learning and

artificial intelligence, advanced robotics and autonomous transport, cloud computing and the IoTs, among others, is expected to profoundly transform the future of work. Many jobs and ways of working will become redundant while many others will be created anew. Production processes, business models, service delivery mechanisms along with employment relationships and social protection frameworks are likely to be reconfigured. Anxiety about the world of work is not new, but it is claimed that this time around, the speed and spread of technological change will be unprecedented. Emerging technologies pose several pertinent challenges. Emerging technologies can be defined as science-based technologies that are characterized by novelty, recent high-growth, and potentially broad impacts. In the past two decades it has become increasingly clear that this combination of characteristics can make standard forms of decision-making inadequate.

A brief description and explanation are given for some of the emerging technologies: -

A) Automation

India has high automation potential, calculated in terms of the task content of various occupations. 4IR technologies are expected to contribute to a hollowing out of labour markets, as many routine and rule-based jobs that typically involve low to medium skills are automated. In India, however, the bulk of the labour force is engaged in unskilled or low-skilled and low-income jobs within the unorganized sector. The category of low-medium skilled jobs within the organized sector, such as those of a cashier, is still very small. India is thus unlikely to experience a hollowing out of the labour market in terms that may be similar to other industrialized economies. However, these low-medium skill level jobs within the organized sector are what millions

within the unorganized sector, particularly youth, aspire toward. As businesses within the organized sector realign to new technological possibilities, a critical pathway for upward labour mobility and income mobility is likely to shrink. This can pose a significant challenge in the Indian context as middle skill jobs have served as a pathway out of poverty. Capital intensive manufacturing industries, such as the automobile industry, are more likely to adopt 4IR solutions. Work processes within the service sector, particularly those that involve routine and repetitive tasks, have high automation potential. Adoption rates will be higher in some sectors, such as financial and legal services, and IT services.

B) 3D Printing

3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. The creation of a 3D printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object. 3D printing is the opposite of subtractive manufacturing which is cutting out / hollowing out a piece of metal or plastic with for instance a milling machine.

3D printing enables you to produce complex (functional) shapes using less material than traditional manufacturing methods.3D printers are devices that deposit layers of a material (usually plastic), slowly building a three dimensional object from a data file on a computer. You can print all kinds of things with them, and the cost has been falling rapidly. There are already a number of options available to consumers, and we've even reviewed one notable printer in the past.



3D printing allows doctors, rather than using flexible materials that conform to the user's body, to use a rigid, non-permeable material to fix the limb in place. Using 3D scans of the user's arm, the fit can be made perfect. By leaving gaps in the material, the arm gets sun and air, can be washed, and doesn't get dirty. In the case of terminal, massively metastasized cancer, we could improve the patient's odds by replacing every affected organ system with 3D-printed replicas. An unlimited supply of bio-compatible organs drastically changes the nature of medicine.

3D printing has immense scope in rapid prototyping. Rapid manufacturing, automotive components, aviation, aerospace, Construction, contour crafting, architecture, furniture, lighting, health etc

It's becoming increasingly clear that 3D printing is going to be a powerful force in future industry.

C) Aquifer

An aquifer is a body of saturated rock through which water can easily move. Aquifers must be both permeable and porous and include such rock types as sandstone, conglomerate, fractured limestone and unconsolidated sand and gravel. Fractured volcanic rocks such as columnar basalts also make good aquifers. The rubble zones between volcanic flows are generally both porous and permeable and make excellent aquifers. In order for a well to be productive, it must be drilled into an aquifer. Rocks such as granite and schist are generally poor aquifers because they have a very low porosity. However, if these rocks are highly fractured, they make good aquifers. A well is a hole drilled into the ground to penetrate an aquifer. Normally such water must be pumped to the surface. If water is pumped from a well faster than it is replenished, the water table is lowered and the well may go dry. When water is pumped from a well, the water table is generally lowered into a cone of depression at the well. Groundwater normally flows down the slope of the water table towards the well.

There are 4 types of aquifers :

1) Unconfined Aquifer

An aquifer which is not overlain by any confining layer but has a confining layer at its bottom is called unconfined aquifer. It is normally exposed to the atmosphere and its upper portion is partly saturated with water. The upper surface of saturation is called water table which is under atmospheric pressure therefore this aquifer is also called phreatic aquifer.

2) Perched Aquifer

It is a special case of an unconfined aquifer. This type of aquifer occurs when an impervious or relatively impervious layer of limited area in the form of a lens is located in the water bearing unconfined aquifer. As shown in Fig. 16.3 the water storage created above the lens is perched aquifer and its top layer is called perched water table.

3) Confined Aquifer

It is also called artesian aquifer. It is a type of aquifer overlain as well as underlain by confining layers. The water within the aquifer is therefore held under pressure. It is sometimes called pressure aquifer also. If the aquifer has high outcrop laterally than the ground surface, there will be positive hydrostatic pressure to create conditions for a flowing well. Water from such well comes to the surface without pumping. The imaginary level up to which the water will rise is called piezometric surface.

4) Leaky Aquifer

In nature, truly confined aquifers are rare because the confining layers are not hundred per cent impervious. An aquifer which is overlain or underlain by a semi-pervious layer through which vertical leakage takes place due to head difference is called leaky aquifer or semi-confined aquifer.

The permeability of the semi-confining layer is usually very small as compared to the permeability of the main aquifer. Thus the water which seeps vertically through the semiconfining layer is diverted internally to proceed horizontally in the main aquifer.

D) Blockchain Technology

The blockchain is an undeniably ingenious invention - the brainchild of a person or group of people known by the pseudonym, Satoshi Nakamoto. By allowing digital information to be distributed but not copied, blockchain technology created the backbone of a new type of internet. Originally devised for the digital currency, Bitcoin, the tech community is now finding other potential uses for the technology. Bitcoin has been called "digital gold," and for a good reason. To date, the total value of the currency is close to \$112 billion US. And blockchains can make other types of digital value. Like the internet (or your car), you don't need to know how the blockchain works to use it. However, having a basic knowledge of this new technology shows why it's considered revolutionary. So, we hope you enjoy this, What Is Blockchain Guide.

The easiest and most basic way to think about the underlying technology is to think about a technology that keeps a master list of everyone who has ever interacted with it. It's a bit of an oversimplification, but if you've ever used Google Docs and allowed others to share the document so they can make changes, the programs keep a list of all the changes that are made to the document and by whom. Blockchain does that but in an even more secure way so that every person who ever touches the document is trusted and everyone gets a copy of all the changes made so there is never a question about what happened along the way. There aren't multiple copies of a document and different versions — there is only one trusted document and you can keep track of everything that's ever happened to it.

Picture a spreadsheet that is duplicated thousands of times across a network of computers. Then imagine that this network is designed to regularly update this spreadsheet and you have a basic understanding of the blockchain.

Information held on a blockchain exists as a shared – and continually reconciled – database. This is a way of using the network that has obvious benefits. The blockchain database isn't stored in any single location, meaning the records it keeps are truly public and easily verifiable. No centralized version of this information exists for a hacker to corrupt. Hosted by millions of computers simultaneously, its data is accessible to anyone on the internet. Currently, finance offers the strongest use cases for the technology. International remittances, for instance. The World Bank estimates that over \$430 billion US in money transfers were sent in 2015. And at the moment there is a high demand for blockchain developers.

The blockchain potentially cuts out the middleman for these types of transactions. Personal computing became accessible to the general public with the invention of the Graphical User Interface (GUI), which took the form of a

"desktop". Similarly, the most common GUI devised for the blockchain are the so-called "wallet" applications, which people use to buy things with Bitcoin, and store it along with other cryptocurrencies.

Transactions online are closely connected to the processes of identity verification. It is easy to imagine that wallet apps will transform in the coming years to include other types of identity management.

E) Robotics

Robotics is a branch of engineering that involves the conception, design, manufacture, and operation of robots. This field overlaps with electronics, computer science, artificial intelligence, mechatronics, nanotechnology and bioengineering. Robots all have some kind of mechanical construction, a frame, form or shape designed to achieve a particular task. It has an electrical system for powering its movement and work and a computer based system for controlling its movement and functions. There are three different types of robotic programs: remote control, artificial intelligence and hybrid. A robot with remote control programing has a pre-existing set of commands that it will only perform if and when it receives a signal from a control source, typically a human being with a remote control. It is perhaps more appropriate to view devices controlled primarily by human commands as falling in the discipline of automation rather than robotics. Robots that use artificial intelligence interact with their environment on their own without a control source, and can determine reactions to objects and problems they encounter using their preexisting programming. Hybrid is a form of programming that incorporates both AI and RC functions. The areas where robotic engineering can be made use of are immense.

F) Artificial Intelligence

AI (artificial intelligence) is the simulation of human intelligence processes by machines, especially computer systems. Particular applications of AI include expert systems, speech recognition and machine vision. The modern definition of artificial intelligence (or AI) is "the study and design of intelligent agents" where an intelligent agent is a system that perceives its environment and takes actions which maximizes its chances of success. The term artificial intelligence is also used to describe a property of machines or programs: the intelligence that the system demonstrates. AI research uses tools and insights from many fields, including computer science, psychology, philosophy, neuroscience, cognitive science, linguistics, operations research, economics, control theory, probability, optimization and logic. Its research also overlaps with tasks such as robotics, control systems, scheduling, data mining, logistics, speech recognition, facial recognition and many others. Computational intelligence involves iterative development or learning (e.g., parameter tuning in connectionist systems).

Evolutionary computation: applies biologically inspired concepts such as populations, mutation and survival of the fittest to generate increasingly better solutions to the problem. These methods most notably divide into evolutionary algorithms (e.g., genetic algorithms) and swarm intelligence (e.g., ant algorithms). With hybrid intelligent systems, attempts are made to combine these two groups.

There is no doubt that the scope and depth of usages of Artificial Intelligence is immense, which could be both destructive as well as constructive in nature.

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Indian Economy in another 30 years

The future will look positive for high skilled labour. In India, in another 30 years, many of the routine jobs will most likely be replaced by technology and cheap labour will cease to be a competitive advantage in India. Agriculture will be one of the sectors most affected by the shift, as 55% of Indians are employed in agriculture. Technology advances may change the scenario: In the short term, the farmer of the future will leverage technology to gather knowledge, increase his skills and produce closer to the market requirement, at higher prices and without losses along the value chain. In the long run, the 'farm of the future' will be driven by talent that leverages sensors, IoT, robotics and artificial intelligence to increase productivity and reduce cost, hence increasing competitiveness of the sector and potentially leading to another 'green revolution'.

ii) Manufacturing sector: Similarly, the manufacturing sector will go through a transformation. While in the short-term, automation may replace routine and manual jobs, the factory of the future will be driven by newly skilled professionals leveraging a connected environment of technology and data insights from research and development to production processes, maintenance and repair, creating customized products and responding to shorter product life cycles. Future factories will operate hyper-efficiently: Internet of things, connectivity, artificial intelligence and analytics will create a more agile and flexible shop floor, improving asset efficiency, at the same time requiring new skills from operators. As a result, India's manufacturing has the potential to boost productivity and hence increase competitiveness.

iii) *IT Industry*: Likewise, India's IT industry will experience a major shift: While today, the IT-

sector has mostly routine-jobs, the sector will see a 56% increase in high-skilled jobs that require analytical and problem solving skills. Intelligent technologies will augment existing jobs and enable us to be more productive, make better decisions, produce goods and services faster and closer to the user, and create new jobs. Rather than fearing how automation, robotics and 3D Printing are replacing jobs, the potential for India lies in creating new kind of jobs that combine automation with human interaction, as machines and humans are highly complementary and make use of productivity gains.

Emerging technologies will act as enabler for generating new employment opportunities. No one has demonstrated this better than Uber: The company's success in developing a mobile application that allows individuals to submit a trip request to drivers who use their own cars has disrupted not only the transportation sector, but the way we think about exchanging underutilized capacity of existing assets or human resources with close to zero transaction costs.

iv) *The way work would be carried out:* Enabled by technology, the future of work will strengthen decentralization of work: On the individual level, this means work and value creation can happen from anywhere. Transformation of the workplace is already happening: Remote working, coworking and teleconferencing are today's drivers empowering the individual and providing new kind of freedom. With the shifts is what and how we work in India of the 2050s, the way, work is organized, changes: Roles within companies will change and the way business is organized will shift to more decentralized structures, empowering individuals and teams.

This trend of individuals offering their service on platforms to increase their income opportunities

will boost a new form of collaborative economy and give rise to new organizational models: allowing individuals to transact directly with each other. The individuals can become nodes in a single marketplace and form "just in time" teams and organizations. New collaborative platforms enable a seamless integration into global labour market on one hand, while it strengthens localized market places on the other hand.

v) *How do we need to prepare :* The new India will see new opportunities for those ambitious to learn and engage. To prepare, the task ahead of us requires re-skilling and strengthening of current capabilities to prevent a growing gap between those who have opportunities and those who are excluded.

Call for Action: Towards an inclusive future

Will the future mean that we need to be afraid of machines solving tomorrow's problems? Not necessarily, if we take action now! Machines will not have replaced humans in doing everything we consider valuable: Eradicating diseases? Erasing poverty? This will be done only with the people-centric innovations in an economy that uses machines to provide insights at speed, customize solutions, democratize access and change existing systems to enhance the wellbeing of the humans. At the same time, we need to jointly work on creating mechanisms to provide opportunities and income to those at the Base of the Pyramid and to create an inclusive work environment. Chairman



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