ARTIFICIAL INTELLIGENCE(AI): APPLICATIONS AND IMPLICATIONS (AI) FOR INDIAN ECONOMY

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Abstract: The Fourth Industrial Revolution, concept introduced at World Economic Forum in Davos by Klaus Schwab in 2016, defines a fundamental shift in business, social landscape, a fusion of technologies that is blurring the lines between the physical, digital and biological spheres. AI is a constellation of technologies where machines have higher levels of intelligence than human capabilities to comprehend and act. Innovations in the form of cloud, AI, IoT paired with higher computing power and big data have created a smarter and more connected world. 'The 4.0 industrial revolution' that has transformed the lifestyle around the globe through Artificial Intelligence/Machine Learning (AI/ML). An estimate by Markets and Markets Research valued AI in agriculture to be $ 432 million in 2016 and expects it to grow at the rate of 22.5% CAGR to be valued at $ 2.6 billion by 2025. AI/ML have opened manifold opportunities but it has also thrown challenges for the economies. The majority of studies emphasise that AI will have a significant economic impact. The rise of new technologies like AI, IoT, AR, VR will usher the next wave of change- making life more convenient, more enjoyable, more liveable. The future of AI should be redefined to meet the requirements of AI driven economy. The focus of the current paper is to rationalize the use of AI/ML across sectors and analyse the applications and implications of AI / ML for Indian economy. The paper has also highlighted the roadmap to the transformation and exploring limitless opportunities, new deeper research orientation towards creative economy and for a strong nation building.

Index Terms: **AI – Artificial intelligence, ML- Machine learning, AR – Augmented reality, VR- Virtual reality, IoT-Internet of Things, CAGR-Compound Annual Growth Rate.**

1. INTRODUCTION

The 4.0 Industrial Revolution, concept introduced at World Economic Forum in Davos by Klaus Schwab in 2016, defines a fundamental shift in business, social landscape, fusion of technologies that is blurring the lines between the physical, digital and biological spheres. AI is a constellation of technologies where machines have higher levels of intelligence than human capabilities to comprehend and act. Though AI is not a new phenomenon it already existed to some degree in many industries and government. The computer vision and audio processing enabled the world to acquire and process images, sounds and speech. The new technology has been built more user friendly. Artificial intelligence or AI, as popularly referred to, has been around us for a few years now. AI, the 4.0 industrial revolution has transformed the lifestyle around the globe. We hear the term every now and then – AI powered cameras, AI robotics etc. Today tech giants across the globe highly invested in studying developing technologies such as artificial intelligence machine learning including IoT. These technologies have already started bringing the revolutionary changes in the way brands do business and are growing leaps and bounds across verticals. This is coupled with the fact that the amount of data being generated is phenomenal. Combining all this data being generated with the advances being made in the computer power, AI and ML will lead to next wave of innovation. The time is not far when businesses will harness AI to do data driven thinking task for them significantly reducing the time they spent testing new innovations and in debating and scoping options. In the more positive realm, these new technologies have the potential to eliminate mundrane repetitive task, reducing human errors and bringing efficiencies. AI systems are providing vital application to supplement human capabilities across enterprises and sectors. Businesses need to be prepared for adopting and integrating the digital and physical technologies to improve their operations and productivity to set the foundation for future innovative growth. They are required to change their mindset for transformative technology from threat mentality to a growth mentality. The new technology AI/ machine learning enabled to evolve new business dynamics, organisational imperative and underlined communication, implementing of block chain technology, supply chain financing and improving the delivery efficiencies. Artificial intelligence is providing vital application to supplement human capabilities across enterprises and sectors as well.

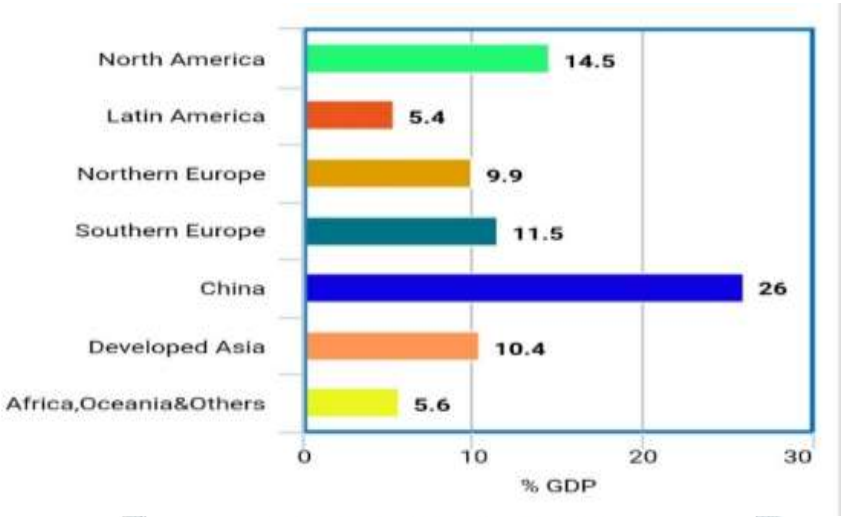
2. Global Inferences

The new innovations in the form of cloud, AI, Internet of Things (IoT) paired with higher computing power and big data has created a smarter and more connected world. The 4.0 industrial revolution' that has transformed the lifestyle around the globe through AI/machine learning and it has not only disrupted industries but also created growth opportunities simultaneously.

The majority of researches emphasise that AI will have a significant economic impact. A research launched by consulting company Accenture covering 12 developed economies, which together generate more than 0.5 % of the world's economic output, forecasts that AI could twice up annual global economic growth rates by 2035. A briefing on the Economic Impacts of AI presented on the European Parliament says, "AI will drive this growth in three important ways. First, it will lead to a strong increase in labour productivity (up to 40 %) due to advanced technologies enabling more efficient workforce-related time management. Secondly, AI will create a new virtual workforce – described as 'intelligent automation' in the report – capable of solving problems and self-learning. Thirdly, economy will also benefit from the diffusion of innovation, which will affect different sectors and create new revenue streams".

Many analytical firms have conducted surveys regarding this very topic- How AI will influence the economy? A study by PricewaterhouseCoopers (PwC) also estimates that global Gross Domestic Product(GGDP) may increase by 14 % (the equivalent of US$15.7 trillion) by 2030 as a result of the accelerating development and take-up of AI as shown in figure 1 given below.

figure 1: expected gains from AI in different regions

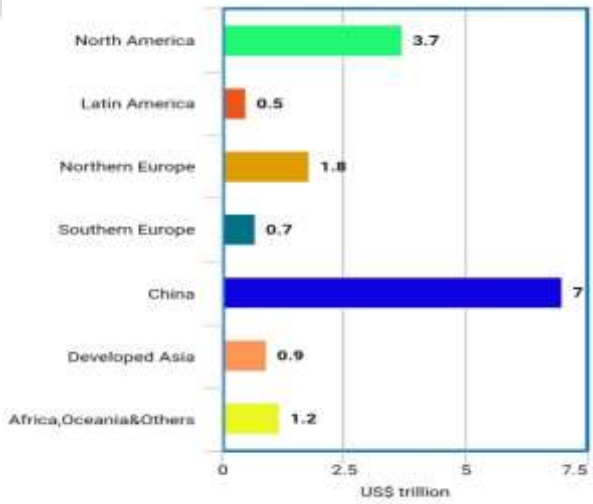


Source: The macroeconomic impact of artificial intelligence, PwC, 2018

According to The Macroeconomic impact of artificial intelligence by PricewaterhouseCoopers, economic gains from AI will be experienced by all sectors of the economy, with each industry expected to see a gain in GDP of at least approximately 10% by 2030. Expected gains in terms of GDP from AI by 2030 in different regions has been shown

In Figure 2.

figure 2: expected gains derived from AI by 2030



Source: The macroeconomic impact of artificial intelligence, PwC, 2018

The services industry that includes health, education, public services and recreation stands to be benefitted the most (21%), with retail and wholesale trade as well as accommodation and food services also expected to see a boost (15%). It is estimated that 326 million jobs will be impacted by AI in 2030 and also find supporting evidence of skills-biased technological change.

An estimate by Markets and Markets Research valued AI in agriculture to be $ 432 million in 2016 and expects it to grow at the rate of 22.5% CAGR to be valued at $ 2.6 billion by 2025. According to CB Insights, agricultural tech startups have raised over $ 800million in the last 5 years. These startups gained popularity in 2014 along with their involvement in multiple industries like healthcare and finance. These agricultural tech startups have raised over $ 500 million to bring AI and robotics to agriculture. The impact of automation in agriculture can be seen in the figure 3 given below.

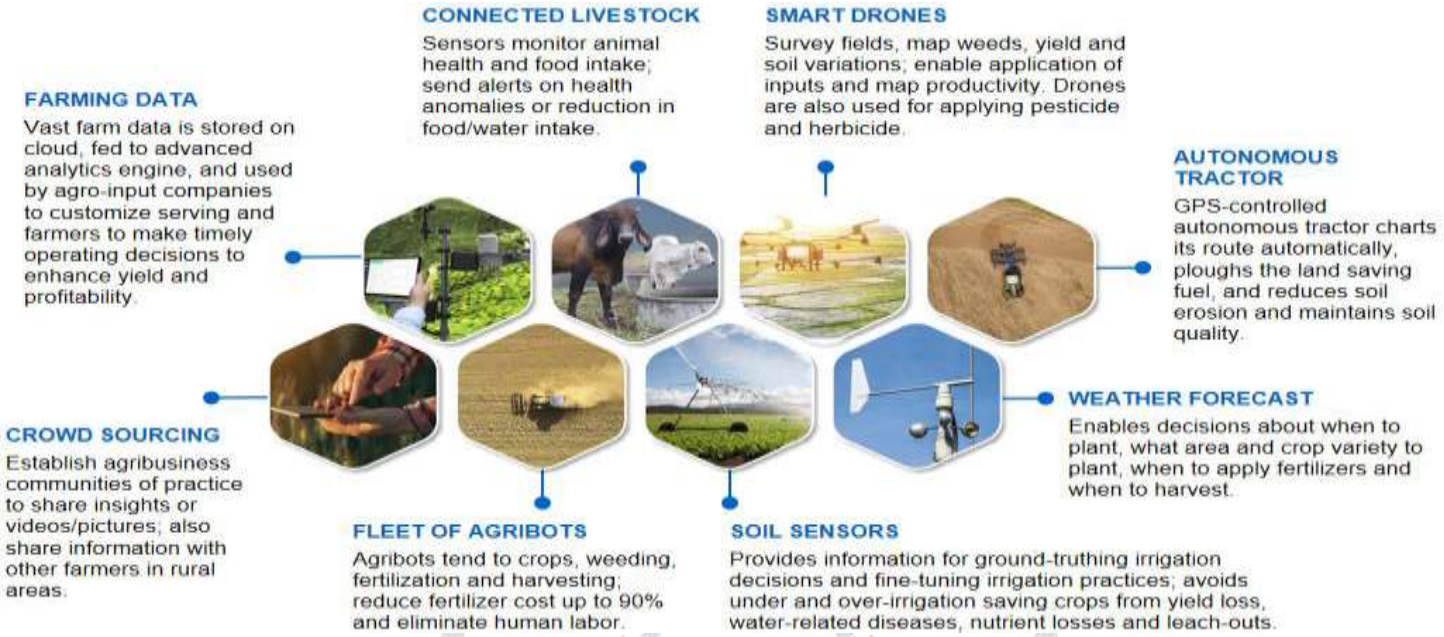


figure 3: ecosystem crucial for benefits of Precision Agriculture

Source: Accenture Research

The fear that AI and automation might lead to reducing of jobs is also widely present among the general public. Actually, this is not far from the truth. AI is widely known for being disruptive in certain sectors. This might be either beneficial or detrimental depending on the particular field where it is being used. Take the case of mobile phones, for example, virtual assistants make use of artificial intelligence and machine learning. But they did not cause any drastic economical changes or take up someone's job. In fact, they created more software related jobs because it required more programmers to be designed and developed. While considering industrial automation using artificial intelligence, a considerable number of jobs were created to do the automation processes but still the technology did end up with reducing jobs. But "the jobs lost far exceed the jobs created"(Mckinsey Global Institute). This has been a debate for years. Some industrial workers have a sense of negativity when it comes to artificial intelligence and automation and they are right in feeling so. In a country like India, where manual labour is cheap, why would we want to automate processes? Of course, this is beneficial in countries like Germany where the working population is shrinking. They have skyrocketing manual labour costs. So, automating things make sense there. This has been shown in figure 4

figure 4: working age population (%, annual average growth over the period)

Source: Oxford Economics

The new technology called for paradigm shift in AI and computing power at the levels of technical giants. During various events, researchers drilled down into machine teaching, optical computing and bio computing. Neural network helps to identify, count and protect the animal Kyrgyzstan (snow leopard trust used). Similarly, optimal computing is second paradigm shift in increasing the computing power. With the increasing amount of data there is a need to use the AI in order to know where data should be stored. Such technology may use 20% of world

electricity and have 5% of carbon emission only. Therefore, there is a need to research technology for optical computing. Machine human interaction is natural user interfaces such as eye tracking, voice and gesture are now reaching the market for differently abled people. Project Florence where plants and humans can converse by language processing, text translation into a light spectrum. Such technology can be used in agriculture. Bio computing where software revolution was based on encoding ones and zeroes but new AI technological revolution would be encoding A,G ,C and Ts. This will enable the scientist to fight diseases of crops to produce more crops to feed the hungry population. Technological development such AI has not only disrupted industries but also created growth opportunities simultaneously. AI technology has been built as more user friendly. AI helps in enabling better recommendations, improved business, travels and meetings.

A 2016 study by Analysis Group (funded by Facebook), considers that AI will have both direct and indirect positive effects on jobs, productivity and GDP. Direct effects will be generated by increased revenues and employment in firms and sectors that develop or produce AI technologies, which may also create totally new economic activities. Indirect ones will come from a broader increase of productivity in sectors using AI to optimise business processes and decision-making as well as increase their knowledge and access to information. Altogether they envisage much more modest gains (US$1.49-2.95 trillion) over the next decade.

As with an analysis of GDP impacts, the impact on labour doesn't necessarily signify the new jobs that will be created as a direct result of AI, but the number of jobs that will come to depend on and be heavily impacted by AI. Interestingly, most of these jobs will be unskilled, however proportionally skilled jobs will be more positively impacted, supporting a bias towards skilled labour. Specifically, 67% of the jobs in 2030 that will depend on AI will be unskilled jobs, however unskilled labour accounts for 69% of jobs in the baseline scenario. The changing composition of jobs across sectors from 1850 to 2015 in the US is given in figure 5.

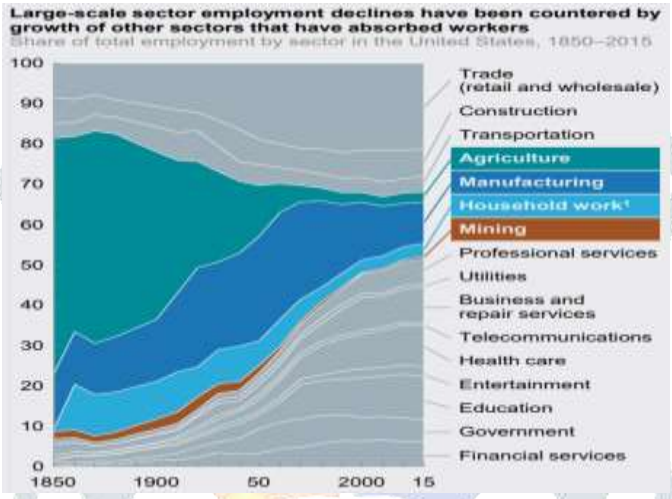


figure 5: changing composition of jobs across sectors from 1850 to 2015 in the U.S.

Source: McKinsey Exhibit E3

AI "The 4.0 industrial revolution" has entirely transformed the lifestyle around the globe. However, it has also given us challenges such as data ownership and labour protection, specifically, automation impact on jobs and wage levels. A study by Oxford Martin Programme on Technology and Employment (2013) shows that only 0.5 per cent of new jobs have been created since 2000 that did not exist before. This is against 173 million jobs that would be automated in the next eight years in G7 countries- Canada, France, Germany, Italy, Japan, the United Kingdom and the United States- which are also the seven largest advanced economies in the world. For the developing world, the World Banks' World Development Report (2016) anticipates the consequence of automation as labour reallocation from labour surplus Asia to labour deficit countries of Latin America and Africa.

Automation also involves re-skilling existing workers, redeploying others to new tasks and retooling potential workers who are students in the university. The 2017 International Data Corporation cognitive user adoption survey for the Asia-Pacific region indicates that 70 per cent of Indian firms plan to make additional investments in workforce-training to leverage the benefits of AI. Furthermore, the concept of "smart" work and demand for specific skills will encourage universities to revitalise the higher education and training and the state to smooth the path of job-market transition.

3. AI AND IT'S APPLICATIONS IN INDIA

AI is expected to play a pivotal role to achieve new India aspirational goals to make India fastest moving economy by expanding consumer market, conducive business environment, strong financial system and digitisation in all spheres. India can share the journey towards prosperity with AI / machine learning. India with its diversity of demographics, languages, culture and landscape offers unique opportunities and challenges for AI and machine learning. Advancement in technology especially AI have the potential to provide large incremental value to a wide range of sectors. Technologies through Automation will make businesses easy and increase creativity. The 4.0 industrial revolution have created a smarter and more connective world. These technologies have started bringing the revolutionary changes in the way brands do businesses and are growing leaps and bounds across the verticals. This is coupled with the fact that the amount of data being is phenomenal. In India Artificial Intelligence Task Force is one body which is using these technologies as a means to end. There is 18 member task force comprising academicians, Government officials, corporates; people with other specialisation are crafting a policy and a legal framework to accelerate deployment of AI technologies in the country. The rise of the digital platforms market place allows the impact of technology to reach more people, more quickly than ever before, bringing economic opportunity to millions of people who live in developing countries. Is it worth using artificial intelligence and machine learning for automation in India? The answer for the above question is both a yes and a no. A 'no' is easy to say if we look at this issue objectively. Automation costs jobs, so let us not do it! But we could also argue that by removing manual jobs out of the equation we are creating a demand in technical jobs, the jobs that pay well or lead into a smarter and vigilant population. The youth will acquire proper knowledge that will enable them to get a sustainable income for their life. And of course,

automation doesn't necessarily take up all the manual jobs. It just minimizes the use of human labour wherever possible. We absolutely cannot remove the 'human' part in any situation. In simple words, machines need humans to be designed, developed and survive. So, AI merely allows the human resources available to us to be put elsewhere in places where a machine is not enough to do the tasks or in situations where technology needs a human oversight**.**

AI helps in enabling better recommendations improved business across sectors. The current scenario of unlimited computing power and decreasing cost of data storage enabled organizations, in the exponential age of AI, to unlock the value trapped in volumes of data. The natural language processing and inference engine enabled AI systems to analyse and understand the information.

The future of AI should be redefined to meet the requirements of AI driven economies. Fast changing global technology landscape regulators must continue to encourage capability building, identify the associated risk of technology and manage them and not block them. The education, the key transformational process, the way to take an abundant latent resources into a creative productive workforce and closing the educational gaps will help to develop human resource potential and ensure benefits of growth are widely spread. AI is the opportunity to help and shape the architecture of future and strengthen regional and global integration. Technology has facilitated the bedrock collaborative innovation in digital public good through the Aadhar and has improved the service delivery and increased the financial inclusion by Direct Benefit Transfer, Unified Payment Interface, Jan dhan yojana and indian stack. The government of India is taking the lead in creating a sustainable platform to foster technological disruptions. In this regard, startups can play an important role to ensure innovation and dissemination. India's startup ecosystem is the third largest in the world, large consumer base, burgeoning policy making by government, STEM population (Science Technology Engineering Management) has boosted technology growth in India. Startup system has propelled job creation, solving consumer problems and creating products for rest of the world. Currently, it is the right time to converge invaluable opportunities for entrepreneurs and investors through transformative power of technology. AI is trying to solve the problem of accessibility, affordability and availability. Government is strongly focussing on building up AI ecosystem with large tech firms and upcoming startups.

The new technologies offering new and unique opportunities to entrepreneurs to innovate and shape not only the future of their business but also the bright future of Indian economy. But to grab the opportunities arising out of VR, AR and AI, companies established or startups need to be agile to adopt and reinvent. In order to become five trillion economies, India should invest in new and emerging technologies like AI, IoT, analytics and blockchain and developing favourable policies to promote and adopt these technologies. While there is a concern that these emerging technologies will take away jobs but at the same time it is also very clear that these technologies will also create jobs that require newer and high level skill sets in economic and non economic sectors.

4. AGRICULTURE AND ARTIFICIAL INTELLIGENCE

In the Indian scenario, the primary sector, as we all know is agriculture. It accounts for 49% of the country's workforce, 16% of the GDP and ensures food security to roughly 1.3 billion people. So, looking into AI's impacts, it is rendered necessary to analyse its effects on agriculture. Agriculture and allied sectors are crucial to India's growth story. To attain and retain an annual rate of growth of 8 –10% for the Indian economy, agriculture sector must grow at 4% or higher rate. To attain 4% annual growth rate technological changes and diversification should be very high. India has not been able to completely remove its exploitative reliance on resource intensive agricultural practices.

In 2016, approximately 50 Indian agricultural, technology based start-ups ('AgTech') raised $ 313 million. For the first time, widespread participation by startups is witnessed in this sector. For instance, Intello Labs use image-recognition software which helps in monitoring crops and predicting farm yields. Aibono uses agridata science and AI to provide solutions to stabilise crop yields. Trithi Robotics uses drone technology which allows the farmers to monitor crops in real time and provide precise analysis of their soil. SatSure, a start-up with roots in India, uses ML techniques to assess images of farms and predict economic value of their future yield. Some of the emerging agricultural technologies involve social and water sensors, satellite imagery, minichromosomal technology and Radio frequency identification technology.

Computer vision specialist Blue River Technology has developed a solution for exactly that, using advanced machine learning algorithms to enable robots to make decisions, based on visual data about whether or not a plant has a pest, and then deliver an accurate, measured blast of chemical pesticides to tackle the unwanted pests. Blue River's key technology is called "see and spray".

Deere&Company said it will invest $305 million to fully acquire Blue River Technology. John May, President, Agricultural Solutions, and Chief Information Officer at Deere said that they welcome the opportunity to work with Blue River Technology that is highly skilled and dedicated in the implementation of machine learning in agriculture. John Deere, a leader in precision agriculture, recognizes the importance of technology to its customers and it considers machine learning to be important for its future.

Therefore, artificial intelligence like satsure combining the power of big data analytics and machine learning using satellite data , IOT , drone and weather data can provide timely location, specifications in agriculture , forestry and urban planning. Aspirational Districts Program with the help of Artificial Intelligence and Machine Learning can address the development issues relating to agriculture across all the states. The crop titled can also be increased by providing farmers with real time advisory to assist them in farming activities detecting advance pest attacks so that the crop will deliver the best returns. AI and ML can also help in improving the supply chains and logistics in Indian agriculture. Some of the major issues which have been addressed by the latest technology are seeds, soil management, land degradation, water management technologies and the use of space technology and information systems in agriculture.

5. AUTOMATION AND INDIAN INDUSTRY

Digital transformation , disrupted technology have become immediate- need of an hour to meet competitive threats , ongoing cost pressures, increasing regulatory requirements and aging technology that are leading to adoption of new business models. The age of algorithms AI, IoT offers an opportunity to rethink the business operations resulting in higher profitable growth. Further, 88% of industry professionals in the manufacturing sector believed that reskilling and upgradation in technology, the cloud platform, data governance, business intelligence would help the sector to tackle the job responsibilities in an efficient manner in the near future. In manufacturing sector, supply chain operations can be optimized and failure of machine parts can be predicted in advance with the help of AI/machine learning. It has been

suggested that the employees of manufacturing sector would require upgrading the skills across all the components of AI and thus it is concluded that AI would be the fastest in the manufacturing sector. In order to take advantage of AI in manufacturing sector and to perform their job responsibilities in the efficient manner 60% of the participants have developed the interest to upgrade their skills through various training programs and initiatives organized by the employers. Given the size of Indian economy and its rapid growth, the real opportunity lies in India's complexity. The wave of successful startups will be able to micro target India's complexities relating to geographies, languages, and demographics with the help of AI/ML.

6. AI AND TRANSFORMATION IN SERVICE SECTOR

Be it entrepreneurship or IT services, aviation, healthcare, defence, tourism , finance, education the future is promising with the changing technology- AI , Machine learning and robotics. In order to become five trillion economy by 2025 India's transformation is to be powered by the factors like efficient policies of the government, infrastructure development, digitization of the economy, demographic dividend and rise of startups and entrepreneurs. Currently, India is at No.7 in nominal GDP terms and No.3 in Purchasing Power Parity (PPP) terms. Internet will dominate an IoT, AI an automation is set to change the businesses in the near future. Thus, the future of entrepreneurs is very exciting. Technologies like AI and ML , cloud has created a level playing field for the new entrepreneurs to make their presence felt within a short span of time rather than years or decades. With the help of new technologies and automation of certain functions will make businesses easy, attractive and creative. According to the survey done by Ericsson Consumer Lab, 73% of consumers would prefer AI as search engines for computer/ mobile devices, 64% believe that AI would make great travel guide while 57% prefer them as personal assistant. In the lower 40th percentile is AI as teachers, medical advisors and financial advisors. Japan is a great example of consumer AI. For preparing 2020 Olympics, Japan has developed robots to assist travellers in daily tasks. The demand for trust and security for both consumers and enterprises lead to creation of block chain. Next step is the global progress towards redefining the new era of internet. According to World Economic Forum, block chain is expected to improve communication and administration which would increase the global trade by $1 trillion. Financial services will be transformed from utility model to a seamless service provider model if banks and financial services companies invest heavily in modern technology. The time is not far away when the financial services will become much like plug and play models. In the current changing scenario when the information has become power to transformational changes playing big role in the way business is being conducted. Government efforts towards improving the digital identity and payments infrastructure and greater digital access, increased volume of data of information and democratisation of such information has substantially reduced the information asymmetry between service providers and buyers of financial services. In the near future with the increasing information, transparency will be more prevalent. Fintech aggregators are making information available to the people to compare the prices for a policy or for a loan. The increasing commoditisation of financial services can prove to be the game changer for banking and financial services. Customers will be enabled to pick financial services, products of the shelf or move from one product to another in a jiffy. The future of financial services will be technology based delivery with a humane approach.

Banks will have to gear up and invest in predictive analytics and artificial intelligence to increase the services and for detection. The financial services company that adopt new technology for speed, efficiency and accuracy are likely to stay ahead on the road of growth. Newer technologies like chatbots, machine learning, and innovation in data analytics are going to completely transform the manner in which the financial products are offered, understood and purchased, though the increasing digital footprints will also raise cyber and data security concerns. Technology innovation, adoption and management are going to be the key to success for the financial services sector. India's new sunshine sector is Fintech companies. This sector has taken a giant leap forward. Fintech sector combines two words 'finance and technology and represents amalgamation of traditional financial services with innovative technologies. It is estimated that more than 600 startups are currently comprising the Indian Fintech sector. Originally, this sector was defined as back end technologies that enabled backing and financial institutions to strengthen their existing brick and mortar setups. But, currently India's Fintech sector covers wide spectrum of business models and service providers comprising of E-lenders, online payment system, automated investment advisory platforms, tax filing portals and banking technology etc. The emergence of new technology such AI, big data and ML has resulted in mushrooming of several innovative Fintech companies in India in recent times and this is considered as just the beginning. Since India's GDP is expected to grow at 6% to 8% per annum for next five to ten years, it is quite likely that Fintech space will grow at a much quicker speed. So, it is expected that the growth of Fintech sector will almost more than double from currently 42% to 95% in near future due to adoption of technology and the value it adds to the entire financial ecosystem.

Technology is disrupting different industries across the world and real estate has also not been untouched. Real estate consultants have moved beyond the traditional ways of prospecting with the internet opening up. Big data analytics has become more integrated with real estate sectors. With the opening up of new technology, various new avenues of doing business in real estate have opened up. The crowd funding platform is a very good example to raise small amounts of money online from several donors to finance a developer's project or venture. These types of technologies speed up the entire transaction life cycle of the real estate business. The block chain technology is another area which has all the hallmarks of revolution in the real estate sector. This has brought greater transparency, efficiency and accuracy in property transactions. However, digitization of records, implementation of Real Estate Regulation Act (RERA) and Goods & Services Tax (GST) are the building blocks for Indian real estate sector to emerge as a transparent and buyer friendly.

The future of air transport, travel and tourism will also be driven by digital technologies to improve service, operations and efficiency. Artificial Intelligence will enhance airport and aircraft planning and reduce the administrative processes. AI and ML together can be used for weather forecast, arrival timings, giving airports the opportunity to proactively manage and mitigate disruptions. The recent study had revealed that passengers prefer self service, automated and mobile technologies over assisted ones. This clearly reinforces the fact that passengers are key to use self-operated services. India is expected to become third largest market in Aviation by 2023. The only way to achieve this growth is through adoption of innovative and newer technology which has the potential to create, secure and smooth journey for the passengers.

Indian E-commerce has become one of the most attractive markets in the world due to its size, growth rate, ease of doing business, investment, rising internet penetration etc. This exceptional performance of Indian E-commerce industry has attracted the world giant Walmart Inc. To acquire the largest Indian E-commerce company Flipkart for a whopping $ 16 Billion. E-commerce contributes 2% to India's rupees 3.4 Lakh Crore FMCG Business. Flipkart has also deployed AI solutions to detect and mitigate bots and resellers and stop

them in the transactional funnel to give a fair chance to genuine buyers. Internet and digital technology are the new superhighways of trade used in E-commerce business.

With the rising concession levels and air pollution most journeys are bound to become multimodal in pursuit of time efficiency and convenience. Fast digitizing Indian economy is offering many unique opportunities for well integrated mobility architecture. It is predicted that convergence between automotive technology and energy to offer seamless multimodal transportation. So soon Mobility-as-a-Service (MaaS) will gain traction and there will be a decline in personal mobility and ownership. The Insurance industry is able to recognize the changing customer behaviour and they have customised products and services according to their specific needs and behaviour due to increase of predictive analytics, IoT, blockchain technology.

New technology AI and IoT will soon be revolutionising the hospitality sector also .AI in hospitality industry has become more reliable. They are using AI powered robots to carry out customer service task, direct messaging and online chat services by using chatbots. With the voluminous information hotels were able to process and help customers to give more personalised and customised experiences. Even Judiciary services have a desire not to miss AI bus. Group of internal experts are working to determine avenues for deploying AI in courts to overcome the problem of judicial backlog. E-courts project is aiming at using the transformative technology along with integrating information and communication system. AI can potentially create technology application to exponentially improve the efficiency of judges and lawyers.AI is more sophisticated technology allowing judges to determine precise answers to their queries. Rapid progression in ML and natural language processing techniques has opened the floodgates for newer tools to the legal sector also. This New technology is expected to help government to identify fraudulent firms, traders evading the tax etc. This will help to increase the accuracy and improve the governance in the government sector.

Marketing organisations have also not remained untouched by the new transformative technology. These organisations are also processing the data for product development with the help of upcoming technological advanvements.AI and machine learning is of great help in consumer decision making and offering relevant prepositions to consumers. These transformative technologies are capable of creating a cost efficient strategy and future will see the conversion of data into analytics and execution. Global Artificial Intelligence Survey (GAIS) findings indicate that AI adoption is going to have modest overall impact on organisational workforce. About one-third respondents of the survey are of the opinion that AI will reduce workforce in next three years and one-fifth respondents expect increase in employment as AI high performers are doing retraining for their employees.

7. AI AND SOCIAL SECTOR

The innovation doesn't confine itself within the main sectors (primary, secondary, and tertiary) but it extended even to the social sector. Indian economy is facing manifold deep rooted challenges in social sector like quality health care, education, governance, ease of living to every Indian. The technology can be disrupted that can bring exponential changes and improvements in these sectors. Innovation is way forward if India has to keep target of 9% of economic growth for next three decades and for economic prosperity of younger generation. New technologies like AI/ML are offering new and unique opportunities to social sector also. As rightly said by Bill Gates **“** The use of technology couples with bold decisions can help India leap frog into inclusive growth and improve the quality of health and education.”

India being a developing country, has a considerable size of illiterate population. So, education has been an important focus in government’s policies always. Hence, when the Indian government designed its policies on AI, it has placed enough emphasis with the educational sector. This need is further amplified by a large youth population unlike any other developed country. In today's world, the concept of success has changed and so have the skills required to be successful. There is a need to equip children socially and emotionally and make them learners’ life long. This will bring success to them in the 21st century. In the era of digital revolution, learning experiences should constantly be upgraded and redesigned according to the need of the hour. We should use the data and place a greater emphasis on the types of skills required for solving problems and critical thinking. There should be a balanced approach between the technology and social emotional skills. The knowledge should be imparted in the children which should be “live ready and not work ready”. It is the time for personalized learning for accelerating academic and cognizant growth. Greater emphasis should be laid on importance of creative, social, emotional and technology skills. Personalized inclusive and immersive learning supported by technology create opportunities and enhance cognitive skills.

According to EdTechXGlobal, EdTech is becoming a global phenomenon, and as their distribution and platforms scales are international, the market is projected to grow at 17.0% per annum, to $ 252 billion by2020. India’s digital learning market was valued at $ 2 billion in 2016 and is projected to grow at a CAGR of 30%, reaching $ 5.7 billion in 2020 as per estimates from Techno Pak. As per Forbes, in 2017, across every market involved in EdTech, international funding reached a new record of $ 9.52 billion, and 813 different EdTech companies received funding last year. These EdTech investments mark an attainment of 30% from 2016. Venture Capitalist (VC) interest in the education space continues to grow. For example, one of India’s leading EdTech start-ups Byju’s raised $ 40 million from Tencent in July 2017, just four months after raising $ 30 million from Belgium-based Verlinvest. Among Byju’s other investors include Sequoia Capital and The Chan Zuckerberg Foundation.

Several AI tools successfully used in other parts of the world can be adapted to the Indian context to target specific challenges like adaptive learning tools for customized learning, predictive tools to inform pre-emptive action for students predicted to drop out of school, automated rationalisation of teachers, customised professional development courses etc.

Content Technologies Inc. (CTI), an AI research and development company, develops AI that creates customised educational content using deep learning to absorb and analyse existing course materials etc. A recent hackathon by NITI Aayog also displayed ‘ReadEx’, an android application that does real-time question generation using natural learning process, content recommendations, and flashcard creation. Pearson’s WriteToLearn software uses natural language processing technology to give personalised feedbacks and tips to improve writing skills of the students. This software will enable the teachers to spend less time in grading the assignments and more time for effective teaching. Artificial intelligence has helped skilling technology augmenting and enhancing the learning and automating and expediting the administration.

AI/ML is not only used for education but also used as an efficient tool for healthcare delivery. Though in the past this sector was not able to keep pace with technology and innovation but there will be paradigm shift in healthcare delivery in the coming decades. Healthcare sector in near future will change from "illness" to "wellness", digital healthcare delivery, e-clinics, from traditional devices to smart devices which monitor and transmit data to computers. This data is then analyzed with the help of AI to interpret and assist doctors in decision making. This new age of innovation has moved from conventional pharmaceutical medication to pharma co-generic therapy. Similarly conventional testing is replaced by molecular diagnostic techniques for early detection, prevention and treatment of diseases. Another significant technological development in the healthcare is moving from convention organ donation to growing organs in the lab. Data driven medicines with data capture storage and analysis using AI as a tool has helped in efficient healthcare delivery. Doctors soon will be directing the computers and AI for wellness rather than treating for illness. AI, AR and VR have potential to dramatically change clinical research as well as practice of medicine in real life and can make healthcare accessible to large chunk of population. At the same time IoT can prove to be an effective tool to transform the practice and delivery of healthcare around the world. The healthcare with technological advancement will soon become more productive and cost effective. With these emerging technologies like AI, VR and IoT the healthcare system is expected to become "acceptable, accessible and affordable". Healthcare is yet one of the most dynamic challenge in India. In spite of being the economic potential, the health sector in India remains multi-layered and complex, and is ready to accept emerging technologies at multiple levels. Adoption of AI for healthcare applications is expected to see an aggressive increase in next few years.

National Strategy for Artificial Intelligence prepared by the NITI Aayog states that the healthcare market globally driven by AI is expected to register an explosive CAGR of 40% through 2021, and what was a $ 600 million market in 2014 is expected to reach $ 6.6 billion by 2021. Thus, healthcare solutions based on AI will make this sector more proactive – moving from "sick" care to true "health" care, with emphasis on preventive methods.

The rise of new technologies like AI, IoT, AR, and VR will usher the next wave of change- making life more convenient, more enjoyable and more liveable.

8. AI AND ITS IMPLICATIONS

Since India's major labour force is in farm sector, if technology invades into the sector, India's underskilled unprepared labor force will become unemployable. Many will find themselves jobless because there will be little they can do better or cheaper than machines. This means that despite large social outlays, poverty is on rise reversing the past trend will not be possible with the technological advancement. The fear of joblessness, inequality and social unrest may arise.

Currently India is accounting for less than 5 % of country's gross domestic product, soon Indian industry sector is expected to sustain double digit growth in the next decade with the policy changes, macroeconomic headwinds, political stability and increasing competition will shape the way the industries will do their businesses in India. Industrial revolution 4.0, a term used for current trend of automation in manufacturing technology is gaining momentum. It includes elements such as artificial intelligence, robotics etc., which are expected to make the traditional workforce redundant. The very important challenge faced by the developing economies (India) is the displacement of labour force due to this robotic automation.

The survey of 100 respondents from corporate India was undertaken across Delhi, Mumbai , Hyderabad, Bangalore, Kolkata, Chennai, Ahmadabad by Business World on the basis of the progress and changes seen in recent years and how they will see India 10 years from now. The responses have been shown in Figure 6 given below.

S. NO	Basis	Strongly Agree	Agree	Strongly Disagree	Disagree	Can't Say
1	Chances for services sector to still contribute the most to GDP	68	22	2	6	2
2	Ongoing Make in India will eventually lead to India becoming the manufacturing hub of the world	12	26	14	24	24
3	India will become the food basket of the world, in terms of agricultural produce	34	22	14	22	8
4	India's role in global economy will increase in strength	74	20	2	2	2
5	India will fully capture the demographic dividend on account of its young population	12	14	20	20	34
6	India will create 1 crore jobs per year so as to absorb the youth into the workforce	6	12	26	32	24
7	Income tax will be abolished by the next decade	2	4	64	24	6
8	Indians will undergo a kindest change –increasingly they will turn entrepreneurs and job givers, rather than job seekers	24	32	20	22	2
9	India will be the start-up hub of the world ,surpassing countries like Europe, USA, Israel etc.	24	32	20	22	2
10	Corporate Leaders will increasingly contribute to other walks of life, other than corporate life	16	32	28	12	12
11	India will meet the up skilling and resulting of the workforce	2	4	64	24	6
12	Automation will kill more jobs than it will create	10	30	14	22	24
13	Internet penetration and reliability will be met across the country, even in the most remote parts	44	34	10	10	2
14	India Will have taken enough measures to tackle cyber security and management issues	18	24	8	10	40
15	Context enterprises will live upto their promise and drive us towards a cashless and digital economy	76	12	2	8	2
16	India will be known as the centre for innovative and excellent educational system	26	34	12	14	14
17	E –learning will improve the overall quality of education in India	6	12	22	38	22
18	Indian Banking sector will become foolproof against scams and having well managed NPA's	26	34	12	14	14
19	IT,ITes and BPM industries will continue at the current pace	28	36	8	12	16

20	The Indian Automobile Sector will continue to grow	32	32	2	10	2

Figure 6: **corporate outlook towards AI/ML**

Source: Compiled by Authors

According to survey, India appears well positioned to take the advantage of emerging AI technologies by virtue of its highly developed IT sector and huge demographic dividend to establish itself as the future hub for Artificial intelligence across the sectors. However, due to non availability of qualified faculty and researchers this advantage could be transformed into a liability. So there is a need for urgent government intervention towards promoting access to such type of scales. There is also a fear that technological efficiency might lead to mass unemployment. Technological advancement is not only heading towards widespread unemployment but also strong warning towards jobless future. Technological advancement will weed out the dull, dangerous and dirty jobs in the near future. Labour cost arbitrage that made developing economies attractive destinations as manufacturing hubs will be stumped out by robotic manufacturing.

While all opportunities sounds fascinating but considerable implications using AI driven technology in Judiciary, to immediate concerns need to be addressed for immediate deliberations and concrete governance framework. One, collection and utilization of big data, machine learning inherently operates with large data sets serving as a fuel for the engine, informing the algorithm of the various correlation patterns and analysis of extensive and meticulous data sets. The vaccum of statutory framework for data correlation and protection renders the use of copious data sets so susceptible to abuse. Two, the issue needs a finer and more pragmatic appraisal and the presumed unbiased nature of an AI driven tool. AI in courtrooms can dispel the biases of judges. This might result in factual inaccuracy. For all its technological superiority, AI today is indeed afflicted by biases (use of inaccurate, incomplete or antiquated data sets).AI driven tools are seeping into final product, and vulnerable to these biases along with its capacity to perpetuate these systematically if it is deployed in unsystematic manner.

Health sector though has become productive and cost effective with the emerging technologies like AI and IoT, however is not free from challenges. The digitization and its continuous adoption has remained cause of concern for this sector. The budget allocation as seen from empirical studies is only 1% of GDP whereas developed nations are spending 15% to 20% of GDP on health sector. This is also an area to be focussed on.

Adoption of AI in marketing raises the issues like AI based analysis are not so engaging for any particular campaign. It can play an important role in pattern analytics where human intelligence has its limits.

With the advent of AI/ML one thing is sure all repetitive heavily process oriented task will become irrelevant for people who will be replaced by machines. New technology is fast changing “white collar” and “blue collar” jobs into “new collar” jobs. About 50% to 70% repetitive and predictive roles in sectors including IT, banking, manufacturing, transportation, healthcare, logistics, and education will be open to automation in the coming years according to the data by Indian Staffing Federation. It simply implies that workers need to upgrade creativity and integrate information processing skills to exploit the opportunities thrown by AI, Big Data Analytics/ML.The impact of primary forces on the job market in the coming years is given in Figure 7.

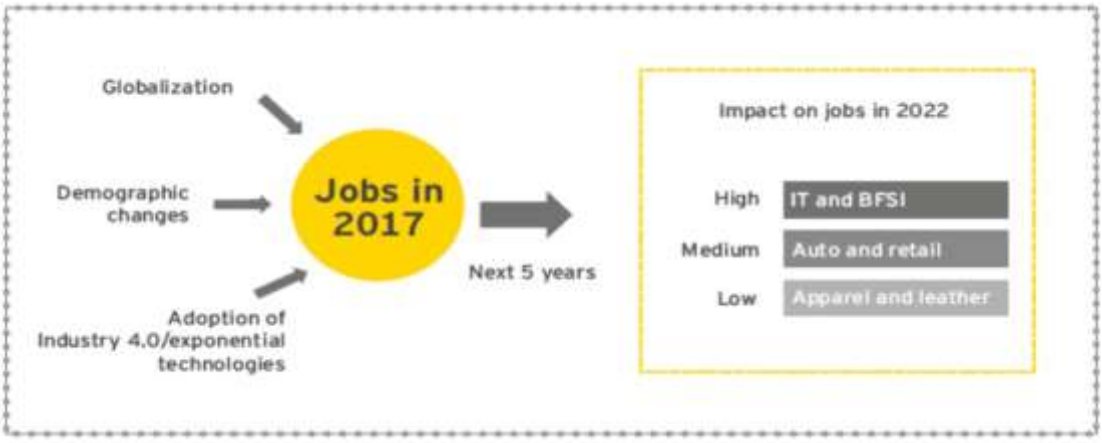


figure 7 : impact of primary forces on job in 2020, Source: Future of Jobs in India: A 2022 perspective, 2017

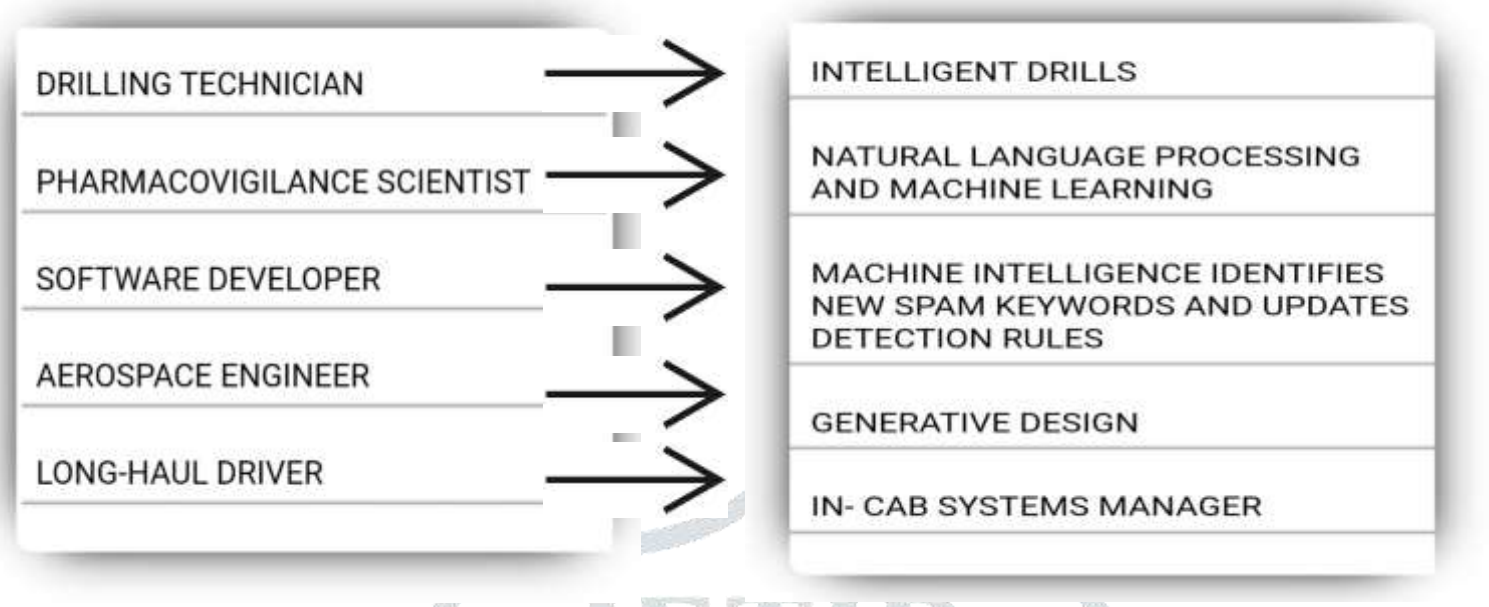


figure 8 : transition in jobs

Source: Compiled by Authors

The Figure 8 transition in jobs clearly indicates the technological advancement in the area of drilling, pharma sector, software developer and aerospace engineer will be converted into intelligent drills, natural language processing, intelligence identification and generative design.

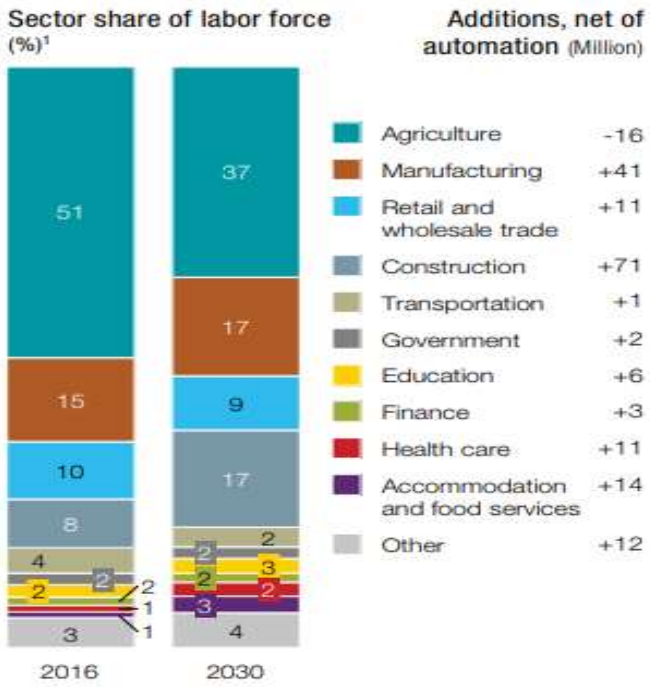


figure 9 : impact of automation: sector wise

Source*: McKinsey Jobs lost , Jobs Gained: Workforce Transitions in a Time of Automation*

The impact of transformative technology across the sector has been shown in Figure 9.

The analysis of the figure indicates that there will be highest additions net of automation in Construction (71 Million). Thereafter, Manufacturing (41 Million), Accommodation and food services (14 Million) and Healthcare (11 Million) respectively. Agriculture will be the hardest hit sector as their will be loss of 16 Million jobs due to automation.

9. SUGESSTION AND CONCLUSION

The world of tomorrow will be driven by knowledge , machine intelligence and digital pathways, to prepare ourselves for this transformation and explore its limitless opportunities, new deeper research orientation, creative economy by "Ideation, Innovation and Incubation" required

for nation building and to meet the needs of 21st century. Microsoft aims to focus on meaningful innovation for lasting impact. The innovations though making the life better but it should also be trusted. It is not sufficient to say what technology can do but it should focus on what AI should do.

Government rules and regulations are essential to prevent in misfortunate incident arising from AI research. But these rules and regulations can themselves hinder the pace of the research activities by introducing unnecessary protocols and procedures. This will damage and derail huge innovations in a fast-moving field like AI. Thousands of innovations are being made every month in this field. Such measures could do more harm than good. But Artificial intelligence should also not be left without any governing authority. Otherwise, it would be easy to pass off AI-related accidents as normal, occasional happenings.

There are five common guidelines agreed upon by scholars and researchers around the world. The first and the most important one would be deterring potential AI-enabled weaponry and cyber-weapons. The second guideline would be to make AI subject to the full set of laws that apply to mankind as well. The third one is simple yet much needed. AI should always disclose that it is not human. The fourth precept is that AI must not divulge confidential and secretive information to others without the explicit approval of its user. The fifth and the final rules of AI application regulation is that it must not increase any bias that already exists in our society and systems.

Today, AI uses hard facts and other data for its predictions. It is also the duty of the governments, especially in the developing nations, to promote and aid AI research. Without the right incentives provided by the government, it is hard to achieve the bigger goals. The government should prioritise identifying academic institutions and provide financial support to establish Centres of Research Excellence focusing on core research in AI. It should incentivise research collaborations between premier academic institutions through special grants. It also should not fail in protecting the intellectual properties of the researches. It is also the duty of the government to establish incubation hubs and venture funds specifically for AI startups in collaboration with State Governments which will help the AI-based startups get off the ground.

Education in recent times requires a holistic and balanced approach. Among academics, social, emotional and personalised learning, greater emphasis is to be laid on the creative, critical thinking and socio-emotional skills by the school. Schools curriculum needs to be focused on personalised, inclusive and immersive learning along with the upcoming technology to develop emotional and cognitive skills in conjunction with academic learning. Technology, no doubt, is changing the face of the education and its impact is also quite pronounce. Technology and media have enhanced children's cognitive and social abilities. Children in today's world need to be equipped with technology along with academics to deal with diverse situation of demanding future. There is a need to total reboot of education system by reskilling and upskilling to have maximum impact on our financial stability, comfort for oneself and family and shaping our future. What is important in today's scenario is not "learning" but the "relevant learning" because industry trends are changing continuously. With the rapid advancement of technology, things are changing fast, education is to be tailored according to the needs of the time. Management education should also be made responsive to thought leadership, technology enabled learning, employability, sustainability and value based education.

AI is seen by many as an engine of growth and productivity. It can increase efficiency and productivity by improving upon existing methods of operations and can vastly aid in our decision-making processes. It could boost certain products and services, thereby creating more jobs and increasing revenue stream. There is a need for upskilling and reskilling of the labour to meet the challenges of the new technologies. Changing demand in the new age job market can be attributed to three factors: increased use of technology, changes in market demography and deceleration of globalisation. With increased adoption of AI technology across the sectors will require upskilling of the workforce. India's growing demographic dividend is forming major part of the market for technology enabled products. As the size of the demography will demand for these products and thus the workforce that can create these products.

Even in the hospitality sector nothing can replace the warmth of handshake while meeting the guests. There is a need to balance the use of automation and technological advancement with human interface and interaction to inspire the diverse culture across the world which is the core value of this industry.

Does this mean that humans are entirely replaceable by computers with machine learning? Well, the answer is no. Quoting Marcos Lópes de Prado in his book Advances in Financial Machine Learning, "No human is better at chess than a computer. And no computer is better at chess than a human supported by a computer." This is what has been called as the 'quantamental' way. Modern financial trading involves these quantamental teams, i.e., systems that allow us to combine human decisions and mathematical forecasts.

"The interesting aspect of technology is that it changes the speed with which the work is done. There is always change in cycle from unlearning to uplearning and relearning that one must engage in, if one has to remain relevant in the changing world. We should prepare ourselves about the impact of automation and artificial intelligence rather than being worried about the impact of automation and artificial intelligence. The future of AI should be redefined to meet the requirements of AI driven economy.The speed with which we adopt and absorb the technologies will lead the economies to the path of rapid economic development."

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