

## **India at the Threshold of Fourth Industrial Revolution**

Indian economy has grown by 8.2 percent in the April-June quarter of 2018-19, the highest in the world; further improving our lead over China. In last four years, we have overtaken 3 major economies of the world in terms of gross domestic product (GDP), viz France, Brazil and Italy. Now, to embark fast upon the road to the Fourth Industrial Revolution (4IR), and leapfrog over the world's major economic superpowers must be our next target with our vast talent pool. The union government has also expressed its desire to move fast to master the 4th industrial revolution. An allotment of \$480 million (INR 3,073 Cr) in the last union budget for Digital India programmes is a step towards this direction. Government's think tank, the NITI Aayog has also been asked to initiate an ambitious national programme on artificial intelligence (AI). Multiple Centers of Excellence have also been announced for robotics, AI, the Internet of Things, etc. But the pace and the level of funds allocation are quite feeble vis a vis the endeavours being made by the major economics of the world. The scale at which China is seeking dominance in global AI industry with its plan to create a \$150 billion AI industry by 2022 is an eye-opener in this regard. So, we have to move faster, to outpace the Chinese in the AI, Robotics, data science automation technologies, drones and so on. Even South Korea has pumped in \$ 2 billion on R&D on AI. We should at least, instead of sourcing robotic and AI based solutions from China, think of harnessing domestic capabilities. Ford, in Sanand in Gujarat, has already replaced vast number of its workers on the shop floor with robots. Robots have already been developed in China and other industrialized nations for brick masonry, tile fixing, sewage clearance and a lot many other tasks. If we would import or outsource AI based and robotic solutions from outside, we would be badly drained out of all our foreign exchange resources and stripped of the employment potential of the new industrial revolution. To the contrary, if we would build homegrown capacities and export these AI and robotic solutions to the outside world, huge employment would be generated and a shower of foreign exchange would be received. So, our universities, elite institutes and the industry have to make a robust and collaborative headway in data science, AI, robotics, 3D Printing, Machine learning, Internet of Things, electric vehicles, hydrogen fuel cell technology etc., and leapfrog over China or any industrialized nation like the US, Germany, Japan, Korea, Taiwan, Malaysia and so on. With the third largest talent pool and the third largest educational network, we can do that, with a proper focus and funds allocation.

Our elite institutes (like IITs, NITs, IIITs), universities and even the larger colleges including autonomous colleges have to prepare to revamp total education, including research and the skill imparting endeavor with a futuristic vision. So, it is high time for our higher education system to integrate Data Science, Robotics, Automation, 3-D Printing, Internet of Things, nanotechnology, biotechnology, 5-G telecom technology, alternative energy vehicles including electric vehicles, hydrogen fuel cell driven vehicles related technologies and job skills. Chinese universities have been rapidly evolving as places of powerful and high quality research in all these spheres and as a result they are also fast emerging as an increasingly important destination for international students. China is becoming a global economic superpower by virtue of the quality and innovativeness of its education, which is fast driving huge increase in prosperity of its people. India can catch up and overtake the world, including its superpower neighbor, by improving the quality and innovativeness of education and research. The Fourth Industrial Revolution (4IR) is characterized by a fusion of technologies that is blurring the lines inter se the physical, digital and biological spheres. This new industrial revolution in offing is unfolding multiple challenges from a variety of breakthroughs in technology, including robotics, artificial intelligence, data science, business informatics, nanotechnology, quantum computing, biotechnology, the Internet of Things (IOT), the Industrial Internet of Things (IIoT), fifth-generation wireless technologies (5G), precision drones, additive manufacturing/ 3D printing and fully autonomous vehicles to necessitate a complete overhaul of our education. According to Klaus Schwab, the Executive Chairman of the World Economic Forum, these emergent technologies are likely to disrupt almost every industry in every country. The breadth and depth of these changes herald the transformation of entire system of production, management, and governance. Moreover, recently "an Oxford study has estimated that 47% of the jobs in the US, 69% of the jobs in India and 77% of the jobs in China will not exist in 25 years. This is not mere conjecture. China's factories are adding robots faster than they are hiring people. India's information technology sector is already witnessing jobless growth and total employment may have already peaked."

World is already making strides into this all pervasive revolution, comprising huge advances in genomics, artificial intelligence, materials and manufacturing technologies, wherein machines are closing in on human ability, robots are replacing humans in industries and in homes too, reusable rockets can make space travel and colonies in space a reality and gene editing can facilitate to create favourable traits and new life forms. All of these necessitate renovation and revamping of

our university curricula, research agenda and skilling programmes here in India. Only those countries would thrive with prosperity in the 20s, whose education and research systems would cope up and master this paradigm shift. Otherwise even in solar power, where India is slated to emerge as the 2nd largest solar market in the world in 2018, 83% of the solar panels have to be imported mostly from China. Panels in the range of Rs 22,229 to Rs 28,385 crores have been imported per annum. According to a parliamentary panel, “it has costed 2 lac jobs in the country every year due to the import of solar panels alone from China.”

Now in the next-gen of the surface mobility within 7-10 years, the fossil-fuel driven (i.e. petrol/ diesel driven) cars would be largely out of roads and the battery driven electric vehicles and/or hydrogen fuel cell powered vehicles would sweep the roads and rails. But, we have not begun to develop alternative technologies and its complete downstream value chains and requisite manufacturing ecosystem at the required pace indigenously. The transport minister, Nitin Gadkari has already announced banning the sale of fossil fuel (Petrol and diesel) driven vehicles by 2030. The market for storage batteries alone for the electric vehicles would be of \$ 300 billion, 3 times that of solar. For zero emission mobility, the cars, buses and trains driven by hydrogen fuel cell are being launched world over. In India, the Tata Motors has also launched one hydrogen powered bus developed by them in collaboration with ISRO and IOC. However, whether we adopt the battery driven cars or hydrogen fuel cell powered cars, almost the entire auto ancillary units’ sector, especially the one manufacturing engines and engine parts is going to die. After shifting to any alternative energy based mobility with electric or hydrogen powered vehicles, it would be harder to find petrol stations, engine spares sector or related trade or any mechanic to fix the fault of around 2000 moving parts that bedevil the fossil fuel run engines. Self driven cars on demand may eliminate the practice of owning a car and hence car dealers might begin to disappear by 2025 and onwards. Therefore we have to anticipate all these changes and lead the world.



(Prof. Bhagwati Prakash Sharma)

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