

Harnessing Industry 4.0 for India's Development: Opportunities and Challenges

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This policy brief summarises key policy recommendations from the ISID-CII Policy Roundtable on Harnessing Industry 4.0 for India's Development: Opportunities and Challenges held on August 25, 2021. The roundtable was addressed by **Mr Amitabh Kant**, Chief Executive Officer of NITI Aayog; **Dr Rajendra Kumar**, Additional Secretary, Ministry of Electronics & Information Technology; **Shri S K Misra**, Chairman, ISID; **Mr Dilip Sawhney**, MD, Rockwell Automation, Co-Chairman of CII Smart Manufacturing Council; **Dr Clovis Freire**, Economist, UNCTAD, Geneva; **Mr T P Chopra**, President, BLP Group, CEO, BLP Industries; **Prof Sunil Mani**, Director, Centre for Development Studies, Trivandrum; **Prof Amaresh Chakrabarti**, Chairman, CPDM, Indian Institute of Science, Bengaluru; **Dr Raja M Mitra**, Consultant, Asian Development Bank, Manila; **Dr Uma Rani**, Senior Economist, ILO, Geneva; **Dr Satyaki Roy**, Associate Professor, ISID; **Mr Parminder Jeet Singh**, Senior Fellow, IT for Change, Bengaluru; **Dr Nupur Chaudhury**, CSLG, Jawaharlal Nehru University, Delhi; and **Dr Anant Kamat**, National Institute of Advanced Studies, Bengaluru; and, moderated by **Prof Nagesh Kumar**, Director, ISID. The YouTube link of the session is available at <https://www.youtube.com/watch?v=sxxOWWfEJFQ> 

Introduction

The first industrial revolution improved efficiency through the “use of hydropower, steam power, and machine tools,” the second industrial revolution brought about “electricity and mass production” (assembly lines); and the third industrial revolution accelerated automation using “electronics and information technology.” These revolutions have changed the lives of people phenomenally. Now, the fourth industrial revolution, also known as Industry 4.0, which comprises artificial intelligence (AI), machine learning, deep learning, data mining, cloud computing, internet of things (IoT), cyber physical system (CPS), mobile robotics, 3D printing, blockchain, and so on, is entering into all economic activities such as mining, agriculture, manufacturing, industry, health, and services. These technologies can increase productivity tremendously, facilitate efficient usage of resources, enable predictive maintenance, enable the detection of diseases, and help respond better to the public health emergencies (e.g., Covid-19 pandemic), thereby bringing significant positive changes to our lives.

Industry 4.0 technologies have not only been changing the mode of production, but tremendously modifying the structure and nature of labour market in the world. It is

startling to see how these technologies are not only replacing the existing jobs, but also changing the nature and mode of work. Given that there are tremendous new opportunities offered by Industry 4.0, there is need to strategise to harness their potential for societal development while minimising the threats. It is the joint responsibility of all stakeholders – government, industry, and civil society – to harness the potential of new technologies and support those who are affected with reskilling and upskilling for the new job requirements in the changing world.

Leveraging Industry 4.0 for India's Development: Applications and Challenges

Industry 4.0 technologies can boost productivity, efficiency, and sustainability of the productive sectors of the economy, if leveraged optimally and effectively. Developing countries like India were left behind in the previous three industrial revolutions, leading to widening inequalities. In fact, technological change favouring higher-level skills has only contributed to the rise in inequality between countries as well as within countries. These inequalities may be further accentuated if some parts of the economy are

deterred from leveraging the Industry 4.0 due to the digital divide, skills gaps, inability to reskill and train the workforce, and other aspects of social inequality.¹ To address these challenges, it is important to foster the digital transformation and retrofit programmes (particularly to speed up the digitisation process in traditional industries) to promote economic diversification to bridge the gap between traditional and modern sectors, and move up the value chain.

India's digital consumer base is the second largest, and as per the Country Digital Index, it is growing at the second-fastest rate amongst the major economies in the world.² The Indian government [Ministry of Electronics & Information Technology (MeitY)] has envisioned a \$1 trillion Digital Economy by 2025. In tune with the vision of \$1 trillion digital economy, MeitY under the Digital India domain has been playing a crucial role in ensuring that the digital infrastructure reaches every citizen of the country. MeitY's concept of "platformisation of government domains" is transforming all government interfaces with citizens and businesses using a (digital) platform to deliver seamless services or benefits to people and businesses across the country. Co-WIN—an online platform for monitoring Covid-19 vaccine delivery—is a great example of how this approach in different domains can really transform the entire service delivery paradigm, and also transform people's perception of the quality of government services. Similar efforts are underway in domains such as agriculture, education, and transport where a platform of a

similar scale is likely to transform the government interfaces with citizens and businesses.

Besides, under the Start-up India domain, MeitY, in collaboration with industry across the country, has established more than 30 centres of excellence with the sole focus is to support, mentor, and guide start-ups and entrepreneurs to enable them to reach out to and compete in the wider market. In addition, MeitY has set up a 'MeitY Startup Hub' which is currently supporting over 4000 tech-focus start-ups.³

However, there is also an urgent need to promote reskilling and training of workforces to accommodate this workforce into Industry 4.0. Therefore, a national programme must be developed to ensure that the reskilling of workforce is carried out systematically and strategically to converge with the existing skilling programmes. Moreover, we have a rich talent pool from several technical institutions starting from ITIs, and IITs, to IIITs, NITs and other technical and engineering organisations to support and promote upskilling or reskilling of workers in the context of future of work perspective.

More importantly, we need to focus our investment not only on innovation, but also to spread it over the entire innovation ecosystem. We need to focus on academics (training and research), industry (product manufacturers, machinery manufacturers), service providers (e.g., the vendors who install new technologies), training providers, innovation start-ups, government (for policies and funding) and NGOs to connect to the society. We really need to work on the entire innovation ecosystem if we wish to leverage as well as harness the fruits of Industry 4.0.

According to UNCTAD's report (2021), India is well-positioned to harness the benefits of Industry 4.0. In UNCTAD's new Frontier technology readiness index, India ranks 43, and is the greatest over performer because at the given per capita GDP, the country's rank is considered to be much better. This is driven by the higher number of scientific publications and patents on frontier technologies and the higher share of digitally deliverable service exports. To corroborate the above, it is seen, for instance, that the publications of AI and Robotics increased substantially to 26,779 from 6218

¹ Most of traditional industries which have not undergone digitization are not able to leverage any potential of Industry 4.0, and the absence of digitisation in them not only creates barriers and obstacles to the development of AI solutions for them, but also deprives them from harnessing the benefits of Industry 4.0.

² McKinsey Global Institute's (MGI) Country Digital Adoption Index represents the level of adoption of digital applications by individuals, businesses, and governments across 17 major digital economies. Source: MGI (2019) report on "Digital India: Technology to Transform a Connected Nation."

³ MeitY Start-up Hub, a nodal entity, has been set up to facilitate MeitY's vision of promoting technology innovation, start-ups and creation of intellectual properties. It will act as a national coordination, facilitation, and monitoring centre that will integrate all the incubation centres, start-ups, and innovation related activity of MeitY.

between 2011 and 2019. An important aspect of the frontier technology readiness index is that most of the Indian scientific and engineering publications are own publications, i.e. they are not in collaboration with any foreign researcher. We need to collaborate with foreign researchers or innovators to learn, adopt, implement as well as to grow in the path of Industry 4.0. Nonetheless, India has actually a fair amount of capability in creating new knowledge in the area of Industry 4.0 technologies which may be used by other countries and in other situations; the actual usage of these technologies within India has been pointed out to be very limited, however.

Furthermore, Industry 4.0 technologies can be deployed to change the future of manufacturing in India. Using AI and IoT, we can improve productivity & reliability, reduce costs, increase efficiency, and improve quality, safety, and sustainability. The application of these technologies is spreading over a number of industries (e.g., renewable sector, transportation, ports & shipping, oil & gas, manufacturing, aviation, steel, automotive, real estate, and fast-moving consumer goods). The applications of these technologies are happening in real time. India can be on the cutting edge of this industrial revolution, and we can do this because the cost at which we deploy these technologies is just a fraction of the cost what they do in the USA or Europe, and this is the right time to use these technologies and take it to the world.

Industry 4.0 and Future of Work: Managing the Impact

Historically, labour market evolves with industrial revolutions or technological revolutions. During the last three centuries, the evolution of labour market has not only been accompanied by the destruction of old or conventional employment, but also by the generation of new or modern types of employment. Now Industry 4.0, which has enabled the application of new or emerging

technologies into all spheres of the economy, has got significant implications for labour and employment in India.

Industry 4.0 is different from the past industrial revolutions because technological unemployment during the past industrial revolutions was not so high as predicted in the theory. It is precisely because the displacement of employment in technology-using sectors was compensated by the reinstatement of employment in labour-using sectors or machine-manufacturing sectors. Moreover, the process of distribution mechanism in the present industrial revolution is also different from that in the past industrial revolutions. The process of distribution of production or productivity gains happens through factor income, i.e. land, labour, and capital receive rents against their contributions to the production processes. If you are not participating in the process of production, you cannot have any claim on productivity gains. Now, the problem with Industry 4.0 is that a substantial amount of labour is going to be redundant in the process of using Industry 4.0 technologies; the existing distribution mechanism will not work because the users of these technologies are not going to share their productivity gains with the redundant workers – this is largely responsible for the rising inequality within the country. Therefore, there must be a different alternative redistribution mechanism; for instance, universal basic income, negative income tax, and distribution of production income to workers who are not linked to the production processes.

However, the workers who are linked to Industry 4.0 are seen to have been significantly impacted. Particularly, the working conditions of people involved in digital labour platforms are very poor and vulnerable. Industry 4.0 has now brought about a rise of digital labour platforms⁴, entirely new forms of business model, where the workers (e.g., online taxi drivers, freelancers) who are informally contractualised have to provide most of the assets (e.g., cars, computers, etc.) required for the business. These workers have also to pay some commission fee not only to access work, but also on the amount of work they actually get. Also, the work processes, viz. allocation of tasks, evaluation of tasks, rewarding of tasks, and so on, are algorithmically managed; hence,

⁴ Globally, a wide range of economic activities are supported by digital labour platforms, viz. online web-based sector, taxi delivery, wholesale retail, e-commerce, agriculture, home-based service providing personal services, telemedicine, platform staffing, and computer software development.

there is hardly any human interaction in these processes.

What are the implications of an unjust business model for workers? Online workers have low earnings, and thus need to rely on bonus to earn more; this leads them to work considerably longer hours per week. They earn substantially less compared to the similar jobs undertaken traditionally. Since the work process is automated, based on algorithmic management, the rating and reputation become key in determining whether tomorrow they get work or get deactivated; education and experience do not seem to play any role in these platforms. There is no freedom and flexibility, in the sense that if a worker declines an assignment, it affects their rating and access to work and they are monitored on a regular basis.

In the above context, the following discussion adds value to our understanding. In contrast to the past industrial revolutions, where physical power was disembodied into machines or mechanised power, the present industrial revolution has increasingly been disembodied human intelligence into machine or computer. The top companies in the world own intelligence; for instance, Ola or Uber own and control intelligence of transportation, and in a similar manner, Amazon owns intelligence of commerce. But the world will always need human ingenuity and skills. Hence, it is important that the workers co-own a share of intelligence of the system, as the intelligence of the company solely comes from the workers. If they co-own intelligence they can ask for a share in the whole value of the company, and thereby overcome their problem of meagre earnings and issues relating to freedom and flexibility. Besides, there is a need to decentralise the digital labour platforms, i.e. moving power away from Amazon to trader, Uber to workers, and so on, to allow for transparency between parties and to better connect workers with consumers.

Nevertheless, countries around the world have been taking certain steps to improve the working conditions of workers such as providing social

protection and work injury benefits, classifying workers as employees, providing access to data, and so on. The regulatory responses are diverse in terms of ensuring protection to workers in the digital labour platforms. The ILO calls for an international policy dialogue to bring together governments, businesses, and workers around issues of labour laws, competition law, and algorithmic accountability.

Another implication of Industry 4.0 is the loss of data privacy, and its consequent impact on labour. There is a not only rapid growth of data digitalisation through data collection platforms (both by private and public) in India⁵, but also trade of data between these platforms. In this situation, if one uses these platforms, one is likely to lose data privacy; and it is not data privacy per se, as the usage of these platforms lead to deprivation and discrimination in job markets. Unfortunately, there is no legal remedy and constitutional jurisprudence which could address these cumulative harms (i.e., discrimination or deprivation in job markets and other markets) experienced by individual users of these digital platforms.

Technologies are assumed to embolden skill, learning, open access to new networks, new resources, and improve work performance, thereby improving people's livelihoods. However, technology is not just restricted to science and engineering, but also includes sociology and politics. The permeation of any technological artifact is invariably embedded in highly context-specific social structures, social processes, power relations, and so on. Hence, the role of technology in the experience of work will be highly differentiated for different social groups, and that is where the subaltern or marginalised, a large majority within the country's workforce, come into spotlight. Now, technologies can perpetuate social disparities as marginalised communities in urban India still do not have the requisite access to beneficial networks and markets. As a result, they are left to operate in informal casual markets; they do not possess any means and opportunities to overcome vulnerabilities unless they are politically connected or happen to be fortunate enough to capture some opportunities in small business. Thus, the differential effects of technology are based significantly on the socio-political context of this group (e.g., civic

⁵ For example, Facebook and Google are private data collection platforms, whereas India Stack Project, which basically allows to digitalise one's own record based on Aadhar, is a kind of public data collection platform.

workers, sex workers, and Dalit communities). The new detrimental labour arrangements are not merely technological outcomes; they are the result of sociological foundations of those technological experiences. And, the non-linear path of technological evolution is not because of rational choices, but due to irrational sociological structures such as caste. Nonetheless, little of these complex dynamics is appreciated or accounted for in policy formulation in India as far as technology goes. What is usually counted for and interpreted by technology policy is the quantifiable, the economic, and the tangible, and this therefore crucially misses the political questions and analyses of genuine agency empowerment and rights.

Technological intensification, however, can empower the marginalised only when frameworks of justice and equity are interwoven, without which technology may only aggravate exclusion and deepen inequality. Genuine modernity can be realised only when technologies are inclusive and are actually converted and translated into capabilities and functioning of our workforce.

Recommendations for Harnessing Industry 4.0 for India's Development

The key recommendations that emerged from the roundtable are summarised.

- We need to devise and develop a mechanism to speed up digital revolutions to address digital inequality and social inequality which are hindering the path of Industry 4.0 in India.
- We need to develop programmes to address the reskilling and training of young manpower, which would facilitate the easy adoption and implementation of Industry 4.0 technologies in India.
- We need to adopt a holistic approach, i.e. focus on entire innovation ecosystem—academy, industry (manufacturers, users, and suppliers), service providers, training providers, innovation start-ups, government, and NGO—if we wish to leverage as well as harness the potential of Industry 4.0.
- Users of Industry 4.0 technologies are not going to share the income and productivity gains to the redundant workers; hence, we must have some alternative distribution mechanisms such as universal basic income, negative income tax, and distribution of productivity to workers who are delinked from the production process.
- We must have some legislative policies or constitutional jurisprudence to enable the workers engaged in digital labour platforms not merely to co-own intelligence of the company, but also to co-own a share of the total value of the company to help address their problems of earnings and of freedom & flexibility.
- Legislative and constitutional jurisprudence are also needed to address the issue of data privacy, thereby whittling away the cumulative harms upon the people who use the digital platforms (e.g., Google and Facebook).
- We must deploy and adopt Industry 4.0 technologies in a careful manner to empower the marginalised, otherwise these technologies may only aggravate exclusion and deepen existing social inequality. Genuine modernity can be realised when technologies are inclusive and are actually converted and translated into capabilities and functioning of our workforce.

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