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Leveraging Industry 4.0 for India's Industrial Transformation

This policy brief summarises key policy recommendations from the Policy Roundtable on 'Leveraging Innovation and Industry 4.0 for India's Industrial Transformation' held at the ISID National Conference on Industrial Transformation held on October 4-6, 2023 supported by ICSSR at ISID. **Prof Rajat Kathuria**, Shiv Nadar University, chaired the roundtable and the speakers included **Mr Parminder Jeet Singh**, formerly of the Internet for Change, Bangalore, **Prof Vinish Kathuria**, Director, Institute for Development Studies, Jaipur, **Ms Shraddha Srikant**, UNIDO India, and **Prof Sujit Bhattacharya**, Chief Scientist, CSIR. The YouTube video of the policy roundtable is available here.

Introduction

Industry 4.0 or the fourth industrial revolution (IR4), refers to the emergence of new technologies such as artificial intelligence (AI), advanced robotics, 3D printing, big data analytics, blockchain, cloud computing, internet of things (IoT), gene editing, nanotechnology, 5G, among others. It is a fusion of old and emerging technologies which is blurring the boundary of physical and digital world. IR4 technologies can transform industrialisation through industrial productivity growth, efficient and sustainable usage of (natural) resources, and competitiveness. Adopted successfully, IR4 technologies can help developing countries leapfrog the previous stages of technological revolutions. There are also several challenges posed by these technologies for labour markets. In the earlier phase of industrialisation, the physical power was embodied in machine, whereas in the current phase of industrialisation human intelligence is getting embodied into machines or computers. How to devise industrial strategies to harness the benefits of digital industrialisation in a more inclusive manner? How can micro, small and medium enterprises (MSMEs) which are technologically laggards, harness the benefits of IR4? These are key questions to be addressed for harnessing their potential for inclusive industrial transformation of India.

Labour Market Challenges of IR4

IR4 is likely to automate most of the routinized jobs such as production and assembly line jobs, which would lead to a decline in the demand. The non-routine jobs involving technological skills, complex cognitive skills, and social and emotional skills would complement the adoption of IR4 technologies, which would increase the demand for non-routine jobs in the near future. The increased demand for non-routine jobs, owing to the advent of IR4

The on-going change in the structure of production because of Industry 4.0 is leading to structural shift favouring non-routine and cognitive skill-based employment.

technologies, would require regular upskilling and reskilling of employees. Upskilling is easy to do. If someone knows C, she can do C+, if someone knows C+, she can do C++ and so on; but reskilling is more challenging especially as it involves learning something entirely new to the existing knowledge. Different regions have varying perspectives with respect to relative importance of upskilling vs reskilling: with Europeans favouring a balance between upskilling and reskilling, whereas in the United States (US), the majority believes that reskilling is more important than upskilling.

Digital Industrialisation

In the previous phases of industrialisation, the factory was the primary institution or central agency for industrial organisation of economic activities in which intellectual property or human intelligence was located at the top of value chain; whereas in IR4 or digital industrialisation (or simply digitalisation), the corresponding central institution is a platform. A platform is a place where all the digital interactions take place. It mines data (as it collects data across the value chain), converts the data into intelligence and then uses this digital intelligence to reorganise all the value chains or economic activities of a sector (e.g., Uber in transportation and Amazon in e-commerce). Uber and Amazon emerged to be the brain of transportation and e-commerce respectively. For instance, the Uber brain really knows where the choke points are going to be at a certain point in time, it knows how many drivers would not be available if there is any festival; it knows everything that is important for transportation sector. The Uber does not own labour, nor any capital (e.g., car), it only owns intelligence of the transportation sector and thus become the brain of that sector. Like transportation, each sector is getting organised around such brain (or platform), very soon there will be a completely new economic form, i.e., digital economy. The digital economy is defined as a situation when the major sectors of the economy systematically start getting run by such brains in a largely autonomous fashion.

Upskilling is plausible, but reskilling is a real challenge before the country to complement the changing structure of labour market.

Different Approaches to Digital Industrialisation

There are three different models to pursue digital industrialisation—US model, China model and EU model. The US-model, largely supported by a substantial amount of state fundings, has the digital monopoly. Internet, google and so on were the results of such fundings. In this model, once you have the global dominating monopoly, a weak regulation is likely to make the whole world a single global digital market where you can dominate with a few monopolies. The digital intelligence is very monopolistic in nature. It is like a brain which is a monopolistic, since body has only one brain. For the USA, if the (whole) world is single digital economy, which sooner or later will be concentred around their platforms. China model is the only one which has been challenging the US-model. China's political desire to insulate its economy becomes an economic advantage, which insulated its digital system. By emulating the US, China became big. Lastly, the European Union has been trying to use the mixed economy model, nevertheless has not been successful yet. It keeps on trying a lot of regulation around data and so on.

Digital Public Infrastructure Approach

In the earlier era, industrialisation was just beginning, there were things called 'infrastructure'. Someone started mining town, laid railroad to mining town, the railroad was private and at a point it became a public goods or utility; these things were made infrastructure; and this is called infrastructure approach to industrialisation. However, in the digital era, infrastructure is

digital intelligence, the big tech companies such as Google and Facebook own the majority of these infrastructures. A sizable chunk of earnings of most of the startups is going to the cloud computing and the venture capital which is actually undertaking the innovation is getting only 15 to 20 percent. The digital infrastructure (e.g., cloud computing) which is taking away the major share of rents could be much cheaper and much more universal. In this context, developing countries should pursue an infrastructure approach to digital industrialisation, i.e., to focus on building digital infrastructure. In the nineteen century, the Netherlands was an industrialised country. They became an industrialised country, not because they had few good industrial plants here and there. Almost anywhere one could start a unit because infrastructure (e.g., basic electricity, roads, education, supply chains and so on) was made available to all. It is the infrastructure on which the businesses flourished in the Netherlands. India should therefore pursue digitalisation, the way the industrialisation was pursued during the earlier era. Unless we take the infrastructure approach to digital industrialisation, i.e., digital public infrastructure, we would not succeed.

India needs to focus on developing two kinds of infrastructure pertaining to digital industrialisation—computing and data infrastructure. The computing infrastructure are hardware and chip-making. There are discussions around with respect to an open-source chip design in India. More discussion is needed to talk about how to have a common access to the cloud computing in India. Kris Gopalakrishnan Committee has recommended for a common data infrastructure where there is mandatory sharing of data and data is equally available like roads, and bridges to all businesses and not restricted to a few big-tech who can monopolise it. India should follow an infrastructure approach, the way it was pursued in earlier industrialisation era and data and digital infrastructure should be made a largely public or at least closely regulated.

IR4 Strategy for Manufacturing MSMEs

The mega trends in geopolitical changes, technological innovations, and climate change are increasingly creating challenges for manufacturing sector as it has to deal with decarbonization, supply chain resilience, speeding up technological deployment, securing workforce and also linking business value with environmental and social responsibility. Industry 4.0 can help address potentially all these challenges of manufacturing sector of the country. Adoption of IR4 technologies in manufacturing sector can transform the sector into a digital manufacturing sector. The digital manufacturing is expected to deliver newer products, new business models, and it would reduce operational cost significantly, improve worker safety and condition of employment and so on. These sort of new products and new process benefits are the main business case for IR4 at large.

Capabilities and Skills for Adoption of IR4 in Manufacturing Sector

Digitalization and digital technologies require infrastructure, internet, electricity and enabling framework conditions. But in terms of capabilities the countries which have superior industrial performance or industrial capabilities are typically front runners in adoption of IR4 technologies as well. Therefore, industrial capabilities along with the digital capabilities lie at the heart of the digital industrialisation.

Three essential skills which drive the adoption of IR4 technologies (digital adoption) are particularly—analytical skill—what problem

A Common data infrastructure pool would ensure a mandatory sharing of data and the universal access to data, like road, bridge, and electricity.

we are looking to solve with the potential digital solutions; specific technology related skills—not just digital technologies, but also operational and production technologies; and soft skills—since we are looking at how we want to design our production systems in the years to come.

Along with skills, industrial capability is crucial for effective adoption of IR4 in manufacturing sector. For achieving industrial capability, investment in technology capabilities require R&D investment, capital investment (i.e., investment in new equipment and digital equipment) and access to finance. In addition to investment in technology capabilities, the production capability is very important. The idea is that the production system needs to be organised, streamlined in a particular way for digital application to be feasible in the first place.

Strategy for Adoption of IR4 by MSMEs

MSMEs tend to underperform larger enterprises in terms of productivity, quality, energy, and environmental management because of their mostly out-dated technology, ill-maintained, poorly designed, and laid out equipment. MSMEs are generally not involved in engineering and product development and suffer from skill-deficits (i.e., operational, technical, and entrepreneurial skills). They tend be under-capitalised, growth-trapped, informally payoff and so on. In this context, the strategy for the adoption of IR4 or digital technologies for MSMEs is to purse manufacturing excellence.

The pursuit of manufacturing excellence is an attempt to make the (production) process (of MSMEs) more efficient (i.e., to maximise production output with minimal and constantly declining inputs), and more effective in terms of minimising wastages, and to attain maturity in how you manage and monitor your processes. The MSMEs' pursuit of manufacturing excellence is to identify critical business bottlenecks, which have nothing to with digital technologies, just production in general; but while identifying those bottlenecks the MSMEs can come up with improvement projects, in which the enterprise could explore how a digital solution would help the project. This means while pursuing this manufacturing excellence the enterprise creates avenues for the adoption of digital technologies. Eventually, MSMEs start to look at digital technology as a necessity rather than treating it as a great new technology but not suitable for them kind of mindset. However, digital technologies cannot be adopted or applied to ad hoc and non-standardised procedures. Therefore, this kind of manufacturing excellence approach also makes the existing system feasible or viable to generate database-insights which digitalisation needs. The point is thus manufacturing lens to digital pursuit is essentially what MSMEs would require for adoption of IR4 technologies.

MSMEs must purse the manufacturing excellence approach. While pursing the manufacturing excellence they are likely to create avenue for the applications of IR4 technologies.

Policy Recommendations

The key recommendations that emerged from the roundtable are as follows.

- Given the change in the structure of production owing to emerging technological innovations, there would be a structural shift favouring non-routine and cognitive skill-based employment. In this context, while upskilling is possible through retrofitting of training programmes, but reskilling is a monumental task for a country like India.
- The industrial capability development is crucial for the successful adoption of IR4 in the manufacturing sector. Both technology capability as well as production capability are crucial for industrial capability development. Investments must

be directed towards technology capability building which requires R&D investment, capital investment (i.e., investment in new equipment and digital equipment) and access to finance. The production capability, i.e., the production system needs to be organised and streamlined so that it becomes feasible for the application of digital technologies.

- To retain their competitiveness MSMEs need to pursue a manufacturing excellence approach. Manufacturing excellence is an effort to make enterprise efficient, effective, and mature (i.e., the ability to anticipate and adapt). While pursuing manufacturing excellence, MSMEs are likely to create feasible avenues for the applications of IR4 technologies.
- There must be a common data infrastructure pool for all users. This pool ensures a mandatory sharing of data and universal access to data like road, bridges, and electricity to all businesses. This would ensure inclusive digital industrialisation in developing countries like India.

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