

Fourth Industrial Revolution: An Analysis of India's Preparedness

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ABSTRACT

The fourth industrial revolution and Industry 4.0 are both interchangeable terms. This initiative was started in Germany in 2006. The German Government launch term Industry 4.0 publically in Hannover fair in 2011. In definition term industry 4.0 is the automation of manufacturing activities, where both modern machines and computers work together. In the words of Klaus Schwab(Executive Chairman of world Economic Forum) it is a era of robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, the internet of things, the industrial internet of things, decentralized consensus, fifth-generation wireless technologies, 3D printing, and fully autonomous vehicles. In India digitalization as a flagship program was launched in 2015. India's rank in Network Readiness Index is 79th out of 121 countries. Network readiness Index issued by World Economic Forum is a key indicator of how countries are performing in the digital world. Thus, with all these factual background this paper tries to analyse the India's preparedness for the Industry 4.0.

Keywords: Industry 4.0; automation; robotics; artificial intelligence; internet of things

1 INTRODUCTION:

World has witness three industrial revolutions till 20th century. Water and steam power was the important elements of first industrial revolution used for mechanical transition of manufacturing from the labour. The period of first industrial revolution was 1760 to 1840. The second industrial revolution brings electric power to facilitate the labour and industrial production. It came into existence in the late 19th century. It was named as industrial revolution 2.0. The use of electronics and information technology altogether made possible in industrial revolution 3.0 or third industrial revolution. it was started during the late 1960s. The internet of things and cyber-physical system effecting every aspect of today's human life. The inclusion of these two in manufacturing is called fourth industrial revolution or Industry 4.0. The new trend of automation,

data exchange in manufacturing dominated by the IT, electronics, robotics, biotech and non-biotech technologies. It is all based on Cyber-Physical-System.

The industry 4.0 uses large scale Machine-to-Machine (M2M) and Internet of Things (IoT) for improved communication and self monitoring to analyse and diagnose the issue without the need of human intervention. The term Industry 4.0 originated in 2011 in Germany. Germany government had launched a high tech project through which Germany had promoted computerization for the manufacturing. The German Government launch term Industry 4.0 publically in Hannover fair in 2011. On 8 April 2013 at the Hannover Fair, the final report of the Working Group Industry 4.0 was presented.

Industry 4.0 designs to make business quicker, smarter while minimizing cost and minimum human intervention. Followings are the three key driving forces of Industry 4.0.

1. **Digitization:** means transformation of whole production process in all sectors through digital technologies.
2. **Industrialization:** integrating these technologies in the companies to improve and evolve.
3. **Optimization:** means enhancing the manufacturing process with the help of State of Art manufacturing technologies and identify new opportunities for growth.

In this line of process “smart factories will automatically adapt production conditions to current conditions and organize production plans according to order demands. Robot technologies are promising to increase the impact of the Fourth Industrial Revolution, Industry 4.0, In this regard, artificial intelligence, which is a key for this transformation, is the ability of a computer or a computer controlled machine to perform various activities by analysing human thinking methods and techniques”. In this backdrop, the present study analyses the India’s readiness for Industry 4.0. The study constitutes three parts. First part discusses the required technologies for Industry 4.0. Second part deals with the India’s readiness for Industry 4.0. India’s key challenges for Industry 4.0 is discussed in the third part.

1. REQUIRED TECHNOLOGIES FOR INDUSTRY 4.0

Nowadays Industry 4.0 is adopted worldwide and influencing cooperative initiatives and efforts. India on this verge of time has already started its journey

towards readiness for Industry 4.0. Digital India, Make in India and Smart Cities are the important projects of the Government of India in this direction. With all these running projects Indian industry also needs to understand the special characteristics of “Industry 4.0” to make themselves equip and gear up for 4th industrial revolution. In this dream, Supply Chain Industry will play a crucial role. Before analyzing the “Readiness for Industry 4.0 – 6-dimensional model”, we must understand 9 major technological components which foundation stones of Industry 4.0 are.

Big Data analysis: Quantum of big data is one of the major challenges of industry. A intelligent analysis need key out the relevant information from the too much data. In this juncture, Big data analysis make possible to identify the performance of an individual component and its operating restrictions in order to prevent future production issues and take preventative action.

Cloud computing: Cloud computing provides different services through the Internet, including data storage, servers, databases, networking, and software. Cloud-based storage makes it possible to save files to a remote database and retrieve them on demand. The industry has seen a large shift in utilizing cloud solutions and the cloud is being used for applications such as remote services and performance benchmarking and its role in other business areas will continue to expand. The cloud allows for a much faster roll-out of updates, performance models, and delivery options than standalone systems.

Internet of things (IoT): The IoT is a key functionality in Industry 4.0 driven solutions. IoT is a system of interrelated computing devices, mechanical and digital machines, objects and people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. For instance, smartwatches in the market have turned our wrists into smartphone holsters by enabling text messaging, phone calls, and more. Devices such as Fitbit and Jawbone have helped revolutionize the fitness world. With the proper connections and data, the IoT can solve traffic congestion issues, reduce noise and pollution.

Simulation: The simulation of systems allows assessment of various scenarios. Once the scenarios are assessed, cost-effective solutions can be developed, tested and implemented much quicker leading to reduced cost and time to market.

Autonomous robots: They are used to automate production methods across the various sectors and are powered by the concept of Internet of Things (IoT). This connects devices and computer machines to communicate with each other. Materials can be transported across the factory floor via autonomous mobile robots (AMRs), avoiding obstacles, coordinating with fleet mates, and identifying where pickups and drop offs are needed in real-time. By connecting to a central server or database, the actions of robots can be coordinated and automated to a greater extent than ever before. They can complete tasks intelligently, with minimal human input. i.e. ASRS stacker cranes, shutter cars, etc.

Augmented reality (AR) Augmented reality grows in use by providing real-time information in an effective manner to allow humans to better integrate and interact with electronic systems. Examples can include the transmission of information on repairs for a part that can be viewed through different devices or the training of personnel using simulations and 3D views of the facility or equipment.

Cybersecurity: The security of information becomes paramount as we move away from closed systems towards increased connectivity from the IoT and cloud. Security and reliability enable the successful implementation of truly modern and digitized production workflow, leveraging all of the benefits of a connected environment.

System Integration: Most systems are highly automated within their own operations and struggle to communicate with other systems. Standards and open architecture support the easy transfer of information both to the business and to the customer/end-user. This can involve defining common languages for data exchange such as JDF for job information.

Additive manufacturing: This continues to become increasingly important for small-batch applications or for the production of individual parts or personalized products. This will be used either directly with the customer or by suppliers to improve designs with increased performance, flexibility, and cost-effectiveness.

2. INDIA'S READINESS FOR INDUSTRY 4.0

In the present scenario it is essential to assess India's manufacturing sector's readiness for the Industry 4.0. The main challenges for India are IoT, Smart Factories and Cloud based manufacturing. VDMA, a foundation of information

technology of German engineering federation, mechanical engineering and plant engineering has identified a six dimensional model to assess the readiness of enterprises for the Industry 4.0. These six dimensions are: smart factories, smart products, employees, Strategy and organizations, smart operations and data driven services. First three dimensions relate to the operational excellence and other three relates to the expended services. Operational excellence defined by the increased efficiency through greater automation and the customization of products at the cost of mass produced product. Whereas enhanced services determine by the higher revenue from digitally refined products and access to new markets. Smart factories and smart products are the physical factors and the smart operations and data driven services are the virtual factors. The six dimensions of readiness are discussed below in detail.

Strategy and organisation: It provides new opportunities for businesses from improving the current processes through the use of digital technologies. This improvement can be examine by, existing knowledge strategy implementation of Industry 4.0, review strategies through a system of indicators for better operations, Measure the enterprise Investments relating to Industry 4.0, Understand the use of technology and innovation Management, Understand the current state of research and development

Smart Factories: the system relies on the cyber-physical system (CPS) which links the physical and virtual world by communicating through an IT infrastructure. The smart factories perform production without human intervention. A company's progress as smart factory can be assess from the following four criterion these are, digital modelling, component infrastructure, data usage and IT infrastructure.

Smart Operations: The technical requirements for self controlling in production are known as smart operations. Smart operations in a company can be determined by information sharing, cloud usage, IT security and autonomous processes.

Smart Product: Smart product is a physical component equipped with the technical component such as sensors, cloud printing etc. ICT add on functionalities in the product determine the readiness in the area of smart product.

Data Driven Services: Data driven services used for evaluation and analysis of collected data from the customers to enhance the business services and benefits

for the customers. It also uses for the after sales services. A company gather information through its IT resources and process the required information needed for operational processes. Readiness in this area can be determined by following three criteria: availability of these services, share of revenue derived, share of data used.

Employees: Digital transformation of a company cannot be possible without the employees help. The readiness for this can be measured by analysing employee's current skill, and the ability to acquire new skill.

After started from Germany Industry 4.0 has been gradually adopted by other nations of the world like United States, Japan, United Kingdom, China etc. To measure the future readiness of industry for the inclusion of Industry 4.0 a new 'Network Readiness Index' (NRI) has been developed by the world's leading ICT experts on the recommendation of World Economic Forum (WEF). This Index is based on the four indices which are Technology, people, Governance and Impact. Each indices has three sub components. Technology includes Access, Content and Future Technologies. People consist of Individuals, Businesses and Governments. Governance made with Trust, Regulations and Inclusion and Impact will be seen on Economy, Quality of life and Sustainable Development Goals (SDGs) Contribution.

According to NRI 2019 top performer of the year's index is Sweden out of 121 countries. Sweden is following by Singapore and Netherlands on 2nd and 3rd place respectively. United States, Germany, United Kingdom and Japan are on the 8th, 9th, 10th and 12th position respectively. In a comparison of China with India, China is ahead of India. China saved 41st rank worldwide whereas India is on 79th position. It is reported in NRI 2019 that the key strength of India's lies in Governance as a result of consistent performances in all three sub-pillars: Trust Regulation and Inclusion. The sub pillar government is offset by weak ICT usages and skills by India. The pillar people is leads by the sub pillar businesses which is slightly good then the technology , mainly because of the level of future technologies. Impact pillar is the greatest challenge for India, where there is much scope of improvement in the sub pillars Quality of Life and SDG Contribution.

2.1. NEW INITIATIVES BY THE GOVERNMENT OF INDIA:

The Government of India has launched a new IoT policy in 2015 with the aim of technological improvement by skill development and building new IoT products

particular to Indian demand in the global IoT market. To fulfill this motive a National Policy for advanced Manufacturing has been formulated. In addition, with a initial amount of 100 crore Rs. a mission on Cyber-Physical system has been launched to enhance the manufacturing capacity.

According to UNIDO's yearbook 'International Yearbook of Industrial Statistics' published in 2016, India's rank is sixth among the 10 largest manufacturing countries. For the country's long term vision in manufacturing government is focusing on 'Make in India' campaign. It is aimed that the share of manufacturing will increase by 25 percent of GDP by 2022. A number of new initiatives and policy reforms, such as implementation of the GST (Goods and Services Tax) and easing FDI policy, has been taken by the government. Followings are the some important steps.

National Manufacturing Policy, 2017: In July 2017, the government has launched a new policy to raise the manufacturing share to 25 per cent of the GDP by the virtue of Make in India initiative, with focus on adoption of digital platforms for Industry 4.0.

Centre of Excellence (CoE): A CoE has established to act as a knowledge centre for entrepreneurs and startups, to disperse the knowledge and concept of IT and its application in Industry 4.0.

National programme on Artificial Intelligence: In the Union Budget 2018-19, the government announced that NITI Aayog will create a road map for national AI programme focussing on developing new AI applications

Mission on Cyber-Physical Systems: As per the Union Budget 2018-19, the Department of Science and Technology will launch CPS mission to support establishment of CoE for training in robotics, AI, digital manufacturing, etc.

India is reviving major reforms and just a few steps away to become the third largest economy of the world by 2030. The government of India has offers three 'Ds' for the business to flourish – Democracy, Demography and Demand. A high demography dividend with education and technical skill is the important factor for shift in future technology. India is a new destination for the global investors. Nowadays, many Indian manufacturing companies in different sectors are giving competition to the world market. The automotive industry of India is the best example of it.

3 COMPETITIVE CHALLENGES OF INDIA IN WORLD MARKET:

China and Europe are the key competitors of India in the increasing technical abilities. In the storm of Industry 4.0 China has been moved up from the low technology low added value to the medium technology and medium value added manufacturing zone. Whereas Europe used to focused on the high technology manufacturing zone shifting towards the medium technology and medium value add zone. Thereby the scope of Europe and China in the global market is expanding. This is creating a crowding out effect and impacting India's manufacturing sector. Use of robotics in manufacturing is still exists in the dream of India.

3.1. INDIA'S COMPETITIVE ADVANTAGE OVER CHINA AND OTHERS:

From the last 25 years India and China competing for the major share of global manufacturing. Despite the push of 'Make in India' initiative India's manufacturing contribution in GDP is still very low as compared to China it is around 27 percent as compared to China's 40 percent. Thus the opportunity still exists in Indian manufacturing sector. Nowadays investors are looking towards India as a more cost effective destination along with Vietnam and Indonesia. Ample quantity of skilled technical labour and low cost manufacturing is the major advantage of India. As a result, Godrej, Bosch, Havells and other large MNCs have already shifted its units in India.

Auto industry occupies a prominent place in the canvas of Indian economy. A sound transportation system plays a pivotal role in the country's rapid economic and industrial development. India is producing a large of vehicles like passenger cars, multi utility vehicles, light, medium and heavy commercial vehicles, motorcycles, three wheelers, tractors etc. India's automotive industry is a key of the economic growth of India fulfilling domestic and global demand and creating new opportunities for exports.

A growing working population and expending middle class, increasing per capita income, increasing disposable income in agriculture sector are the key new demand driven factors in India. Presence of a large pool of skilled and semi skilled workers and strong educational system attracts global manufacturing companies. In addition, favourable government policies, lower excise duties, , the constitution of NEMMP (National Electric Mobility Mission Plan 2020), FAME

(Faster Adoption and Manufacturing of Hybrid and Electric Vehicle) are advantageous for the sector.

3.2. KEY CHALLENGES FOR INDIA'S MANUFACTURING SECTOR:

Lack of adequate Physical and Digital infrastructure: Basic infrastructure such as roads rails and electricity is still a problem for India's manufacturing sector. Moreover, India's telecommunication network also still suffers from low data speeds and unstable connection.

Cyber security regulation: cyber security as one of the top-five business risks and it is prominent in India. Besides cyber security, the regulatory environment pertaining to data privacy would also need to be strengthened.

High cost of Future Ready Factories: Building Smart factories required a significant capital outlay. Getting access to digital technologies for MSMEs remains a challenge due to the high cost of these technologies.

Tradition Leadership versus Leadership Industry 4.0: Industry 4.0 required leaders more than the traditional business approach. The need of the hour is agile leadership and mitigating this challenge should be India's foremost priority. The new leaders should have a approach of adaptation of future technologies widespread in organization. India is still lacking in this agile leadership.

CONCLUSION:

Industry 4.0 is a fusion of physical and virtual factors. The need of the hour is complete digital transformation of manufacturing. This transformation requires a collective effort of entrepreneurs, people and government. Up-skilling of workforce is a mandatory task, which requires adaptation, significant planning and investment. Only a futuristic leadership and adequate government strategies can make all this possible. The traditional organizational structure human to human interaction should be gradually replaced by new digitalize organizational structure human to machine. India is doing work hard in this direction. History of India proved that we have a strong adaptation capacity. Made in India, Make in India, Digital India and development of new Smart cities are the some dominant strategies of government of India to welcome Industry 4.0. Seeing all this, it will not be difficult to say that in future India will not only perform better but also lead the entire world.

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