

Industry 4.0: Problems and Prospects in Indian Context

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Abstract

Technology has changed the face of the industrial and manufacturing world. This is the age of the fourth industrial revolution, commonly known as Industry 4.0. It means the introduction of automation and data exchange in manufacturing technologies like Cyber-Physical Systems, Internet of Things, big data and analytics, augmented reality, additive manufacturing, simulation, horizontal and vertical system integration, autonomous robots as well as cloud computing. It links between man and machine by integrating and combining artificial intelligence in machines. The main aims of Industry 4.0 to initiate transformation in industrial manufacturing through digitalization and exploitation of the potentials of new technologies. In essence, Industry 4.0 is related to the creation of creates 'smart factory'. Amazon, Uber, Facebook, 'smart factories' and 3D printing, are among modern pioneers of the new industrial revolution.

But with a great opportunity, comes great challenges. The aim of this paper is to present and facilitate an understanding of Industry 4.0 concepts, its drivers, enablers, goals, and limitations.

Keywords: Industry 4.0, Fourth Industrial Revolution, Smart Factory' Artificial Intelligent

Industry 4.0: Problems and Prospects in Indian Context**Introduction**

Technology has changed the face of business and industrial world. This is the age of the fourth industrial revolution, commonly known as Industry 4.0. The invention of the steam engine in the year 1784 was

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the first industrial revolution. The second industrial revolution was in the form of electrical energy in 1923. It made possible the assembly line and mass production. In 1969 the introduction of electronics and IT was the third industrial revolution. It leads to the atomization and modernization of the manufacturing process. Now we are witnessing a fourth industrial revolution in the form of digital transformation. There is innovation in the field of digital technology in the economic and social aspects of human life. Today the world is going to be one giant information system. As we know that revolution

brings both prosperity and as well as adversity in the form of opportunities and threats. Are we ready to accept the challenges or ready to grab opportunities for Industry 4.0?

Industry 4.0: Concept

The term 4.0 was first introduced by the German government to promote the computerization of manufacturing. It is about introducing the smart factory, where cyber-physical systems (CPS) monitor the manufacturing processes and make decentralized decisions. The fourth industrial revolution takes the automation of manufacturing processes to a new level by introducing customized and flexible mass production technologies.

This means that machines will operate independently, or cooperate with humans in creating a customer-oriented production field that constantly works on maintaining itself. The machine rather becomes an independent entity that is able to collect data, analyze it, and advise upon it.

This becomes possible by introducing self-optimization, self-cognition, and self-customization into the industry. The manufacturers will be able to communicate with computers rather than operate them.

The rapid changes in the information and communication technologies (ICT) have broken the boundaries between virtual reality and the real world. The idea behind Industry 4.0 is to create a social network where machines can communicate with each other, called the Internet of Things (IoT) and with people, called the Internet of People (IoP). This way, machines can communicate with each other and with the manufacturers to create what we now call a cyber-physical production system (CPPS). All of this helps industries integrate the real world into a virtual one and enable machines to collect live data, analyze them, and even make decisions based upon them.

COMPONENTS of INDUSTRY 4.0

1. Cyber-Physical Systems: The cyber-physical system is used to integrate computation and physical processes. Through these computers and networks are able to monitor the physical process of manufacturing.

2. **The Internet of Things (IoT):** The Internet of Things is what enables objects and machines such as mobile phones and sensors to “communicate” with each other as well as human beings to work out solutions.
3. **The Internet of Services (IoS):** It is easy to see that in today’s world each and every electronic device is more likely to be connected to either another device or to the internet.
4. **Smart Factory:** Smart factories are a key feature of Industry 4.0. A smart factory adopts a so-called Calm-system. A calm system is a system that is able to deal with both the physical world as well as the virtual. Such systems are called “background systems” and in a way operate behind the scene. A calm system is aware of the surrounding environment and the objects around it.
5. **Smart robots and machine:** In future robots will become intelligent and they will be able to adapt, communicate and interact. Robots and humans will work for hand in hand.
6. **Big data:** It refers to the large, diverse sets of information that grow at ever-increasing rates. It encompasses the volume of information, the velocity or speed at which it is created and collected, and the variety or scope of the data points being covered. Big data often comes from multiple sources and arrives in multiple formats.

Advantages of Industry 4.0

1. **Improved Productivity and efficiency:** Industry 4.0 technologies enable to produce more with less. Production can be made faster with minimum allocating resources more cost-effectively and efficiently. The production line will become more efficient as a result of Industry 4.0-related technologies. The cost of manufacturing will fall by the better use of resources, faster manufacturing, less machine, and production line downtime and lower overall operating costs as a result of Industry 4.0 technologies
2. **Increased Knowledge Sharing And Collaborative Working:** Industry 4.0 technologies allow production lines, business processes, and departments to communicate regardless of location, time zone, platform, or any other factor. Industry 4.0 also presents opportunities to improve the service offered to customers and enhance the customer experience

- 3. Flexibility and Agility:** The benefits of Industry 4.0 also include enhanced flexibility and agility. For example, it is easier to scale production up or down in a Smart Factory. It is also easier to introduce new products to the production line as well as creating opportunities for one-off manufacturing runs, high-mix manufacturing.
- 4. Makes Compliance Easier:** Industry 4.0 technologies make it possible to automate compliance including track and trace, quality inspections, serializations, data logging, and more.
- 5. Opportunities for Innovation:** Industry 4.0 technologies will provide knowledge about the manufacturing process, supply chains, distribution chains, business performance, and even product manufacturers.
- 6. Higher Revenues:** Fully automating production line and implementing other Industry 4.0 technologies will reduce staffing costs that can be used for investment,
- 7. Increased Profitability:** Industry 4.0 technologies enable to produce higher quality, higher margin, and/or more innovative products. It will make it possible to offer customers personalized products while still using mass-production methods to make those products.
- 8. Optimization:** Optimizing production is a key advantage to Industry 4.0. Smart Devices will be able to self-optimize production will lead to an almost zero downtime in production.
- 9. Customization:** Creating a flexible market that is customer-oriented will help meet the population's needs fast and smoothly. It will also destroy the gap between the manufacturer and the customer. Communication will take place both directly and externally to customers. This fastens the production and delivery processes.
- 10. Pushing Research:** The adoption of Industry 4.0 will lead to an increase in research and development programs related to digital technology and Artificial intelligence etc. Education and training program can be used to create required skilled labor.

Challenges facing Industry 4.0

Transformation conventional industry into Industry 4.0 will require a huge capital, which negatively affects smaller businesses and might cost them their market share in the future. The following are challenges related to implementing Industry 4.0.

1. Digital Illiteracy: In India large part of the population is lives in rural areas. A large population is still illiterate in terms of digital systems. They do not digital facilities or digital gadgets.

2. Digital divide: In India there is a problem ‘have’ and ‘have not’. The Gap between ‘have’ and ‘have not’ must be reduced to get the benefits of Digital India. The problem of the digital divide needs to be solved through last-mile connectivity in remote rural areas. Currently, about 55,000 villages are not getting mobile connectivity. "This is largely due to the fact that providing mobile connectivity in such locations is not commercially viable for service providers. (economictimes.indiatimes.com)

3. Less Adoption Rate – The digitalization of the economy requires digital literacy and readiness to change. India is facing the problem of both low digital literacy and readiness to change a large portion of still depends on old and outdated traditional techniques.

4. The problem of internet connectivity: Due to poor internet connectivity digitalization process of the Indian economy cannot be accelerated. Still, there is a problem of high-speed internet access in every remote area. According to ASSOCHAM-Deloitte study report, it is estimated that India needs over 80 lakh hotspots as against the availability of about 31,000 hotspots at present to reach the global level of one Wi-Fi hotspot penetration for every 150 people. One of the main problem in India regarding digitalization is the slow/delayed infrastructure development. Spectrum availability in Indian metros is about a tenth of the same in cities in developed countries. This has put a major roadblock in providing high-speed data services.

5. Data security – Data security is one of the burning problems of the economy. Still advancement in network security is inadequate. Data leakage is a question of concern for implementing e-governance. **Security:** The most challenging aspect of implementing Industry 4.0 techniques are IT security risks. With the creation of cloud-based services like DigiLocker, data security has emerged as a major challenge.

6. The problem of Technical support and Coordination - India is a country of diverse culture and languages. Integration of different state systems with central government systems costly, lengthy and time-consuming process.

7. The lack of clarity about economic benefits: The lack of clarity about economic benefits is also great challenges for industry 4.0 like

- Unclear economic benefits, excessive investments
- Insufficient qualification of employees
- Lack of standard, regulations, and forms of certification

- Unclear legal the situation concerning the use of external data
- Low maturity level of required technologies
- Unresolved questions concerning data security
- Lack of prioritization/support by top management
- Too slow expansion of basic technologies broadband
- Insufficient network stability/data back up

8. Policy support problems: Apart from above limitation implementing industry 4.0 needs support from policy-makers like

- Promotion of qualified junior staff
- Support on international standardization
- Creation of competitive data protection law
- Tax incentives for corporate investment
- Research and development promotion
- Provision of highly available broadband network
- Government support/aid for training
- Creation of an 'industry 4.0 industry and research cluster

THE FUTURE WORKFORCE

We are getting closer to Ashton's dream every day. The number of IoT devices is growing at an ever-increasing speed. Cars, clothes, watches, and such all connected to the internet. According to Statista, there will be over 70 billion Internet of Things devices connected by the year 2025. (towardsdatascience.com) According to a report by Nasscom and Deloitte , The Internet of Things (IoT) market in India is expected to grow up to USD 15 billion by 2020 from USD 5.6 billion in sectors like manufacturing, automotive, transportation, and logistics. According to the report, the IoT market in India stands at USD 5.6 billion with 200 million connected units in 2016. (economictimes.indiatimes.com)

In terms of revenues, investment, and technological advancements there are many benefits of industry 4.0. But the issue of employment generation will be one of the major challenges in the era of digitalization. If all the work will be done by Robots then questions arise, "what will humans do? Jobs are shrinking due to Artificial Intelligences and robotics.

The following are some of the important changes that will affect the demographics of employment:

1. Quality Control: As Industry 4.0 depends on big data there for the need for quality control workers will decrease and the demand for big data scientists will increase.

2. Robotic Production: Employees who support in production activities like packaging labeling grading etc. will be replaced by smart devices equipped with cameras, sensors, and actuators. The demand for such employees will go down and will be replaced with “robot coordinators

3. Robotic Vehicles: Human drivers of the vehicle will replace by self-driven vehicles. Therefore the demand for many drivers will be reduced and also there will restriction-free working hours and higher utility.

4. Line Simulation: Demand for manufacturing engineers who work on optimization and simulation will decrease while demand for manufacturing engineers who typically work to simulate production lines will increase. Jobs for mechanical engineers specializing in the industrial field will increase.

5. Maintenance: The demand for a number of conventional maintenance technicians will fall and they will be replaced with highly advance technically smart devices to find out and predict failures. A feature like self-maintenance will be added to smart machines so they will be able to maintain themselves.

6. Technical Knowhow: Smart factory will not only manufacture smart machine but also do the business of selling machines as services which will be set-up and maintained by the manufacturer while the client takes advantage of the services it provides. This will create jobs in maintenance and there will be an increase in sales.

The adoption of Industry 4.0 globally, workers will need to acquire differently or an all-new set of skills. This will increase the employment rate but it will also isolate large sector workers. The sector of workers whose work is perhaps repetitive will face a challenge in keeping up with the industry. Different forms of education that support Industry 4.0 must be introduced. But it will be a problem for the large part of workers.

Government Initiatives:

According to IBEF, Government of India has set a target of increasing the contribution of manufacturing output to 25 percent of Gross Domestic Product (GDP) by 2025. In 2015, the Indian government launched an IoT Policy that aimed at skill development, technological upgrades, and building IoT products specific to Indian demands, thereby occupying a considerable share in the global IoT market 15. The government is formulating a National Policy for Advanced Manufacturing to enhance India’s global manufacturing competitiveness. A program like Cyber-Physical Systems (CPS) has been launch by the government of India. This would be key tools to enhance the contribution of manufacturing output. Government also introduced the policy of ‘Make in India’ This initiative will focus on

creating digital platforms for Industry 4.0. Apart from these programs called ‘Centre of Excellence’ (CoE) was introduced for IT for Industry. This will act as a knowledge center for entrepreneurs and startups, propagating the concept of IT and its application in I4.0. In the Union Budget 2018-19, the government announced that NITI Aayog will create a road map for national AI program focusing on developing new AI applications. Similarly in the government is focusing on an area like the establishment of CoE for training in robotics, AI, digital manufacturing, etc. The program ‘Green Energy Corridors’ was introduced by the government to increase the use of renewable energies by making smart grids that will support the variable input of renewable energies and create storage. The Andhra Pradesh state government has planned to set up IoT hub 2020. India’s first smart factory is being set up in Bengaluru at the Indian Institute of Science’s (IISc) Centre for Product Design and Manufacturing (CPDM) with an investment from The Boeing Company. To facilitate the growth of digital infrastructure, the policy of ‘Right of Way’(RoW) across all states with a reasonable cost structure is required along with a single-window mechanism for granting RoW permissions. To support Government initiative, PPP models must be used for the sustainable development of digital infrastructure. For high-speed data networks, the government should provide additional spectrum to telecom service providers.

Conclusion

Industry 4.0 is definitely a revolutionary approach to manufacturing techniques. The concept will push global manufacturers to a new level of optimization and productivity. Industry 4.0 is simply a progressive technique to production techniques. The idea will push global producers to a new level of optimization and productivity and the customer will get the benefit of highly customized products which was not possible in conventional production technology but for a country like India adopting Industry 4.0 will be quite challenging for government and policymakers. For India digitalization process is a challenging task due to lack of infrastructure and other support systems. Policy makers should solve problems with inadequate economic and social infrastructure. There is a need for more research and development and creation of human capital in this area to solve issues like privacy, security, and employment to gain the benefit this revolutionary approach related to manufacturing industries.

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