International Journal of Research in Advent Technology, Special Issue, March 2019
E-ISSN: 2321-9637
3rd National Conference on Recent Trends & Innovations In Mechanical Engineering
15th & 16th March 2019
Available online at www.ijrat.org

Industry 4.0, India Today and Tomorrow

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Abstract: - In today's mechanical world, technology is advancing day by day. From the early 18th century, the human civilization has progressed with more efficiency by the invention of the first machine i.e. the steam engine, which gave the rise to the first Industrial Revolution in 1784. As time progressed, in the early 20th century, the steam engine was replaced by electrically-powered machines introducing the concept of mass production and thereby it made a lot of changes in different works in the industries. The concept of division of labor was introduced in the second industrial revolution in 1870. Then "Automation" which brought drastic changes in the machines with the use of robots and machines powered by computer systems which was the Industrial Revolution 3.0. Now in the present 21st century, there will be an Industrial Revolution 4.0 that will change the functioning of industries and production processes by the use of Artificial Intelligence (AI), Internet of Things (IoT), Smart Factories, Factories of Future (FOF), Augmented and Virtual Reality (AR & VR) and Cyber Physical Systems (CPS) and many more. This paper mainly focuses on the future of Industry 4.0 in India and how far it is ready to compete with other countries. Also it is discussed here the implementation of smart technology in principal sectors like manufacturing, transportation, health and agriculture following with the outcomes and challenges faced by India.

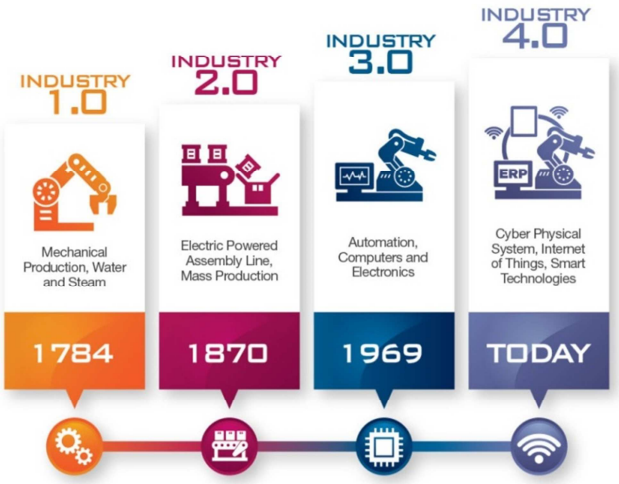
Keywords: Steam Engine, Industrial Revolution, Mass Production, Artificial Intelligence, Internet of Things, Smart Factories, Factories of Future, Augmented and Virtual Reality, Cyber Physical Systems.

1. INTRODUCTION

In Industry 4.0, *Cyber Physical Systems (CPS)* is one of the important criteria where the relation between *Human to Machine (H2M)* and *Machine to Human (M2H)* becomes more efficient. The CPS is used to give the instructions to the machines through a computer program. The input is given by humans and the machine interprets the program as input and gives the necessary results as output. Many multinational agencies are working together to improve the *Cyber Physical Systems.*

Since many decades, the CPS has improved a lot with promising success in most of its implemented fields. In *Human to Machine* concept, the human gives the instructions to the machines and the machine interprets the instructions and gives the output. But this *H2M* concept is a time and energy consuming process, also there is a scope of human error. We already know that the Internet may be referred as a network of networks which are used to exchange information and which is also a form of communication. Such a network of devices that contain electronics, software, sensors, and connectivity which allows these things to connect, interact and exchange data, is called Internet of Things. By IoT, the *H2M* concept becomes easier to understand and implement. The built-in technology, these devices can communicate and interact over the internet, and they can be monitored and controlled. The IoT involves extending internet connectivity beyond standard devices, such as desktops, laptops, smart phones and tablets, to any range of physical devices and everyday objects.

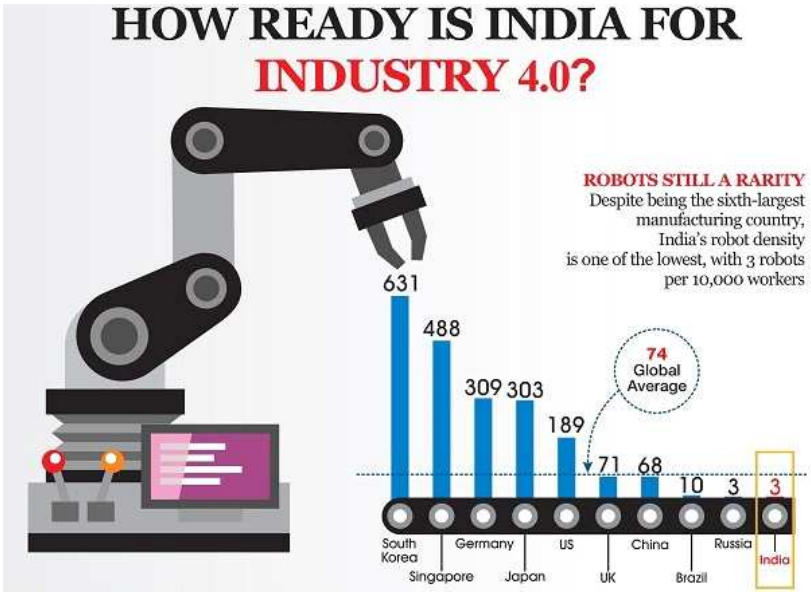
Internet of Things and Cyber Physical Systems are envisioned to create a world, where every task is supposed to become optimized and acquire results with a high degree of accuracy with minimal errors. These two concepts are mainly used in manufacturing sector to satisfy the customer requirements 24/7 with efficiency and accuracy with less usage of man power and conserving the energy and time.



2. CURRENT STATUS IN THE WORLD

Every manufacturing industry's main vision is to grow or improve the customer satisfaction and gain profits within short span of time and to reduce man power and energy. This is achieved by the utilization of automation and computers in the industries. According to rough estimates the Industry 4.0 market is to exceed EUR3.5 trillion by 2020.

Currently, India is competing with countries like South Korea, Singapore, Germany, Japan, USA, UK, China, Brazil, and Russia. Industry 4.0 focuses more on application of robots in industries. Reports say that, South Korea is the number one country in utilization of robots in various industries. Also countries like Singapore and Germany rank next to South Korea in implementation of Industry 4.0.



3. CURRENT STATUS OF INDIA IN IMPLEMENTATION OF INDUSTRY 4.0

In India the Industry 4.0 is still in progress. The current GDP stands at 11.4%. The expected goal is to achieve 25% up to 2022.

Manufacturing sector

The application of the technologies in industry4.0 has begun in India. Few companies have started using the technologies like 3-d Printing, Machine vision, Micro Factory. In Bangalore the first Smart factory was set up and it is developed by the Indian Institute of Sciences (IISC) Center

for product design and manufacturing (CPDM) ,the company seems to be developing right platform to the bases of its "smart factories". Newly divided states like Telangana have started to achieve IOT hubs (internet of things) by 2020. Industrial IOT particularly caters to the manufacturing sector. Currently it accounts for 60% of Indian IOT market which is estimated to be 1,167,303crs approximately. The usage of robotic technology is not popular in manufacturing Sector. But one of the largest manufacturers of two-wheelers in India (Bajaj) has installed co-bots (collaborative robots) at its plant to automate the assembly sector and most of the industries use 3-d printers for the product design this helps to save a lot of time and energy. Learning the software needed to design the product is also a bit easy. The government introduced a scheme to encourage the youth towards industry 4.0 like "skill India" and provided necessary centers to learn like CITD (Centre Institute of Tool Design) where they can learn how to use the latest machineries and design software. A Non Profit Organization introduced a scheme to help the youth to adopt industry 4.0 by giving loans to get the capital to start a company through a trust called BYST (Bharatiya Yuva Shakti Trust). They trained about 30000 young entrepreneurs and they have given loans about 260crs to them.

Transportation Sector

The scope of application of new technologies is vast in this sector. The new technologies decrease the problem of time management. Now at present we have many metro rail systems in the urban cities like Mumbai, Chennai, Jaipur, Hyderabad etc . The Indian Government has taken the first step towards application of high speed rail system. We bought 18 bullet trains from Japan and first track will be running by 2020. The local transportation has been improved a lot. In olden days we needed to book a cab by meeting the transportation company in person but now we can book by sitting at home at and at lower cost. This helped to create many jobs. The Indian railways has converted few diesel trains to electric trains and the first train was flagged off by our Prime Minister Narendra Modi at Diesel Locomotive works(DLW) in Varanasi, Uttar Pradesh, India.

Information Technology sector

We can say that most of the Technologies in industry 4.0 were adopted by India. Indian government has in introduced a scheme called Digitalization. In this program it introduced Aadhaar card it is the first step towards digital society and now we get our ration by just giving our biometric print (Finger print). It was first introduced in Delhi and it is a huge step in advancement of digitalization.

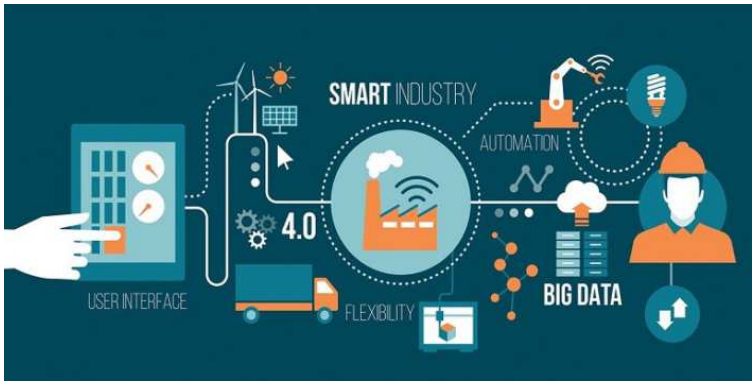
4. SMART FACTORIES IN INDUSTRY 4.0

The smart factory is a flexible system that can self-optimize performance across a broader network, self-adapt to and learn from new conditions in real time, and autonomously run entire production processes without any human intervention.

The **Smart Factory** concept tells about the usage of complete fully connected and flexible system rather than using the traditional automation.

A true smart factory can:

- Integrate data from wide range of systems consisting of physical, operational, and human assets to support manufacturing
- Maintenance
- Inventory tracking
- Digitization of operations through the digital twin
- Other types of tasks around all manufacturing networks



The result can be a more efficient and a prompt system, less production duration, and a greater sense to predict and adjust to bring changes in the facility or in a broader network, possibly leading to achieve position in the competitive marketplace.

FEATURES OF A SMART FACTORY

1. Connected

1.1. Continuously pull traditional datasets along with new sensor and location based datasets.

1.2. Real time data enabling collaboration with suppliers and customers

1.3. Collaboration across departments.

2. **Optimized**
   - 2.1. Reliable, predictable production capacity
   - 2.2. Increased asset uptime and production efficiency
   - 2.3. Minimized cost of quality and production
   - 2.4. Automated production and material handling with minimal human interaction
3. **Transparent**
   - 3.1. Real time linkages to customer demand forecasts
   - 3.2. Transparent customer order tracking
4. **Proactive**
   - 4.1. Predictive anomaly identification and resolution
   - 4.2. Real time safety monitoring
   - 4.3. Automated restocking and replenishment
5. **Agile**
   - 5.1. Flexible and adaptable scheduling and changeovers
   - 5.2. Configurable factory layouts and equipment's
   - 5.3. Implementation of product changes to see impact in real time

The Smart Factory: Why now?

- Rapidly evolving technological capabilities
- Increased supply chain complexity and global organisation of production and demand into different stages
- Growing competitive pressures from unexpected sources
- Organizational transformation resulting from the collaboration of IT and OT
- Ongoing talent challenges

Benefits of the smart factory

Asset efficiency

Asset efficiency should translate into lower asset downtime, optimized capacity, and reduced changeover time, among other potential benefits.

Quality

The self-optimization characteristic of the smart factory can be able to predict and detect defect trends sooner and can help to identify various human, machine, or environmental causes of poor quality. This could lower the scrap rates, and increase fill rates and yield. A more effective quality process could lead to a quality product with minimal defects.

Lower cost

Optimized processes usually lead to processes which are cost-efficient —those with more obvious inventory requirements, more effective hiring of employees and staffing decisions, as well as optimum processes and variety of operations.

Safety and sustainability

The smart factory can also impart real benefits around labour wellness and environmental sustainability. The types of operational efficiencies that a smart factory can provide may result in a smaller environmental footprint, than a conventional manufacturing process, thus resulting in greater environmental sustainability.

Greater process autonomy may provide for fewer chances of human errors, including industrial accidents that cause injury.

Impacts of the smart factory on manufacturing processes

Manufacturers can implement the concept of smart factory in many different ways—both inside and outside the four walls of the factory—and redesign it to adjust, as existing priorities change or new ones emerge. In fact, one of the most important features of the smart factory which is agility—also provides manufacturers with multiple options to leverage digital and physical technologies by depending upon their specific needs.

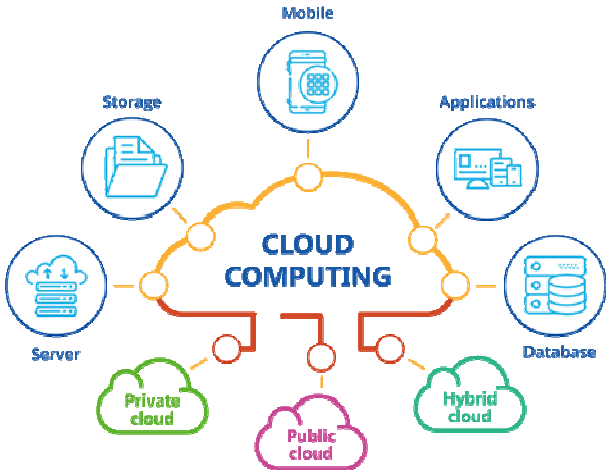
The impacts of the smart factory on manufacturing processes will likely be different for each organization. These technologies power the digital supply network and, by extension, thus creating new opportunities to digitize production processes.

5. CLOUD COMPUTING IN INDUSTRY 4.0

Cloud computing may be defined as the practice of using a network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer. The term is generally used to describe data centers available to many users over the Internet. Large clouds, predominant today, often have functions distributed over multiple locations from central servers. If the connection to the user is relatively close, it may be designated an Edge server. Cloud computing helps business in all industries adapt to today's rapidly changing technology. With Artificial Intelligence and automation being integrated more frequently into industry, cloud computing is a way for businesses to readily change with the times without losing data.

Cloud tech has unprecedented compute, storage and networking capabilities. Compute services make it so that platforms are capable of merging automation, robotics, and Internet of Things, which contribute to innovative developments in the long run.

Innovative new applications on integrated cloud platform services are adaptable to individual needs. They are also predictable and able to perform consistently when confronted with an unimaginable amount of data. *The Fourth Industrial Revolution* will be driven by the integration of resources and new technology. The cloud yields results for success in business while driving business to the tech frontier.



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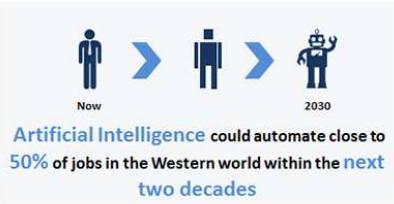
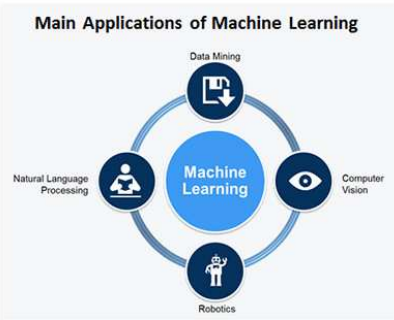
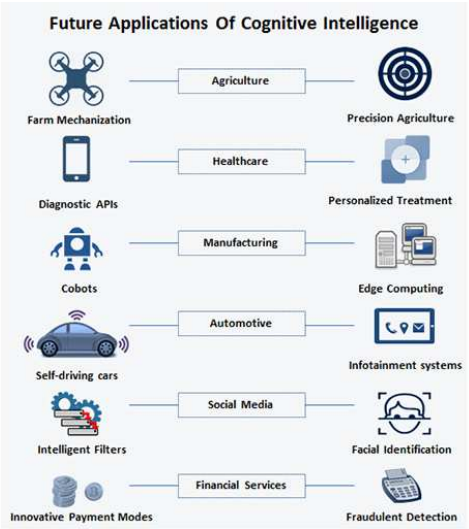
6. COGNITIVE COMPUTING IN INDUSTRY 4.0

Cognitive Computing (Artificial Intelligence) defines technology platforms that are based on the scientific principles of AI. These platforms surrounds machine learning, analytical reasoning, language processing, speech recognition and, human to machine interaction among other technologies which maybe a game changing tool for industries, especially in manufacturing sector







7. CHALLENGES FACED BY INDIA IN ACCORDANCE TO INDUSTRY 4.0

Since Industry 4.0's prime requirement is AI and IoT driven technologies and other industrial processes, these are some challenges faced by India right now:

<u>Challenges faced in adoption of IoT and AI</u>

1. AI-based applications to date have been driven largely by the private sector and have been focused primarily in consumer goods. The emergent scale and implications of the technology make it imperative for policymakers in government to take notice.
2. Early lessons of AI success in the United States, China, South Korea, and elsewhere offer public and private funding models for AI research that India should consider.
3. The sequential system of education and work is outdated in today's economic environment as the nature of jobs shifts rapidly and skills become valuable and obsolete in a matter of years.

<u>Challenges faced in agricultural sector</u>

1. Since more than 50% of India's economy depends on it, therefore, more research has to be done in order to install the latest technology and software in modern agriculture.
2. The private sectors are less interested in investing in agriculture.
3. The latest technology and software requires deep knowledge to understand and operate them, which the farmers don't have.

<u>Challenges faced in transportation sector</u>

1. Indian roads are congested and of poor quality, which leads to higher transport costs.

2. Implementation of AI and IoT is not possible in rural areas

The ports are inefficient and congested since proper monitoring is not there. Even with AI management, a substantial rise in the economy cannot be guaranteed.

8. OPPORTUNITIES FOR INDIA IN INDUSTRIAL REVOLUTION 4.0

Every country aims to be a 'developed' country but there are few aspects which are needed to be satisfied. The various opportunities for India in Industrial Revolution 4.0 are enlisted below:

MANUFACTURİNG SECTOR: -

Manufacturing sector involves all the production aspects and also includes human resource management. The Industrial Revolution 4.0 mainly concentrates on productivity, manufacturing with output of great accuracy where very advanced machinery is used and this also reduces the production damage, time consumption and human power to a greater extent. In India manufacturing processes are given importance due to its role in the GDP.

HEALTH-MEDİCALSECTOR: -

In present scenario, the medical field is equipped with much technical equipment that is used to cure many life threatening diseases. For example, with the help of nanotechnology, the damaged tissue can be reproduced or repaired. Recent developments in medical sector includes, Artificial Stimulated Cells, 3D printed Artificial Organs, Smart Inhalers, Precision Medicines, Health wearable etc. and those still in development are Robotic Surgeries, Wireless Brain Sensors, etc.

TRANSPORTATION SECTOR: -

In countries like India, transportation is not organized and safe. By implementing Al and IoT, there is a huge scope of improvement in the transportation system like optimized traffic where the AI actually studies the traffic patterns to optimize and plan routes based on peak traffic hours, maintenance, and constructions. Using autonomous vehicles to prevent accidents. The usage of Al and loT can lead to decrease in the costs promoting more safety with enhanced customer experience.

AGRICULTURAL SECTOR:-

Agriculture is referred to as the back bone of Indian economy, but in the present scenario agriculture sector has least priority because of no proper knowledge and no guidance is given regarding agriculture to current generation. But the involvement of technology has contributed in the recognition of agriculture. Already automated machines are being used in agriculture which reduces a great amount of time and man power. Also scientists and experts are coming forward with new ideas which are helping this sector to grow.

9. CONCLUSION:-

In this paper, we have analyzed the present situation in India and came to a conclusion that the Government and various private sectors are coming forward and adapting to the latest trends in the technologies, which promises a substantial growth in the country's economy, creating more opportunities in principal sectors like agriculture, health, manufacturing and transportation.

As India is still a developing country, certain things are needed to be taken cares of, which are summarized below:

1. *Cloud Computing*

   Cloud computing being a vast subject, requires a lot of knowledge and skill. Many private organizations in India are adapting to the science of cloud and making headway towards a fully reliable computing experience.

2. *Cognitive Computing*

   This concept is still in development in India and requires lot of research in this background. The utilization of AI is possible in the near future.

3. *Smart Factory*

   Smart factories involve the transformation from traditionally automated to fully connected systems. Some organizations in India have already adapted to the concept of smart factory and there is a boost in efficiency in mass production and other manufacturing processes.

REFERENCES:-

[1] The challenges of integrating industry 4.0 in degree of mechanical engineering. Manufacturing engineering society of mechanical engineering International conference 2017, Spain.
[2] Moving from industry 2.0 to industry 4.0: A case study from India on leapfrogging in smart manufacturing.15th Global conference on sustainable Manufacturing
[3] www.pmindia.gov.in
[4] www.bystonline.org
[5] www.fujitsu.com/in
[6] www.yashodahositals.com
[7] "Industry 4.0: IISC building India's 1st smart factory in Bangalore" Times of India Skill development for industry 4.0, BRICS skill development working group
[8] Industry 4.0: India Inc. Gearing up for a change: AIMA- KPMG report March 2018.
[9] The expected contribution of Industry 4.0: technologies of industrial performance. International journal of production economics 204 (2018) 383-394
[10] https://www2.deloitte.com/insights/us/en/focus/industry-4-0/smart-factory-connected-manufacturing.html
[11] An Industry 4.0 case study in fashion manufacturing. FAIM2017, Italy.

[12] Smart manufacturing, innovative product and service design to empower Industry 4.0. ELSEVIER, computers and industrial engineering 125(2018)

[13] Industry 4.0: The future concepts and new visions of factory of the future development.