Industry 4.0: The Rise of Automation and Digitalization

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Abstract

Industry 4.0 is the Industrial revolution's new phase that is primarily based on high-speed network connection, automatic products, artificial intelligence, machine learning, and RTD (Real-Time Data). Here, 4.0 indicated the fourth revolution which started in **2011** from a project of the German government in the technology sector that will promote the computerization of data in manufacturing.(Rojko, 2017) In this, the information collected is delivered to everyone in microseconds. It plays vital in the company's short-term as well as long-term functioning (in the supply chain(distribution), and manufacturing) and it provides ease in connecting all departments along with the staff together. It helps top-level management in monitoring the work of all departments and their employees. Further, components, benefits, disadvantages, Industry 4.0' s scope in business, and its revolution will be briefly explained.

Key Words: Industry 4.0, cloud computing, data management, artificial intelligence, machine learning, less labor, automation.

Introduction

Industry 4.0 became the game changer as it replaced the overall technology in the production field. Manufacturing became digitalized as goods are now being made, supervised, and distributed with help of the Internet. It is based on the high-speed network connection, machine learning, and artificial intelligence. It helps in the efficient and effective working of any organization. It is bringing a new revolution in how businesses of manufacturing, automobile, and others are working.(Bartodziej & Bartodziej, 2017)
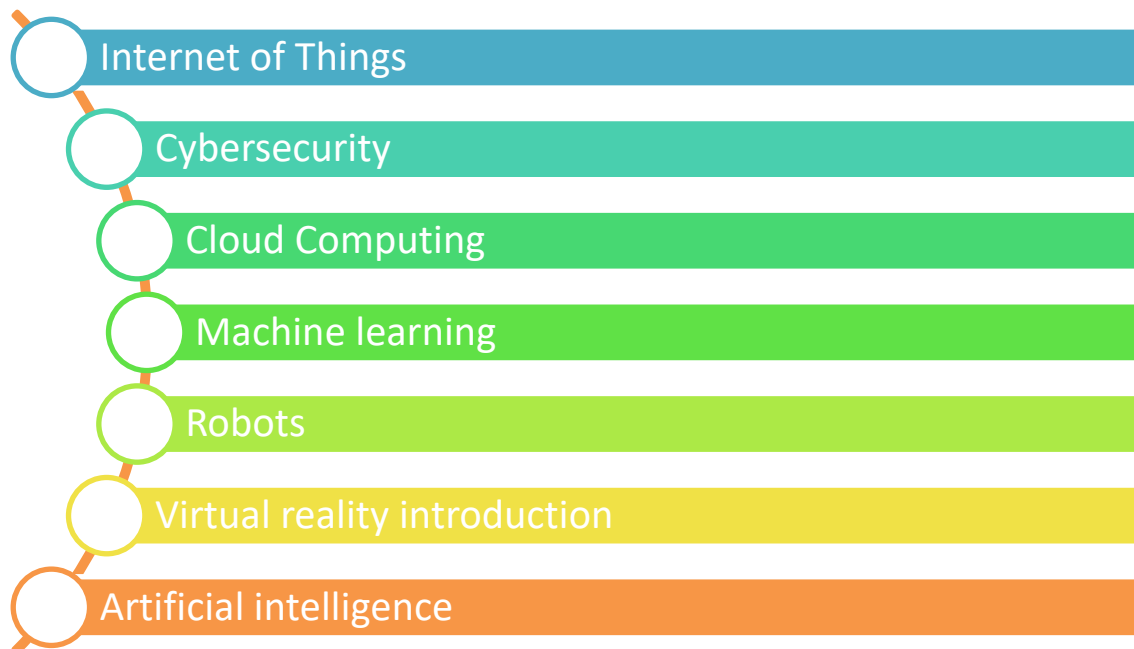
Industry 4.0 can very easily change how employees in any industry work. Due to the invention

and efficient use ofthe Internet, the right data reaches the right employee atthe right time. (Barreto et al., 2017)They can supervise the employees or check at which phase the production process has reached. Even the robots or machinery are installed with pre-programmed memory to detect any mishappening or any failures during the process.

Industry 5.0 and Industry 6.0 concepts are currently in the air but they will soon change the entire concept of production. They, as per discussions and the latest trends, will mainly work on footpaths of robots and will be fully machine-driven. The best about them is that they will be based on nanotechnology and artificial intelligence.

Components

There are a number of components of Industry 4.0. These components make this industry unique from previous ones. They started the fourth revolution in 2011 from a project of the German government. In this project, the technology sector will promote the computerization of data in manufacturing and the delivery of data along with automation in various production processes. Several elements make up industry 4.0 and they are:(Pereira & Romero, 2017)

Internet of Things

Cybersecurity

Cloud Computing

Machine learning

Robots

Virtual reality introduction

Artificial intelligence

2.1 Internet of Things: It plays a vital role in smart factories. This enables machinery in factories to have sensors that are connected to devices with high-speed internet connections. This

helps in the collection, analysis, and exchange of a large volume of valuable data among employees as well the superiors.(Weyer et al., 2015)

2.2 Cybersecurity: It safeguards the devices connected with each other with help of the internet. These tools, which shield data from risks like cyber threats and hackers, can either be hardware or software.

2.3 Cloud Computing: It is a technology in which we use the internet for storage purposes and data management on remote servers. Afterward, one can access data with help of the internet. Cloud computing customers do not own their physical infrastructure, they just rent the usage from any third party.(Birje et al., 2017)This service is provided by:

Service providers	Market share
Amazon web services	34 %
Microsoft Azure	21%
Google cloud platform	11%
Alibaba Cloud	5%
IBM Cloud	3%
Tencent cloud	2%
Oracle	2%

2.4 Machine Learning: Machine learning is an area of AI and computer science that particularly focuses on using data and algorithms to mimic the way people learn, with the goal of steadily improving accuracy.

2.5 Artificial Intelligence: Artificial intelligence (AI) is the duplication of human intellect in robots that have been trained to think and act like human beings.(Dopico et al., 2016) They do activities like:

1. Visual insight
2. Speech recognition
3. Decision-making process
4. Languages translation

2.6 Robots: A robot is a machine that works and mimics a human being. They mainly perform functions and human movements automatically. They are really helpful in the production process as a human cannot always be present.

Advantages of Industry 4.0

There are many benefits provided by Industry 4.0 to manufacturing and automobile businesses. Some of them are:

- More productivity
- Improved Efficiency
- Increase in knowledge
- Reduction in costs
- Flexibility
- Innovation Opportunities
- High revenue
- Good customer experience
- More Profitability

They are explained as follows:

- **Increasing Productivity:** New technologies brought by this industrial revolution enable companies to do more in very less time as well as with resources. They are cost-effective along with efficient.(Li et al., 2017)

- **Improved Efficiency:** Components like artificial intelligence, machine learning, automation, and cloud computing increased productivity. The automation brought less human involvement, so that, they can focus on other important matters. Employees can also track processes and report them.(Zhong et al., 2017)

- **Increased knowledge:** As these components are now a necessity of the hour, knowledge about new techniques and technologies is not only expanding in smart industries but also in small ones(Chen et al., 2017). They allow all production lines to communicate with employees and high-level management altogether.

- **Flexibility:** Due to this revolution, it is very easy to scale up and down in factories that are smart. It is very easy to add any new product line and this will create more opportunities for the manufacturing unit.(Hozdić, 2015)

- **Reduce Cost:** The initial cost will fall due to the use of machine learning, artificial intelligence, data management, automation, and cloud computing. The need for labour will reduce due to the use of robots. Thus, fewer wages and salary expenses. Workers can be hired remotely as they only need to supervise the production process going on in the industry.(Shamim et al., 2016)

  - **The reasons for reduced costs are:**
    - Efficient use of resources
    - More machine work- fewer mistakes
    - Fewer quality issues
    - Fast manufacturing work
    - Reduction in product waste

Drawbacks of Industry 4.0

Everything with an advantage always comes with hidden disadvantages. Thus, Industry 4.0 has its own set of Disadvantages:

Need for high skilled labour

Inequality

Cybersecurity Risk

Ethical issues

Less employment in the country

- **Less employment in the country:** As the need for people with lower education and skill levels has declined, the demand for highly skilled workers has soared. So, employment losses might be the result.

- **Inequality**: The one who can afford and implement the techniques of Industry 4.0 is the one who benefits the most. The truth is that those who offer both physical and intellectual resources typically get the biggest rewards (shareholders, investors, and innovators). The small industries of developing countries will take years to add approaches like cloud computing, machine learning, and artificial technology and get benefits from them but one day they will surely benefit from them. (Stock & Seliger, 2016)

- **Cybersecurity risk:** When everything is connected from top-level management to labour working in factories, there is the risk of theft of data that is available in the cloud services purchased by smart factories. The risk of theft is proliferating day by day due to advancements in data analytics and coding.

- **Ethical issues:** As the data about all the employees, transactions, and final accounts are available to the cloud service provider, there is always a risk that the provider may use it for any personal gain.

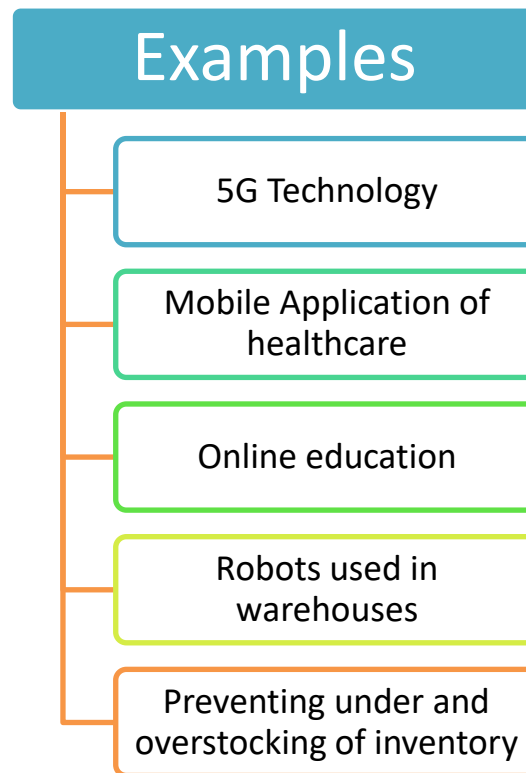**Examples and implications of Industry 4.0**

The manufacturing processes, supply networks, and industrial operations are and will be significantly impacted by Industry 4.0.(Mrugalska & Wyrwicka, 2017) By automating production, digitalising production, and linking the manufacturing site with a wider supply chain network, this new paradigm is transforming the industrial environment in the world.

The European Union promotes industrial transformation through its industrial strategy, as well as by sponsoring infrastructure and research in Industry 4.0 projects. The Factory of the Future in France and Italy, as well as Catapult centres in the UK, are examples of national projects that Member States are funding. European countries are giving young entrepreneurs as well as old money companies a chance to test their intellect in implementing techniques like artificial intelligence, mass communication, machine learning and robotics in their operational activity. (Davies, 2015)

With the smart factory, Audi is transforming its manufacturing to be future-ready. Big data, or the generation and intelligent connectivity of massive amounts of data, will enable data-driven and consequently extremely flexible and highly efficient manufacturing in this factory of the future. (VIAR, 2018)

The industrial industry has seen a rush of robot assistance during the past few years. Starship Technologies has made delivery bots available that may move items around metropolitan streets. Cobots were developed by Dynamic Group Ltd. to counter the prevalent wisdom that robots must eventually replace the requirement for human operators by working alongside manual assembly procedures in the manufacture of medical devices.

At their AI day event, Tesla just introduced Optimus, a humanoid robot prototype that advances this trend. If Optimus were to adopt Tesla's autopilot technology, its versatility may allow it to operate alongside human co-workers at automobile assembly factories as well as in the home or office. (Mathur, n.d.)

Examples

- 5G Technology
- Mobile Application of healthcare
- Online education
- Robots used in warehouses
- Preventing under and overstocking of inventory

Conclusion

Industry 4.0 has transformed how production, data collection, and delivery of data were conducted. Now, they are done in a very efficient and effective manner. It helped in reaching the right data to the right employee at the right time. Smart factories are using this technology and production systems, employees and managers communicate with help of the internet, and the production activities taking place in these factories are almost automatic.

According to respondents in the empirical research Production Work, 60.2% of those polled said that human labour will continue to be important to future production. 36,6% of respondents gave human employees another essential importance. There will still be manual procedures in Industry 4.0 that will require individuals with intellect, creativity, empathy, and flexibility to do them effectively.(Gabriel & Pessl, 2016)

Overall, there is an increase in the production volume which is good for manufacturing as well as automobile industries. As the data is being shared between employees and managers, there is a slight involvement of cybercriminals but with time passing and a new industrial revolution, this

problem will eventually be solved.

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