![CIS - We make IT possible!]

# Optimizing Industry 4.0 with
# Internet Of Things

# Table of content

# 01 Optimizing Industry 4.0 with the IOT

Industry 4.0 as we define it is a phase of connected machines acting as smart equipment communicating autonomously with each other and raising the standards of productivity and automation. The fourth industrial revolution brings about an advancement over the third revolution, which incorporates an industrial level of connectivity. This makes use of futuristic technologies like IoT (Internet of Things), Cyber Physical Systems, Cloud Computing and Big Data Technologies, etc.



**Optimizing**
Industry 4.0

Today, with the growth in digitisation, the way products are produced in the industries, the way an industry is managed and the way a product is marketed, has changed and is moving towards automation. And this growth in digitisation is described as the fourth revolution in the manufacturing world. The first industrial revolution started with mechanization through water and steam power, and followed to second revolution where mass product production came into the picture with the use of electricity. Then came the third revolution where computers came into the picture and automation came to a rise. To add to this automation the fourth revolution has come with the concept of connected machines.

# What Is Industry 4.0?

The name Industry 4.0 is given to the Fourth Industrial Revolution. This is the recent trend that has been seen in the manufacturing industry and represents a change and development in the automation and data exchange. The technologies used in the Industry 4.0 are Cyber-physical systems, Cloud computing, and IoT (Internet of Things). This revolution fosters the smart factory idea.

The term Industry 4.0 was developed in the Hannover Fair in 2011, from a high-tech German government project that promoted computerized manufacturing.

# Four Design Principles

Industry 4.0 has adopted four design principles that identify a manufacturing company as part of Industry 4.0. They are:

## Inter Connectedness

The possibility and chance for various sections of a manufacturing company like machines, sensors, people, devices are able to connect and communicate with each other with the help of IoT and IoP (Internet of People).

## Information Transparency

Transparency is a key factor in Industry 4.0 that allows operators to collect vast information and date from all manufacturing points due to the inter-connectedness. These data and information can be then used to analyze and identify key areas that require innovation & improvement.

## Technical Assistance

Humans beings can get support from the assistance systems with the help of aggregating and visualization enabling them to make informed decisions on matters that require urgent solutions. The option to have cyber-physical systems that can assist humans to do a wide range of tasks that is unpleasant, unsafe and exhausting for humans.
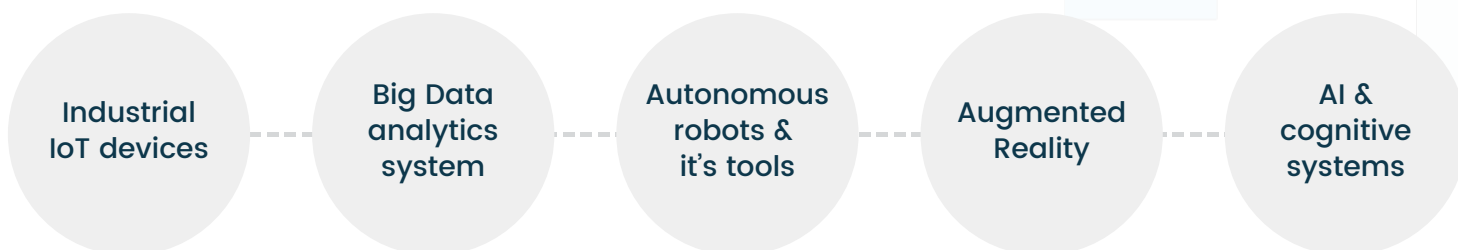
## Decentralized Decisions

The capability of the cyber-physical system to do the tasks autonomously and make decisions without the help of humans. Only in cases where interferences and conflicting goals occur the task is then assigned to higher levels.

# Sources of New Emerging Digital System

As part of the Industry, 4.0 new digital systems are emerging that can gauge both digital and physical data. The sources of these are:

| Industrial IoT devices | Big Data analytics system | Autonomous robots & it's tools | Augmented Reality | AI & cognitive systems |

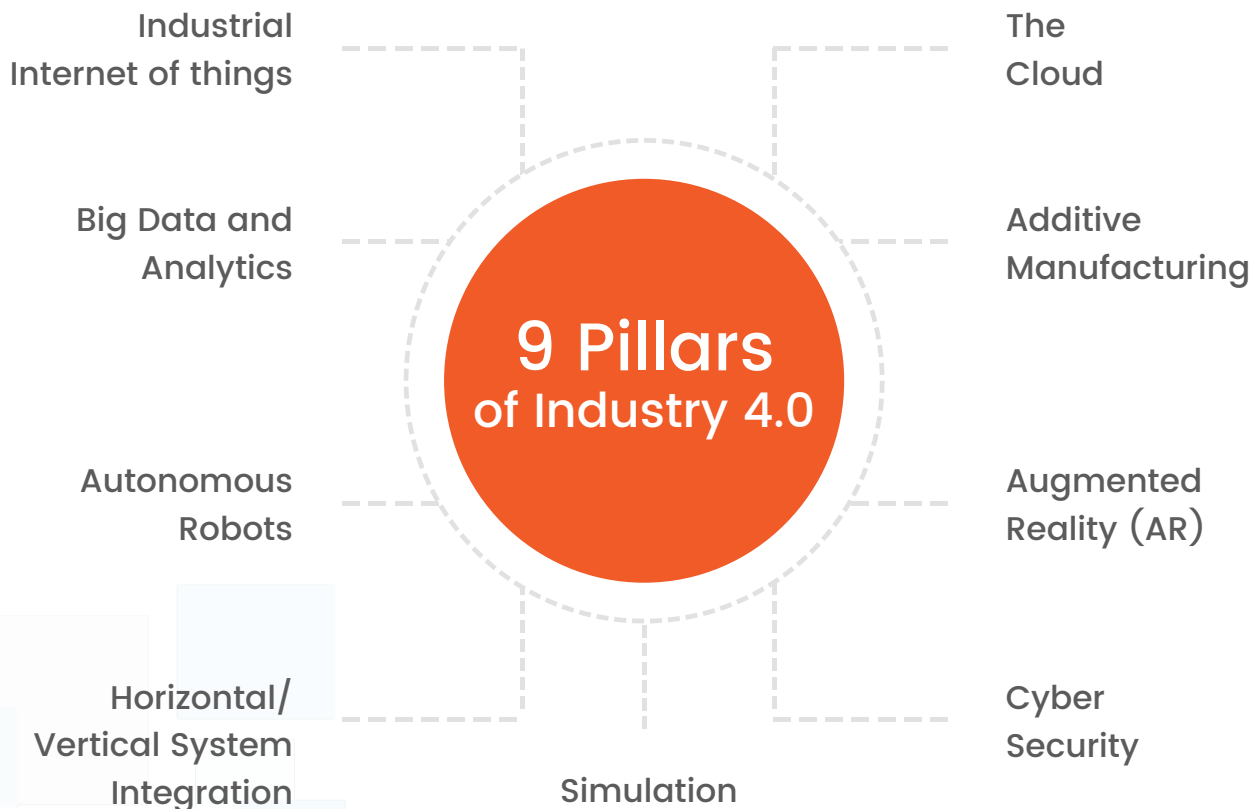# Industry 4.0 has optimised the Industry 3.0 Revolution

At the starting phase of the third industry revolution, computers brought along automation and an increase in productivity with more managed operations and now as the Industry 4.0 has come into the picture, the computers are interconnected and can share information among each other, thus extending the range of automation across the industrial ecosystem. It uses the technologies like Internet of Things, and Cyber-physical systems. This revolution is giving rise to the concept of smart industry where all the machines and equipment work in precise coordination being interconnected. This connectivity gives rise to more data production, which can be leveraged for efficient and productive operations. Through this approach of sharing information readily among equipment, industrialists can leverage the true potential of Industry 4.0.

# The Growth of Industry 4.0 Applications Today

Industry 4.0 is still in its very initial phase where some organisations feel that there is still a lot time left for the concept of industrial connectivity to evolve and they are struggling to find the right application of Industry 4.0 across their organisation. On the other end, there are several cases where organisations have adapted the Industry 4.0 revolution. These cases involve the use of various technologies like IOT, Big Data and AI that are helping people adopt the Industry 4.0 faster with a variety of applications like predictive maintenance, autonomous testing, autonomous vehicle, supply chain optimisation, additive manufacturing, cloud-enabled application, etc. These are only a few applications that describe the significant adoption of Industry 4.0. However, with the increasing rise of automation and the constant research towards increasing productivity across the industrial ecosystem, the fourth industrial revolution is expected to progress significantly for about 30 years to bring about a great difference.

## 02  Pillars of Industry 4.0

As the customer trends are evolving, the way in which industries work and add along the supply chain is also changing. The growth of Industry 4.0 is triggered by the German industrial concept of adopting digitisation in the industrial ecosystem. The key basis of Industry 4.0 revolution is giving rise to a smart industry where machines can communicate with each other and the human-machine interaction, which eventually results in greater efficiencies, automation, and productivity. Industry 4.0 focusses towards industry advances, that are – more data-driven and analysed operations, greater integration of automation, optimal level of business solutions, greater level of organisational communication, etc. The Industry 4.0 is based on a set of pillars, which serves the basis of the fourth industrial revolution.

Industrial Internet of things

The Cloud

Big Data and Analytics

Additive Manufacturing

**9 Pillars of Industry 4.0**

Autonomous Robots

Augmented Reality (AR)

Horizontal/ Vertical System Integration

Simulation

Cyber Security

# 01. Industrial Internet of things

Industrial Internet of Things is inevitably the most important pillars of Industry 4.0, which is directed towards the adoption of digitalisation. Internet of Things is defined as the technology of interconnected things through cloud-based network. IoT applications allow the machines to respond as smart devices, collect data, transfer this data to other devices, communicate with the designed ecosystem, create responses based on commands, take smart decisions autonomously, and adopt higher agility. Internet of Things integrates with other futuristic technologies like cloud computing, Artificial Intelligence, Big Data and Machine Learning to give rise to the several Industry 4.0 applications like – predictive maintenance, fleet management software, autonomous manufacturing, automated testing, etc. IoT is one of the main pillars that has brought the concept of Industry 4.0 to life.

# 02. Big Data and Analytics

Big Data is an important parameter that defines the implementation of Industry 4.0. It refers to a large amount of data sets or a collection of data from the organisation, which helps in making future organisation decisions and define a strategy. Industrial data can include the data input in various machines, the testing data, the human resource data, the various strategies implemented, the decisions made in the past, and the data generated by various machines. This data can be monitored, measured and evaluated to solve various challenges and increase efficiency at an organisational level. This data can be used for data as a tool – to increase the efficiencies of various operations, and data as a strategy – for collecting data over strategies and using this monitored data for building new strategy models. Data as an industry on the other end helps industries to build new software for handling big data solutions and automate the analysis process.

# 03. Autonomous Robots

Robotics have been one of the most important areas of development since the third industrial

revolution (Industry 3.0) and as with the introduction of fourth revolution autonomous robots have come into the picture. In the previous phase the autonomous robotics had been struggling as a majority of organisations felt reluctant in adapting the technology and relying on it readily. So, humans and robots worked in closed coordination where human brain gave commands to robots who performed the task under the supervision of human. But with the introduction of the fourth revolutions of the industrial growth (Industry 4.0) the growth of autonomous robots is accepted to accelerate. This is going to take place in coordination with the adoption of futuristic technologies like Artificial Intelligence, IoT and Big Data.

# 04. Horizontal and Vertical System Integration

Vertical system refers to the flexible systems and customisable system across the industrial eco-system and the scope of their integration with each other so as to increase the efficiency and agility across the factory. While, horizontal system integration refers to the partners within the SCs. For the integration, Big Data plays an important role in collecting the data across the vertical and horizontal systems. This is directed towards creating smart factory which can work in a self-organised manner. This pillar of Industry 4.0 supports integrations between the various vertical systems and these integrations will be evaluated and visualised by the SC members.

# 05. Simulation

Simulation tools are important for the activities related to production so to give rise to a sustainable manufacturing environment. These are digital tools that manage the design for the production and comes in the vertical system that are self-configurable, so to increase the efficiency of production system. The smart simulation models can make the dynamic investigation synchronised and resourceful based on the data acquired and hence giving rise to productivity in the Industry 4.0.

# 06. The Cloud

Cloud computing remains an important pillar of the fourth industry revolution. It creates a bridge between the server and the client-based system. And it serves the basis of connectivity between machines and the industrial ecosystem. In the Industry 4.0, there are main 3 models that include – SaaS systems (Software as a Service) that allows the customers to use software raised on the cloud platform as a service; PaaS systems (Platform as a Service) that allows the software developers to get an access to the applications stored on the cloud; IaaS systems (Infrastructure as a Service) that allows the basic storage capabilities. Cloud computing also copes up for enterprise mobility software, which incorporates greater flexibility in the industrial environment.

# 07. Additive Manufacturing

Additive Manufacturing refers to 3D Printing, and enables the production of customized goods based on individual customer requirements. The most efficient ways are prototyping and 3D printing methods that can be utilised for making small batches of manufactured products by gaining advantage of having less stock on their hand and overproduction.

# 08. Augmented Reality

Augmented Reality or AR is an innovative technology that creates a bridge between the virtual world and the real world for creating a more engaging perception of visual elements. The use of AR and VR technology enhanced the human-machine interaction, thus further enhancing the control over maintenance processes and visual inspection tasks in a virtual productive manner. AR combined with sensors give rise to motion control technology, which can be used for advanced inspection tasks. Physical objects combined with computer generated graphics can be used for making many applications.

# 09. Cyber Security

One of the most crucial parameters that cannot be afforded to ignore with the rise of Industry 4.0 is the concern of Cyber Security. With the rise of automation and digitisation, all the data is raised on cloud and the risk of cyber hacks increases. However, systems need to be developed to control the hacks, unauthorised access to data and security breaches. To destroy the cyber attacks the previous terror attacks are analysed via radiation control and this can lead to data safety. Based on the big data analytics from the previous attacks, the possible threat data can be analysed and systems can be made to suspect any similar breach and control them on an initial point itself.

## 03 The Influence of IoT in Industry 4.0

In the era of technology, there is a constant upgrade of technologies and introduction to new technologies. The business industry has gained a high profit from such technological uses and growing with time. IT professionals are using high-end technologies for their projects for better results. Currently, the two promising technologies that are making the business people go crazy are the Internet of Things and industry 4.0. It has made a buzz around the world with its capabilities and technological creations. Although the two of them are not synonymous, sometimes they work interchangeably. There are various devices that we use daily in our analog world.



**Influence**
**Iof IOT in**
**Industry 4.0**

# What is the Internet of Things?

The internet of things helps to make them technical by adding various kinds of networking technologies to the systems and digital sensors to the devices. The best of them known by all is echo smart speakers of Amazon's Alexa, nest and some other thermostats incorporated with smart Ecobee. Smart thermostats are sensors that are installed in multiple rooms that can be controlled through mobile devices with the help of the internet to have control over the room temperatures.

**Internet of Things**
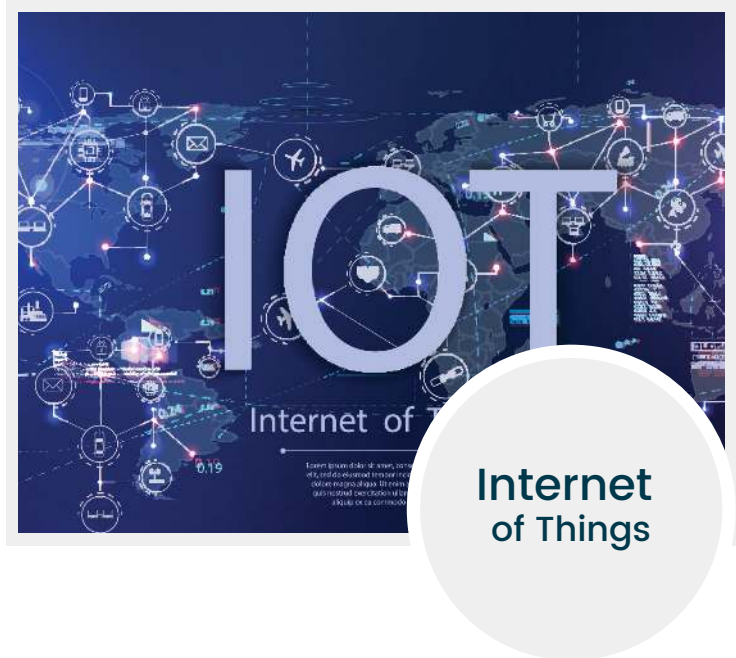
The temperature cans also auto-function depending on the weather outside when a person is not home. The thermostats also detect leaving of the person automatically and take over the control. It is said that about 70% of the population uses IoT devices but do not know the use of the technology. According to a survey it is reported that by the year 2020, 30% of the industrial interaction is done through conversations with smart technological machines. The technology is used not only in thermostats but also for other municipal and commercial uses like that of digital manufacturing systems and sensor incorporated trucks for better management.

On the other hand, Industry 4.0 is known as the fourth industrial revolution in the business world. Industry 4.0 is a manufacturing technology that includes cloud computing, Internet of Things, cognitive computing and cyber-physical systems. Industry 4.0 is the data exchange and manufacturing that is used in the manufacturing of products in any industry. After the third industrial revolution, the fourth edition brings a whole new change in the manufacturing industry. With the incorporation of the internet of things in technology, the machines can communicate with each other and take decisions to complete tasks without the intervention of humans. With the incorporation of smart machines, the manufacturing industries have a better management system

by accessing huge data. It automatically increases the productivity and efficiency of the company. The real power of the technology lies in the machines that are capable of interacting and communicating among themselves.

# The impact of the internet of thing on industry 4.0

With the constant change of technologies in the business world, the internet of things and industry 4.0 has found its place in the business industry. Many industrial companies are in denial of the technology because of a lack of knowledge in its implementation in industry and the impact of the same. The internet of things is one of the most used technologies and has an impact on every other technology used n the market today. The impact of IoT in industry 4.0 is discussed below.

## Identification of opportunities

With the help of IoT technology, multiple machines can communicate and gather a large volume of data and information at the same time. it can also identify the data, maintain them, and regulate the data performance. However, huge data can cause complexities which can be treated with the help of the manufacturing and controlling techniques of the industry 4.0. The technology helps the companies to identify the areas that need immediate attention which automatically increases the productivity and efficiency of the workers. With the quick identification of the problems, the problem can be resolved quickly and the company can save around $20 million annually.
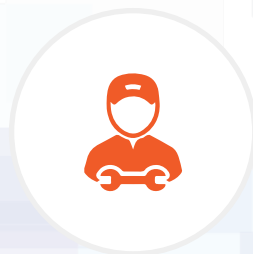
## Self-assessing vehicles and equipment

The industry 4.0 technologies have extended their machines to various industrial sectors. Nowadays, many shipping yards have introduced automated machines and vehicles for the shifting of the products and materials. With automated machines, the workload of humans has reduced.

## Optimizing supply chains and logistics

The supply chain system helps to manage and work according to the priorities of the company. However, many times delivery can get delayed due to weather condition or other problems. With the help of IoT technology, machines communicate with one another to reschedule their work according to the priorities.

## Introducing robots

The way the industry works is changing every day. With the advancing technologies, the competition in the market has increased among the companies. Nowadays, companies of all sizes, big or small invest a huge amount to improvise their company systems. The high-end technologies are costly but assure a high return on investments. Therefore, companies with huge budgets can afford robots for their company. The autonomous robots help to manage the warehouse by safely transporting the products and loading them in trucks. The floor space of the warehouse can be well utilized. The robots also save money by reducing the hiring of extra warehouse workers.

## 3D printing

The industry 4.0 technology has brought about a revolution in the printing industry with the introduction of 3D printing. The technology was earlier used only for prototypes. However, with the new features, the technology is now used for developing actual products. With the advancing technology and the use of metal, the industries have the opportunity of new possibilities in their companies.

# IoT and cloud

The most important component of the technology of industry 4.0 is the incorporation of the internet of things. The entire technology is dysfunctional without the technology of IoT within it. The IoT helps with all the internal function abilities of the technology. It also helps the system to use the cloud for the better use of data storage. The operations and the types of equipment required for the insight operations. The Internet of things also helps the other small companies to access the technology since they are unable to do it by themselves.



IOT and cloud

# 04 Challenges That Manufacturers Face With Adoption of Industry 4.0

Industry 4.0 is revolutionizing the world and every month many articles are being published showcasing the benefits of Industry 4.0 advancements. The main objective of the articles is often to highlight how the manufacturing plants are implementing the technologies brought about by Industry 4.0 and its associated IoT. So while most of the manufacturers are more concerned about improving operations and producing quality products, they do not have the time to read so many articles on the benefits of Industry 4.0. In this article, we will hence give a brief overview of what Industry 4.0 is and the challenges and solutions that it offers to manufacturers who intend to adopt it. Despite several benefits that Industry 4.0 offers there are some challenges that lead to many manufacturers to take a step back before implementing the revolution brought in by Industry 4.0. According to Deloitte 6 out of 10 manufacturers revealed that the obstacles of executing Industry 4.0 technologies are so strong that they are able to attain only limited progress with it.

Despite several benefits that Industry 4.0 offers there are some challenges that lead to many manufacturers to take a step back before implementing the revolution brought in by Industry 4.0. According to Deloitte 6 out of 10 manufacturers revealed that the obstacles of executing Industry 4.0 technologies are so strong that they are able to attain only limited progress with it.

The six most cited challenges that manufacturers face with Industry 4.0 are:

1. Many manufacturers fail to have the resolution to introduce radical digitalization plan.

2. Absent of a leader who has the capacity to make cross-unit coordination within the company.

3. Not all manufacturer have the in-house support or talent to deploy and support the development of the initiatives launched by Industry 4.0.

4. Concern over the ownership of data when selecting third-party vendors who will host and operate the company data.

5     The lack of technical know-how about the Industry 4.0 technologies among the vendors and IT consultants who can partner to execute the initiative.

6     For the initial connectivity, there is often issues with integrating the data from different sources because off the lacking in technical knowledge.

## 05   Solutions That Industry 4.0 Offers to Businesses

Industry 4.0 is a revolution that does have a set principle of design and technologies but it does not cater to 'one-fits' all approach. While there are several ways that the manufacturing companies that have failed to implement the technologies brought forth by the Fourth Industrial Revolution can adopt them by lowering the barriers. But it is still a long way to go for the manufacturing companies to implement it fully. The first step they can take is to have a clear estimate of the ROI that the digital solution brought by Industry 4.0 can bring to the business.

The entire manufacturing value chain can benefit and transform from Industry 4.0 technology. It helps with production efficiency to better deployment of service; innovation is products and so on. Here is a list of the solutions that Industry 4.0 can offer to manufacture businesses.

### Gain In Revenues

As mentioned earlier Industry 4.0 was initiated in Germany and Europe has adopted it before anyone else. As a result of this, there has been a significant increase in the revenue in the European industry. As per the PwC report, the use of Industry 4.0 among the European Industry has resulted in Euro 110 billion increase in revenues. There has been an average growth of product portfolios among companies that have used the technology. About 50% of the enterprises that have used Industry 4.0 technology is about to have double-digit growth in the next five years.

Furthermore, big data analytics will help companies to have a better under-standing of the customer needs and requirements. As the insights from the analysis can be used for improving products and services.

## Increased Efficiency To Better Productivity

In technical professionals, productivity can be increased by 45 to 55 percent when the use of automated technology that Industry 4.0 uses according to McKinsey. Many multinational and renowned companies like Cisco, Airbus, Siemens have used Industry 4.0 technologies to increase their efficiency. Many businesses are developing the IoT ecosystem gadgets that can offer effective and hassle-free cross-platform connectivity and data exchange between multiple IIoT systems.

Human robots on the factory floor are also increasing the efficiency thereby productivity. As per MIT, such robots can cut down on about 855 of the idle time that workers have and increase productivity by 60% as per Australia's Drake Trailers. There are several other instances where productivity has been doubled or more with the use of robots.
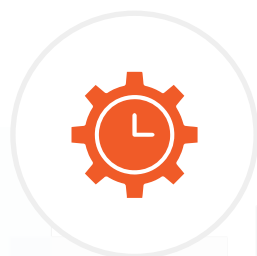
## Reduction in Machine Downtime

Many international companies like Boeing and GE Aviation are using Industry 4.0 technology for the purpose of predictive maintenance. This will ensure that any equipment failure can be identified before it happens and notify the team. The technology used in this kind of job has the capacity to spot granular changes over time as it learns on the job thus helping the team to optimize the produc-tion process. As per Deloitte report, the predictive maintenance will reduce total cost of maintenance by 5 to 10 percent, planning time by 20 to 50 percent and increase the availability and uptime of the equipment by 10 to 20 percent.

# Better Matched Supply and Demand

A company can have a better interaction with their supplier with the help of cloud-based inventory.  This will ensure that there is:

- The fill rate of the service parts is high
- There is production uptime with very little risk
- Customer service level is higher

Instead of having individual silos you have the option of paring the inventory with the big analytics solution that can help you in forecasting the demand by a minimum 85 percent. You can check the bottlenecks and optimize the real-time supply chain. This will also help you to have a better ROI.

Digital transformation or Industry 4.0 is changing the way manufacturing industry has been operating in the last couple of decades. With this new industrial revolution the ROI is becoming tangible, can be scaled. So while there will be issues with embracing the technology but once that is done it will change the way the company operates.

## 05 Some Statistics Related To Industry 4.0 To Keep An Eye On

**1** The estimated amount of cost reduction in the automotive sector due to the adoption of Industry 4.0 between 2016-2020 is $28 Billion. This amount is equal to a percentage reduction on the investment cost of 3.9% for the automotive industry. The average cost reduction across all the industries is 3.6% of per annum investment.

**2** The adoption of Industry 4.0 along with Internet of Things (IoT) is expected to make the inventory management more efficient and reduce the annual inventory levels. The annual reduction in the industry levels is expected to go lower by 2.6 percent. This rate will increase with the increase in the rate of adoption of Industry 4.0.

**3** The adoption of Industrial Internet of Things (IIOT) is expected to increase the industrial productivity by 30%, which is a significant rise in productivity after the third industrial revolution (Industry 3.0). This will be followed by a 30% decrease in the maintenance costs due to the application of predictive maintenance. The Industrial IoT applications will track the data from all the machines and equipment to regularly monitor the health and performance of all the elements and indicate a maintenance schedule in the case of dysfunction or performance loss.

**4** The average number of years in which an organization can expect the return from their investments in Industry 4.0 is 2 years. This means that an organization can expect significant returns on their investment in the adoption of Industry 4.0 in just 2 years. This represents in the face of increased productivity, lower maintenance cost, and lower operational costs.

**5** As the statistics say, the total number of manufactures who adopted some elements of Industry 4.0 in 2016 were about 33% and this number is expected to increase to about 72% by the end of 2020. This is more than double in just 4 years. The industrial growth of automation technologies is on a constant rise since 2016 and is also expected to multiply significantly by the end of 2020.

**6** The adoption of Industrial Internet of Things (IIoT) has helped a majority of manufacturers experience significant progress in the year 2015. Manufacturers who adopted IIoT in 2015 witness a progress of 27%. This percentage is expected to grow with the growth in the connectivity, adoption of Industry 4.0, and integration of cyber-physical systems.

## 06 Summary

Industry 4.0 is indeed an industrial revolution in today's business world. It has entirely changed the ancient manufacturing industry into a new tech genius industry with automated machines and types of equipment. All of these were not possible without the incorporation of the two very important technologies of today's world, the Internet of things and Artificial intelligence. According to a survey, it is only a matter of time that cyber-physical computing, IoT, Artificial intelligence and cloud computing become a part of every company. There are many ways that IoT has affected Industry 4.0. Some of the manufacturing and administrating areas that have changed with the technology are the industry value chain, IT security, machine safety, product lifecycles, reliability, productivity and efficiency, services, worker skills, and education. There are various other socio-economic factors as well. Overall, the technology is still discovering new traits and the companies with the technology can already feel the difference it is making to their companies. Nowadays, the internet of things is used by every company and individual.

## How We Can Help You

CIS has been helping businesses across various domains like automotive industry, manufacturing sector, logistics, etc. with the adoption of Industrial Internet of Things (IIoT). We have a global client base and a team of skilled IoT developers who can help you with the adoption of IoT for Industry 4.0 integration. We are here to empower the organizations with:

- Designs, integration, development, management, and deployment of end to end IoT processes.
- Smoothly integrating IoT solutions to the existing architecture of the enterprise.
- Improving decision-making process through augmented intelligence.
- Integrating and transforming the business processes.
- Delivering new data after proper analysis.

# About Cyber Infrastructure

CIS is a prominent CMMI Level 3 IT solutions and outsourcing company that serves a global client base spread across 100+ Nations with leading-edge web, mobile, software, IoT, AI, Blockchain, Big Data, and Enterprise Mobility Solutions. The company has been in business for 16+ years now and is served by a team of over 650 employees. The company boasts a 95% client retention rate and offers optimum client delight.

Email
info@cisin.com

Phone
+91-731-6664000

FAX
+91-731-6664000