



## APPLICATION OF INDUSTRY 4.0 IN MANUFACTURING

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### ABSTRACT

*In current circumstance, all businesses are attempting to extend their arms everywhere throughout the globe to turn into a solid rival in manufacturing world. Industry 4.0 includes a wide arrangement of advances that gives a decent stage to development and imaginative arrangements. To actualize such condition, it requires the use of cutting-edge forecast devices that includes the transformation of information into data in a methodical procedure to clarify vulnerabilities. This innovation is a chance to change the economic standards of the business. As we probably are aware India is in its verge of advancement. It is critical to comprehend India's pushed towards "Make in India". In this way it is significant for an India to embrace industry 4.0 innovation and to get adjusted to the equivalent. This thus contributes in the advancement of Indian economy.*

**KEYWORDS:** *Industry, Manufacturing, 4.0, Scalable, Technology, Automated, Performance, Globalization, Make in India, Economy, Application*

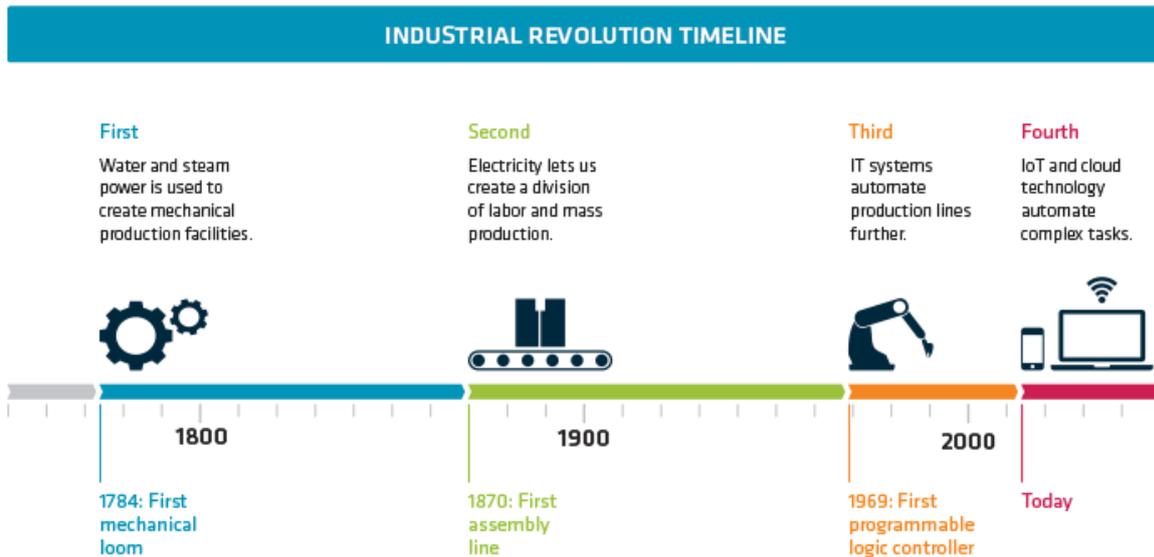
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### INTRODUCTION

Alongside the benefit, industry also cares about consumer loyalty, item quality and its customization and furthermore cost of production. Thick advanced change is on its way, in the background of world's driving ventures. They are strengthening their item portfolio with computerized functionalities and furthermore putting resources into information investigation to drive advancement and critical enhancements in effectiveness as a storm cellar ability. India and China are going after lion's share in worldwide assembling, from recent years. Even though India has infrastructural issues, bureaucratic wattle and furthermore awkward supply

of assets, India supplies inexhaustible gifted works and some of huge producers like Havells, Godrej and Bosch hold their units in India. India has a colossal undertaking in its fantasy of being the world's favoured manufacturing destination in future. The fourth industrial upheaval is on its way and there is no venturing back.

Industry 4.0 will be a challenge and may likewise have the responses for India's proceeded with bit of leeway in the worldwide manufacturing process. This is the time of cutting-edge fabricating, composite materials, quantum building, 3D printing and industrial autonomy.



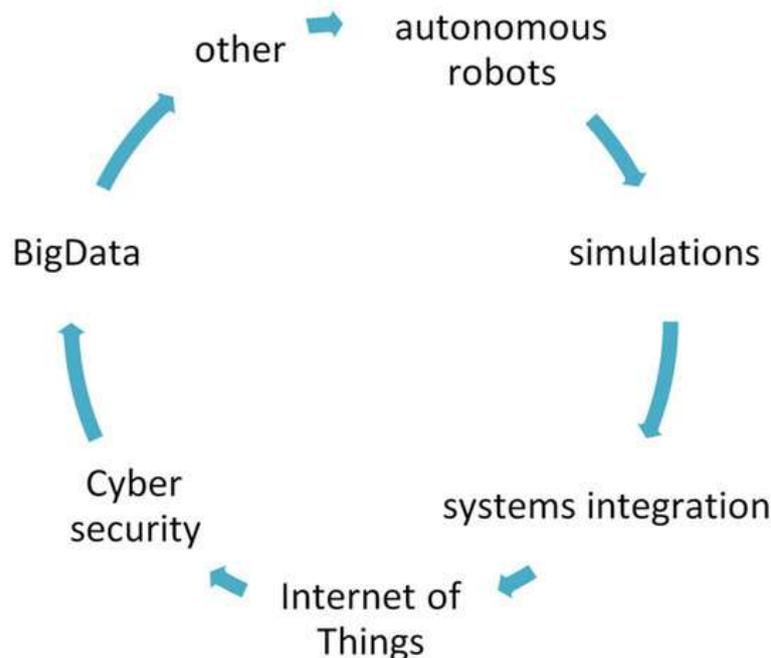
**LITERATURE REVIEW**

**What is Industry 4.0?**

Industry 4.0, also called manufacturing 4.0, is the marriage of IT and manufacturing operations – the maturation of digital technology in the manufacturing industry. Mark Holleran, formerly the CEO of Xplore Technologies, says it represents a "holistic shift from centralized to decentralized manufacturing," which requires the adaptation of processes, talent, business structure and technology.

"Technology, including advanced robotics and artificial intelligence, sophisticated sensors, cloud computing, IoT, data capture and analytics, and digital fabrication ... are all coalescing into the ushering in of this next industrial revolution," Holleran told Business News Daily.

Here's a look at some of the major components paving the way forward for manufacturing 4.0 and how they work. Together, they create a high-tech ecosystem of smart devices that achieve an optimized, efficient workplace.





- **Internet of things**

As the number of smart devices and amount of data captured, analysed, and stored grows, connectivity and communication will only become more important. Both within the enterprise and to third-party partners, companies will need their data to be shareable and compatible to enable a higher level of operation.

Declan Keir-Saks, director of Deskera, said IoT is the bridge that allows the granular insights provided by high tech solutions to join into a coherent, enterprise-level picture for modern manufacturers.

"IoT manufacturing enables virtual tracking of capital assets, processes, resources and products," Keir-Saks said. "This gives enterprises full visibility, which streamlines business processes and optimizes supply and demand."

When implemented correctly, decision-makers will be equipped with more and better information, automated processes, and the ability to intervene on a predictive or preventive basis to avoid downtime or any other issues that might ding production output.

- **Artificial intelligence and machine learning**

The information delivered by sensors and IoT-driven systems is too vast for humans to reasonably analyse. AI and machine learning algorithms can contextualize the data and flag anomalies or make recommendations.

"AI and machine learning can help detect early warning signals of assets [becoming] unhealthy," said Derick Jose, co-founder and chief data scientist at Flutura Decision Sciences and Analytics. "For example, top-drive RPM temperature anomalies could be [the] signature of an impending breakdown."

Moreover, AI serves to improve efficiency in the overall operation, Jose said. By quickly returning predictions on the impact of minor changes, decision-makers can understand the effects before they implement something new.

AI is specifically useful when it comes to digesting the massive flows of information captured by sensors and IoT-enabled devices. Those vast troves of data would be nearly impossible for a human operator to contextualize, so allowing computers to do it makes that captured data valuable.

- **Mixed reality**

Mixed reality is also a major component of Industry 4.0. Big companies are already issuing mixed reality devices like helmets and glasses to employees in hopes that the increased communication and visualization of contextualized data will boost productivity and intelligent decision-making.

"Mixed reality is a real game-changer in manufacturing," Tim Lynch, CEO of Psychsoftpc, said. "For repair personnel, it allows them to 'see inside' the machine that needs repair or 'see through

walls' to the cables and pipes behind to know exactly where to drill or cut."

Couple those capabilities with the predictive maintenance enabled by IoT and AI, and you've got a recipe for high-tech success. If the data suggests a machine is overheating, for example, and the machine-learning algorithms flag it is anomalous enough to warrant dispatching maintenance, workers can employ mixed reality to determine whether a machine is beginning to overheat, and precisely which components are affected.

To take it a step further, imagine the maintenance person diagnosing the affected machine recognizes a problem but doesn't have the expertise to fix it. Mixed reality devices can connect someone with the proper expertise to the person on-site, who can then show them step by step, through digital overlays, how to perform the repairs.

For training purposes, mixed reality creates an environment where employees can experience virtual situations relevant to their job without risking actual equipment or manufacturing uptime.

"In training, workers can practice on virtual products to gain experience that will carry over to the real world," Lynch said. "They can be put in simulated situations that they could face in doing their job and learn how to handle them virtually before being exposed to them at work."

- **3D printing**

3D printers have existed since 1983, though were often only in the hands of large companies. Back then, the term was "rapid prototyping," and they certainly continue to do that today. But it's not just prototypes anymore; 3D printers are also employed in low-volume manufacturing, perhaps to test products or bring samples to trade shows.

"When small companies develop new products and need to make 50 parts to test, or just to bring to a trade show, tooling up for traditional manufacturing can be very expensive," Doug Collins, owner of Avid 3D Printing, said. "They might not have the capital to tackle [traditional manufacturing]. 3D printers allow low-volume production without as much investment, so they can save that capital for the other important stuff, like marketing."

As the technology continues to improve, it's more common to find 3D printed parts within larger projects. One example is GE Aviation's 3D printed fuel nozzle, which is part of the CFM LEAP airplane engine. By printing certain components, manufacturers can save time and money to create the same final product.

### **What are the advantages?**

With such immense promise and cutting-edge technology, Industry 4.0 requires a major upfront investment. According to a 2017 survey of 1,000 small and mid-size manufacturers, invested an average of \$250,000. For larger businesses, the cost



would inevitably be higher. But the expected payoff – connected, smart devices and an automated production process – promises a major return on investment.

Advantages manufacturers stand to reap from implementing those technologies include:

- **Increased competitiveness**  
Outsourcing to low-wage regions of the world was previously an imperative for manufacturers wanting to remain competitive. However, investments in technology are now enabling wealthier countries to compete once again.
- **Increased productivity**  
Automation, analytics and machine-learning algorithms have taken much of the step-by-step work out of the hands of human operators. That means quicker, more efficient production around the clock, with human operators primarily monitoring and maintaining systems.
- **Increased revenue and profitability**  
Industry 4.0 not only creates a more efficient and higher quality production process, but it enables things like predictive and preventive maintenance and upgrades, which results in lower downtime and less capital expenditure over time.
- **Manufacturing process optimization**  
With more connectivity, shared data and better analytics, closer collaboration along the entire supply chain becomes possible, which could lead to increased efficiency, optimization and innovation in the long run across the manufacturing industry.
- **Seamless record-keeping and traceability**  
The immense capture and analysis of data also means better record archiving and search capabilities. This has ramifications from government regulatory compliance to customer satisfaction.

### Current State in India

Since 1970 Industries in India and all over the world have adapted automation and robotic technologies that are driven by electronics and information technology. Present technology consists the automation of isolated machines. General adoption of information and communication technology by manufacturing industry is now leading for deterrent approaches to production development and to the whole logistic chain. As we know increase in population is paving the way for increase in productivity and quality with limited time.

### Identification of potential problems

By studying current industrial technology some of issues or problems were found. These can be categorized into five groups. They are as follows: -

- **MANAGER AND OPERATORS INTERACTION**

At present industries, managers design logistic schedules and operators control machines to check whether they are performing the tasks which are assigned to them. Even though expert managers and operators are deciding these tasks, there is a lack of significant factor: health condition of the machine

- **MACHINE FLEET**

Exposure of identical machines for different tasks in completely different working condition is very common. Most prognostic methods are designed to encourage limited number machines and better working condition. The advantage of identical machines is not being used properly in the present health and prognostic management methods by the worthwhile knowledge gathered from different situations, as a fleet.

- **PRODUCT AND PROCESS QUALITY**

Final product of an industry gives the scrutiny on machine condition through backward reasoning algorithm. Production scheduling can be improved by the feedback provided by the product quality to system management. Because of the absence of such feedback loop more researches should be done on this.

- **BIG DATA AND CLOUD**

Achievement of self-learning and self-aware machines is critical for data distribution and management in big data environment. Research must be done in the efficient implementation of current data management technologies by adapting prognostics and health management algorithms.

- **SENSOR AND CONTROLLER NETWORK**

Sensors act as the gateway of the machine as it senses its surrounding physical environment. Yet they pass wrong and inaccurate readings to decision making algorithms due to its degradation or failure, which leads to the incorrect outputs.

- i. Indian firms have a deep challenge. Even though India has become a destination for outsourced analytics for European and North American companies, they have not utilized locally available expertise.
- ii. India also lags in promoting a strong digital culture, operational disruption from cyber security breaches and clear digital operation vision from leadership.
- iii. Currently, India (27%) drop behind the global average (33%) and Asia-Pacific (36%) in terms of level of digitization.



- iv. By analysing the current technology and its limitation and the problems associated with them some of the industries have come forward and adopted industry 4.0 technology to be a strong competitor in the global market. Industry 4.0 is the one which can take the India to its next level in its development. India should benefit from it.

### INDUSTRY 4.0 as an OPTIMAL SOLUTION for Manufacturing

Internet and mobile phones as a new transforming technology succeeded because they were followed by a societal transformation and not because they were new. Internet as a technology did not invent Social networks, but social networks formulated thanks to the Internet, and enabled it to develop further. In the same way rules of the industry players will be changed by bringing new functionalities through Industry 4.0. The development in different industries will proceed at different rates.

In the same way India needs to take few steps to ensure a manufacturing success story in Industry 4.0

- **It must improve its fledging internet of things (IOT) industry:**

As the growth of industry 4.0 is based on the growth of IOT market, it is necessary to work on seamless data integration. To create a smart Factory all heterogeneous devices, must be networked and connected in the industrial automation system through IOT. Even though Indian IOT is emerging now it is the crucial part of digital India to transform India into a digital knowledge driven economy.

- **To develop a robust data security environment:**

Practical application of smart factory is impossible without a robust security infrastructure. Security services industry must be developed to manage advanced targeted cyber-security threats and attacks and strict government rules and regulations are to be made for data security and protection.

- **Skill development**

It is the right time for the India to improve its skill in some the areas in which it has not done well so far, like advanced automation, automation bionics, industrial ICT, cognitive robots etc., and it must take care of safety related abilities as Industry 4.0 involves Human machine cooperation and engagement. An instructive approach from corporations helps India in its preparation for leadership in Industry 4.0.

### From a business perspective, Industry 4.0 supports four major tenets of operational execution:

- 1) Interoperability
- 2) Information Transparency

- 3) Actionable Insights
- 4) Automation

### These tenets in turn, support several business imperatives. These include:

- **Scalability**

Automation in the factory gives manufacturers the ability to transition personnel to more value-added activities and provides the foundation to extend and expand product and service offerings. As they look to expand globally, automation maintains process consistency across locations.

This also allows manufacturers to focus on what they do best to find and refine their sweet spot. This moves manufacturers into a more advantageous position from taking on every job to taking on those jobs the organization can do well, while achieving the best profit margins.

Cloud technology is central to Industry 4.0. It allows manufacturers to scale operations by focusing more on core competencies versus IT operations. Many small to mid-market manufacturers have limited IT staffs; they must be very strategic with IT resources. The cloud is the great IT equalizer — giving small and mid-market enterprises access to leading software capabilities, while freeing them from having to monitor and manage infrastructure. The cloud also gives manufacturers the ability to spin up computing power, providing agility to help organizations “rise to the occasion” when needed.

- **Security and Redundancy**

As digitization in the factory continues, security implications grow and a sophisticated and layered approach to security is critical. This is challenging for manufacturers who may not have the security resources in-house to adequately address this growing challenge. Again, leveraging a cloud-hosted software model can give manufacturers the ability to confidently charge forward in their Industry 4.0 initiatives.

- **Control and Visibility**

In an increasingly complex and global manufacturing enterprise, a single digital thread across all operations is needed to support responsiveness, improve collaboration, reduce risk, and streamline compliance requirements. Visibility from order entry to inventory to finished product is required to inform customers, partners and other stakeholders as to status at any time.

- **Customer Experience**

This visibility is key to provide the omni-channel order and fulfilment options that customers demand today. It’s also critical to support co-creation — the ability to collaborate with customers and suppliers. Making business processes transparent and/or open to engagement from customers and suppliers can support improved satisfaction, stronger relationships and loyalty.



### • Customization

Mass market manufacturing has given way to personalization and customization. This entails shorter production runs and the need to switch out lines more often. Manufacturers need to be able to configure and reconfigure the shop floor quickly and easily to avoid expensive machine and line downtime. Velocity is the new business currency.

Technologies such as augmented reality can help reduce lag time between design and production. 3-D printing is pivotal in this area. To date, the use case for rapid prototyping has proved to be a game changer, and other broader use cases are now coming into focus. These include 3-D printing for spares or replacement parts — providing the ability to improve responsiveness for customers at a time of need. Additionally, manufacturers also benefit from 3-D printing of replacement parts — another game-

changing value proposition when you consider all the benefits — reducing the acquisition time and cost of parts, especially for old or obsolete parts, and enabling manufacturers to implement speedy repairs that significantly reduce downtime while extending equipment shelf-life and return on investment.

### • Innovation

Crucially, manufacturers need to address whether the business systems they have in place are ready to support the journey toward Industry 4.0. Product Lifecycle Management (PLM), Enterprise Resource Planning (ERP), Manufacturing Execution Systems (MES), and Computer Aided Drafting/Computer Aided Manufacturing (CAD/CAM) all must be integrated to support the move toward increased digitization and customization.



### Broadly, advantages of Industry 4.0 can be listed as

- Leads to innovation
- Effective globalization
- Optimum utilization of resources
- Smooth product flow
- Efficient continuous real time tracking
- Efficient energy consumption
- Autonomous controlling
- Greater flexibility meeting high-level last-minute changes
- Detailed end to product transparency in real time
- Secure and reliable backup system for every step-in cloud storage

### Major challenges in Industry 4.0 are

- Training
- Type of process and work organization
- Lack of research and specialist staff
- Supplier of mechatronic system and machineries
- Strong network infrastructure
- Highly efficient cyber security
- Effective plant layout

### CONCLUSION

India is a population of 1.2 billion people and its resources are stretched to say the least. However, India must rework the way it has historically dealt with issues; the world around it is changing. As we



discussed earlier fourth industrial revolution is on its way to occupy the world and likely provides large opportunities. Through Industry 4.0 it is feasible to create prolonged ecosystem with qualified employees and to bear on India's edge in manufacturing and can orchestrate to large scale customization. Although it is very tough to manage the process centrally, if players in the system apply right levers there will be reinforced effects. Thus, it is imperative to communicate the ideas that players in government and corporate sector will profit most, if an initiative of Industry 4.0 goes together. By adopting Industry 4.0, we will have a major competitive advantage over global competitors in economy. But first and foremost, we need to have the essence of speed to capture this opportunity and to achieve our goal.

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