



Industry 5.0: A Paradigm Shift Towards Human-Centric Industrial Revolution

Dr. Namrata Prakash Associate Professor, School of Management Graphic Era University Dehradun.

Dr. Suruchi Sharma Associate Professor, School of Management Graphic Era University Dehradun.

Mr. Monu Bhardwaj Research Scholar, School of Management Graphic Era University Dehradun.

Mukherji R. K. Associate Professor, Graphic Era deemed to be University, E-Mail- rkmmukh@gmail.com, ORCHID: <https://orcid.org/0000-0001-8163-4512>

Introduction

"Industry 5.0" refers to a society where humans work alongside automated objects and artificial intelligence tools. Automated machines may assist individuals in working more swiftly and effectively by employing cutting-edge tools such as the Internet related Objects and big data. This adds a more personal touch to the productivity and efficiency cornerstones of Industry 4.0.

Robots have traditionally performed dangerous, monotonous, or physically demanding activities in industrial settings, such as welding and painting in car factories and loading and unloading large objects in warehouses. The goal of Industry 5.0 is to connect the cognitive computing capacities of office equipment with human intelligence and inventiveness in coordinated activities as they grow smarter and more networked.

As the first firm to provide industrial robots that can safely and productively coexist with people at the workplace, Universal Robots of Denmark asserted its claim. The firm's robots were initially used along with hominoid employees in 2008 at Linatex, a provider of specialist polymers and rubber for manufacturing uses. Traditionally, industrial robots have functioned apart from people and behind safety cages. (1) There are limitless prospects in production when human and mechanical labour are combined. And because Industry 5.0's use cases are still in their absolute infancy; producers ought to be vigorously considering how to combine human and mechanical labour in command to optimise the distinctive advantages that may be gained as the undertaking stays to develop.

What is Industry 5.0?

Industry 5.0 is mostly focused on how to incorporate human employees into these systems in the automated industrial environments of the future, where people will cohabit alongside robots and IoT gadgets. Industry 5.0 is more concerned with the impact on people and how cutting-edge technologies, such as IoT and Big Data, can be used to improve human work and capabilities. This is in contrast to Industry 4.0, which was primarily focused on using robots and intelligent machines for maximum efficiency and high performance in manufacturing.

How the Industry 5.0 concepts emerged

Learning about Industry 5.0's origins and principles may be a bit difficult. Especially taking into account how it regularly crosses over with Industries 4.0, both in terms of technology and applications as well as in terms of time.

Naturally, Industry 4.0 is years away, but only for a brief period of time. The term "Industry 4.0" is widely acknowledged to have gained popularity when the vision for the Fourth Industrialization was announced at the Munich Messe trade event in German in 2011. Of course, the original Agile manufacturing idea was also primarily developed for the German smart manufacturing and industrial automation industries, as well as for other countries that are European Union members and are beholden to European law. Automation was originally considered to have a significant impact on European corporate culture and laws, despite the fact that it spread fast to other parts of the world.

On the other hand, Industry 5.0 started off with a more widespread and worldwide reputation. But this idea also has German roots, according to research. Japan offered all its forecast for the use of robotics, technology, and smart factories at the CeBIT 2017 trade show in Hannover. It used to be known as Society 5.0. According to reports, the idea of Industry 5.0 was inspired by a Japanese vision. It is an advancement of the original idea in which people play a more significant part in providing economic value alongside robots.

Another significant aspect that contributed significantly to the growing acceptance of Manufacturing 5.0 as a original technological trend is the recent experience of the worldwide COVID-19 outbreak and the economic turmoil connected to it. Former to and through the COVID-19 emergency, businesses who were implementing Industry 4.0 solutions and practises generated a vast amount of fresh data that shined light on many flaws in this idea and exposed areas that obviously needed reform.

Characteristics of Industry 5.0

Three main pillars serve as the foundation for the evolution and expansion strategy espoused by Industry 5.0:

- **Sustainability.** One of the needs laid forward by Industry 5.0 is the development of manufacturing systems based on renewable energy sources. According to the European Commission's assessment, the industry must be sustainable in order to respect the planet's output limitations and cut carbon emissions by 55 percent by 2030. Thus, it advises the use of circular processes that decrease waste, maximize environmental protection, and reuse and recycle natural resources.
- **Human-centricity.** Humans are at the core of the manufacturing model according to Industry 5.0. The basic idea is simple: the inquiry should be, "What can technology do for us?" rather than, "What can we accomplish with new technologies?" The use of technology is ensured to not violate employees' fundamental rights. Thanks to this more socioeconomic and human-centric approach, we can now protect rights like the freedom to privacy, autonomy, and humanity.
- **Resilience.** The Covid-19 epidemic has made resilience a crucial component of the fight. The research from the European Commission demonstrates how vulnerable our businesses are to geopolitical shifts and ecological disasters like the Covid-19 epidemic. As a result, in Industry 5.0, being able to react appropriately to difficult situations and produce positive results is essential.



The goal of Industry 5.0 is to successfully navigate changes and difficulties by adopting a justifiable, human-centered, and robust strategy.

Technologies in Industry 5.0

Six main areas have been identified by the European Commission as part of its technology framework as catalysts for Industry 5.0:

- 1) Customized human-machine communication.
- 2) Intelligent materials and bio-inspired technology.
- 3) Simulation and digital twins.
- 4) Technologies for data transport, storage, and analysis.
- 5) Computerized intelligence (AI).
- 6) Energy-saving, renewable energy, storage, and self-sufficient technologies.

In order to move closer to the objectives of Industry 5.0, this technology framework must be a tactical ally. For instance, predictive analytics provides instruments to strengthen the sector's resilience in order to foresee potential contingencies, such as catastrophic weather disasters or shifts in demand. Cobots, or collaborative robots, are being used increasingly often in manufacturing facilities and warehouses to work alongside humans and relieve them of the most difficult, dangerous, or monotonous duties. This is exciting since the development of cobots demonstrates the possibility of a technology paradigm in which robots and people collaborate and share tasks.

Industry 5.0: a change of paradigm

Industry 5.0 vs. Industry 4.0.

Therefore, Industry 5.0 is gaining popularity as a post-pandemic goal for the future of industrial automation. In this future, technology such as robots, smart machines, the Internet of Things, artificial intelligence, and big data will still be crucial for business success, but a greater emphasis will be placed on self sufficiency, adaptability, and the cultivation of human skill, all of which will be aided by technology that is becoming more perceptive and efficient.

As you can clearly see, Business 5.0 and Ir 4.0 are rather similar. The differences between them and what the Industry 5.0 movement is contributing to the issue are probably not immediately apparent.

Comparing these two technical ideas to one another is the most effective approach to make this clear.

Industry 4.0 — the rule of robots

The World Economic Forum's founder and German engineer, Klaus Schwab, is credited with coining the phrase "Industry 4.0." It alludes to abrupt changes in business practises, methods, and technologies that are fueled by the use of cutting-edge technology innovations.

The widespread adoption of specific automation technologies, such as robots, smart automation and connectivity techniques, humongous device to device information exchange , the Web of Things (IoT), and artificial intelligence, is primarily what Schwab refers to as the transition to Industry 4.0, which he sees as a significant change in industrial capitalism (AI).

- The Industry 4.0 idea is centred around these technical advancements as well as certain methods and strategies for putting them into practise. They are seen as the foundation for the tremendous rise in productivity and efficiency that this new generation of industrial automation technologies is supposed to bring about.
- For greater clarity, let's attempt to condense the Industry 4.0 vision into a handful of succinct sentences.
- Multinational manufacturing and logistics facilities owned by large corporations are increasingly using fully automated industrial machinery and robotic technologies.
- Collaborative robots, also known as cobots, are industrial tools that are more compact, more accessible, and easier to use in small and medium-sized organisations.
- Instead of using human labour to do the bulk of repetitive, boring, and hazardous jobs, shrewd technologies and computerization solutions are used.
- The use of a new generation of industrial robots enhances production line efficiency and product quality consistency, enabling businesses to produce high-quality goods at cheaper prices.
- Connected robots, IoT devices, and industrial automation systems continuously produce significant amounts of data regarding production line flows, manufacturing processes, and labour processes.
- An AI-based solution may then evaluate the acquired data to derive knowledge and business insights for further industrial environment and manufacturing process optimization.

- Higher product diversification is made possible by modern robots' increased flexibility and smart production technologies, which also expand the range of accessible consumer goods.
- The incorporation of adaptable automation technologies results in "mass customization," or giving customers a wider range of pre-configured alternatives at a reduced cost of production.
- Many manufacturing jobs are moving to countries with source of labor because industrial automation facilities and robotic technology may be used everywhere in the world.
- Human employees are whichever expected to keep up with the machines or are being replaced by them, doing a growing range of activities in settings that are highly optimised for maximum productivity.

It shouldn't be too challenging to understand why some elements of the Industry 4.0 idea were viewed by many as being somewhat defective, lacking, and in need of development.

This is largely the reason why the idea of Industry 5.0 began to catch on.

The initiative's three main components are as follows:

1. The goal of Industry 5.0 is to assist humans, not replace them.

Need not think that the advancement of robots will allow us to reduce the number of employees and replace people on production lines who do monotonous, repetitive jobs. Organizations with a successful track record respect human perception and conflict mitigation skills. According to Case Western Reserve University economist Susan Helper, "people generally view of manufacturing workers as being a bad option for a robot." The New York Times was told by Susan Helper. However, in practice, these issues are quite difficult, and the assembly line worker typically makes assumptions. You have some difficult problems to solve without that person, it turns out.

Tesla CEO Elon Musk said that "excessive automation" was a mistake for his business and that "Humans are underestimated."

Robots are far steadier than people and well at doing specific effort, but they nonexistence human characteristics like adaptability and the capacity for critical thought. Working with humans, robots can realize their original goal of helping us and ugly our subsists. Universal Robots refers to collaborative robots as "cobots" to emphasized the standing of indivual in robotic expertise.

The chief technical officer and co-founder of Universal Robots, Esben stergaard, claims that "Industry 5.0 will make the factory a place where creative individuals can come and work, to create a more customized and human experience for workers and their consumers." (4)

2. Industry 5.0 focuses on achieving the ideal harmony between production and efficiency.

The objective of Industry 4.0 is to increase concert by integrating devices, procedures, and systems. In Industry 5.0, efficiency and production both advance one step. Collaborative relationships among people and robotics are being improved. In industrial settings, workers "realized that the robots relieved them of physically difficult labor and allowed them to focus on other things." At this point, technique and robots work well calm." "Industry 5.0 acknowledges that man and machine must be integrated to meet the production complexity of the future in dealing with rising personalization through an efficient robotized manufacturing process," said Marc Beulque, vice president of global procedures at Rogers.

3. The development of Companies 5.0 is unavoidable.

Later utilising expertise to rise the efficiency of a progression, there is no benefit to relapsing to the old path of doing things. As a result, we now utilise computers with word processing software instead of typewriters. In a similar vein, Industry 5.0 heralds the conclusion of the manufacturing age. Given the efficiencies that may be attained, there is no purpose in going back.

The easiest way to put it is that the spread of robotic automation is inevitable, according to the European Economic Social Committee (EESC).

The European Union (EU) advisory council has advocated for a speeding up of the field's robotics and artificial intelligence research, recognising that Europe trails below the US and China in the advancement of innovations like those (AI). Automatization should be fully embraced by the EU for the advantage of consumers, companies, and workers. Even if Industry 5.0's developments cannot be stopped, companies and their judges must nevertheless deal with a number of crucial issues and implications. For example, the researchers of a study that was originally featured in OMICS have articulated alarm around the problem of too much mechanization. They appear to share the worries of business people like Musk, whose previous hostile attitudes to technology have since eased.

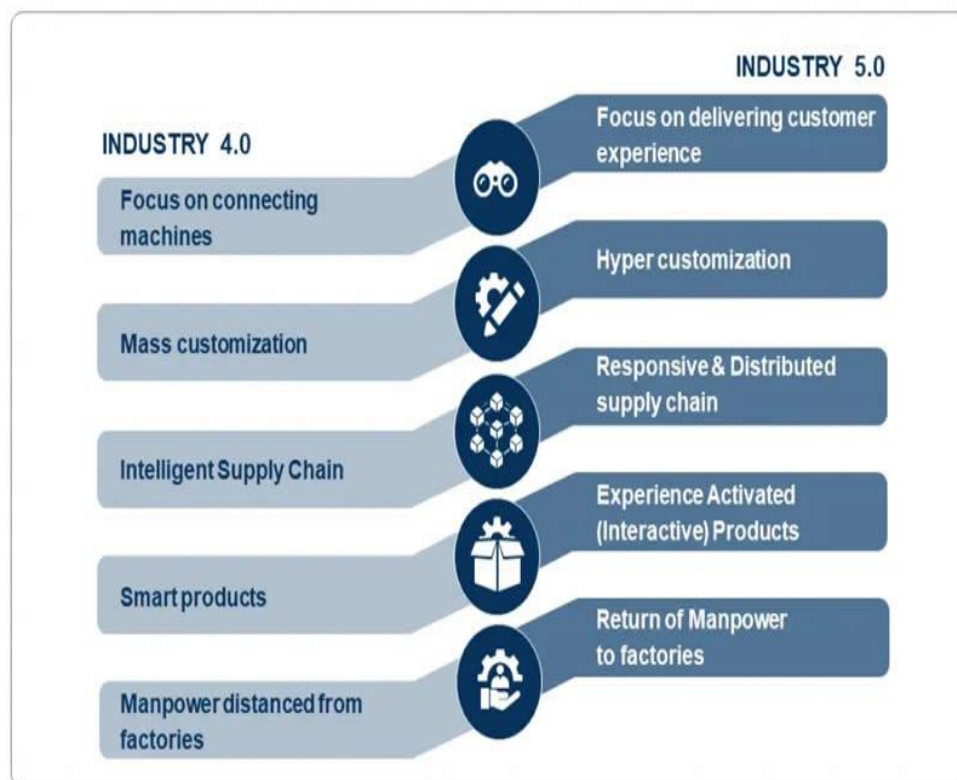
The paper claims that "highly coupled systems are susceptible to systemic dangers such as full network failure." Extreme connectivity generates novel social and political structures. Unless they are regulated, they may prime to strict governance.

To deal with these and the frequent other possibilities and challenges that companies 5.0 undoubtedly provides, preparation and planning in line with each manufacturer's needs and planned outcomes will be required. The question is not whether a business can benefit from having people work alongside machines, but rather how to best leverage leading-edge expertise to take full advantage of the potential of human/machine connections.

Companies 5.0 is still in its infancy, which means we're still heavily focused on enhancing and optimising Industry 4.0 through the usage of readily available technology. The Fifth Industrial Revolution seeks to move industry toward one that is more human-centric, resilient, and sustainable.

Workers, businesses, and the environment all gain from industry 5.0. This paradigm change we're going through isn't just about productivity and efficiency; it's also about making sure that production values employees and the environment. According to Frost & Sullivan, there is a comparison between industries 4.0 and 5.0. -link to source and a lot more

Highlights of Industry 5.0 compared to Industry 4.0



FROST & SULLIVAN

According to Frost & Sullivan, industry 4.0 and industry 5.0 are contrasted - source and much more here

Industry 5.0 is a priority for the EU since it sees it as a complement to Industry 4.0. The phrase was "created" for about the same reasons by the research and consulting companies and industry professionals who began discussing the need for an Industry 5.0 (see elsewhere).

Prerequisites of Industry 5.0?

Trained personnel

The Chief Robotics Officer position was created by Factory 5.0. This individual has expertise of areas like robotics and artificial intelligence and specialises in the interface between machines and operators. Making judgments in light of these considerations is part of his job description.

With the growth of virtual education, staff training will also advance significantly. As a result, businesses may operate more cheaply as there is no need to halt production in order to train their staff. Additionally, this results in safer training that shields workers from unneeded dangers during training. The resultant interactive learning environments also increase staff motivation and communication.

It is also anticipated that a wide range of career opportunities connected to the interaction with robotic systems and artificial intelligence would emerge.

A suitable technique

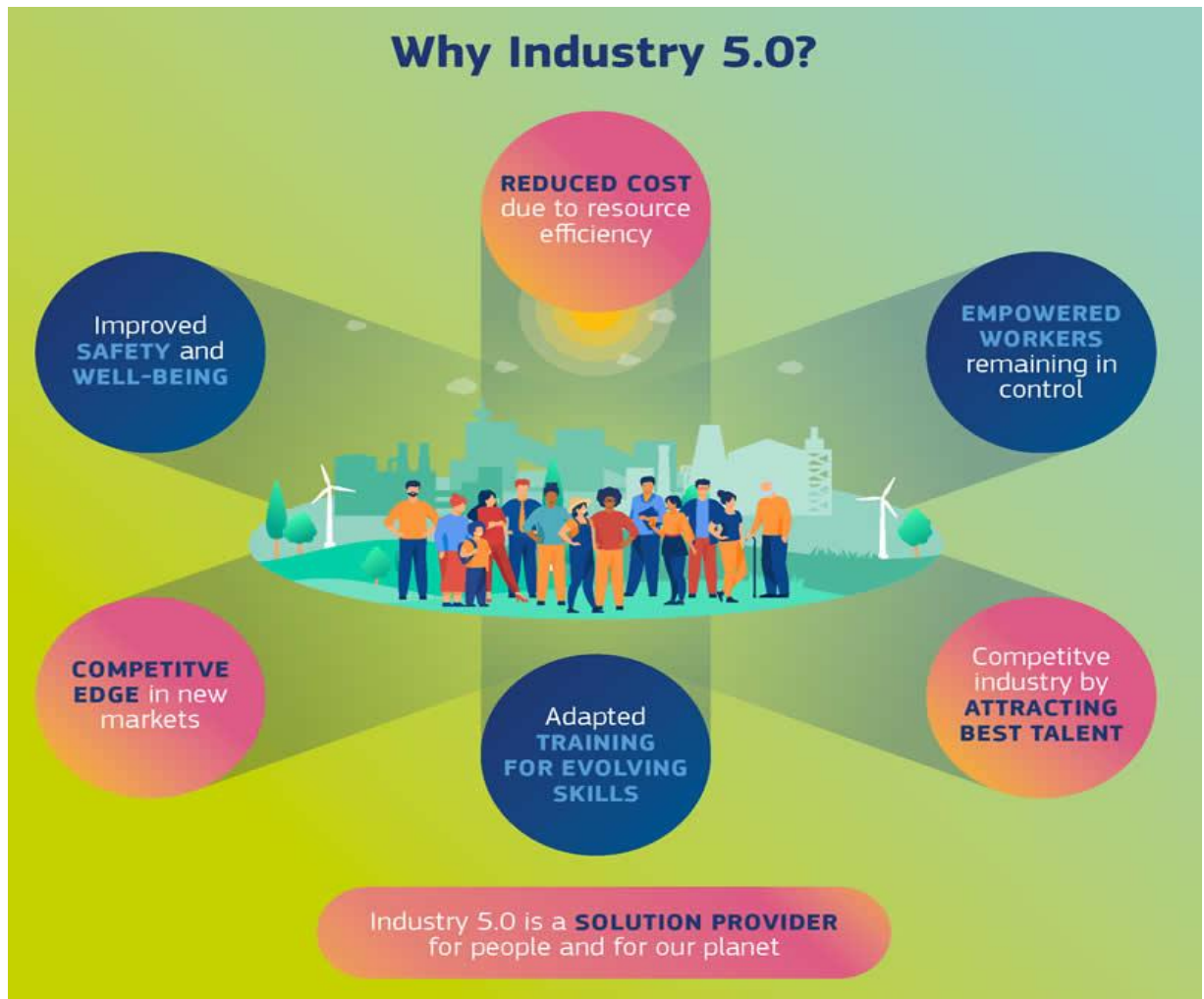
Cobots, or collaborative robots, are a concept associated with Industry 5.0 that are created for easy and intuitive human interaction.

This technology considers humans in procedures like plant safety and objectives. They function almost like apprentices, able to see human behaviour and mimic it while assisting operators.

Factory 5.0 will also need the expansion of Digital Twins, which is another essential technology. These are visual representations of a process or product, and their creation enables improved comprehension and testing.

Additionally, the emergence of increasingly sophisticated processes will necessitate the adoption of appropriate software that can manage this enormous quantity of data and give human operators a place to engage with machines.

Why industry5.0?



Final words An industry revolution is typically sparked by game-changing technical advancements that have altered industries in fundamental ways. Economic and societal repercussions result from these shifts. Some are desired and intentional, while others are unwanted and unplanned. Industry 4.0 is technology-driven, much like its predecessors. However, value is what drives Industry 5.0. The former needs the latter to remind them of the crucial societal demands, values, and responsibilities as their ultimate aims, and the later needs the former for the technological pushes and answers. The proliferation of buzzwords like "Industry 4.0+," "Industry 4.5," and even "Industry 6.0" and "Industry 7.0" in the not-too-distant future should be taken into consideration. These buzzwords could be appealing for writing academic papers or grant proposals, but they are not encouraging for making commercial decisions or overcoming technology obstacles. Cool heads and sage minds are needed to do this. As we owe the industry a clear vision for the future, it is our hope that this piece will ignite and inspire deeper, lengthy, and in-depth conversation around these themes.

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