INDUSTRY 5.0:
HUMANIZING
INDUSTRIAL REVOLUTION

INDUSTRY 4.0 IS STILL RELATIVELY NEW. BUT MANY TECHNOLOGISTS ARE BEGINNING TO SPECULATE UPON WHAT IS TO COME WITH THE NEXT INDUSTRIAL REVOLUTION—INDUSTRY 5.0 AND THE ROLE HUMANS WILL PLAY IN AUTOMATED MANUFACTURING.

BY SUJATHA VISHNURAJ

"Industry 5.0 makes use of innovative and smarter devices, systems, automation, and materials. This involves big data, collaborative robots, smart sensors, IoT, IoE, emerging artificial intelligence, multi-agent systems and technologies, complex adaptive systems, etc. Software applications will remain to be the basis for improving user experiences, implementing new technologies, and achieving digital manufacturing."
— Arun Krishnamurthi, CEO & MD, AXISCADES Technologies Ltd.

INDUSTRY 4.0 CELEBRATED TEN YEARS OF existence in 2021. The term was first coined during the Hannover Trade Fair in 2011 by Bosch. For the past ten years, Industry 4.0 has proved its benefits and its shortcomings. While the smart factories brought increased productivity, the 4th industrial revolution also came with limitations.

Industrial production has been hallmarked using phase categorisation since the 1st industrial revolution that occurred in the 19th century. Industry 1.0 marked a shift from the handicraft economy to machinery and impacted the industries such as mining, textile, agriculture, glass, and others. The 2nd industrial revolution known as the technological revolution came about shortly after the first and is set apart by the introduction of electricity. Industry 3.0 is termed the digital revolution, started in the 70s in the 20th century through the automation of memory-programmable controls plus computers. The central point of this particular phase is mass production and the use of digital logic, integrated circuit chips; derived technologies included computers, digital cellular phones, and the internet.

Industry 4.0—the present, originated as a high-tech strategy in order to promote computerisation, efficiency gains through automation and all-around technological advancement. It was quickly adopted by industry leaders throughout the world. Industry 4.0 is a union among the physical assets and advanced technologies such as AI, IoT, robots, 3D printing, cloud computing, etc. The organisations that adopted 4.0 are flexible and prepared for data-driven decisions.

What is wrong with Industry 4.0? Is it still relevant?

Elon Musk recently tweeted that "humans are underrated", and that heavy automation didn't have the results he expected in Tesla's gigafactory. Now isn't that a great example of what's wrong with digital transformation and smart factories?
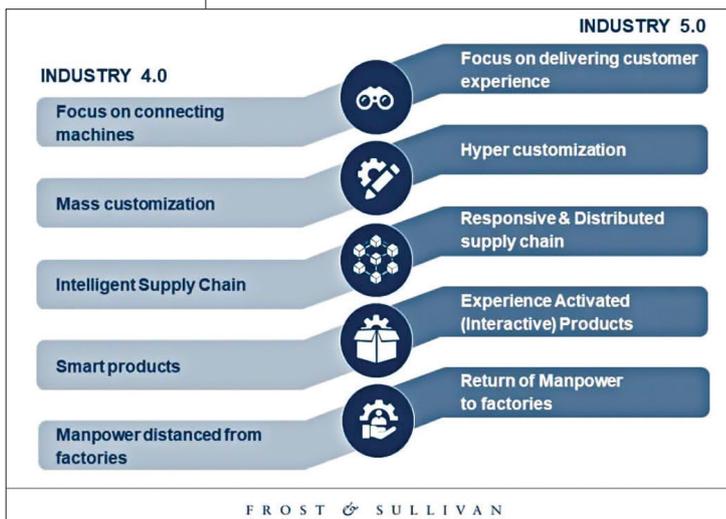
Industry 4.0 provided manufacturers with a plan for further automation, digitisation, and cost of service reduction. While many benefits have been already realised, some technologists have pointed out the drawbacks that are now starting to become apparent. While Industry 4.0 is incredibly optimised to large-scale mass production, it is not well-suited to the issue of customised products and low-run manufacturing. Another concern with Industry 4.0 is that the ethical and social ramifications of such large-scale automation are not often considered.

The term Industry 5.0 popped up several years ago as a reaction to the vision of Industry 4.0. It was driven by the impact of the pandemic, focus on topics such as sustainability and resilience and the call for people centric technologies. Industry 5.0 shifts the focus from the shareholder value to stakeholder value and reinforces the role and the contribution of industry to society.

A combination of IoT, cloud computing, and big data analytics promised higher productivity, predictive maintenance, and end-to-end process automation for all industrial operators. And while these benefits are appearing in fits and starts, we have yet to introduce a holistic reimagining of processes and systems – the ultimate promise of Industry 4.0. Arun Krishnamurthi, CEO & MD, AXISCADES Technologies Ltd says, "Industry 4.0 mandates the necessity for personnel with digital proficiency, which could result in the exclusion of many skilled individuals who don't necessarily have that dexterity." The IoT solutions remained siloed, monolithic, each trapped in its own narrow area of functionality.

"It also raises the issue of data privacy; in order to successfully implement an AI system, data is needed to train and test it. The data needs to be shared for this to happen and many businesses are hesitant to give third-party developers access to their data. Moreover, when various machines and devices are connected to one or more networks in a smart factory, flaws in any one of those pieces of equipment could make the whole system vulnerable to attack. Most companies are not prepared to deal with these kinds of security threats," Arun adds.

According to MIT's "The Work of the Future" study, which ran from 2018-2021, Industry "four-point-0" is not just about robotics. Robotics is a relatively minor feature of contemporary factory work. There seems to be a number of different causes for many failures of Industry4.0. Often Industry 4.0 is done not to solve a problem, but merely to do Industry 4.0. Another problem is that the complexity of Industry 4.0 is often underestimated, and due to the fundamental differences in different factories with different products, it is hard to scale the system. Industrial tech has become too complex, and industry 4.0 will soon

INDUSTRY 5.0

INDUSTRY 4.0

- Focus on connecting machines
- Mass customization
- Intelligent Supply Chain
- Smart products
- Manpower distanced from factories

- Focus on delivering customer experience
- Hyper customization
- Responsive & Distributed supply chain
- Experience Activated (Interactive) Products
- Return of Manpower to factories

FROST & SULLIVAN

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lose relevance without providing the value expected.

Rajesh Nath, Managing Director, VDMA says, "It would perhaps not be correct to say that anything was 'wrong' with Industry 4.0, but Industry 5.0 adds the 'person' touch to Industry 4.0. It is perhaps a further development or evolution of Industry 4.0. In fact we are looking to move from 'mass customisation' which was the centre theme at Industry 4.0 to 'mass personalisation' which is crux of Industry 5.0."

INDUSTRIAL REVOLUTION WITH A SOUL: INDUSTRY 5.0

Arun explains, "The idea of Industry 5.0 is primarily concerned with integrating people & human intellect into the automated industrial environments of the future, working alongside robots and IoT devices. Industry 5.0 is focused on the human impact and how futuristic technologies, can be used to enhance human work and capabilities, in contrast to Industry 4.0, which is about utilising robots and smart machines for maximum efficiency and high performance in manufacturing." He continues, "You could say that Industry 4.0 is concerned with sales maximisation freeing humans from repetitive and routine tasks whereas industry 5.0 is about creating value by allowing humans to implement their ideas to develop personalised products and solutions."

Industry 5.0 is the upcoming technology of the previous generation designed for efficient and intelligent machines. The revolution of industry 5.0 means that humans and machines are working together, improving the efficiency of industrial production. In order to adopt industry 5.0 for the companies, proper interaction is required among the machines as well as operators. Knowledge in the fields like robotics as well as artificial intelligence will form the basis for making decisions around the advanced factors.

Sougnadh K.M, Country Manager of India, Universal Robots shares, "Collaborative automation offers companies a competitive advantage through higher and more consistent product quality, greater

output and lower overall costs. This places companies in a position to hire more human employees, creating more jobs."

Industry 5.0 was first introduced as a conceptual counter to all of the downsides of Industry 4.0 via a LinkedIn article written by Michael Rada. This article pointed out that the capability of total automation presented by Industry 4.0 must be controlled, otherwise the technology will eventually only serve a select few instead of advancing all of humanity. While still in its infancy, Industry 5.0 already has several different aspects and serves to provide a plan for the further advancement of technology that does not leave humans behind.

Arun cautions, "Only a small number of forward-thinking businesses that may have already succeeded in implementing Industry 4.0 across their businesses/

"There is an increased safety of the employees because for example Collaborative Robots (COBOTs) can take up hazardous and dangerous works. It also looks into more personalised products and services increase customer satisfaction, loyalty and attracts new customers which results in increased profit and market share for the companies."
— Rajesh Nath, Managing Director, VDMA

1. Industry 5.0 already has several different aspects and serves to provide a plan for the further advancement of technology that does not leave humans behind.

Source & courtesy infographic EU

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manufacturing will be able to implement Industry 5.0, since a significant number of businesses worldwide, across various sectors, are still on the verge of entering or implementing Industry 4.0 solutions."

Sougnadh says, "Industry 5.0 is crucial for challenging the idea that total automation is the optimum approach. On the shop floor, robotic automation undoubtedly improves uniformity and productivity, but in real time, things can be very challenging. On factory floors, human judgement is frequently needed because robots are rigid, incapable of critical thought, and non-adaptive."

Industry 5.0 seeks to solve concerns on an overly-pervasive IoT and AI technological world by stressing the importance of a human touch for mass personalization and using cobots instead of full-automation. Using technology in this way is more in line with the intention of an invention, something that is meant to serve people.

Cobots are being designed for intuitive interaction

with humans. A cobot's AI model could be trained to anticipate the human worker's next action, which is far more feasible for the general factory setting. In this way, robotic technology exists to increase human productivity, not replace it. As Industry 5.0 is still in its very early stages of development, there is still plenty of room for improvement.

KEY COMPONENTS OF INDUSTRY 5.0

The idea of Industry 5.0 is not limited to 'industry'. It applies to every sector and every organisation one can think of. Industry 5.0 has three key pillars: human-centric, resilient and sustainable.
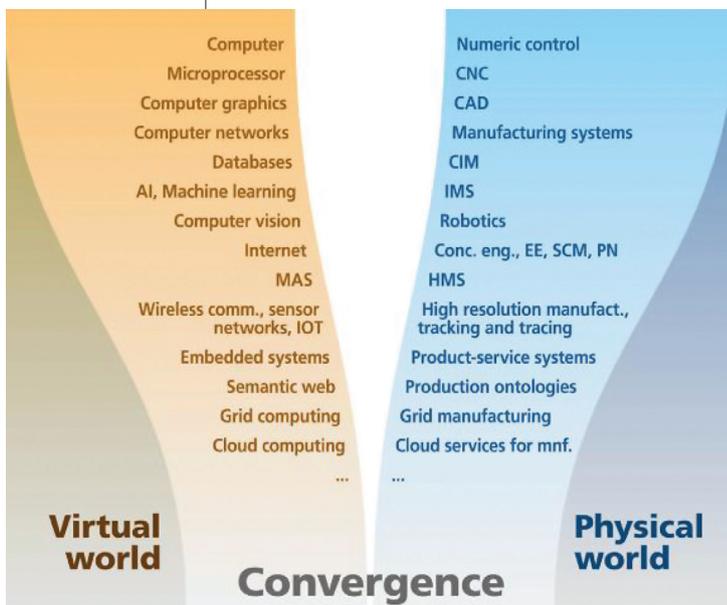
Rajesh explains, "The new phase of industrialisation or Industry 5.0 constitutes humans working alongside advanced technologies and AI-powered robots to enhance processes within the workplace. At its heart, Industry 5.0 reflects a shift from a focus on economic value to a focus on societal value, and a shift in focus from welfare to wellbeing."

Human-centric strategy: A human-centric strategy is one that "promotes talents, diversity and empowerment." The most importantly a shift in perspective from people serving organisations, to organisations serving people. Sougnadh clarifies, "On the shop floor, robotic automation undoubtedly improves uniformity and productivity, but in real time, things can be very challenging. On factory floors, human judgement is frequently needed because robots are rigid, incapable of critical thought, and non-adaptive."

If organisations become truly human-centric, though, the first implication for strategy is that it needs to be about gaining a competitive advantage and using it to create unique added value for employees.

Resilient Strategy: Business today is largely driven by efficiency and optimising profits, not resilience. If resilience will truly become one of the three pillars of Industry 5.0, the primary focus of organisations will no longer be growth, profit and efficiency. But will be on creating organisations that are 'anti-fragile,' meaning

Virtual world	Physical world
Computer	Numeric control
Microprocessor	CNC
Computer graphics	CAD
Computer networks	Manufacturing systems
Databases	CIM
AI, Machine learning	IMS
Computer vision	Robotics
Internet	Conc. eng., EE, SCM, PN
MAS	HMS
Wireless comm., sensor networks, IOT	High resolution manufact., tracking and tracing
Embedded systems	Product-service systems
Semantic web	Production ontologies
Grid computing	Grid manufacturing
Cloud computing	Cloud services for mnf.
...	...

Convergence

that they are able to anticipate, react and learn timely and systematically from any crisis and thereby ensure stable and sustainable performance.

Sustainable Strategy: With widely-shared concerns about climate change, the notion of sustainability barely needs an introduction. Fully embracing sustainability in a company's strategy, though, implies much more than what's currently been done. Strategy in Industry 5.0 means that companies are becoming part of the solution, rather than part of the problem.

HOW INDUSTRY 5.0 FITS IN

With Industry 5.0, many people wanted to bring the human, social, and environmental dimensions back into the equation. They felt this wasn't the case in Industry 4.0 and initially mainly focused on the human touch.

A quote from the 2019 article of Frost & Sullivan says, "Industry 4.0 relies heavily on automation and has been intimidating workers on factory shop floors. They spoke about envisioning a futuristic scenario of the next big thing — Industry 5.0, which will bring back empowered humans to the shop floor."

The International Society of Automation also wrote about it, with a focus on cobots, which said, "By placing humans back at the centre of industrial production, Industry 5.0 gives consumers the products they want and gives workers jobs that are more meaningful."

Rajesh resonates with that sentiment, saying, "Industry 5.0 promises increased automation impacting employment positively in many sectors through the deployment of next-generation technology. It gives us a more solution-oriented address incorporating improvements by introducing highly automated manufacturing systems to provide greater opportunity for personalisation to customers and the optimisation of human efficiency. Industry 5.0 provides increased importance to the human-machine interaction subject field and offers a larger platform for research and development in this domain. In industry 5.0, the operator within the production cell gets more engaged in the planning method than in the more or less automated manufacturing method. It allows liberty of design to function and allows more tailor-made and personal products."

So, in summation, Industry 5.0, as we know it now, brings in this 'human' touch and several topics that receive much attention nowadays — the place of people in a future of work with more human-machine

Industry 5.0 ...

HUMAN-CENTRIC
... promotes talents, diversity and empowerment

RESILIENT
... is agile and resilient with flexible and adaptable technologies

SUSTAINABLE
... leads action on sustainability and respects planetary boundaries

collaboration, human-centric solutions, and, well, also some technical matters.

IS THE INDIAN MANUFACTURING SECTOR READY FOR COBOTS?

Sougnadh summarizes the response to pertinent question very simply, "India has a surplus of labour, and the manufacturing sector is labour-intensive. For Indian industrial enterprises, automation has been a constant challenge. Due to numerous concerns, including significant investment, safety considerations, specialist staff or operators, and specialised workplace environments, there has been a lot of pushback, particularly in the case of SMEs. All of these problems have been resolved by technological improvements, and automation is now commonly used in both small and large businesses. Increased automation in India has also been made possible by the terrible pandemic. In a way, the covid-19 dilemma compelled producers to choose cobots in order to keep up with rising consumer demand and accomplish their objectives. Due to the variety of benefits that cobots offer, the new approach to automation through cobots has been particularly advantageous for manufacturers. Additionally, the introduction of Industry 4.0 and numerous government-led programmes have been crucial in the adoption of cobots throughout the nation." MT

References:
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• Science Direct
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