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AN OVERVIEW ON THE FUTURE OF INDUSTRY 5.0

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Abstract

There are two different worlds when it comes to manufacturing and business. The first is the corporate world which focuses on profits, progress, and productivity. The second world gives more significance to sustainability, resilience, flexibility, and growth. The ideal situation would be the intersection of both of these worlds. This, in other words, is the ideology behind Industry 5.0, or the fifth industrial revolution. Industry 4.0 or the fourth industrial revolution has been in operation for the past ten years. The theme of Industry 4.0 is "Smart Manufacturing for the future". Industry 4.0 emerged with the arrival of automation technology, Big Data, and the Internet of Things (IoT). However, Industry 5.0 takes the next step, which involves collaboration between increasingly powerful and accurate machinery and the unique creative potential of the human mind. An important distinction here from the approach of Industry 4.0 as described by the European Union, is that "it places the wellbeing of the worker at the centre of the production process and uses new technologies to provide prosperity beyond jobs and growth while respecting the production limits of the planet." In other words, Industry 5.0, at its heart, reflects a shift from a focus on economic value to a focus on societal value and a shift in focus from welfare to wellbeing. This idea is not new. It has already been introduced through concepts like Corporate Social Responsibility and the Triple Bottom Line. However, putting people and the planet along with profits in the very definition of Industry is quite new. This paper discusses the opportunities as well as the future potential of this new phase of industrialization in the Post-COVID era.

Keywords: Industry 4.0, Industry 5.0, COVID-19, Industrial Internet of Things (IIoT).

Introduction

Every time a new source of energy is discovered, we move from one phase of industrialization to the next one. Since the first industrial revolution, human beings have understood the potential of applying technology to improve progress. Steam machinery, assembly lines and computing are some of the advancements that have taken place in the last few centuries, all of them with the sight of generating increasingly powerful technology. A strong necessity to increase productivity without focusing on human workers is imposing punishing challenges on the global economy. Industry 5.0 is an evolution of the fourth revolution which changes this paradigm. It lessens the emphasis on technology and assumes that the true potential for progress lies in the collaboration between humans and robots. The concept of Industry 5.0 has been introduced where robots are intertwined with the human brain and collaborate with them in work.

Prior to the advent of the Industrial Revolution, traditional methods were employed for production, which may have been more efficient for large-scale manufacturing. However, with the introduction of steam power and mechanized systems, the First Industrial Revolution emerged, leading to

an eightfold increase in production. The Second Industrial Revolution followed with the birth of the motor and engine, marked by advancements in mechanical, electric and electronic devices within the industry. A significant milestone during this period was Frederick Taylor's publication of "The Principles of Scientific Management". The slowdown of industrialization and technological advancement pushed for this revolution. The Third Industrial Revolution, also known as the digital revolution, commenced with the implementation of partial automation in manufacturing and production, resulting in enhanced reliability and efficiency. Computer numerical control (CNC) was introduced (1952) as a semi-automatic software solution, streamlining the machining of parts and improving production volumes. To modernize Industry 3.0, substantial resources and optimization of existing solutions were required, giving rise to Industry 4.0. Industry 4.0 integrated manufacturing systems with Information and Communication Technology, enabling process automation and real-time data analysis for improved decision-making.

Industry 4.0 introduced several transformative technologies, including additive manufacturing, artificial intelligence, augmented reality, block chain, and cyber security. It addressed challenges such as demand fluctuations and market volatility. The interconnectedness of computers, materials, and AI minimized the need for human intervention in decision-making, characterizing Industry 4.0. The need for an Industrial Revolution arose from the necessity to convert conventional machines into self-learning systems capable of improving performance, maintenance, and management through interactions with their environment. The "Internet of Things (IoT)" facilitated cyber-physical communication between interconnected systems using standardized protocols. Industry 4.0 also facilitated the implementation of digital food traceability, enhancing food safety and information accessibility. During the COVID-19 pandemic, Industry 4.0 provided digital solutions to critical issues and established synergies between the physical, digital, and biological domains.

Industry 5.0 represents the convergence of human intelligence with the precision and efficiency of machine-driven processes, particularly leveraging AI in industrial production. It emerged as a response to the challenges faced by Industry 4.0, emphasizing human-centric approaches and addressing societal needs. Industry 5.0 aims to bridge the gap between manufacturing and the requirements of society. Achieving the goals of the Fifth Industrial Revolution necessitates the implementation of advanced systems such as Network Sensor Data Interoperability, smart homes, and collaborative robots (Cobots). Collaborative robots enable operators to enhance their speed and accuracy in performing tasks. Industry 5.0 places humans at the core of manufacturing and industrial production, offering workers more fulfilling and meaningful roles.

Industry 5.0 endeavours to revive the role of human workers in factories by promoting collaboration between humans and machines. This collaboration aims to enhance process efficiency by harnessing human brainpower and creativity through integration with intelligent systems. Waste management through Industry up cycling is a key objective of Industry 5.0. It builds upon the foundations of Industry 4.0 while incorporating new features such as Smart Additive Manufacturing, Predictive Maintenance, Hyper Customization in the industry, Cyber-Physical Cognitive systems, and the introduction of Collaborative Robots.

Society 5.0

Society 5.0 is a “Human-Centered Society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space.” Society 5.0 was proposed by the Japan Cabinet to balance economic advancement with the resolution of social problems in Japanese society. In Society 5.0, a huge amount of information from sensors in physical space is accumulated in cyberspace. In cyberspace, this big data is analyzed by artificial intelligence (AI), and the analysis results are fed back to humans in physical space in various forms. Social reform (innovation) in Society 5.0 will achieve a forward-looking society that breaks down the existing sense of stagnation, a society whose members have mutual respect, transcending the generations, and a society in which every person can lead an active and enjoyable life. The vision of Society 5.0 requires us to

reframe two kinds of relationships: the relationship between technology and society and the relationship between individuals and society through technology.

Society 5.0 is characterized by the interconnectedness of people, objects, and systems, merging the virtual and physical realms through data collection from sensors and devices. Big data is analyzed by AI capabilities and reintegrated into the physical space, generating new value across various domains for individuals, industries, and corporations. This new value fosters social innovation, bridging gaps related to region, age, gender, and language, and facilitating the provision of customized products and services to meet diverse individual needs. Society 5.0 has the potential to address challenges in fields such as mobility, healthcare, agriculture, food, manufacturing, disaster control, energy, and more.

The concept of Society 5.0 aligns with Hitachi's vision of a sustainable society where everyone can lead a safe and fulfilling life. With a comprehensive portfolio of digital solutions and an integrated approach, Hitachi is well-positioned to collaborate with the government in realizing this vision by establishing a robust framework for a seamless transition to Society 5.0. Through the application of cutting-edge digital technologies, Hitachi aims to address various social challenges and actively contribute to the government's "Digital India" initiative. Hitachi's collaborative co-creation efforts with the government in sectors such as railways, finance, agriculture, urban development, and e-governance are driving India towards readiness for the demands of Society 5.0 in the future.

Evolution of the Industrial Revolution

With a new source of energy being innovated from time to time, there has been an upgrade from one phase of industrialization to another. This is the history of the 5 industrial revolutions starting from the 18th century before which everything was handmade.

Industry 1.0

Beginning in around 1780, this first revolution focused on mechanization based on machines that were powered by steam and water. This phase focused mainly on improving the textile industry from handmade to mechanical.

Industry 2.0

A century later, in 1870, the second industrial revolution, also known as the Technological Revolution was a phase of rapid scientific discovery, standardization, mass production, and industrialization from the late 19th century into the early 20th century. This phase witnessed the birth of the motor and engine. It is based on electrification and took place with mass production through assembly lines.

Industry 3.0

Stepping forward another 100 years, to 1970, the computer makes an appearance. Industry 3.0 saw automation through the use of computers and electronics. This was enhanced by globalization (Industry 3.5), involving the off shoring of production to low-cost economies.

Industry 4.0

We are currently at the brink of the fourth industrial revolution, which is based on the concept of digitalization and includes automation, artificial intelligence (AI), Block chain, Big Data, cyber-physical systems, and the Industrial Internet of Things (IIoT). The main elements of manufacturing in this revolution are smart factories and dark factories. Smart factories include cyber-physical workspaces while dark factories are completely devoid of human employees.

Industry 5.0

We will soon be living in the fifth industrial revolution with a focus on man and machines working together. Based on personalization and the use of collaborative robots, workers are free to deliver value-added tasks for customers. This latest iteration goes beyond manufacturing processes to include increased resilience, a human-centric approach, and an improved focus on sustainability.

Need for Industry 5.0

Human-Centric Focus

The sole focus of Industry 4.0 is to improve the efficiency of the process, and it thereby inadvertently ignores the human cost resulting from the optimization of processes. This is the biggest problem that will be evident in a few years when the full effect of Industry 4.0 comes into play. Since all the human employees are replaced by robots, there will be severe consequences of unemployment. Consequently, it will face resistance from labour unions which will overlook the benefits of Industry 4.0 as pressure to improve the

employment number increases. In the new revolution, the nature of jobs will change rather than the presence of unemployment. For example, the Chief Robotics Officer (CRO) would be responsible for defining and managing different aspects of the life cycle of the robots. They will need to identify ways and means to improve the way robots function to boost productivity.

Greener Solutions

The world has seen a massive increase in environmental pollution beginning from the Second Industrial Revolution. However, unlike in the past several decades, the manufacturing industry is now more focused on controlling different aspects of waste generation and management and on reducing adverse impacts on the environment from its operation. Government support, along with endorsements from international organizations such as the UN and WHO, has provided significant backing to companies that prioritize environmental awareness. Additionally, there exists a dedicated customer segment that actively seeks out and purchases eco-friendly products. Fully embracing sustainability in a company's strategy, though, implies much more than what's currently been done. Rather than merely reducing a company's negative impact, truly sustainable companies focus on increasing their positive impact. Unfortunately, Industry 4.0 does not have a strong focus on environmental protection, nor has it focused on technologies to improve the environmental sustainability of the Earth.

Human-Robot Collaboration

Industry 4.0 was concerned about automation but Industry 5.0 will emphasize establishing synergy between humans and robots. The robots will not compete but will collaborate with human workers to complete tasks. In this sense, these machines will "work with them" rather than "work for them" Industry 5.0 will change the definition of robots. They will be seen as companions to human employees sharing a common workplace. Just like an apprentice, cobots will watch and learn how to perform various functions. The repetitive and dangerous tasks will be left to the mechanical while the creative tasks will be done by the biological.

Industry 5.0 and COVID- 19

The ripple effect of COVID-19 continues to impact how we work, learn, live, and play. The era of COVID-19 was unprecedented. No matter how futuristic and pragmatic companies were, they were influenced by the shock of the pandemic. Now that vaccines have been introduced and there has been a lot of research about the disease, things have started to become normal. However, there is no guarantee that something like this will never happen again. One of the most important features of Industry 5.0 is that it emphasizes growing resilience. As a result, it is more adaptable to future crises, if any. It reflects strength and growth in the Post-COVID Era.

During the lockdown, schools resorted to online learning, and jobs called for work from home. As a result, everybody needed a stable internet connection and multiple gadgets in their daily life. By 2027, it is predicted that the number of social media users (4.59 billion in 2022) will significantly increase to 5.85 billion, following the rapid growth of the Internet, and Internet-related technologies. This mass digitization was a far-fetched dream in Industry

However, it happened too soon because of the pandemic. In this case, Industry 5.0 plays a major role in bringing back the human touch in a world where everything is overly digitized. While Industry 4.0 focuses on digitalization, Industry 5.0 focuses on personalization where every product is personalized according to the needs of the customer. Humans and robots work together in perfect harmony to create such products.

Conclusion

Since people could not rely on each other to fix their problems during COVID, they came up with solutions by themselves. As a result, they became better problem-solvers, more innovative thinkers, and more productive teams. In short order, the students become professors. And the dialogue has changed from "How do I fix this?" to "I have some ideas on how to make this process work better." The ability to take better responsibility and apply more innovative thinking will serve us all well during Industry 5.0, especially in balancing automation with increased demands for personalization. We do not know what might happen in a few years. Industry 5.0 is the ideal solution as of now. However, it can only be optimized if people have a strong foundation of human values and principles. This should begin as early as childhood. There has been a general decline in core values such as 'fear of

sin' and 'morality in society'. The incorporation of these principles into the education system has been long overdue. To build discipline and avoid negligence, humans should be taught to work alongside robots and not let the latter take full control.

Whether Industry 5.0 will be considered a universally accepted methodology or not, it is certainly an interesting philosophy that bears watching over the next few years. Through this paper, I'd like to encourage all the readers to become aware and work towards this new phase of industrialization because the best way to predict the future is to create it.

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