Journey of Industrial Revolutions till Industry 5.0: An Analytical Perspective

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Abstract
The advent of new technology and industries during the industrial revolution, a pivotal era in human history, altered how people lived and worked. Fast-moving developments in science, engineering, and manufacturing characterized a period of unheard-of expansion and development. Since the beginning of the first industrial revolution up until Industry 5.0, the world has experienced a succession of technological upheavals that have completely changed the way we manufacture, consume, and interact with goods and services. With the introduction of steam power and the industrialization of textile production in the late 18th century, the first industrial revolution got underway. The fifth industrial revolution, known as Industry 5.0, is just around the corner and is anticipated to usher in a new era of sustainable development and human-machine collaboration. To examine the progression of industrial revolutions from their birth to Industry 5.0 and throw light on the important influences, obstacles, and possibilities that have affected the direction of industrial development over the past few centuries.

Keywords: Industrial Revolution, Technological Upheavals, Human-machine collaboration, Sustainable development, Industry 5.0.

Introduction
New industries and technology that revolutionised how people lived and worked emerged during the industrial revolution, which has been regarded as a pivotal time in human history. Some researchers have examined the path taken by industrial revolutions from their start to Industry 5.0. illustrates how autonomous robots have developed from biological inspiration through implementation and control, for example. In the creation of autonomous robots, technology has played a crucial role in driving innovation. A distinguishing feature of each industrial revolution has been innovation that is driven by technology. The invention of the steam engine, which made it possible to mechanize the textile industry, for instance, was the driving force behind the first industrial revolution. The fusion of physical and digital technology, which led to the development of smart factories and intelligent equipment, also sparked the
fourth industrial revolution, known as Industry 4.0. Furthermore, the progression of industrial revolutions has been significantly influenced by economic changes. By enabling mass production and reducing prices, the first industrial revolution significantly altered the economic environment. The third industrial revolution, often known as the digital revolution, paved the way for the development of the knowledge economy, in which information and technology played a crucial role in driving economic progress (Bekey 2005). Figure 1 depicts how the evolutions have happened from Industry 1.0 to 5.0:

**INDUSTRY 1.0 - INDUSTRY 5.0**

<table>
<thead>
<tr>
<th>Mechanization</th>
<th>Electrification</th>
<th>Automation</th>
<th>Digitalization</th>
<th>Personalization</th>
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<tbody>
<tr>
<td>Keywords: Water, Steam</td>
<td>Keywords: Electricity</td>
<td>Keywords: Computers, Assembly Line</td>
<td>Keywords: Networking, Automation</td>
<td>Keywords: Collaboration, Sustainability</td>
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*Figure 1 Industry Revolution from Industry 1.0 to Industry 5.0*

Source: www.sentevc.com

Technology, the economy, and society have all advanced significantly during industrial revolutions. New methods of thinking and opportunities for manufacturers to enhance their procedures and goods have been brought about by each revolution. Manufacturers have a tremendous opportunity to use technology and human intelligence to create sustainable, effective, and innovative manufacturing processes with the advent of Industry 5.0, the fifth industrial revolution (Kagermann et al., 2013).

The requirement for more efficiency, flexibility, and speed in production processes has propelled industrial revolutions up to Industry 5.0. Manufacturers can now produce highly personalised items and react swiftly to changes in demand thanks to the development of smart factories and modern production technology. The voyage of industrial revolutions to Industry 5.0 can be better understood by examining the evolution of smart factories from Industry 1.0 to Industry 4.0. He emphasizes the significance of enhanced manufacturing process efficiency, flexibility, and speed as well as the enormous changes in technology, labour, and production methods that have powered this trip (Crandall 2017).
Literature Review

According to Borovik and Skobelev (2017), major adjustments to how society and business are currently run will be necessary for Industry 5.0. They recommended that businesses adopt digital transformation in order to remain competitive and emphasized the significance of making investments in the workforce's acquisition of digital skills. The authors also talked about how governments must make sure that Industry 5.0 technologies are available to all facets of society and foster an atmosphere that is conducive to their adoption. According to the authors, industry 4.0 is a stage in which multiple industrial processes are connected and optimized using digital technologies. Automation, data analysis, and real-time decision-making in manufacturing are made possible at this stage because of the integration of technologies like the internet of things (IoT), big data, and artificial intelligence (AI). Found the following structure from Industry 1.0 to 5.0:

The goal of Industry 5.0 is to integrate mechanical capability and human intellect to get the best results possible. High levels of customization will be possible when these two systems are integrated, and productivity will rise as a result. Through avoiding waste, limiting environmental effect, and optimizing resource utilization, Industry 5.0 is also anticipated to place a high priority on sustainable growth. Industrial revolutions have been marked by major obstacles and openings that have sparked change. A significant force behind this journey has been the demand for faster, more flexible, and more efficient production processes. Manufacturers now face formidable obstacles because of technology breakthroughs, shifting consumer preferences, and globalization (PRV Engineering 2018). Figure 2 shows the key focus of all the industrial revolutions (Maddikunta, et al.)

![Figure 2. Key Focuses Industry 5.0](Source: www.forbes.com)
According to Luthra et al. (2018), many technological developments, economic changes, and sociological transformations have influenced the progression of industrial revolutions from Industry 1.0 to Industry 5.0. Industry 5.0 is anticipated to usher in a new era of human-machine collaboration with a focus on sustainable growth, while Industry 4.0 reflects the current state of industrial revolution. Nonetheless, there are many obstacles to the adoption of Industry 4.0 projects for sustainable supply chain management in developing nations, including a lack of infrastructure, skilled labor, and constrained financial resources. Innovative solutions that incorporate sustainable practices into Industry 4.0 projects are required to overcome these obstacles.

In order to establish a sustainable Industry 4.0 framework, Kamble et al. (2018) offer a thorough literature evaluation to pinpoint present trends and prospective developments. They assert that significant technological advancements have accompanied each industrial revolution, resulting in increased productivity, efficiency, and economic prosperity. He is the embodiment of a new stage in the industrial revolution, one that is marked by the incorporation of cyber-physical systems, the internet of things, and artificial intelligence into production methods. These technologies have the ability to completely transform how businesses run by enabling real-time data analysis, preventative maintenance, and autonomous decision-making. They do stress the necessity of an Industry 4.0 strategy that is sustainable and in line with Industry 5.0's goals.

The use of text-mining tools and techniques for systematic literature reviews, which can help in assessing and condensing the large quantity of material on the progression of industrial revolutions to Industry 5.0, is the focus of Feng et al 2017 study. They go over how to utilize machine learning and natural language processing to extract pertinent data from huge datasets and spot patterns and trends in the literature. underline the need of understanding and synthesizing the results in a meaningful fashion, as well as the need for thorough examination and validation of the results acquired by text mining. They claim that text mining can be a useful addition to conventional literature review techniques, allowing researchers to quickly spot important themes and trends in huge datasets and gain fresh understanding.

According to Shiroishi et al. (2018), the process of industrial revolutions has been marked by the adoption of new technologies that have changed how industries function. The integration of cyber-physical systems and the internet of things has produced previously unheard-of levels of automation and connection, which has made Industry 4.0 a significant turning point in this path. They also stress the coming of Industry 5.0, which will emphasize human-centric methods of industrial production and usher in a new era of inter-human cooperation. Overall, according to the history of industrial revolutions has been marked by a
constant process of technical innovation and transformation, with Industry 5.0 standing in for a new era of human-machine collaboration and sustainable growth.

An overview of text mining and its uses in several disciplines, including as machine learning and natural language processing, is given by Hearst (2016). Text mining can be used to extract important data and insights from massive amounts of text data, specifically in the context of systematic literature reviews. Underlines the potential of text mining to provide insights and spot patterns in vast amounts of text data, which can be important in comprehending the history of industrial revolutions and the shift to Industry 5.0. To guarantee accurate and dependable results, it is crucial to approach this procedure cautiously and carefully analyse the methods and equipment used. An overview of text analysis and its uses in systematic literature reviews is given by Welbers et al. (2017). They contend that text analysis can help in the discovery of trends, themes, and patterns in substantial amounts of textual data. In the context of Industry 5.0, text analysis can help in locating and synthesizing relevant material. Also, it can be useful in spotting new patterns and knowledge gaps that can lead to future research. The authors stress the need to employ a standardized and repeatable method for text analysis. They place emphasis on the requirement for openness and documentation of the procedures and techniques employed during the analytical process.

Rada (2018) claims that the emphasis on human-machine collaboration and engagement marks a change from Industry 4.0. Instead, then replacing human abilities, Industry 5.0 seeks to augment and improve them. Industry 5.0's ultimate objective is to establish a socially and environmentally responsible manufacturing environment that is sustainable. That Industry 5.0 is a continuation of the industrial revolution's journey, building on earlier technical developments to usher in a more environmentally and socially conscious era.

**Conclusion**

In conclusion, the transition between Industries 1.0 and 5.0 has been a revolutionary process marked by the adoption of new technologies and the ensuing alterations in the production and manufacturing processes. Industry 5.0 will likely bring about similar societal and economic changes to previous industrial revolutions have in terms of efficiency and productivity enhancements. Because it highlights the value of sustainability and human-machine collaboration, Industry 5.0 is distinctive. It represents a departure from the conventional ideas of automation and digitization in favor of a more all-encompassing strategy that takes the health of both people and the environment into account. Industry 5.0 aims to increase efficiency, production, and sustainability while ensuring that the environment is protected through the integration of emerging technologies like AI, IoT, and blockchain. Industry 5.0 has the potential to tackle some of the most important problems...
facing the world today, such as climate change and inequality, and to build a more sustainable and just future. Further investment in R&D, education and training, and cooperation between businesses and governments are required to fully realize the potential of Industry 5.0. Also, it is crucial to make sure that everyone, especially underserved and marginalized communities, can participate in the transition to Industry 5.0. Overall, the transition from previous industrial revolutions to Industry 5.0 has been a complicated and dynamic process that has been influenced by a variety of drivers, difficulties, and possibilities. Industry 5.0 represents a major change towards a more collaborative and sustainable future, and its implementation calls for continued investment, innovation, and cooperation.

References
reviews: A systematic literature review. In Proceedings of the 2017 24th Asia-Pacific Software Engineering Conference (APSEC), Nanjing, China, 4–8 December 2017 (pp. 41-50).