

# SKILL ENHANCEMENT THE FUTURE READY WORKFORCE FOR INDUSTRY 5.0

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**Abstract.** *As Industry 5.0 develops, the need to prepare a workforce for the future grows, driven by the incorporation of cutting-edge technology like robotics, artificial intelligence, and the Internet of Things. This article examines methods for retraining and upskilling workers so they may prosper in this new setting, where technical innovation and human ingenuity coexist. It emphasizes the importance of developing a balanced skill set, combining technical skills with soft skills to foster collaboration between humans and machines. It also addresses the challenges of overcoming resistance to change and ensuring accessibility to training for all workers. By investing in these strategies, organizations can build a resilient, adaptable, and sustainable workforce, ensuring long-term success in the rapidly evolving industrial landscape of Industry 5.0. This paper explores real-life examples of human-centric Industry 5.0, highlighting how advanced technologies like AI and robotics work alongside humans to enhance personalization, creativity, and decision-making.*

**Keywords** Reskilling, Upskilling, Skills Gap, Industry 5.0, Human-Centric

## INTRODUCTION

Industry 5.0 is a vision of industrialization that focuses on creating a human-centric and sustainable future by integrating humans and advanced technologies such as AI, IoT, and robotics. It's not just about increasing productivity and efficiency but also about prioritizing human well-being, societal goals, and environmental sustainability in the production process. The goal of Industry 5.0 is to optimize industrial output through human-machine collaboration. It puts the human back at the center of the production process while utilizing the cutting-edge technologies of the fourth industrial revolution, including robotics, augmented reality, artificial intelligence (AI), the Internet of Things, and mega-data. A constant effort to stay up with the quick changes in technology. Giving employees whole new skill sets to enable them to move into various professions within the changing sectors is a crucial part of reskilling learning cultures. For those whose existing jobs are very susceptible to automation, this may be required. The practice of teaching current employees new skills to perform a different function within the organization is known as employee reskilling. Conversely, upskilling concentrates on improving present abilities and knowledge to adjust to the evolving requirements of current positions. For the workforce to be ready for Industry 5.0, both strategies are essential. In the context of Industry 5.0, strategic upskilling and reskilling programs drive innovation and competitiveness by coordinating employee development

with organizational objectives. Employees can adapt and succeed when they have a solid foundation in a variety of technical and interpersonal abilities.

## OBJECTIVES

- To understand the emerging skill demands of Industry 5.0, which blends advanced technologies with human-centric approaches.
- To emphasize the importance of continuous reskilling and upskilling to prepare workers for collaborative roles alongside AI and automation.
- To showcase real-life strategies and best practices adopted by industries and institutions to build a future-ready workforce.

## SCOPE

The article focuses on showcasing real-life applications of Industry 5.0 across various sectors, including manufacturing, healthcare and education and also emphasizes how human-centric technologies are being integrated with human skills to enhance productivity, personalization, and sustainability.

## THE PROGRESSION OF INDUSTRIAL REVOLUTION

The progression of industrial revolutions has dramatically

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reshaped economies and societies. The First Industrial Revolution (1760–1840) introduced mechanization, powered by steam and water, transforming manufacturing processes. Mass manufacturing, electricity, and improvements in communication and transportation were all brought forth by the Second Industrial Revolution (1870–1914). The emergence of computers, automation, and digital technologies during the Third Industrial Revolution (1960s–2000s) transformed industries through information technology. The Fourth Industrial Revolution (2000s–present) is being fueled by big data, robots, artificial intelligence, and the Internet of Things. The upcoming Fifth Industrial Revolution (2020s–future) places a strong emphasis on sustainability, human-centric innovation, and human-advanced technology cooperation.

## COMPARING INDUSTRY 4.0 WITH INDUSTRY 5.0

With the use of technologies like Internet of Technology, AI, and robots, Industry 4.0 emphasizes automation, data interchange, and smart production. Through networked machinery and systems, it seeks to maximize productivity, lower expenses, and maximize efficiency. In contrast, Industry 5.0 builds on this foundation but shifts the focus to human-centric innovation. It emphasizes collaboration between humans and machines, where technology enhances human creativity and decision-making. Industry 5.0 also prioritizes sustainability, resilience, and ethical practices, aiming for a more inclusive, eco-friendly, and adaptable industrial ecosystem. The key difference lies in human involvement and the emphasis on societal impact and well-being.

## THE INDUSTRY 5.0 PILLARS

The fundamental tenets of Industry 5.0—people-centricity, sustainability, and resilience—create an industrial environment that is focused on people. People-centricity places a strong emphasis on the cooperation of people with cutting-edge technology, enabling employees to use their creativity and judgment while robots take care of repetitive duties. Sustainability ensures that industrial practices prioritize environmental responsibility, focusing on reducing waste, promoting energy efficiency, and supporting the circular economy. Resilience is about building adaptable systems capable of withstanding disruptions, whether from technological change, market shifts, or external crises. Together, these pillars foster an industry that is more inclusive, eco-friendly, and agile, driving long-term innovation and growth.

## IN-DEMAND INDUSTRY 5.0 SKILLS FOR EMPLOYEES

Technical proficiency is essential in Industry 5.0 for workers to interact with and comprehend the cutting-edge technologies that are revolutionizing the workplace. Digital and technology abilities are fundamental among these. Technical and digital abilities must be well-established. Workers must be skilled in fields like robotics, machine learning, data analytics, artificial intelligence (AI), and the Internet of Things. It's getting more and more crucial to comprehend how to operate collaborative robots and automation systems. Additionally, to safeguard data and guarantee smooth digital operations, expertise in cloud computing and cybersecurity is essential. Employees must be adept at utilizing the appropriate digital tools to identify new trends, optimize workflows, and predict changing job requirements in order to remain competitive in this new century. This calls for both an understanding of the tools and the capacity to use them in practical situations to make strategic decisions. Additionally, mechanical engineering and design abilities are becoming more and more crucial.

When dealing with robots, automated systems, and other high-tech gear, employees must be able to develop, operate, and maintain complicated equipment. Making wise decisions that lead to operational improvements requires the capacity to gather, evaluate, and understand vast amounts of data. Because Industry 5.0 is largely dependent on insights derived from data, having workers with data analysis skills is essential to streamlining production and improving results. These technical skills are integral to navigating the complexities of Industry 5.0 and unlocking the full potential of emerging technologies. Making wise decisions that lead to operational improvements requires the capacity to gather, evaluate, and understand vast amounts of data. Because Industry 5.0 is largely dependent on insights derived from data, having workers with data analysis skills is essential to streamlining production and improving results. Navigating the intricacies of Industry 5.0 and realizing the full potential of future technologies require certain technical abilities.

Soft skills like communication, creativity, and problem-solving are crucial in Industry 5.0 as human-machine collaboration increases. Workers need to be adaptable, able to adjust with the times, and always learning new things. Collaboration, project management, and leadership will be essential for overseeing intricate, technology-driven projects. Additionally, when companies incorporate sustainable practices, ecological consciousness, ethics, and compliance expertise are essential. Furthermore, strategic and leadership abilities are essential for directing innovation and change.

Digital leadership, change management, sustainability awareness, and innovation management abilities enable people to guide teams through technological changes while keeping an eye on environmental responsibility and human values.

## THE RESKILLING AND UPSKILLING REVOLUTION

Certain old skill sets will become outdated due to Industry 5.0's automation and data-driven nature. While computers will increasingly do repetitive jobs, there will be a greater need for human abilities in areas like creativity, critical thinking, problem-solving, and complicated decision-making. A significant effort to reskill and upskill the current workforce is required due to the growing skills gap. Because of shifting lifestyles, the needs of younger generations, and the increasing integration of robotization and artificial intelligence into daily life, businesses need to take immediate action to improve employee skill sets in order to remain competitive.

Organizations must adopt a flexible and agile approach to workforce development through reskilling and upskilling in order to meet the changing needs of Industry 5.0. Employees that get training are able to close skill gaps and maintain their effectiveness and relevance in their positions. A staff with the necessary skills can innovate and adjust to new technology and industry trends more rapidly. Programs for skill development are essential for encouraging learning, increasing employee enthusiasm and output, keeping current talent, and drawing in new candidates. Increased productivity and operational efficiency might result from a team that is properly trained to use new technology. Employees with more reskilling are more able to support moral, socially conscious, and environmentally good behaviors. Reskilling is less expensive than continuously employing new employees.

## STRATEGIES FOR EMPLOYEES' RESKILLING AND UPSKILLING IN INDUSTRY 5.0

In Industry 5.0, customizing learning paths to each employee's needs is crucial for effective skill development. Organizations must leverage data-driven insights to identify skill gaps, learning styles, and career goals. Adaptive learning platforms support personalized training in areas like AI, robotics, and human-machine collaboration by dynamically adjusting content. A hybrid learning approach—combining traditional instruction with digital tools such as

online courses, webinars, and simulations—caters to diverse learning preferences and ensures continuous upskilling without disrupting work routines. Emphasis on soft skills like emotional intelligence, communication, and adaptability is equally important, as these are essential for collaboration in human-centric environments. Micro-learning through short tutorials and on-demand content allows employees to stay current with evolving technologies while maintaining productivity. Incorporating project-based learning and real-world simulations enhances practical application, boosting confidence and knowledge retention.

## Strategies for Reskilling and Upskilling

- *Integration of Digital Learning Tools:* Offer e-learning modules, mobile learning apps, and virtual reality-based simulations to make learning more flexible and interactive.
- *Micro Learning and Modular Courses:* Break training into short, focused lessons that are easier to absorb and retain, especially suitable for working professionals.
- *Collaboration with Educational Institutions:* Partner with universities and training institutes to provide certifications, diploma programs, and technical training aligned with Industry 5.0 skills.
- *On-the-Job Training and Job Rotation:* Encourage hands-on learning through job shadowing, mentoring, and role rotations to build practical, cross-functional experience.
- *Skill Gap Analysis:* Regularly assess current workforce capabilities versus future needs to identify skill gaps and plan targeted development interventions.
- *Soft Skills and Human-Centric Training:* Train employees in creativity, emotional intelligence, critical thinking, and problem-solving—skills that complement advanced technologies.
- *Government and Industry Collaboration:* Leverage government-funded upskilling programs, public-private partnerships, and industry-wide initiatives to expand training outreach.

## CHALLENGES AND OPPORTUNITIES IN EMPLOYEE SKILL DEVELOPMENT IN INDUSTRY 5.0

As Industry 5.0 reshapes the workplace, employees face both challenges and opportunities in reskilling and upskilling. One major challenge is the rapid pace of technological change, requiring workers to constantly update their skills to keep up with advancements in AI, robotics, and IoT. This

can lead to a skill gap, leaving employees struggling to adapt to new roles. Additionally, resistance to change may arise, particularly among those who fear job displacement due to automation. The digital divide also presents a barrier, as not all employees have equal access to the necessary learning resources or technologies. However, Industry 5.0 also presents numerous opportunities. The integration of AI-driven personalized learning platforms allows for tailored training, addressing specific skill gaps and boosting engagement. The rise of human-robot collaboration opens new career paths that blend creativity with technology, such as AI trainers or robotics managers. Online learning platforms offer greater accessibility and flexibility, enabling employees to learn at their own pace. Moreover, organizations can leverage data-driven insights to craft targeted reskilling programs, ensuring that training is relevant and effective. Overall, Industry 5.0 offers an exciting opportunity to develop a more agile, skilled, and human-centered workforce.

## HUMAN-CENTRIC INDUSTRY 5.0

The human-centric development of industry, known as Industry 5.0, emphasizes the cooperation of people and cutting-edge technology to improve well-being, sustainability, and productivity. In contrast to Industry 4.0, which prioritized efficiency and automation, Industry 5.0 centers innovation around people, striking a balance between human creativity and values and technology growth. The collaboration between humans and intelligent systems—like AI, IoT, and collaborative robots—that are intended to supplement rather than replace human work is at the heart of this paradigm. Production is made safer, more effective, and more customized because to this synergy. Upskilling and reskilling are crucial because Industry 5.0 values employees' contributions to strategic choices and innovation, which further empowers workers. In addition to eco-friendly methods targeted at sustainability, ethical technology use—ensuring privacy, transparency, and responsible AI—is a fundamental premise. In the end, Industry 5.0 aims to create a resilient, inclusive future where technology advances humankind and creates wiser sectors that put people and performance first.

## OBSERVATIONS AND DISCUSSIONS

### Real-Life Example of Human-Centric Industry 5.0 in Stanford Hospital (United States)

The remark “A high degree of understanding and training is essential and is emphasized before the system is put to use in clinical practice by any center” is cited by author Mr.

Gopal Krishna Kurup in the journal of medical physics. The group of medical physicists, technologists, and radiation oncologists should be familiar with the CyberKnife's technology and workings. Accuray Inc. created the CyberKnife System, a robotic radiosurgery device that uses intensely concentrated radiation beams to treat both malignant and non-cancerous tumors. The CyberKnife System is widely used in radiation therapy facilities across the world, including prestigious institutions like Stanford Hospital in the United States and Apollo Hospitals in India. This advanced robotic radiosurgery technology is crucial for delivering highly focused radiation beams with precision. The system's robotic arm can deliver radiation with sub-millimeter accuracy, maximizing the dose to the tumor and reducing exposure to surrounding healthy tissues. The precise radiation dose and angle are planned by the doctors. The doctor is a key player in this human-AI partnership. They develop and authorize the treatment plan, keep an eye on the system throughout radiation therapy, and make clinical judgments depending on the patient's reaction to the treatment. While the doctor guarantees medical judgment and individualized care, the robot guarantees technical accuracy. Brain tumors, lung cancer, prostate cancer, spine tumors, and liver and pancreatic malignancies are among the many ailments that are frequently treated using the CyberKnife System. Its main benefits include being non-invasive (which means surgery is not necessary), usually done as an outpatient operation, causing less harm to healthy tissue, and having a high degree of precision. The main function of the robot is to automate the radiation delivery process. However, the oncologist (doctor) maintains control over the course of treatment. Physicians are in charge of creating the treatment plan, establishing the radiation dosage, choosing the delivery angles, and keeping an eye on the entire process. Additionally, they evaluate the patient's reaction to the therapy and modify the treatment plan as necessary. The doctor maintains complete control over all important medical choices, guaranteeing a cooperative approach between cutting-edge technology and human knowledge. One of the best examples of human-AI cooperation in cancer is the CyberKnife System. The surgeon maintains total control over the treatment plan, ensuring safety and efficacy while the robot guarantees accuracy and efficiency. As this technology develops, medical professionals will need to learn specific skills to accurately run the system, devise treatment plans, and analyze imaging data. They can fully utilize CyberKnife's AI-driven capabilities while preserving clinical judgment and patient safety thanks to ongoing learning. In a human-centered healthcare setting, reskilling physicians not only keeps them abreast of the most recent advancements in medicine but also improves treatment results, shortens procedure times, and raises the standard of patient care overall. Health care professionals need to be educated in AI literacy, ethics, and the integration

of human judgment in order to assure patient-centric care, evaluate ethical implications, and comprehend AI outputs.

## Real-Life Example of Human-Centric Industry 5.0 in the Foxconn Smart Factory (China)

Foxconn Chairman Young Liu, during his keynote at Computex 2025 in Taipei, stated that AI is already helping resolve production issues quickly and allowing human experts to focus on more complex, value-driven operations. Smart factories where AI handles routine tasks and humans handle quality control or innovation. Foxconn, one of the world's largest electronics manufacturers, has implemented smart factory technologies across many of its facilities in China to enhance efficiency, productivity, and precision in mass production, particularly for major clients like Apple. Foxbots are industrial robots developed and used by Foxconn. The Foxconn Smart Factory in China is a prominent example of advanced automation and human-AI collaboration in modern manufacturing. In this smart factory setup, AI plays a crucial role by handling repetitive tasks such as printed circuit board (PCB) assembly, packaging, and other routine operations. These tasks are efficiently carried out by "Foxbots," which are designed to boost productivity and precision on the assembly line. While AI and robotics manage the high-volume, standardized processes, human engineers focus on critical tasks that require creativity, judgment, and expertise. Their responsibilities include ensuring design integrity, inspecting high-risk or non-standard outputs, and continuously improving manufacturing processes. A key highlight of the Foxconn Smart Factory is its balance between automation and human insight with robots managing large-scale production efficiently, and humans driving customization, quality control, and innovation. This model exemplifies how smart factories can enhance operational efficiency without compromising the value of human expertise. In Foxconn's iPhone production lines, robots conduct the majority of assembly tasks, while human technicians manage final inspections, respond to exceptions, and ensure that each device meets custom specifications before sending the product into the market. In this advanced setup, robots are responsible for performing repetitive, routine, and hazardous tasks, such as assembling electronic components and packaging products. These automated systems help maintain high levels of consistency, speed, and accuracy, which are essential in mass production environments. On the other hand, human workers, particularly engineers and supervisors play a crucial role in maintaining production quality, making complex decisions, and managing tasks that require customization. Their focus is on process improvement, innovation, and the management of human

resources, ensuring that the factory remains responsive to changing demands. This human-AI collaboration brings several key benefits. It helps reduce labor costs and human error, improves worker safety by keeping people away from dangerous tasks. Foxconn's model demonstrates how automation and human expertise can work hand-in-hand to optimize manufacturing outcomes. Analyzing production data, and contribution towards innovation not only enhance employee career growth and job security but also strengthen Foxconn's ability to remain agile, competitive, and human-centric. Workers should be reskilled in robot programming, safety protocols, and human-machine interaction. Employees transition from purely manual tasks to robotic system supervision, data monitoring, and maintenance is only done by employee skill development programs.

## Real-Life Example of Human-Centric Industry 5.0 in Khan Academy

At the World Economic Forum Annual Meeting on January 9, 2025, it was emphasized that AI in education should be a collaboration between teachers and technology, enabling educators to focus on delivering engaging lessons and providing crucial mentoring. AI tools supporting teachers while the teacher maintains emotional and cognitive engagement with students. Otter.ai and Grammarly are widely used AI tools in education that support teachers by automating time-consuming tasks. These tools play a significant support role by handling transcription, grammar checking, and note-taking, which greatly reduces the burden of routine content preparation and review. With these responsibilities managed by AI, teachers are able to focus more on delivering impactful lessons, engaging students in meaningful dialogue, and providing personalized support. This shift allows educators to invest more time in fostering critical thinking, creativity, and emotional connection in the classroom. The use of tools like Otter.ai and Grammarly ultimately helps save time in content preparation and feedback, making teaching more efficient while enhancing the quality of student-teacher interaction. This is a strong example of how AI enhances educational experiences without replacing the essential human element in teaching.

Khanmigo, developed by Khan Academy, is an AI-powered tutor designed to assist students with subjects like math and science. It plays a valuable support function by offering personalized practice and real-time guidance, helping students work through problems at their own pace. While Khanmigo interacts directly with students, the teacher's role remains central. Educators observe the AI-student interactions, monitor progress, and intervene when deeper understanding or clarification is needed. This ensures that students not only receive immediate help from the AI but also

benefit from the teacher's expertise and emotional support. This model of AI-assisted learning enhances classroom instruction by giving students individualized attention while allowing teachers to focus on concept mastery, engagement, and critical thinking development. It highlights the power of human-AI collaboration in delivering effective, student-centered education. Digital literacy is essential for navigating the Khanmigo platform and integrating it into daily teaching routines. Teachers must also possess instructional design skills to adapt AI-generated lesson suggestions to suit diverse learning needs. Being flexible is essential because it allows educators to adopt new resources and transition from conventional teaching techniques to more facilitative ones. Furthermore, ethical consciousness guarantees the proper application of AI, especially in preserving equity and safeguarding student data. With this combination of abilities, educators may utilize Khanmigo to improve learning with confidence while maintaining their crucial role as responsive and sympathetic teachers. Teachers require continual retraining in AI technologies, digital pedagogy, and ethical data usage in order to use these kinds of digital tools efficiently. These illustrations demonstrate that human-centric Industry 5.0 is about fostering the human capacity to collaborate with new technologies, not merely about introducing new technology.

## CONCLUSION

As Industry 5.0 redefines the relationship between humans and technology, building a future-ready workforce is no longer optional. It is essential. Reskilling and upskilling empower employees to adapt to rapid technological advancements while enhancing their creativity, problem-solving, and collaboration skills. By investing in personalized, continuous, and hands-on learning experiences, organizations can ensure their employees remain agile and competitive in an evolving industrial landscape. Focusing on both technical and soft skills helps create a well-rounded workforce capable of driving innovation, sustainability, and human-centric progress. Ultimately, focusing on skill enhancement of employees is the key to unlock the full potential of Industry 5.0. Real-life examples of human-centric Industry 5.0 clearly illustrate the significance of skill development in fulfilling the upcoming future demands. Moreover, skill development promotes adaptability, allowing workers to remain flexible

and resilient in the face of rapid technological change and global disruptions.

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