THE US WORKFORCE OF THE FUTURE: A REVIEW ON THE INDUSTRIAL REVOLUTION

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ABSTRACT

The introduction of the fifth Industrial Revolution has affected the mode of operation of businesses. It promotes a system that focuses more on humans than technology to create a workforce with the desirable skills to meet up with the technological advancement of the era. This study focuses on understanding the new industrial revolution and its possible impact on the future workforce. It portrays the need for workforce development and upskilling, challenges with current workforce development and upskilling initiatives, examples of successful upskilling programs, and a future outlook of the workforce system that will evolve with the new revolution.

KEYWORDS: US Workforce, Future and Industrial Revolution

INTRODUCTION

The 5th Industrial Revolution symbolizes the current AI revolution, characterized by the incorporation of quantum computing and the establishment of a symbiotic relationship between human skills and machine capabilities. This transformative era, defined by its green and digital essence, aspires to create an industry that is both human-centric and sustainable (Seda and Utku, 2021). Central to this revolution is the strategic infusion of artificial intelligence into the workforce, aimed at elevating work efficiency and achieving unprecedented milestones. In a technological age marked by rapid advancements, the importance of workforce development and upskilling emerges as a fundamental key to success. Workforce development, as an economic approach, uniquely prioritizes the growth and empowerment of the workforce rather than exclusive attention to businesses. Simultaneously, upskilling plays a crucial role by providing additional training and skill acquisition opportunities for employees, thus enhancing their capabilities and overall efficiency. This journal endeavors to offer a comprehensive overview of the 5th Industrial Revolution, delving into the significance of workforce development and upskilling within this transformative landscape. The discussion not only addresses the challenges faced but also provides typical examples, offering a forward-looking perspective on the future trajectory of the Industrial Revolution in shaping the workforce.

OVERVIEW OF THE 5TH INDUSTRIAL REVOLUTION.

The 5th Industrial Revolution (5iR) signifies a progression beyond the fourth Industrial Revolution, distinguished by its dual components. The first component centers on the emergence of innovative technologies, while the second component embodies the consequential shift in production methodologies catalyzed by these technological strides (. Velma M, Pratik G, Pratik D and Dhahran D 2022). This revolutionary phase strives to establish a harmonious equilibrium between machine capabilities and human engagement, heralding an era teeming with unprecedented opportunities for humanity. At its essence, the 5th Industrial Revolution is grounded in two pivotal concepts: Human-centeredness and sustainability (Mu. R 2023) Human-centeredness envisions an era where the collaboration between people and machines seamlessly unfolds, operating within the same loop of productivity. On the flip side, sustainability entails the deployment of technology that not only considers the human body but also prioritizes environmental friendliness. This involves enriching customer satisfaction by incorporating benefits into goods and services, thereby contributing to overall well-being.

PREVIOUS INDUSTRIAL REVOLUTIONS

Arnold Toynbee, the 19th-century economic historian, is credited with coining the term "industrial revolution" to characterize Britain's economic development from 1760 to 1840 (. Velma M, et al 2022). The first industrial revolution unfolded in the 18th century, around the 1780s, predominantly in Europe and South America, marking the era of mechanization. During this transformative period, steam engines emerged as innovative replacements for traditional horse and human power.

The second revolution, known as the electrification era, spanned from the late 1800s to the onset of the First World War. Notable advancements included the production of steel, electricity, and combustion engines. The introduction of electricity facilitated the division of labor, fostering mass production in industries.

The third industrial revolution, characterized by globalization and automation, took place around 1980. This era saw the advent of computers, digitization, and the internet, leading to the digitization of information and the automation of production through electronic and IT systems.

The fourth industrial revolution, which began in the 21st century around 2000, is defined as the digitization era. Key innovations include artificial intelligence, robotics, blockchain, cryptocurrency, as well as augmented and virtual reality.

The second decade of the 21st century marked the initiation of the 5th Industrial Revolution, also known as the personalization era. It aims to establish multi-level cooperation between human and machine consciousness, prioritizing purpose over mere profit (. Velma M et al 2022).

The 5th industrial revolution represents an evolution that allows both products and materials to coexist for utilization, eliminating waste and pollution, thereby regenerating planet Earth. Fueled by digital innovation, this revolution seeks to create a regenerated economy with new work practices and culture. This evolution places human intelligence in high regard, utilizing AI in recruitment to identify top talents. Human resource teams are liberated from daily administrative tasks, enabling them to focus on cultivating the desired workforce for organizational growth and productivity. The revolution has fundamentally altered how companies operate, facilitating access to current and accurate information without the burdens of sifting through piles of documents. The rise of remote working culture, accelerated by the pandemic, has introduced enhanced communication channels, video conferences, and secure environments for task sharing, monitoring, and collaboration. Furthermore, the integration of 5G technology has had a positive impact on work culture. The 5th industrial revolution embraces a paperless approach, reducing duplication of work and errors. Advanced tools for digital printing, scanning, and signing, coupled with machine learning, propel the paperless revolution to new heights, fostering paperless offices and digital environments

KEY TECHNOLOGIES OF THE 5TH INDUSTRIAL REVOLUTION

Human-centeredness and sustainability lie at the heart of the 5th Industrial Revolution (5IR), distinguishing it from the fourth industrial revolution where machines and humans operated in separate workflows and spaces due to safety concerns arising from the adverse effects of manufacturing industrial products on both human well-being and the environment.

The concept of human-centeredness within the 5th evolution advocates for the seamless integration of human and machine workflows on the same loop. (Mu. R 2023). Technologies that are devoid of adverse effects on humans and the environment play a pivotal role in fostering sustainability and the harmonious integration of various technologies. A notable advancement in this regard is the emergence of Collaborative Robots (Cobots) during the 5th IR. In the preceding industrial revolution, robots were prevalent but operated behind safety barriers, limiting their collaboration with humans. However, the 5th IR introduces Cobots that can seamlessly work alongside humans in the same space, ensuring safety through innovative features. These robots are equipped with ultrasonic sensors on their arms to detect the proximity of individuals. Accelerometers gauge operating speed, while gyro sensors accurately measure inclination. Machine vision is employed when assessing the color or shape of the work is necessary. Collaborative robots facilitate the simultaneous support of multiple items through effective communication and integration between machines. This adaptability enables the adjustment of production size based on demand fluctuations and the creation of production systems capable of accommodating changes in production items.

The safety features and human-like functionality of collaborative robots extend their utility beyond traditional industrial settings, finding application in diverse service fields such as medicine, education, and retail. This showcases the versatility and transformative potential of the 5th Industrial Revolution, emphasizing a collaborative and innovative approach to human-machine interaction.

SMART CELL INDUSTRY

A smart cell stands as a revolutionary entity, optimizing the material production capacity of biological cells through the synergy of biotechnology and cutting-edge digital technologies, including information analysis. Positioned as a cornerstone of the 5th Industrial Revolution, smart cell industries represent a pivotal technological advancement. The integration of biotechnology with IT, AI, and other digital technologies in the preceding industrial revolution laid the groundwork for substantial evolution and development. Notably, smart cell industries have played a crucial role in advancing this integration. A compelling illustration is the derivation of heat and impact-resistant resins from plants, employed in crafting home appliance enclosures and exterior decorative parts for automobiles. The advent of smart cell industries necessitates a profound connection with digital technologies, encompassing massive information analysis facilitated by AI, the incorporation of modularized equipment for each manufacturing process, and the utilization of experimental humanoid robots. This interplay between biotechnology and digital technology emerges as the linchpin for establishing a sustainable economic activity during the 5th Industrial Revolution—a paradigm that is both human-centric and environmentally conscious. (Mu. R .2023).

THE NECESSITY FOR WORKFORCE DEVELOPMENT AND UPSKILLING

In the context of the 5th Industrial Revolution, upskilling has emerged as the cornerstone of contemporary workforce development strategies. (Sheila. K 2022) the pervasive influence of automation and artificial intelligence (AI) has precipitated profound shifts in the landscape of employee training and development. The economic upheaval triggered by the pandemic critically impacted the operational cadence of diverse businesses, with the United States grappling with a discernible skill gap, as highlighted in a Deloitte study (Sheila. K. et al 2022) Despite the relatively low unemployment rate, a significant portion of the workforce found themselves engaged in precarious "gig" economy jobs, while the specter of automation and offshoring loomed over low-wage positions. In response to this transformative economic milieu, a substantial labor reallocation unfolded, underscoring the imperative of enhancing workers' skills through proactive upskilling initiatives. Upskilling is unequivocally positioned as the linchpin for the comprehensive retooling and redevelopment of the workforce (Sheila. K. et al 2022) its efficacy becomes particularly pronounced in mitigating the impact of fluctuating labor demands. The ostensibly robust employment landscape of 2019 underwent a

paradigm shift post-pandemic, characterized by dynamic changes in job growth and requisite skills. As businesses endeavored to adapt, new entrants were enticed into the labor force, while concerted efforts were made to facilitate the adaptation of existing workers through upskilling programs. The symbiotic nature of upskilling renders it a win-win proposition for both employers and employees, fostering a sense of shared value and mutual benefit between the two parties. Opportunities for career development act as a powerful incentive for employee loyalty to organizations, a fact substantiated by a global trend report revealing that organizations investing in employee training experience a 53% lower likelihood of attrition. While upskilling constitutes a significant upfront investment, its long-term cost-effectiveness becomes evident. Employee turnover incurs substantial expenses, with a Gallup report indicating an annual cost of $1 trillion for businesses (Sheila. K et al. 2022). Focusing upskilling efforts on entry-level and low to mid-skilled workers, whose roles face the risk of obsolescence, presents an avenue to curtail the need for frequent recruitment. The implementation of upskilling not only contributes to cost savings but also enhances production rates. Capgemini research underscores that upskilled employees tend to concentrate on activities conducive to business growth and increased output (Sheila. K et al. 2022). Leading companies like Google, Verizon, and Marriott International exemplify the transformative impact of substantial investments in upskilling programs. These initiatives empower employees to refine existing skills, pursue higher education, or acquire new skills, enabling them to assume additional responsibilities, transition to more challenging roles, and even progress into management positions.

SKILL GAP ANALYSIS

The skill gap, as defined by the American Society for Training and Development (ASTD), refers to the disparity between an organization's current capabilities and the required skills to achieve a desired level of success. (Manjunath. S, Shravan M. B Murthy and M B Dechakka.2019). This mismatch is perceived as the difference between the skills employees need and the skills available in the workforce. An organization's skill gap, specifically, hinders growth and competitiveness by impeding its ability to find the right employees for critical positions. This gap can lead to reduced company performance, manifested through lower productivity and diminished quality. (Jessica. B and Seamus. G. 2009 and Manjunath. S, Shravan M. B Murthy and M B Dechakka. 2019). The challenges in addressing the skill gap often lie not in the absence of available skills but in the selection process when hiring competent workers. Factors contributing to the skill gap encompass weaknesses in the academic system, which fails to equip graduates with essential soft and technological skills Eduardo. (Marissa L Shuffler, Amanda L Thayer, Wendy L Bidwell and Elizabeth H Lazaro. 2015 and Manjunath. S. 2019) additionally, challenges arise when new employees struggle to assimilate into the working environment (Zain. F Kaye, G. D and Cao G. 2015. Manjunath. S, et al 2019) compounded by the rapidly changing nature of our environment. To navigate

this landscape of increasing competition, companies and organizations are intensifying their scrutiny and adopting strategies to bridge the skill gap.

IMPORTANCE OF CONTINUOUS LEARNING

Janice Litvin, an esteemed professional speaker and author, emphasizes the significance of continuous learning by highlighting that individuals rarely stay in the same job throughout their careers. Litvin argues that a lack of growth can lead to stagnation in one's work. Moreover, she asserts that being open to various avenues fosters resilience to market changes and prepares individuals for sustained growth and success in their careers (Rose Y. 2023)

Amy Wallace, the Vice President of Learning and Development at Members 1st Credit Union in Enola, Pennsylvania, echoes the sentiment that complacency poses risks. Wallace emphasizes that it is an obligation to ourselves, our customers, and our organizations to consistently grow and challenge our thinking (Rose Y. et al 2023).

Learning is not only a professional necessity but also personally rewarding, offering both immediate and long-term benefits (Rose Y.et al 2023). According to Lockhart Spann, immediate benefits include increased job security, heightened confidence, and professional and personal growth. These factors contribute to higher job satisfaction and improved performance (Rose Y. et al 2023).

Continuous learning also provides lasting benefits, allowing professionals to build a strong network and position themselves as thought leaders in their respective fields. Lockhart-Spann suggests that this strategic positioning opens doors to new opportunities at subsequent career levels (Rose Y.et al 2023)

CHALLENGES TO IMPLEMENTING UPSKILLING INITIATIVES

McKinsey conducted a survey in 2017, interviewing 116 executives from large organizations to identify potential obstacles to upskilling and reskilling efforts. The results revealed that one in four business managers lacks a concrete understanding of the impact of future automation and digitization on skill requirements. Similarly, a quarter of them do not possess the necessary knowledge to quantify the business case for reskilling their workforces. Additionally, one-third of respondents believed that the existing HR infrastructure is inadequate to implement a new strategy addressing emerging skill gaps (Kweilin. E, Rahul. G, and Julian. S, (2020). The challenge of reskilling is expected to be particularly acute in function-intensive sectors such as manufacturing, transportation, retail, and operations-aligned occupations, where automation and digitization can significantly impact repetitive tasks. Employees in these sectors often have lower educational levels, emphasizing the need for up skilling to ensure stability. Kweilin. E, Rahul. G, and Julian. S, 2020 and. Ling. L, 2022). Another obstacle is the resistance among employees, especially

in older age groups, to invest in upskilling due to apprehension about changes to the familiar systems they are accustomed to (. Kweilin. E et al. 2020 and ling. L 2022). To address these challenges, companies should make upskilling more accessible for their employees. This could involve providing learning resources, internet access, information, and financial support for tuition. An urgent recommended solution is to align curricula with the demands of the 4th industrial revolution, focusing on skills in high demand and implementing better assessment criteria. (Whisper M. and Lies. 2021 and Ling. L, 2022). Moreover, many companies fail to allocate sufficient funds to support reskilling and upskilling initiatives. Collaborative efforts between the public sector and business organizations are crucial to investing in the future workforce, influencing long-overdue improvements to the education and training system (Ling. L, 2022).

Figure 1: Distribution of the workforce across economic sectors in the United States 2021

Source: Statista, 2023

The figure shows how the US employment was distributed throughout economic sectors between 2011 and 2021. In 2021, 1.66 percent of US people were working in agriculture, with industry (19.18%) and services (79.15%) following closely behind.

Figure 2: Labor force participation rates by rates by

Source: Statista, 2023

Among adult men (20 years of age and older), Hispanics had the highest participation rate (79.5%) in the labour force among the four largest racial and ethnic groups: White, Black, Asian, and Hispanic. With 66.5%, Blacks had the lowest rate. Compared to White men, who made up 69.9 percent of adult male labour force participants, Asian men made up 74.7 percent. As adults, Black women (60.6%) had a higher employment rate than Asian women (58.8%), Hispanic women (58.2%), and White women (56.4%). Among teenagers (16–19 years old), Asians (21.2%) had a lower labour market participation rate than Whites (38.5%), Hispanics (32.7%), and Blacks (30.3%).

Real-world examples of successful Reskilling programs

Verizon's reskilling program

Verizon's reskilling program, a $44 million investment in workforce development, is a collaborative effort with JFF and Generation USA, aiming to prepare 500,000 individuals for future jobs by 2030. This initiative particularly targets unemployed and underemployed individuals affected by automation, with a focus on black and Latinx applicants, women, and those without a degree. The program

involves a pilot group of nine colleges and provides support through experts, fostering growth while addressing systemic challenges in the targeted population (Meredith. H, 2023). Bank of America's career development initiative focuses on onboarding experiences, training opportunities, and career development for employees across organizations. With an annual investment in 40,000 teammates, their goal is to hire individuals from low or moderate-income backgrounds. The academy collaborates with a non-profit organization to offer skills training and career paths, effectively reducing the attrition rate and promoting workforce growth (Meredith. H, 2023). Mastercard's Learning Management System (LMS) strategy, implemented to stay competitive in the financial market, involves using Degreed, an LMS system, to foster a learning culture and innovation. This approach proved beneficial during the pandemic, facilitating remote working and helping Mastercard stay relevant amid market changes. Collaborating with subject matter experts allowed for a customizable and flexible learning experience for employees, contributing to the organization's learning and development goals (Meredith. H, 2023)

Future Outlook: Navigating the 5th industrial revolution and its impact on the workforce

In the landscape of the 5th industrial revolution, cyber-physical systems become increasingly intricate, demanding strategic solutions to address emerging challenges this era sees a collaborative partnership between employees and robots or algorithms, redistributing tasks to automate routine, repetitive, and hazardous functions. This realignment allows employees to focus on managerial roles and encourages greater creativity. Consequently, there is a pressing need for workforce development and upskilling, ensuring proficiency in the in-demand skills of the 5th revolution [Gotfredsen. S and. Seda, G and Utku, G 2021). The evolving nature of business operations in this revolution has a direct impact on the skills required, leading to the emergence of skill gaps. Companies that proactively address these gaps stand to gain a strategic advantage in this transformative era, primarily by prioritizing in-demand skills among their workforce. To better understand the shift in skill demands, a comparison of the top 10 in-demand skills for the years 2015, 2020, and 2025 has been compiled, shedding light on the evolving skill landscape of the 5th industrial revolution.

They were further divided into 4 categories (Seda, G et al, (2021)

- Problem-solving.
- Working with people.
- Technology use and development.
- Self-management.

- **Problem-solving:** The table above highlights the enduring demand for complex problem-solving, critical thinking, and creativity as essential skills since 2015, and projections suggest they will maintain their significance in the next five years. The increasing integration of automation in the 5th industrial revolution creates a dynamic environment where employees can contribute more value by addressing intricate problems. This necessitates a heightened level of critical thinking, empowering individuals to utilize their problem-solving skills. This is particularly vital in meeting the personalized demands of customers for products and services. Moreover, it plays a crucial role in fostering collaboration in the human-robot-algorithm interface, further emphasizing the importance of these skills in the evolving landscape.

- **Working with people:** The advent of the new era is poised to redefine interpersonal relationships among employees. As they collaborate with robots and algorithms, fostering cooperation among individuals within and beyond the organization becomes imperative. Leaders must adopt a leadership style tailored to the evolving organizational structure and the competitive landscape, ensuring employee adaptation and heightened motivation. Transformational leadership and collaborative leadership behaviors are recognized as effective tools in this era, given their human-centric orientation. Elevating engagement, empowerment, and participation emerges as effective strategies, enabling employees to adapt to the transformation and enhance their contributions to achieving company goals. Leadership behaviors in this revolutionary era will amplify the social impact of both leaders and employees. (Aprilisa E. Realizing Society 2004 and. Seda, G et al 2021)

- **Technology Usage and Development:** Digitalization stands as a self-reinforcing advantage (Eirik K, Lasse L, Bram T, Ivan B and Sujit P. Stability in turbulent times 2021 and Seda, G et al 2021)**.** Employees equipped with skills pertinent to technology usage and development possess the potential to significantly contribute to business success. This extends beyond the IT department; departments such as HR, marketing, production, and sales will undergo operational shifts. For instance, the incorporation of AI for job interviews (Seda, G et al 2021) necessitates the hiring of AI specialists in the HR department. Similarly, data analysts could play pivotal roles in marketing departments, handling promotional activities.

- **Self-Management:** In preparation for the transformative wave of the 5th industrial revolution, developing self-management skills such as active learning and the use of learning strategies is crucial. By 2025, this revolution is anticipated to shift the division of labor between humans and machines, potentially displacing up to 85 million jobs while ushering in 97 million new roles aligned with the revolution's requirements (Benan, Ö. Ü. B. 2020 and Seda, G et al 2021). Notably, 85% of the jobs expected to emerge by 2030

have yet to materialize (DELL Technologies. Realizing 2017 and. Seda, G and Utku, G 2021) creating a significant skill gap that necessitates upskilling and reskilling. Active learning goes beyond passive information reception, emphasizing engagement through questioning, discussion, and reasoning (Petress, K 2008 and. Seda, G and Utku, G 2021). Acquiring new skills through active learning not only facilitates skill development but also imbues the work with meaning, thereby elevating motivation, job satisfaction, and overall performance. The broader spectrum of self-management skills encompasses stress tolerance, resilience, and flexibility. Dundar et al. (2020) delineated flexibility into five dimensions: time flexibility, numeric flexibility, space flexibility, wage flexibility, and functional flexibility. Of particular importance is functional flexibility, which refers to employee adaptability. Individuals with diverse skill sets can seamlessly transition between various roles within an organization, effectively navigating dynamic technological landscapes and accommodating fluctuating workloads (Seda, G and Utku, G 2021).

CONCLUSION AND RECOMMENDATIONS

The 5th Industrial Revolution, marked by the integration of AI and quantum computing, is a paradigm shift that unites human skills with machine capabilities. In the context of this era propelled by technological advancements, the importance of workforce development and upskilling becomes paramount for achieving success. This study delves into the essence of the 5th industrial evolution, offering an overview of the preceding industrial revolutions for context. The conceptual framework of the study revolves around the significance of workforce development and upskilling, with a focus on the United States as a reference point. The challenges associated with the implementation of these initiatives are explored, drawing insights from a study conducted by McKinsey involving 116 executives in prominent organizations. The identified challenges include a lack of prior understanding of the system's relevance, inadequate tools, accessibility issues, and affordability concerns. Addressing these challenges, the study recommends a curricular alignment with the 4th industrial revolution, emphasizing demand-driven skills and enhanced assessment criteria. Additionally, the research identifies the top 10 in-demand skills for the evolving 5th industrial revolution, as uncovered by Gugercin & Gugercin (2021). These skills were categorized under the following groups: Problem-solving, Working with people, Technology use and development and Self-management.

Frankiewicz & Chamorro-Premuzic (2020) emphasize that the transformation in the 5th industrial revolution is primarily centered on human beings rather than just technology. While organizations are directing their focus towards advanced technology and digitization, the actual implementation of these changes relies on the employees. Considering the anticipated impact on the future's in-demand skills, it is expected that the roles and responsibilities of the HR department will expand to address skill gaps across various organizations in this new era (Kadar D, Gazed. D and Bullet. S 2019 and Seda, G et al 2021). However, this study acknowledges certain limitations, such as variations in the stages of the revolution among different countries, preventing the generalization of results. The transition to the 4th revolution began earlier in developed countries compared to developing ones (Boogies V, S Asimov, Chistyakova K and Borisov Y 2019 and Seda, G et al 2021).

For instance, a study conducted in Turkey in 2016, involving 1000 private sector organizations, reported that Turkey's digital maturity was between the second and third revolutions during that period (Aprilisa E. Realizing Society 2004 and Seda, G et al 2021). Therefore, it is crucial to consider these expected skills for the new revolution while acknowledging the disparities in locations.

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