Human Factors in Design, Engineering, and Computing, Vol. 159, 2024, 208–217
https://doi.org/10.54941/ahfe1005584

Organizational Change and Building Human-Tech Resilience in Industry 5.0

Daniel Rukare, Nikhil Soi, and Asmita Singh Bisen

Hult International Business School, London, E1 1LD, United Kingdom

ABSTRACT

Industry 5.0 represents an era of transformation that emphasizes human-centered design and collaboration with advanced technologies with the aim of optimizing value creation through quality, service and cost. One of the key challenges of this paradigm is finding a balance between individual development and organizational readiness for the effective use of new skills. To succeed, organizations must tailor workforce development to their needs, foster a culture of continuous learning, implement human improvement technologies, encourage cross-functional collaboration, and measure the development of skills that impact value creation. By aligning individual growth with organizational priorities, companies can maximize the potential of Industry 5.0 and lead to competitive advantage and sustainable growth in this new industrial landscape.

Keywords: Industry 5.0, Human centric technology, Organizational adaptability

INTRODUCTION

This is the age of technology and therefore every country is looking for new technology, inventing technology, innovating and adopting new technology. Challenges related to the lack of human contact in production processes and the displacement of jobs in Industry 4.0 are addressed by Industry 5.0. Industry 5.0 involves a production system that combines the precision and efficiency of advanced technology with the problem-solving skills and creativity of human workers. Industry 5.0 also emphasizes the importance of social responsibility and sustainability and promotes fair and ethical working practices. Industry 5.0 therefore focuses not only on adaptation and development, but also on sustainability (Choudhary, 2023).

A fundamental shift from Industry 4.0's emphasis on pure automation to a collaborative work environment where humans and machines work together. Advanced technology enhances human capabilities, enabling employees to focus on high-level tasks such as strategy, innovation, and creative problem solving. -welfare and safety are paramount, and is designed to minimize risks and artificial intelligence systems assist decision making.

Human tech resilience must adjust what they do and how they do it, and what machines do and how they do it, to match current needs and available resources and the operational realities of today's businesses.

A highly intelligent and intelligent practitioner, powered by human creativity, experience and innovation, and powered by information and

technology, to overcome challenges and create innovative, cost-effective solutions to ensure sustainable productivity and consumer welfare. These things are unthinkable.

While businesses respond immediately to ongoing operations to "go" in the short term, political, economic, social, cultural, technological, environmental and legal forces can change, so we must also strengthen our business in the long term. their business operations; The model works in an unexpected way.

Industry 5.0 combines human intelligence with the accuracy and efficiency of AI machines in industrial production. Industry 5.0 develops tools to tackle the challenges faced by Industry 4.0 by promoting human centricity and meeting society's needs. It can help identify inconsistencies between products and company requirements (Leng et al., 2022).

METHODOLOGY

This study utilizes a narrative review methodology to analyze recent research on human technological savviness and resilience in Industry 5.0. The narrative review methodology involves a qualitative synthesis of research findings to provide a comprehensive understanding of a specific topic. This approach is particularly useful for exploring complex and multifaceted issues such as technological resilience, where integrating insights from diverse sources can lead to a more holistic perspective.

These areas were selected because they represent key components of technological resilience in Industry 5.0. The methodology employed ensures a comprehensive understanding of current global talent trends, providing valuable insights for employers to bridge the expectation gap and develop effective hiring and retention strategies.

Table 1. Quantified data (Page Outsourcing, 2024).

Qualified Data From the Survey Done by Page Outsourcing			
Demographic Analysis		**Employment Status**	
Age Bracket	**%Tage of Respondents**	**Type**	**%Tage of Respondents**
20s	12%	Employed	63%
30s	25%	Unemployed	24%
40s	29%	Business Owner/Freelancer	8%
50s	35%	Other	5%

Table 2. Percentage of workers demanding autonomy (Page Outsourcing, 2024).

Percentage of Workers Demanding Autonomy		
S.no	**Type**	**%tage**
1	In Office more than 12 Months	37%
2	Remotely more than 12 Months	25%
3	Same arrangements mpre than 12 months	35%

Table 3. Educations /s adoption (Page Outsourcing, 2024).

Education v/s Adoption	
Percentage of Employers and Employees Using AI in Their Current Role	
Employers	38%
Employees	30%

Data Collection and Sources

The data collection process involved sourcing articles from reputable academic databases such as Scopus, Web of Science, and Google Scholar. Keywords such as "Industry 5.0," "technological resilience," "upskilling," "knowledge management," "smart logistics," and "human-centric technologies" were used to identify relevant studies. Additionally, industry reports from ManpowerGroup, Gartner, and Page Outsourcing were included to incorporate practical insights and current trends in technological resilience and workforce management.

Inclusion and Exclusion Criteria

The inclusion criteria for the review were as follows:

- Studies published within the last five years to ensure the relevance and timeliness of the findings.
- Articles that specifically address aspects of technological resilience in the context of Industry 5.0.
- Research that includes empirical data, theoretical frameworks, or case studies related to upskilling, technology adoption, knowledge management, and smart logistics.

Exclusion criteria included:

- Studies focusing solely on Industry 4.0 without discussing the transition to Industry 5.0.
- Articles that did not provide substantial insights into technological resilience or human-centric approaches.
- Non-peer-reviewed articles to maintain the credibility and reliability of the findings.

ORGANIZATIONAL CHANGE

Building Human Tech in Industry 5.0

For companies to use Industry 5.0, it is necessary to have the necessary communication between machines as well as operators from the workforce. This is knowledge in areas such as robotics as well as artificial intelligence (Zhang and Chen, 2020) (Chowdhury et al., 2020).

The role of the business organization is based on value-based decision making. It is necessary to train workers and provide special training in

order to reduce the costs of companies, since it is not necessary to shut down production to train employees. Provide safety training that can prevent employees from exposing themselves to unnecessary problems during training (Leong et al., 2020).

Communication and employee motivation are improved by creating communication knowledge environments. The work is related to communication and embedded systems as well as artificial intelligence (Longo, Padovano, and Umbrello, 2020).

Industry 5.0

The development of the industrial revolution caused significant changes in all the subsystems of society. However, introduced by the new ideas of social development, such as sustainability, anthropocentrism and carbon emissions, production systems / standards are struggling to adapt to the needs of new projects. Industry 5.0 solves the problem of incompatibility between industrial and social needs of production according to a new perspective. Compared to previous industrial revolutions, which focused on the economic aspects of sustainability, the industry 5.0 perspective emphasizes the needs of people and society. With the publication of the EU White Paper, we are moving into the era of Industry 5.0 (Jayal et al., 2010) (Ijomah et al., 2007).

In addition, the aim is to develop an understanding of Industry 5.0 and the sustainability of production and its performance over time when advanced production methods are used, and when adopting them must have environmental aspects into account (Alvarez-Aros and Barnal-Torres, 2021). The term Industry 5.0 refers to people working side by side with robots and intelligent machines. These are robots that help people work more efficiently and faster by using advanced technologies such as the Internet of Things (IoT) and big data. It adds a personal touch to the automation and efficiency players of Industry 4.0. In manufacturing, robots have traditionally performed dangerous, monotonous or physically demanding tasks, such as welding and painting in automotive factories and loading and unloading heavy materials in warehouses (Longo, Padovano, and Umbrello, 2020).

Industry 5.0 and Organizational Change

In the era of Industry 5.0 companies are challenged to create a culture that values learning and skill development to stay competitive (Chowhan, 2016). This approach is deeply rooted in the idea of building resilience, which has evolved through stages over time. Initially, organizations focused on Preventative Control prioritizing monitoring and compliance systems, for stability and efficiency (Alvarez Aros & Bernal Torres, 2021). Subsequently, the phase of Mindful Action emerged, emphasizing awareness and responsiveness within organizations. Empowering employees and equipping them with tools became crucial during this stage to effectively adapt to changing environments (Chen, 2011).

As organizations advanced they moved into the Performance Optimization stage where the focus shifted towards developing systems that not only improved processes but also leveraged emerging opportunities in value

creation (Rahman et al., 2013). Following this optimization phase organizations transitioned into Adaptive Innovation realm where the emphasis shifted towards fostering envisioning and innovation capabilities. This stage is crucial for organizations to foster growth maintain adaptability and seize opportunities, in markets (Zahra et al., 1999).

The concept of Paradoxical Thinking has become increasingly important, for organizations as they must effectively manage tensions. This involves balancing value optimization with preparing for opportunities to maintain competitiveness (Wahyuningsih et al., 2019). Research has shown that investing in practices that enhance skills leads to levels of innovation which in turn significantly boosts performance (Chowhan, 2016). This emphasizes the role of learning and skill development in driving success and competitiveness within organizations. Additionally, the rapid advancements in technology with Industry 4.0 and Industry 5.0 have heightened competition, across industries making it essential for organizations to prioritize learning and skill enhancement to stay competitive (Alvarez Aros & Bernal Torres, 2021). Organizations that establish a culture of learning not only promote innovation but also gain a competitive advantage in the ever-changing business environment.

Organizational culture acts as a tool for companies to gain advantages by fostering valuable, unique and difficult-to-imitate cultural aspects (Chen, 2011). This underscores the importance of aligning culture with learning and skill-enhancement goals to drive competitiveness.

The importance of managerial skills, in improving effectiveness is widely acknowledged, highlighting the significant role of skill development in boosting overall organizational performance (Rahman et al., 2013). By investing in skill development programs companies can not foster. Also, strengthen their competitive edge in the market (Zahra et al., 1999).

This entrepreneurial mindset aligns well with the value of learning and skill enhancement encouraging employees to think and adapt to evolving market trends. Evaluating culture using frameworks like the Denisons method has been proven to enhance business competitiveness further highlighting the connection between culture, learning and organizational success (Wahyuningsih et al., 2019). By utilizing culture to promote learning businesses can establish a sustainable competitive advantage in Industry 5.0.

In today's business environment, human resource management plays a role, in optimizing resources, especially human capital to sustain competitiveness (Siruri & Cheche, 2021). By prioritizing job enrichment and effectively utilizing employees' skills and capabilities organizations can strengthen their position.

Strategic management of resources plays a role, in determining employee dedication and staying ahead in the competitive landscape emphasizing the strategic value of HR practices in promoting continuous learning and skill growth (Yamin, 2024). This emphasizes the necessity for companies to harmonize their HR strategies to boost employee competencies to enhance performance and competitiveness.

The processes of learning are vital for organizational progression and performance enhancement (Saha et al., 2016). By incorporating

aspects like culture, critical thinking, reflective abilities and ongoing learning opportunities organizations can establish an environment for continuous learning and skill improvement. Moreover, organizational agility is acknowledged as an element in driving competitiveness stressing the significance of adaptability and responsiveness to market fluctuations (Saha et al., 2017). Companies that prioritize agility and learning have a position to tackle obstacles and leverage emerging prospects in Industry 5.0.

Gaining advantages from the maturity of project management underscores the importance of interpersonal skills, in project accomplishments (Huang et al., 2023). Through enhancing project management abilities and strengthening soft skills organizations can enhance planning, execution and assessment processes ultimately securing an advantage.

Training programs, in the workplace are seen as components of a corporate strategy highlighting the importance of continuous learning in driving the success of organizations (S & Gomathi, 2015). These programs do not improve the skills of employees. Also boosts organizational competitiveness by ensuring a proficient workforce.

Human- Tech Resilience in Industry 5.0

The strategic importance of technological resilience is multifaceted, encompassing the need to sustain operations, enhance competitiveness, mitigate risks, and ensure long-term success. In the context of Industry 5.0, where human-centric and sustainable practices are paramount, technological resilience enables organizations to integrate advanced technologies while maintaining a focus on human well-being and sustainability. This holistic approach not only improves operational efficiency but also positions organizations to thrive in an increasingly digital and interconnected world.

The transformation of professional skills by artificial intelligence (AI) necessitates implementing measures and strategies for upskilling or reskilling workers. Organizations must map transversal skills, improve current skills, and develop new ones to adapt to AI-driven changes (Morandini et al., 2023). Recent reports from organizations such as ManpowerGroup, Gartner, and Page Outsourcing further underscore the growing capabilities of humans in adopting the fast-paced nature of technology. According to ManpowerGroup, there is a significant emphasis on developing a "learnability" culture where workers continuously seek to develop new skills and adapt to new technologies. Gartner reports indicate that organizations are increasingly investing in reskilling and upskilling programs to mitigate skill gaps, with a focus on enhancing digital literacy and technical skills. Page Outsourcing highlights that employers are actively seeking candidates who demonstrate adaptability, resilience, and a proactive approach to learning, ensuring that the workforce is prepared to navigate the complexities of Industry 5.0. These insights align with the academic findings, reinforcing the importance of continuous learning and adaptability in achieving technological resilience.

Central to this transition is the development of personalized training programs designed to upskill and reskill personnel, ensuring that the workforce remains adaptable and proficient in utilizing advanced technologies. These training programs leverage large language models and

human-centric principles, enabling the creation of customized learning experiences that address specific skill gaps and promote a culture of continuous professional development (Fraile et al., 2023).

The adoption of new technologies, such as Autonomous Mobile Robots (AMRs), is integral to this process. These technologies not only enhance operational efficiency but also ensure safer working environments and garner worker acceptance through thoughtful integration into existing workflows. This approach exemplifies the core principle of human-centricity, as it emphasizes the importance of worker safety and acceptance in technological advancements (Chivilò & Meneghetti, 2023). Additionally, enhanced knowledge management systems play a critical role in this ecosystem by supporting the continuous cycle of knowledge creation, acquisition, and dissemination. These systems are crucial for integrating new technologies and ensuring that organizations can maintain their resilience and sustainability in the face of rapid technological changes (Lovrenčić, 2023).

Smart logistics, a significant component of Industry 5.0, emphasizes the interaction between humans and technology, enhancing operational efficiency through the adoption of collaborative robots and human-machine systems. This shift from the technology-focused Industry 4.0 to the more human-centric Industry 5.0 highlights the importance of human involvement in the digital transition, ensuring that technological advancements are implemented in ways that are both effective and inclusive (Jafari et al., 2022). The transformation of professional skills by artificial intelligence further necessitates strategic measures for upskilling and reskilling. Organizations must proactively identify the skills required for AI adoption, improve current skills, and develop new ones, thereby preparing their workforce for the evolving demands of AI-driven environments (Morandini et al., 2023).

Moreover, the Industry 5.0 framework integrates fundamental principles such as collaboration, coordination, communication, automation, and data analytics to create resilient value systems. This framework spans multiple levels, including societal, network, and plant levels, and addresses various dimensions of industrial operations, including organization, management, technology, and performance assessment. By framing a new triple bottom line that encompasses resilient value creation, human well-being, and sustainable societal development, Industry 5.0 redefines the value of industrial activities in terms of profit, people, and society (Ivanov, 2022). This holistic approach ensures that technological advancements contribute to the broader goals of societal well-being and environmental sustainability, while also fostering resilience in the face of rapid and disruptive changes.

The Strategic Importance of Tech Resilience in Industry 5.0

The concept of technological resilience refers to an organization's ability to withstand, adapt to, and recover from technological disruptions. As industries increasingly integrate advanced technologies, the ability to manage and sustain these technologies becomes crucial for maintaining competitive advantage and ensuring business continuity. Technological resilience is essential for sustaining operations in the face of disruptions.

Organizations equipped with robust resilience strategies can quickly adapt to technological changes and recover from disruptions, minimizing downtime and maintaining productivity. For instance, the integration of advanced technologies like artificial intelligence and machine learning enhances an organization's ability to predict and mitigate potential disruptions (Ivanov, 2022).

CONCLUSION

The rise of Industry 5.0 marks the beginning of a new era in the Industrial Revolution, where human resources and technologies could work together in synergy. This study examined the relationship between self-development approaches and the adoption rates of organizations pursuing Industry 5.0, revealing the potential and conflicts in this transition process. Therefore, the conclusions drawn in this article highlight the need for a balanced approach that focuses on creating value in terms of quality, service and costs, using technologies and a people-oriented approach (Longo, Padovano, and Umbrello, 2020). The conflict between rapid skills adoption and organizational readiness is reflected as a critical factor for Industry 5. Organizations that do not foster a culture of learning and training are likely to lag behind organizations that are receptive to change and committed to building of a culture of staff development. The research emphasizes the need for an integrated approach that links human development to organizational objectives. This includes strategic workforce planning and forecasting, promoting continuous learning and providing affordable upskilling solutions. The role of human-centered technologies that enhance but not eliminate the human experience should not be overstated as this is the foundation of Industry 5. Furthermore, this study highlights the importance of identifying key performance indicators to inform the development of improvement efforts of skills to evaluate. in the field of value generation. These metrics are valuable for tailoring workforce development strategies and assessing whether training activities are beneficial to organizations. In conclusion, successfully navigating the Industry 5.0 landscape requires a paradigm shift at the organizational level that focuses on change as the new normal and the integration of human capital with technological resources. Balancing employee training and development with organizational readiness is key to Industry 5.0, which positions employees as leaders in creating value and achieving sustainable competitive advantage.

REFERENCES

Alvarez-Aros, E. and Bernal-Torres, C. (2021). Technological competitiveness and emerging technologies in Industry 4.0 and Industry 5.0. Anais Da Academia Brasileira De Ciências, 93(1). https://doi.org/10.1590/0001-3765202120191290

Chen, Y. (2011). Green organizational identity: sources and consequence. Management Decision, 49(3), 384–404. https://doi.org/10.1108/00251741111120761

Chivilò, M. and Meneghetti, A., 2023. An Industry 5.0 perspective on feeding production lines. Sustainability, 15(9), p. 7254.

Chowdhury MZ, Shahjalal M, Ahmed S, Jang YM (2020) 6G wireless communication systems: applications, requirements, technologies, challenges, and research directions. IEEE Open J Commun Soc 1:957–975.

Chowhan, J. (2016). Unpacking the black box: understanding the relationship between strategy, HRM practices, innovation and organizational performance. Human Resource Management Journal, 26(2), 112–133. https://doi.org/10.1111/1748-8583.12097

Choudhary, J., 2023. Industry 5.0: The Human-Tech Revolution and India's Role in Leading the Way. [Online] Medium. Available at: https://medium.com/illumination/industry5-0-the-human-tech-revolution-and-indias-role-in-leading-the-way-faf187dddb87.

Fraile, F., Psarommatis, F., Alarcón, F. and Joan, J., 2023. A methodological framework for designing personalised training programs to support personnel upskilling in Industry 5.0. Computers, 12(5), p. 101.

Ijomah, W. L., McMahon, C. A., Hammond, G. P. and Newman, S. T., 2007. Development of design for remanufacturing guidelines to support sustainable manufacturing. *Robotics and Computer-Integrated Manufacturing*, *23*(6), pp. 712–719.

Ivanov, D., 2022. The Industry 5.0 framework: Viability-based integration of the resilience, sustainability, and human-centricity perspectives. International Journal of Production Research, 61(6), pp. 1683–1695.

Huang, G., Lee, S., & Clinciu, D. (2023). Competitive advantages of organizational project management maturity: a quantitative descriptive study in Australia. Plos One, 18(6), e0287225. https://doi.org/10.1371/journal.pone.0287225

Jafari, N., Azarian, M. and Yu, H., 2022. Moving from Industry 4.0 to Industry 5.0: What are the implications for smart logistics? Logistics, 2(4), p. 36.

Jayal, A. D., Badurdeen, F., Dillon Jr, O. W. and Jawahir, I. S., 2010. Sustainable manufacturing: Modeling and optimization challenges at the product, process and system levels. *CIRP Journal of Manufacturing Science and Technology*, *2*(3), pp. 144–152.

Leng, J., Sha, W., Wang, B., Zheng, P., Zhuang, C., Liu, Q., Wuest, T., Mourtzis, D. and Wang, L., 2022. Industry 5.0: Prospect and retrospect. *Journal of Manufacturing Systems*, *65*, pp. 279–295.

Leong YK, Tan JH, Chew KW, Show PL (2020) Significance of industry 5.0. In: Show PL, Chew KW, Ling TC (eds) The Prospect of industry 5.0 in biomanufacturing. CRC Press, pp. 1–20.

Longo, F., Padovano, A. and Umbrello, S., 2020. Value-oriented and ethical technology engineering in industry 5.0: A human-centric perspective for the design of the factory of the future. *Applied Sciences*, *10*(12), p. 4182.

Longo F, Padovano A, Umbrella S (2020) Value-oriented and ethical technology engineering in industry 5.0: a human-centric perspective for the design of the factory of the future. Appl Sci 10(12):4182.

Lovrenčić, S., 2023. The role of knowledge management in transition to Industry 5.0. In: 2023 46th MIPRO ICT and Electronics Convention (MIPRO). Opatija, Croatia: IEEE, pp. 1190–1195.

Morandini, S., Fraboni, F., de Angelis, M., Puzzo, G., Giusino, D. and Pietrantoni, L., 2023. The impact of artificial intelligence on workers' skills: Upskilling and reskilling in organisations. Informing Science: The International Journal of an Emerging Transdiscipline, 26, pp. 65–85.

Page Outsourcing, 2024. Talent Trends 2024. [Online] Page Outsourcing. Available at: https://www.pageoutsourcing.com/talent-trends

Rahman, A., Ng, S., Sambasivan, M., & Wong, F. (2013). Training and organizational effectiveness: the moderating role of the knowledge management process. European Journal of Training and Development, 37(5), 472-488. https://doi.org/10.1108/03090591311327295

Saha, N., Chatterjee, B., Gregar, A., & Sáha, P. (2016). The impact of SHRM on sustainable organizational learning and performance development. International Journal of Organizational Leadership, 5(1), 63–75. https://doi.org/10.33844/ijol.2016.60291

S, D. and Gomathi, S. (2015). Effective workplace training: a jump starter to organizational competitive advantage through employee development. Mediterranean Journal of Social Sciences. https://doi.org/10.5901/mjss.2015.v6n3p49

Saha, N., Gregar, A., & Sáha, P. (2017). Organizational agility and HRM strategy: do they really enhance firms' competitiveness?. International Journal of Organizational Leadership, 6(3), 323–334. https://doi.org/10.33844/ijol.2017.60454

Siruri, M. and Cheche, S. (2021). Revisiting the hackman and Oldham job characteristics model and Hertzberg's two-factor theory: propositions on how to make job enrichment effective in today's organizations. European Journal of Business Management and Research, 6(2), 162–167. https://doi.org/10.24018/ejbmr.2021.6.2.767

Wahyuningsih, S., Sudiro, A., Troena, E., & Irawanto, D. (2019). Analysis of organizational culture with Denison's model approach for international business competitiveness. Problems and Perspectives in Management, 17(1), 142–151. https://doi.org/10.21511/ppm.17(1).2019.13

Yamin, M. (2024). The influence of strategic human resource management and artificial intelligence in determining supply chain agility and supply chain resilience. Sustainability, 16(7), 2688. https://doi.org/10.3390/su16072688

Zhang C, Chen YA (2020) Areview of research relevant to the emerging industry trends: industry 4.0, IoT, blockchain, and business analytics. J Industr Integr Manag. 5(01):165–180.

Zahra, S., Nielsen, A., & Bogner, W. (1999). Corporate entrepreneurship, knowledge, and competence development. Entrepreneurship Theory and Practice, 23(3), 169–189. https://doi.org/10.1177/104225879902300310