

Training Effectiveness & Workforce Reskilling in the Era of Industry 4.0: An Analytical Research in Madurai City

Ms. R. Christy Jebamalar^{1*} | Dr. S. Subramanian²

¹ Ph.D. (Part-Time) Research Scholar, AMET Business School, Academy of Maritime Education and Training (AMET), Kanathur, Chennai, Tamil Nadu.

²Head of the Department / Research Supervisor, Department of Maritime Commerce, Academy of Maritime Education and Training (AMEET), Kanathur, Chennai, Tamil Nadu.

*Corresponding Author: christy.rajiah@gmail.com

Citation: Jebamalar, C. & Subramanian, S. (2026). Training Effectiveness & Workforce Reskilling in the Era of Industry 4.0: An Analytical Research in Madurai City. *International Journal of Advanced Research in Commerce, Management & Social Science*, 09(03(II)), 235–243. [https://doi.org/10.62823/IJARCMSS/9.3\(II\).9485](https://doi.org/10.62823/IJARCMSS/9.3(II).9485)

Abstract

The perception of Industry 4.0 spins around the operation of mechanization and intelligent systems to transform work processes and construction methods, necessitating companies to abandon antiquated training skills in favour of contemporary, ongoing learning strategies in order to adapt to evolving job roles and skill requirements, thereby emphasizing the prominence of continual augmentation of the workforce. As a result, improving employee skills and making sure that businesses are ready for technological improvements depend heavily on the efficacy of training and workforce reskilling. In order to meet the technological and competence requirements of Industry 4.0, this research examines how Madurai City enterprises may improve their training programs and assist staff in acquiring new skills. Automation, AI, IoT, robots, data analytics, and digital platforms are some examples of these fields. The study intends to identify the primary reskilling and upskilling requirements of workers and examine the elements that contribute to successful training in a quickly evolving tech environment. It focuses in particular on the significance of training materials, the abilities of trainers, contemporary training methods, technology-driven learning, employee engagement, and organizational support. Employees' technical proficiency, digital aptitude, problem-solving abilities, flexibility, self-assurance, and general job performance may all be greatly enhanced by effective training. Reskilling the workforce also enables workers to adapt to changing job positions and new technology. Organizations must adopt ongoing, hands-on, technology-focused, employee-centered learning methodologies in place of more conventional training approaches.

Keywords: Industry 4.0, Training Effectiveness, Workforce Reskilling, Upskilling, Digital Skills, CAGR.

Introduction

Organizations may overcome talent shortages, adopt new technologies, and increase productivity through continuing skill development, resulting in long-term growth and innovation. The upskilling and reskilling industry is expected to be valued \$58.7 billion in 2025 and \$148.4 billion by 2034, with a strong compound annual growth rate (CAGR) of 10.9% between 2026 and 2034. Meena & Parimalarani (2018) Participants were asked to rate their level of satisfaction with a number of aspects, such as leave rules, working conditions and environment, prestige, employee growth and development, pay and promotion, and more. Predicting the transfer of training (ToT) from management training was the goal of Yaqub et al. (2021).

The predictive power of ToT elements, including person traits (self-efficacy), training intervention design (training techniques), and work environment (organizational support) among the participants, was empirically evaluated in this study. The findings showed that training intervention design, work environment, and self-efficacy all directly and favourably correlated with training transfer. The results suggest that training methods, organizational support, and self-efficacy are important determinants of ToT. The development and execution of successful management training initiatives for managers are positively impacted by these findings. Organizations should consider all three variables to enhance training transfer. This study's generalizability would be improved by doing a replication in both domestic and foreign settings (Fraile et al., 2023).

Review of Literature

In order to accomplish the objectives of Industry 4.0, Ling Li (2022) recognized the essential talents that the industry needs and developed a blueprint to help people pick up new abilities. The results of the study suggest that a key element of an organization's strategic goals should be lifelong learning. To guaranty that learning options, including reskilling and upskilling, are accessible, available, and inexpensive for the workforce, significant efforts are required. As a key component of the Industry 4.0 vision, this paper presents a unique perspective on the need for a future-ready learning society.

According to Ruñ-Valdés et al. (2023), the process begins with determining the need for training, which can be done through expert collaboration, competency assessments, performance evaluations, and interviews. Additionally, a strategy of constant adaptation is implemented to maintain labour skills up to date as technology develops. In the end, this approach helps individuals by providing opportunities for career progression and technology adaptation, as well as the organization by increasing efficiency and competitiveness.

Historical approach in this publication by Sanchez et al. (2023), looking at how training and the use of simulation-like experiences have changed over time identify recurrent themes in workplace training with this method. In order to understand how these new discoveries relate to the historical themes noted, we then carried out a thorough analysis of recent studies on training that make use of simulation technologies. Lastly, we summarized the body of research on the application of simulation technology in training, highlighting potential future avenues and making suggestions for scholars and practitioners alike.

According to Tamsah et al. (2023), TE improved SSC and HWP but had no direct effect on the rise in EC. This implies that the relationship between these two factors was mediated by SSC. Furthermore, the effect of TE on HWP was mediated by SSC and EC. These results are expected to add to the limited body of knowledge regarding the connection between HWP and human resources (HR) planning, especially in light of the COVID-19 pandemic.

Cristini et al. (2024) investigate how changes brought about by the digital and green transitions, along with demographic shifts and broader megatrends, may affect the demand for training among businesses. The evaluated studies and documents provide insightful information about the shifting workforce demographics as well as the talents that will be highly sought after in the future. They also bring up significant issues with methods and instructional strategies that take into account the distinctive qualities of learners, as well as how skills learned at the end of training or retraining programs are assessed. The investigation highlights the significance of key player governance and stakeholder engagement.

Öurcan & Pojar (2024) the intricacy of the subject justifies this mixed methods approach, which offers a theoretical perspective and a data-driven analysis of organizational issues and workforce skill requirements in digital transformation. According to the research discussed in this article, concentrated upskilling and reskilling initiatives are essential for closing the skills gap, enabling businesses to fully utilize Industry 4.0 while laying the groundwork for a long-term, people-centered Industry 5.0. In order to stay competitive in a digital economy, HR professionals, legislators, and academics can learn a lot from this article about developing an innovative, adaptable workforce.

Reskilling is an essential organizational technique that helps employers successfully traverse challenging business conditions, according to Pillans (2024). Implementing strategic workforce planning, adopting flexible work design techniques, and developing focused upskilling and reskilling initiatives are the three main steps that organizations must concentrate on.

Asiedu & Tenakwah (2025) examine how proactive workforce development initiatives might support long-term talent streams. The article provides a framework for developing successful upskilling and reskilling initiatives, emphasizing the value of data-driven workforce planning, cutting-edge learning tools, and a growth-oriented culture. Additionally, it offers HR directors useful advice on how to leverage contemporary learning technology, implement data-driven workforce planning, and cultivate a growth-oriented culture within their companies.

Ghosh et al. (2025) as they modify their strategic thinking to create corporate learning strategies that meet future expectations, human resources leaders and training managers will find this insight especially helpful. According to research, companies can achieve long-lasting improvements that produce quantifiable outcomes by encouraging continuous feedback, setting specific objectives, and coordinating training with business goals. In talent development, the PwC model demonstrates how methodical evaluation promotes creativity, diversity, and operational flexibility.

According to Elavarasi (2025), disparities in skills impede innovation and operational efficiency, especially in both technical and critical soft skills. Identify key enablers for efficient management, such as proactive evaluations of skill requirements, curriculum alignment with industry expectations, ongoing learning pathways, and the use of digital training tools like VR/AR. Nonetheless, issues including budgetary limitations, a lack of managerial dedication, and fragmented cooperation between academia and business persist.

The workforce's current skill deficiencies are highlighted by Leogrande et al. (2026), which prompted the creation of a framework for intelligent learning management systems designed for businesses going through digital transformation. An Intelligent Learning Management System (LMS) prototype is presented in order to solve these skill gaps. According to the suggested methodological approach, the framework has identified notable skill gaps in the workforce of SMEs. Additionally, this study shows that firms face significant obstacles in developing workforce skills because of different competency gaps related to digital transformation. In the end, the suggested approach helps businesses identify the talent shortages required for a successful digital transition.

Objectives of the Study

- To identify employees' primary needs for upskilling and reskilling in order to adapt to Industry 4.0 technology.
- To examine the factors influencing Madurai City employees' training efficacy.
- To suggest suitable methods for improving workforce reskilling and training efficacy so that workers are prepared for the changing requirements of Industry 4.0.

Research Methodology

Research Design

The study will utilize a expressive and investigative methodology to evaluate the efficacy of training creativities and explore the reskilling needs of staffs within the framework of Industry 4.0.

Study Area

Employees from Madurai-based industrial, service, logistics, banking, IT, and other technology-oriented firms will partake in the study.

Population of the Study

The study population will be made up of workers who have joined in organizational training platforms and are either presently using or are expected to adapt to Industry 4.0 technology.

Sample Size

A total of 300 characters will be chosen for the study to provide a representative sample from various industries and job taxonomies.

Sampling Technique

To assure illustration across diverse industries, employment levels, and personnel kinds, stratified sampling may be used first, followed by proportionate sampling.

Sources of Data

- Primary data will be acquired from workforces using a uniform questionnaire.
- Secondary data will be collected from books, research journals, government publications, industry reports, organizational papers, and relevant web resources.

• Statistical Tools

For percentage analysis, use Cronbach's Alpha for reliability testing and ANOVA to compare employee groups. To analyze training effectiveness and workforce reskilling, use correlation analysis, KMO and Bartlett's Test, and factor analysis to identify key aspects.

Analysis

Table 1: Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	N of Items
.776	35

The exploration of dependability for 35 gears indicates a Cronbach's Alpha score of 0.776. This suggests that the questionnaire has a high degree of internal consistency and reliability. The 35 statements can be deemed sufficiently consistent in evaluating the study's intended constructs because the alpha value is greater than the widely recognized criterion of 0.70. As a result, the questionnaire is trustworthy and appropriate for additional statistical analysis, including factor analysis, correlation, ANOVA and hypothesis testing.

Table 2: Percentage Analysis

Category	Classification	Frequency	Percent
Gender	Male	179	59.7
	Female	121	40.3
Age	Below 25 Years	71	23.7
	25-35 years	102	34.0
	36-45 years	68	22.7
	46-55 years	59	19.7
	56-65 years	51	16.9
Education Qualification	School level	74	24.7
	Under Graduate	84	28.0
	Post Graduate	80	26.7
	Professional	62	20.7
Job Level	Junior	66	22.0
	Middle	126	42.0
	Senior	67	22.3
	Managerial	41	13.7
Work Experience	Below 5 years	62	20.7
	5–10 years	66	22.0
	11–15 years	45	15.0
	16–20 years	61	20.3
	Above 20 years	66	22.0
Industry Sector	Manufacturing	41	13.7
	IT & ITES	48	16.0
	Banking & Finance	39	13.0
	Logistics	64	21.3
	Retail	48	16.0
	Healthcare	60	20.0
Awareness of Training Programme	Yes	276	92.0
	No	24	8.0
Have you attended any training programme related to digital technologies?	Yes	276	92.0
	No	24	8.0

The demographic profile shows that male defendants make up 59.7% of the 300 participants, while female defendants make up 40.3%. Perpetrators between the ages of 25 and 35 make up the largest age group (34.0%), followed by those under 25 (23.7%), those between the ages of 36 and 45 (22.7%), and those between the ages of 46 and 55 (19.7%). In terms of educational background, 24.7% have finished secondary school, 28.0% are undergraduates, 26.7% have postgraduate degrees, and

20.7% have professional credentials. The majority of workers (42.0%) are middle-level, followed by senior-level workers (22.3%), junior-level workers (22.0%), and managerial personnel (13.7%). With 22.0% of suspects reporting five to ten years of experience and another 22.0% reporting more than twenty years, work experience is fairly evenly distributed across categories. 13.7% of the plaintiffs are in the industrial sector, 13.0% are in banking and finance, and 16.0% work in retail. One interesting finding is that 92.0% of contributors are aware of training programs, with an equal percentage (92.0%) having donated in digital technology training. Only 8.0% reported being unaware of or not having participated in such training programmes. According to this profile, the respondents are primarily working professionals with substantial expertise in digital technology training, which puts them in a good position to assess workforce reskilling and training efficacy in the context of Industry 4.0.

Table 3: Reskilling and Upskilling Requirements and the training programme related to digital technologies

ANOVA						
Reskilling and Upskilling Requirements		Sum of Squares	DF	Mean Square	F	Sig.
Regular training to improve my digital skills.	Between Groups	8.279	1	8.279	3.982	.047
	Within Groups	619.518	298	2.079		
	Total	627.797	299			
Require training in Artificial Intelligence and automation technologies.	Between Groups	13.274	1	13.274	6.963	.009
	Within Groups	568.072	298	1.906		
	Total	581.347	299			
Improve my knowledge of data analytics and digital tools.	Between Groups	25.139	1	25.139	15.296	.000
	Within Groups	489.781	298	1.644		
	Total	514.920	299			
Training in Internet of Things (IoT) would improve my work capabilities.	Between Groups	8.279	1	8.279	3.982	.047
	Within Groups	619.518	298	2.079		
	Total	627.797	299			
Develop Cyber security awareness to perform my job effectively.	Between Groups	13.586	1	13.586	10.312	.001
	Within Groups	392.611	298	1.317		
	Total	406.197	299			
Require continuous upskilling to cope with technological changes.	Between Groups	23.132	1	23.132	14.496	.000
	Within Groups	475.534	298	1.596		
	Total	498.667	299			
Training in problem-solving and critical thinking is essential for job.	Between Groups	8.426	1	8.426	4.752	.030
	Within Groups	528.361	298	1.773		
	Total	536.787	299			
Digital communication and collaboration skills are important for Career growth.	Between Groups	19.821	1	19.821	9.890	.002
	Within Groups	597.259	298	2.004		
	Total	617.080	299			
Reskilling programmes can improve my ability to handle new job responsibilities.	Between Groups	15.400	1	15.400	9.301	.002
	Within Groups	493.437	298	1.656		
	Total	508.837	299			

All nine reskilling and upskilling requirements show statistically significant differences between the groups at the 5% level, according to the ANOVA results. The null hypothesis, which asserts that there is no substantial difference between the groups for any of the nine claims, can thus be rejected. These results highlight the need for continual digital training, AI and automation, data analytics, IoT, Cyber security, constant upskilling, critical thinking, digital collaboration, and reskilling programs to enable workers to successfully adjust to the changing needs of Industry 4.0.

Table 4: Training Effectiveness and Employee Performance

- T1- Training has improved knowledge and skills.
- T2- Training has improved work performance.
- T3- Training has increased productivity.
- T4- Training has improved ability to adapt to technological changes.
- T5- Training has increased confidence in performing job-related tasks.
- T6- Training has helped me perform new responsibilities effectively.
- T7- Training has improved problem-solving abilities.
- T8- Training has improved readiness to work with Industry 4.0 technologies.
- T9- Training has contributed to career development.
- T10- Overall, the training programmes provided by organisation are effective.

IS- Industry Sector

Pc- Pearson Correlation

Sig. - Sig. (2-tailed)

Correlations												
		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	IS
T1	PC	1										
	Sig.											
	N	300										
T2	PC	.787**	1									
	Sig.	.000										
	N	300	300									
T3	PC	.702**	.735**	1								
	Sig.	.000	.000									
	N	300	300	300								
T4	PC	.740**	.753**	.734**	1							
	Sig.	.000	.000	.000								
	N	300	300	300	300							
T5	PC	.056	-.026	.042	.033	1						
	Sig.	.338	.651	.464	.565							
	N	299	299	299	299	299						
T6	PC	-.241**	-.239**	-.237**	-.328**	.153**	1					
	Sig.	.000	.000	.000	.000	.008						
	N	299	299	299	299	299	299					
T7	PC	-.206**	-.252**	-.234**	-.274**	.155**	.561**	1				
	Sig.	.000	.000	.000	.000	.007	.000					
	N	300	300	300	300	299	299	300				
T8	PC	-.022	.020	.064	-.035	-.199**	.296**	.027	1			
	Sig.	.702	.730	.270	.543	.001	.000	.644				
	N	300	300	300	300	299	299	300	300			
T9	PC	.256**	.184**	.239**	.155**	-.002	-.132*	-.083	.195**	1		
	Sig.	.000	.001	.000	.007	.970	.023	.151	.001			
	N	300	300	300	300	299	299	300	300	300		
T10	PC	.174**	.239**	.255**	.142*	.036	-.039	.116*	-.022	.199**	1	
	Sig.	.002	.000	.000	.014	.534	.501	.044	.699	.001		
	N	300	300	300	300	299	299	300	300	300	300	
IS	PC	.017	-.003	.056	.003	.048	.004	-.036	.048	.012	-.022	1
	Sig.	.763	.952	.337	.960	.407	.942	.536	.404	.835	.708	
	N	300	300	300	300	299	299	300	300	300	300	300
**. Correlation is significant at the 0.01 level (2-tailed).												
*. Correlation is significant at the 0.05 level (2-tailed).												

The correlation findings indicate that various training and reskilling factors are notably interconnected, especially T1–T4. However, the lack of significant correlations between IS and T1–T10 suggests that these specific training variables do not exhibit a statistically significant linear relationship with IS in the current dataset. Consequently, any hypothesis suggesting a meaningful direct correlation between IS and the individual training/reskilling factors would not be backed by this correlation analysis.

Table 5: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.696
Bartlett's Test of Sphericity	Approx. Chi-Square	1581.904
	df	28
	Sig.	.000

The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy is 0.696, which shows that the level of sampling adequacy is acceptable. Because the KMO value exceeds the suggested threshold of 0.60, the sample is deemed suitable for factor analysis. Additionally, Bartlett's Test of Sphericity yields an approximate Chi-square value of 1581.904 with 28 degrees of freedom, and the significance value is 0.000 ($p < 0.001$). This finding is statistically significant, suggesting that the correlation matrix is notably different from an identity matrix. Thus, there are meaningful correlations among the variables.

Communalities		
	Initial	Extraction
Organisations should provide regular Industry 4.0 training programmes.	1.000	.870
Organisations should provide personalised training based on employee skill gaps.	1.000	.923
Practical and hands-on training should be increased.	1.000	.220
Organisations should use modern digital learning platforms.	1.000	.765
Employees should be encouraged to participate in continuous learning programmes.	1.000	.692
Organisations should regularly assess employees' training needs.	1.000	.427
Collaboration with universities and training institutions can improve reskilling opportunities.	1.000	.935
Organisations should provide incentives for employees who acquire new skills.	1.000	.922
Extraction Method: Principal Component Analysis.		

Overall, six of the eight variables have extraction values more than 0.60, indicating that the extracted components adequately describe them. Particularly well-articulated are the factors related to Industry 4.0 training, digital learning platforms, incentives, individualized training, institutional collaboration, and continuous learning. However, practical and hands-on training (0.220) shows a relatively low communality, suggesting that the extracted factor structure may not adequately represent it and may require more consideration in the factor analysis. Overall, the results indicate that the majority of the factors pertaining to training, reskilling, and upskilling demands are sufficiently represented by the extracted components.

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.504	31.299	31.299	2.504	31.299	31.299	2.124	26.549	26.549
2	1.847	23.093	54.392	1.847	23.093	54.392	1.964	24.544	51.093
3	1.401	17.518	71.910	1.401	17.518	71.910	1.665	20.816	71.910
Extraction Method: Principal Component Analysis.									

Prior to rotation, the three components account for a cumulative variance of 71.910%. This cumulative percentage stays at 71.910% after rotation since the rotation procedure only redistributes the variance across the components without changing the total variance explained. According to the PCA results, three basic components may adequately describe the eight variables, accounting for 71.91% of the total variance.

Rotated Component Matrix ^a			
	Component		
	1	2	3
Organisations should provide incentives for employees who acquire new skills.	.955		
Organisations should provide personalised training based on employee skill gaps.	.955		
Collaboration with universities and training institutions can improve reskilling opportunities.		.949	
Organisations should provide regular Industry 4.0 training programmes.		.901	
Organisations should regularly assess employees' training needs.		.444	
Organisations should use modern digital learning platforms.			.854
Employees should be encouraged to participate in continuous learning programmes.			.827
Practical and hands-on training should be increased.			.342
Extraction Method: Principal Component Analysis.			
Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 5 iterations.			

Component 1– Incentive and Personalised Reskilling Support:

Component 2 – Institutional and Industry 4.0 Training Support:

Component 3 – Digital and Continuous Learning:

Suggestions and Conclusion

Employee skill gaps, job duties, experience levels, and future career goals should all be taken into account when designing training programs. Continuous training programs in AI, automation, IoT, robotics, cloud computing, and other emerging technologies should be implemented by organizations. Administrations should use learning supervision systems, e-learning platforms, virtual classrooms, simulations, and mobile learning solutions to ensure better flexibility and accessibility. Rather than relying solely on theoretical instruction, more importance should be placed on practical learning via projects, case studies, simulations, demonstrations, and on-the-job training. To keep training programs current, organizations should regularly assess their employees' current skill sets and identifies new skill requirements. In addition to technical skills, organizations must foster critical thinking, problem-solving, communication, teamwork, adaptability, and creativity in order to achieve successful digital transformations. The article accentuates the value of training, reskilling, and upskilling for businesses in the age of Industry 4.0. Because of the rapid changes in job roles, work processes, and employee skill requirements caused by technology, businesses must take a prearranged method to talent development. Employees should be able to continue to improve their knowledge and abilities using this strategy. Training programs must be realistic, employee-focused, adaptable, and responsive to the changing needs of technology.

The report also emphasizes the importance of creating a work environment that encourages employees to learn new skills and embrace technological innovations. Employee participation in skill-development programs can be encouraged through incentives and recognition. Regularly estimating their training needs allows organizations to identify skill gaps and develop targeted growth strategies. Finally, cultivating a culture of continuous learning and reskilling is critical for cumulative workforce flexibility, employability, career advancement, and long-term legislative competitiveness. Businesses that make proactive investments in employee development will be better prepared to deal with technological changes and develop a workforce capable of assembly the challenges of Industry 4.0.

References

1. Asiedu, E., & Tenakwah, E. S. (2025). Future-proofing your workforce: upskilling and reskilling as HR's top priorities. *Strategic HR Review*, 24(4), 169-173, <https://doi.org/10.1108/SHR-01-2025-0008>
2. Cristini, C., Bianchi, F., & Mauro, M. (2024). Training and professional retraining: challenges for the future. *Analysis of the State of the Art on the Future of Human Workforce*, 62.

3. Elavarasi, R. (2025). A study on workforce development and skill enhancement in the manufacturing industry at Trichy. *Research Explorer: International Journal on Economic and Business Management*, 14(49).
4. Fraile, F., Psarommatis, F., Alarcón, F., & Joan, J. (2023). A methodological framework for designing personalised training programs to support personnel upskilling in industry 5.0. *Computers*. <https://doi.org/10.3390/computers12110224>
5. Ghosh, R. K., Gupta, B., Dutta, G., & Chakraborty, S. (2025). Measuring Success: Evaluating the Impact of Reskilling and Upskilling. In *Reskilling and Upskilling in the Age of AI* (pp. 200-217). Chapman and Hall/CRC.
6. K. Samuvel, & Gilsha K G. (2023). A study on impact of upskilling or reskilling of employees in IT services. *International Journal of Advanced Research in Science, Communication and Technology*. <https://doi.org/10.48175/ijarsct-11457>
7. Leogrande, A., Di Molfetta, M., Notarnicola, V., Trotta, M. G., & Magaletti, N. (2026). An Intelligent Learning Management System for Identifying Skill Gaps and Supporting Workforce Reskilling in SMEs, <https://hal.science/hal-05552200>
8. Ling Li (2022). Reskilling and upskilling the future-ready workforce for industry 4.0 and beyond. *Information systems frontiers*, 26(5), 1697-1712, [10.1007/s10796-022-10308-y](https://doi.org/10.1007/s10796-022-10308-y)
9. Meena, M. R., & Parimalarani, G. (2018). Factors Influencing Job Satisfaction Of Bank Employees In Madurai City. *Journal of Emerging Technologies and Innovative Research*, 5, 12.
10. Nandal, N., & Nain, A. (2026). Reskilling for tomorrow: how HR can drive workforce agility in a changing economy. *Strategic HR Review*, 25(3), 130-136, <https://doi.org/10.1108/SHR-10-2025-0104>
11. Pillans, G. (2024). Reskilling and rethinking work: how to build a future-fit workforce. *Strategic HR Review*, 23(4), 158-163, <https://doi.org/10.1108/SHR-03-2024-0023>
12. Ross, P., & Maynard, K. (2021). Towards a 4th industrial revolution. *Intelligent Buildings International*, 13, 159-161. <https://doi.org/10.1080/17508975.2021.1873625>
13. Rotatori, D., Lee, E. J., & Sleeva, S. (2020). The evolution of the workforce during the fourth industrial revolution. *Human Resource Development International*, 24(2), 92-103. <https://doi.org/10.1080/13678868.2020.1767453>
14. Ruiz-Valdés, S., Alberto Ruiz-Tapia, J., & Carmen Gómez-Chagoya, M. (2023). Trends and challenges in the upskilling and reskilling of the workforce in the 21st century: an analysis of the strategies and results in the acquisition of skills for adaptation to technological and labor change. *Journal of Human Resources Training/Revista de Formación de Recursos Humanos*, 9(24), 13, [10.35429/JHRT.2023.24.9.13.20](https://doi.org/10.35429/JHRT.2023.24.9.13.20)
15. Sanchez, D. R., Rueda, A., Kawasaki, K., Van Lysebetten, S., & Diaz, D. (2023). Reviewing simulation technology: Implications for workplace training. *Multimodal Technologies and Interaction*, 7(5), 50, <https://doi.org/10.3390/mti7050050>
16. Tamsah, H., Ilyas, G. B., Nurung, J., Jusuf, E., & Rahmi, S. (2023). Soft skill competency and employees' capacity as the intervening factors between training effectiveness and health workers' performance. *Cogent Business & Management*, 10(1), 2199493, <https://doi.org/10.1080/23311975.2023.2199493>
17. Turcan, R., & Pojar, D. (2024). Impact of industry 4.0 technologies on skill requirements and workforce availability in key sectors. In *Competitiveness and sustainable development* (pp. 203-212), <https://doi.org/10.52326/csd2024.31>
18. Wahab, S. N., Rajendran, S., & Yeap, S. (2021). Upskilling and reskilling requirement in logistics and supply chain industry for the fourth industrial revolution. *Logforum*, 17. <https://doi.org/10.17270/j.log.2021.606>
19. Yaqub, Y., Singh, A. K., & Dutta, T. (2021). An empirical study of factors influencing training transfer in the management training intervention. *Journal of Workplace Learning*, 33(5), 361-374, <https://doi.org/10.1108/JWL-02-2020-0034>.

