

IMPACT OF TECHNOLOGICAL DRIVERS ON JOB TRANSFORMATION WITH IMPLICATIONS FOR RESKILLING AND UPSKILLING

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Jelena Slavić

University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia

E-mail: jelena.slavic@tfzr.rs

Željko Stojanov

University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Republic of Serbia

ABSTRACT:

Industry 4.0 and the transition to Industry 5.0 are significantly changing the nature of work, introducing new technologies. The main aim of the paper is to examine the impact of technological drivers on job transformations, with a focus on the implications of reskilling and upskilling. The paper applies a literature review approach, developing a conceptual framework that shows the key links among technological factors, job change factors, and outcomes. The results indicate that technological drivers lead to job redesign, job creation, job displacement, job threat, and worker distrust, leading to the need for employee reskilling and upskilling. This is of great importance for organizations and their employees, in order to understand job transformations due to the impact of technologies, and to improve the skills and competencies of their employees.

Key words: Industry 4.0, Technological drivers, Job transformation, Reskilling, Upskilling

INTRODUCTION

Following the major industrial revolutions, Industry 4.0 (I4.0) is leading to the complete digitalization of industries and significant technological changes. The rapid development of technologies in I4.0 is changing the labor market as well as organizations and their employees. I4.0 introduces completely new technologies such as artificial intelligence (AI), Internet of Things (IoT), cognitive computing, virtual reality, big data, 3D printing, cloud computing and robotics (Adjei & King, 2024). In addition to I4.0, there is also an increasing transition to Industry 5.0 (I5.0), which focuses on putting humans at the center and achieving sustainable development. I5.0 is an industry that is resilient, sustainable, and human-centric oriented, complementing the goals of I4.0 while emphasizing the contribution of business to promoting worker well-being and facilitating the transition to sustainable growth (Sarkar et al., 2024). Contemporary technologies are changing and improving ways of working and doing business, but they are also causing changes in organizations regarding employees. Today, industries must strive to achieve a symbiosis between humans and AI, robotics, and other technologies that support employee work. From an organizational perspective, human-robot collaboration is expected to redefine the organization of work in the manufacturing environments, but the human role remains essential, as upskilling and craftsmanship reflect judgment, adaptability and attention to detail that automation alone cannot replicate (Callari et al., 2025). Human-robot collaboration aims to eliminate repetitive tasks in production by replacing them with machine-controlled operations, thereby encouraging more creative thinking (Pacheco et al., 2024). The integration of human intelligence with advanced technologies increases productivity and promotes development (Rahaman et al., 2025).

Recent studies show that contemporary technology has serious impacts on the labour market, leading to changes in jobs and the creation of new jobs. Also, they are enabling companies to significantly optimize production processes and improve resource efficiency. (Bouyahrouzi et al., 2025). They can also cause negative outcomes, such as insecurity among employees and a fear of losing their jobs, which can even lead to the gradual displacement of certain professions and jobs. The full automation of factories and the

introduction of technological innovations affect various factors that lead to job-related changes. New technologies create a demand for new skills and competencies, driving the need for employee reskilling and upskilling. Upskilling and reskilling can help employees acquire new skills and knowledge, increasing their employability and earning potential (Chuang et al., 2024). According to the World Economic Forum (2025), by 2030, 170 million new jobs are expected to be created, while the displacement of existing jobs will total about 92 million. The fastest-growing roles by 2030 are mainly driven by technological developments such as AI, robotics, and digital technologies. Existing literature shows that artificial intelligence, digital skills in ICT, and big data analytics are the top drivers, with artificial intelligence playing a crucial role, especially in the manufacturing and services sectors (Miah et al., 2024).

Although current research indicates that technological changes affect jobs and employees, these effects are mostly observed separately, focusing on individual changes in the job or on employees' skills and job losses. The aim of this paper is to examine the relationships among technological drivers, job change factors, and job change outcomes, as well as the implications for reskilling and upskilling. Job changes include not only job displacement or job creation, but also the impact on employees and possible positive outcomes. As a result of this analysis, a conceptual framework was developed.

LITERATURE REVIEW METHOD

The study uses a literature review methodology, a systematic way of collecting and synthesizing previous research, with the aim of providing an overview of a particular question or research problem (Snyder, 2019). The literature review search is conducted in the following databases: ScienceDirect, Emerald, MDPI, IEEE, ACM, Springer and Wiley. The appropriate databases were selected for their relevance to I4.0, technology and research on the reskilling and upskilling. It covers the last 10 years of published papers to ensure the study remains relevant and in focus amid rapid technological development. The next step in conducting the review is filtering articles based on title, abstract, and keywords, and then reading full-text articles. After final selection, 10 papers were chosen as relevant for further analysis (Figure 1).

Given the large number of studies on I4.0 and modern technology, to develop a conceptual model, a literature review was conducted to examine existing research and connect technological drivers, job change factors, and outcomes. In addition, the role and impacts of reskilling and upskilling were analyzed.

The criteria for literature selection were based on the Inclusion/Exclusion (I/E) criteria: (1) review of title, abstract and keywords, (2) papers published in English, (3) journal/conference publications, and (4) focused on reskilling and upskilling. To conduct an adequate literature review, the keywords related to review as Industry 4.0, job transformation, reskilling, and upskilling were defined. In Table 1. selected primary studies are presented. The selected studies were analyzed to determine the relationship between technological drivers and job change factors with implications for reskilling and upskilling. Based on synthesis of the reviewed studies, a conceptual framework was developed to present the relationship between technological drivers and job change factors and outcomes.

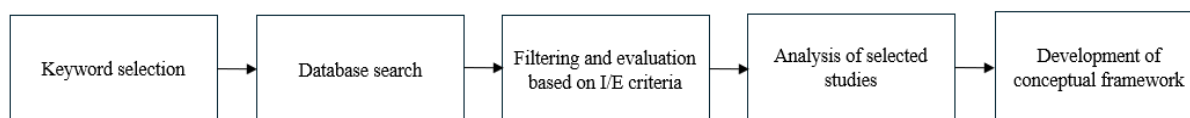


Figure 1: Method of conducting literature review

Review of selected studies

The most significant sources of change today in organizations and in work environments are technological drivers. Technological drivers are most often artificial intelligence, robotics, and digital technologies that have major contributions. Due to technology adoption and its future implications in the industrial society, there is significant speed of technological job control and the possible effects on workers' future employment (Chigbu & Nekhwevha, 2021). In addition to the above, the human-technology relationship, or the introduction of collaborative robots into human work, is further changing business across industries. Cobots, along with humans, constitute a large and important part of modern industries. Authors state that

redefinition of job structure is required in the high-tech sectors and automation does not replace people but require a higher level of skills (Ikata & Kent, 2022).

Table 1: Overview of selected primary studies

PS	Citation	References
PS1	Cingillioglu & Schoettner, 2025	Cingillioglu, I., & Schoettner, M. (2025). Adapting to AI-mediated workplaces: how STEM trainees navigate new challenges and opportunities. <i>Information Technology & People</i> , 38(8), 251-275.
PS2	Chigbu & Nekhwevha, 2021	Chigbu, B. I., & Nekhwevha, F. H. (2021). The future of work and uncertain labour alternatives as we live through the industrial age of possible singularity: Evidence from South Africa. <i>Technology in Society</i> , 67, 101715.
PS3	Chuang et al., 2024	Chuang, S., Shahhosseini, M., Javaid, M., & Wang, G. G. (2024). Machine learning and AI technology-induced skill gaps and opportunities for continuous development of middle-skilled employees. <i>Journal of Work-Applied Management</i> , (ahead-of-print).
PS4	Egasmara et al., 2025	Egasmara, F., Rahayu, A., Wibowo, L. A., Rofaida, R., Sofia, A., & Fauziyah, A. (2025). Workforce planning optimization utilising AI to improve firm performance: a systematic literature review using VOSviewer. <i>Journal of Work-Applied Management</i> , 1-13.
PS5	Ikata & Kent, 2022	Emma-Ikata, D., & Doyle-Kent, M. (2022). Industry 5.0 readiness–“Optimization of the relationship between humans and robots in manufacturing companies in Southeast of Ireland”. <i>IFAC-PapersOnLine</i> , 55(39), 419-424.
PS6	Jamal et al., 2023	Jamal, A. F., El Nemar, S., & Sakka, G. (2025). The relationship between job redesigning, reskilling and upskilling on organizational agility. <i>EuroMed Journal of Business</i> , 20(2), 474-492.
PS7	Shimray & Subaveerapandiyani, 2025	Shimray, S. R., & Subaveerapandiyani, A. (2025). AI and workforce dynamics: a bibliometric analysis of job creation, displacement and reskilling. <i>Global Knowledge, Memory and Communication</i> .
PS8	Zirar et al., 2023	Zirar, A., Ali, S. I., & Islam, N. (2023). Worker and workplace Artificial Intelligence (AI) coexistence: Emerging themes and research agenda. <i>Technovation</i> , 124, 102747.
PS9	Zhanseitov et al., 2025	Zhanseitov, A., Akybayeva, G., Mambetova, S., Kazbekov, T., & Berdimurat, N. (2025). The impact of artificial intelligence on the labour market and HRM. <i>Procedia Computer Science</i> , 272, 489-495.
PS10	Wanasinghe et al., 2023	Wanasinghe, T. R., Gosine, R. G., Petersen, B. K., & Warrian, P. J. (2023). Digitalization and the future of employment: A case study on the Canadian offshore oil and gas drilling occupations. <i>IEEE Transactions on Automation Science and Engineering</i> , 21(2), 1661-1681.

Contemporary technologies create new jobs and change existing ones, leading to the need for new knowledge, skills, and competencies. Emerging job roles are concentrated in knowledge-intensive sectors, while displacement risks are more directed in low-skilled, routinized occupations (Shimray & Subaveerapandiyani, 2025). Jobs created by AI and machine learning technologies reshape job structures by creating new roles, displacing middle-skilled workers, and redesigning existing jobs. An important mechanism for the transformation of job responsibilities is job redesign, requiring employees to learn new skills, indicating that the organizational technological development positively affects job redesign (Jamal et al., 2023). The characteristics of AI are changing workplaces (information sharing, interactions, and ownership structures), and a model by Cingillioglu & Schoettner (2025) illustrates the connections among the findings and highlights the cascading pathways that connect AI technologies to new challenges in professional adaptation. People need to keep up with changes and technology trends, in case of a mismatch, many may lose on digital transformation.

Artificial intelligence is causing tectonic shifts across industries, perhaps more than any other technology. AI is creating new jobs to a large extent, but also a large part of people, 70% of whom, after a survey, stated that AI leads to job displacement in traditional industries (Zhanseitov et al., 2025).

Some studies outline a plan to predict how jobs and workplaces will change, merge, and some will disappear completely, underscoring the importance of implementing reskilling through various training programs (Wanasinghe et al., 2023). This technological impact often implies strategies such as reskilling

and upskilling. Workers should be reskilled and upskilled with a strategic career development plan rather than being replaced by AI and robots (Chuang et al., 2024). Reskilling and upskilling are central to mitigating all these effects. (Shimray & Subaveerapandiyam, 2025). This suggests that, in addition to job changes driven by technology, employees' career paths are also influenced by these changes.

The workforce's readiness also depends on both the country's location and its financial situation. A large part of the automotive industry workforce in Africa is expressing great concern about job security due to technological changes. Although reskilling and upskilling are widely recognized as key responses to skill gaps, some studies indicate that they are not sufficient to fully address job insecurity caused by technological change (Chigbu & Nekhwevha, 2021).

In the expansion of artificial intelligence, AI leads to changes in jobs, and there is an emergence of distrust among employees and fear for the survival of their jobs. Artificial intelligence offers greater opportunities to highly qualified workers, while low-skilled or unskilled workers express significant distrust of AI (Zirar et al., 2023). It is necessary to improve the skills of employees if organizations or employees themselves work on it. Employee resistance stems from job security and fear of displacement, which require transparent communication, proactive reskilling initiatives, and strong organizational change management to ensure that AI adoption enhances organizational efficiency (Egasmara et al., 2025). Rather than fostering fear or optimism about technological change, policies should aim to adapt labour markets to coexist with automation with supporting the transition to non-routine cognitive jobs through reskilling and upskilling initiatives is essential (Park et al., 2026). These findings indicate that artificial intelligence plays a crucial role as technological driver and has a significant impact on the job changes and their outcomes in the I4.0/5.0 environment.

Despite job distrust concerns, a recent study (Ikata & Kent, 2022) found that human-centric technologies have a positive impact on the workforce. Research showed that 81.8% of the workforce believes their future work prospects can be improved with Cobot training, while 60% do not believe humans will be irrelevant in manufacturing. Based on the literature review, it is evident that the creation of new jobs, the redesign of existing jobs, job displacement, and job threat or distrust are largely influenced by modern technologies. Largely artificial intelligence, automation and robotics imply these changes. In addition, technologies such as cobots lead to a positive impact on job changes. All the changes that occur mostly define reskilling and upskilling as some kind of solution that organizations need to implement for their employees.

FINDINGS

Through literature review of primary studies, findings highlight that technological impact on jobs is significant and inevitable. Through the analysis of studies, two categories, containing several individual concepts, were identified: technological drivers and job change factors, and outcomes with implications on reskilling and upskilling. By connecting relationships between their individual concepts, a conceptual framework was developed. The proposed conceptual framework is only based on literature review of selected studies, rather than on empirical evidence.

In the main conceptual framework presented in Figure 2, the key factors are separated into technological drivers, job change factors and outcomes. They are distinguished into individual elements that indicate the entities' belonging, while arrows indicate the effect that technology has on job change factors. Job changes factors and outcomes, depending on the employee's perspective, can be positive and negative, where job creation and redesign are mostly associated with positive effects (marked green), while job displacement and distrust are presented as negative (highlighted grey).

The findings suggest that digital technologies and AI relation with job redesign positively affect the reskilling and upskilling program with increasing organization agility and profit, and AI environments reshape interaction, learning, autonomy, task ownership, and professional development (PS6, PS1). Digitalization and automation are changing jobs through job merging and the application of necessary skills, where reskilling is the main key (PS10).

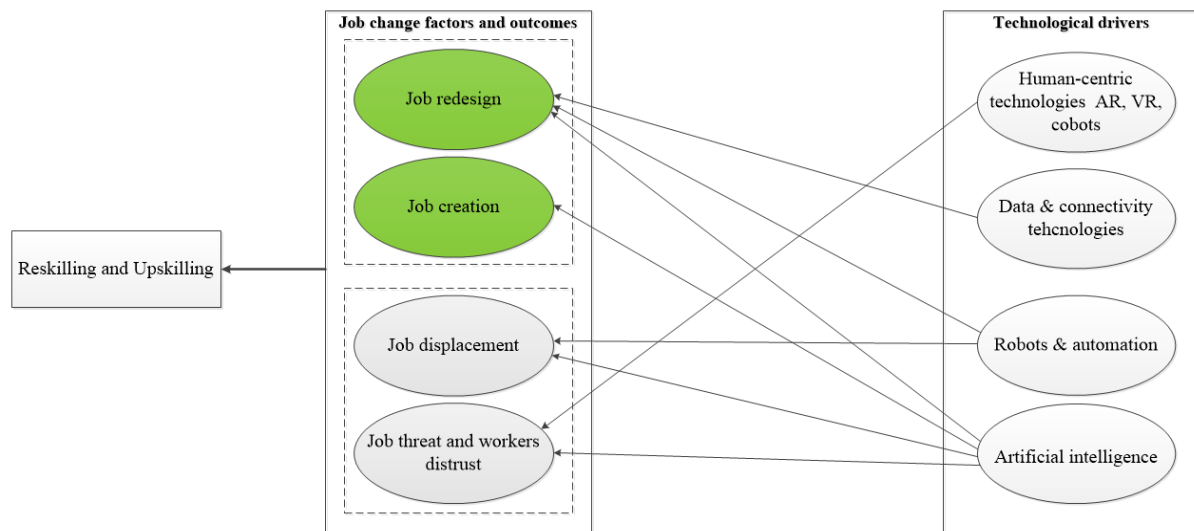


Figure 2: Technological impact on job transformation

Job creation – AI relationship indicates that the biggest technological driver for creating new jobs is AI and machine learning. Also, it can be concluded that job changes impacted by technology are also based on employee's skill level, and there is increased demand for high-skilled employees. Reskilling and upskilling of mid-level employees for jobs that require higher skills, created by advanced technology are crucial (PS3)

The reviewed studies highlight the job displacement – AI relationship, showing that AI has significant impact on job displacement as well as has a dual impact on job creation and job displacement, affecting low-skilled workers and automating routine tasks, creating the need for reskilling and upskilling (PS9, PS7). On the other hand, automation's impact on job displacement implies low motivation for reskilling, retraining, and upskilling, given the rate at which robots are being adopted and how smarter they are becoming with newer models designed to automate tasks (PS2).

Also studies illustrates that automation and AI cause distrust and fear of job displacement (PS8, PS4). Further, in Figure 2, the findings point that there is one relationship between job distrust and human-centric technology that yields positive outcomes, with cobots having a significant impact on employees and no fear of replacing people with technology (PS5).

The findings indicate that majority of job changes are caused by artificial intelligence and it is the most dominant technological driver. The literature suggests that technology have impact on job transformations, as creation of new jobs, redesign of existing ones, as well as triggering job distrust and causing employees to view technology as a threat with the need of reskilling and upskilling.

The role of the conceptual framework is the integration of key concepts, technological drivers and job change factors in I4.0/5.0 into one model. The model also presents the possible positive and negative outcomes of the impact of contemporary technologies on job transformation and workforce adaptation. Hence, the need for reskilling and upskilling can contribute to organizations in improving employees' skills and competencies, as well as their operations.

CONCLUSION

In today's environment, it is inevitable that technologies will bring about changes in various aspects, including changing jobs and the work environment. For all those operating with contemporary technology they need to improve their employees' skills and knowledge, through reskilling or upskilling, as well as to keep investing in new technologies. Organizational agility and the willingness of employees to adapt to and embrace changes without fear and distrust are also needed. As the main contribution of the paper, the conceptual framework is developed based on the literature review which links the technological impact on job factors and defines the need for reskilling and upskilling. It was also emphasized that the main and dominant technological driver is artificial intelligence.

Future research is aimed at examining the impact of technological developments on employee skills and organizational enablers, to better understand and identify the need for reskilling and upskilling in the I4.0 environment.

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