

# Factor Analysis of Future Work Skills of Open University Support Staff

Kemmanat Mingsiritham<sup>1</sup>, Apinya Sonkanok<sup>1</sup>, Seksan Amatmontree<sup>1</sup>, Sasiyanai Sanpang<sup>1</sup> & Apisit Thaoyabut<sup>1</sup>

<sup>1</sup> Office of Educational Technology, Sukhothai Thammathirat Open University, Thailand

Correspondence: Kemmanat Mingsiritham, Office of Educational Technology, Sukhothai Thammathirat Open University, Thailand.

Received: August 30, 2024

Accepted: November 2, 2024

Online Published: November 29, 2024

doi:10.5539/jel.v14n2p251

URL: <https://doi.org/10.5539/jel.v14n2p251>

## Abstract

The future of work is rapidly evolving owing to the swift developments in technology and societal changes. While failure to adapt signifies being disrupted, those who do adapt become the disruptors, impacting economies, societies, environments, and education. Traditional work skills may no longer suffice in the current world of work, necessitating the rapid adaptation and development of previously unknown skills. Due to the underdevelopment and debatable methodological framework for the skills necessary to work in the future, the problem of linking future work skills of support staff. This study aimed to conduct a factor analysis to identify the skills necessary to work in the future and survive the onslaught of rapid technological advancements and digital disruption seen over the years.

**Keywords:** future work skills, open University, skills 4.0, digital university, future skill demands

## 1. Introduction

The era of digital disruption is characterized by innovation and technology playing crucial roles, wherein significant changes in technology influence people's lifestyles, work, education, and business operations. Predictions for the next five years, as revealed by the World Economic Forum, indicate that the world of work would face a double disruption scenario, stemming from the COVID-19 pandemic and the utilization of automation systems that replace human labor. Consequently, the risk of job loss potentially increases for individuals whose skills do not align with the changing market demands. Recent surveys have shown that over 50% of the workforce by 2025 may lack the necessary skills, comprising four main categories: analytical thinking, interpersonal, technological, and self-management skills (SkillSea, 2020). These findings align with the report "The Future of Skills: Employment in 2030" (Bakhshi et al., 2017), which studied factors influencing occupational changes in the future, such as labor market demands, emerging occupations, and the development of new skills that the future workforce should possess. Various factors, including technological advancements, the introduction of automation systems replacing human intelligence, and trend analysis on a global scale, were considered. Consistent findings were observed across labor markets in the United States and the United Kingdom, indicating that occupations relying on social skills or creative thinking were in high demand. Furthermore, McKinsey (2021) noted that artificial intelligence (AI) technologies have not only changed people's behaviors and daily lifestyles but also significantly impacted the economy and society. These technologies have altered the ways of working and various business operations from before, leading to the emergence of a new normal, particularly when combined with the advancements in technology that have facilitated the replacement of many tasks. This has further accelerated the rapid changes in the labor market. The traditional work skills that existed may no longer be sufficient for working in the current world. Therefore, individuals in the AI era must expedite their skill development efforts, both in upgrading existing skills (upskilling) and acquiring new knowledge and skills (reskilling) they were previously unaware of. This would help individuals keep up with the changes and adapt to new roles or tasks different from before. Otherwise, there is a risk of becoming obsolete and losing jobs immediately. McKinsey Global Institute's report, "The Future of Work after COVID-19," projected that by 2030, over 100 million workers, or 1 in 16 individuals, would need to transition to new occupations, with more than half of the total workforce requiring advanced new skills. The necessary skills for transitioning workers have also evolved, with social and emotional skills gaining prominence, while technological skills remain crucial. Workforce development efforts in all sectors can promote skill enhancement by implementing training programs and additional education tailored to meet the

workforce's needs, emphasizing skill development over purely academic knowledge to facilitate suitable career transitions (Lund et al., 2022). Consequently, work skills have undergone significant changes, becoming more complex, and digital technologies have enabled continuous learning and self-development opportunities for learners.

Considering these rapid changes, humans have had to adapt and develop themselves to survive, leading to the emergence of numerous new skills. These skills serve as the starting point for the development of future work skills in government of Thailand. Individuals' skills and abilities are crucial components that contribute to workplace competency. The new future work skills have become practical guidelines that are produced, developed, supported, and disseminated by various public and private organizations, globally. The concept of new future work skills is based on the belief that traditional learning, which emphasizes learning and memorizing subject matter content, is facing new challenges. Educational institutions must address the changing behaviors of learners. Learners hold expectations that educational institutions must adapt both in terms of teaching methods and delivering value to learners, including digital communication channels (Li, 2017). If educational institutions are not aligned with the new environment, they are at risk of disruption. This poses a challenge for educational institutions, especially higher educational institutions, which must be leaders in leveraging digital technologies for change and must adapt to the use of technology to meet learners' needs (Burtch & Greenwood, 2016; Verstegen et al., 2018).

In Thai open universities that adopted classroom-free teaching approaches, learners can engage in self-directed learning. This surge in digital technology challenges has led these universities to incorporate technology, including enhanced management practices, thus transitioning towards becoming digital universities to accommodate evolving learning behaviors. This transition is deemed crucial for propelling digital universities towards ensuring lifelong self-directed learning. The potential of personnel constitutes the most vital component in driving digital transformation, aiding in enhancing the efficiency, speed, and development of capabilities within existing processes through digital tools, while also augmenting the efficiency of their work. Additionally, it helps complement the work capabilities of personnel (Wessel et al., 2021; Chuchu & Ndro, 2019). This serves to provide ample educational opportunities to learners, showcasing the continuous potential and capabilities of personnel, which is pivotal in propelling digital universities to respond effectively to inevitable changes (Cunha et al., 2020). With the rapid changes occurring, it is imperative to analyze university personnel's future work competencies to drive the sustainable transition towards digital universities, which is essential for accommodating digital innovations and technologies, thus establishing guidelines for preparing personnel to transition towards sustainable digital organizations. The research gap is to understand the evolution of support staff in open university new mission in the digital disruption. Therefore, we first present an overview of literature in the digital transformation to observe the links between digital lifestyle and digital era work requirements. Finally, we have made an empirical analysis of its relationship with future competitiveness and digital skill in a rapidly changing digital world.

## 2. Literature Review

Digital transformation signifies a noticeable change that is evident in consumers carrying more portable digital communication devices, enabling them to lead convenient lives anywhere and anytime. The use of digital channels such as applications and online social media on various platforms has invigorated the trend toward more digital lifestyle behaviors and made adopting digital life more convenient (Skog et al., 2018; Drechsler et al., 2020). This increased connectivity demands that educational institutions adapt by shifting their focus from traditional methods to prioritizing the online presentation of content, creating easily understandable content, communicating, and creating experiences for digital era consumers. This transition aims to provide easily understandable presentations, whether through infographics, images, or video clips, which are shared and disseminated in the current digital world. Additionally, the personnel involved must be able to work in more diverse contexts and possess a variety of knowledge and expertise, boosted through continuous skill development to constantly learn new things. Developing personnel with the digital competencies necessary to respond to digital era work requirements should involve knowledge management and exchange for each task, analyzing each job to determine the necessary digital skills, and providing opportunities for staff to participate in choosing development topics. It is essential to develop foundational skills that everyone needs before progressing to further task-specific skills. Furthermore, digital system development must be undertaken in a user-friendly format, analyzing personnel according to their abilities to determine suitable development methods (Nadkarni & Prugl, 2020; Balyer & Öz, 2018).

The transition to an era in which the world is rapidly changing in every dimension, including social, economic, educational, and technological aspects, has led everyone into the digital world. Adapting to constantly learn and develop skills, keeping up with the pace, and continuously preparing for changing circumstances enables

individuals to be more competitive and have greater opportunities for success than those who are unprepared. The skills required for the future help employees succeed in the future workforce and enable organizations to adapt to future requirements. For future competitiveness in a rapidly changing digital world for the new skills set, seven main skills are used in this study for the development of a decision tool for open university support staff. These skills can be groups as follows (Annica et al., 2020; Ehlers, 2020; Nesrin et al., 2021; Leopold et al., 2024):

1) *Digital Technology Skills*: The application of digital technologies in various aspects of work has increased. For example, cloud technology, artificial intelligence systems, and machine learning have become increasingly prevalent. Workers must have a thorough understanding of digital technologies and the ability to utilize them efficiently and flexibly. This includes the utilization, comprehension, creation, and access of digital technologies as well as an awareness of the necessity and significance of utilizing digital tools for beneficial outcomes.

2) *Learning and Adaptability Skills*: These skills involve the ability to comprehend and assimilate diverse knowledge, fostering varied perspectives and the ability to confront changing circumstances. It involves adjusting to assigned roles and responsibilities to facilitate an evolving work environment, thereby enhancing overall work efficiency.

3) *Leadership Skills*: These skills involve the ability to inspire colleagues to unleash their full potential for the team's benefit. By acting as supporters, motivators, and catalysts, leaders encourage everyone to participate fully by providing them with opportunities to fully utilize their abilities.

4) *Creative Thinking and Innovation Skills*: These skills involve the ability to initiate new things, develop work innovatively, and collaborate creatively with others. This includes understanding how to innovate, transform, and efficiently improve work by learning from mistakes.

5) *Analytical Thinking Skills*: These skills involve the ability to use logic and reasoning to analyze various hypotheses, linking all available information for analysis, synthesis, interpretation, and evaluation to obtain accurate data or appropriate answers. To the best extent possible, this is intended for use in decision-making, assessment, and effective resolution of various organizational issues.

6) *Interpersonal Skills*: These skills involve the ability to collaborate, communicate effectively, and empathize, encompassing an inclusive and emotionally supportive workplace that fosters a culture of acceptance and mutual understanding. Such an environment aids employees in establishing relationships based on trust and a sense of community. Stronger relationships facilitate conflict resolution, including the provision and receipt of feedback.

7) *Emotional Intelligence Skills*: These skills refer to the capacity to regulate and handle one's emotions adeptly, as well as predict and comprehend others' emotions. Possessing emotional intelligence skills enables effective communication and collaboration, facilitates working well with colleagues, and enhances teamwork efficiency.

### 3. Method

This research "Factor Analysis of Future Work Skills of Open University Support Staff" was conducted as follows

#### 3.1 Research Design

Exploratory factor analysis (EFA) was employed to identify the factors related to future work skills that were extracted from an analysis of concept papers and related research. Subsequently, the identified components were used to formulate questions regarding the necessity and demand for various aspects of future work skills for staff at open universities.

#### 3.2 Research Sample

A research sample of 250 individuals employed at an Open University in Thailand was acquired using a two-stage random sampling technique. All sample group must have at least 1 year of work experience at an open university and gave their consent before sharing information. The determination of the sample size for this study, necessitated by the requirements of factor analysis, was carefully considered by the researchers. Hair et al. (2010) recommended a sample size of five units per variable be adopted for compositional analysis. Given that 50 variables were included in this study, a minimum sample size of 250 was required.

#### 3.3 Research Instrument

The researcher used an online questionnaire to gather participants' perspectives regarding various facets of future work skills. Comprising 50 competences in seven areas of competence (Table 1), the future work skills questionnaire employed a five-point scale, ranging from the lowest (1) to the highest (5). The content validity was assessed by a panel of five experts, yielding values within the range of .80–1.00. To evaluate its reliability, the questionnaire was piloted on a separate group of 30 individuals (not included in the main sample) and the

Cronbach's alpha coefficient was estimated as .987.

Table 1. Categories of competence included in the instrument

Category	Indicators (items)
Digital Technology Skills	1–9
Learning and Adaptability Skills	10–16
Creative Thinking and Innovation Skills	17–23
Emotional Intelligence Skills	24–28
Analytical Thinking Skills	29–35
Interpersonal Skills	36–42
Leadership Skills	43–50

### 3.4 Data Analysis

The data were analyzed using means and standard deviations, and the EFA was based on the Varimax rotation method after selecting components with an eigenvalue greater than .50 (Hair et al., 2010).

### 4. Results

The result indicated could be carried out on the data. The components of future work skills were subjected to EFA with consideration given to eigenvalues from 1.00 and above. This process led to the identification of seven components, each with an eigenvalue greater than 1.00. Cumulatively, these components explained 78.81% of the total variance. Subsequently, orthogonal rotation using the Varimax method was performed to establish a clearer delineation of the relationships between the variables and components, as illustrated in Figure 1.

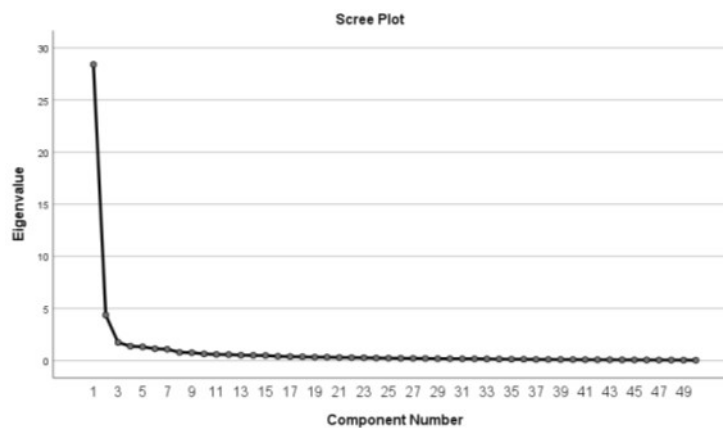


Figure 1. Variables

The seven factors identified were very similar to the constructs defined by the underlying theoretical framework. In fact, the only factor generated was "Learning and Adaptability Skills" were grouped are categorized under digital technology and creative thinking and innovation (referred to as creative thinking and learning), as illustrated in Figure 2.

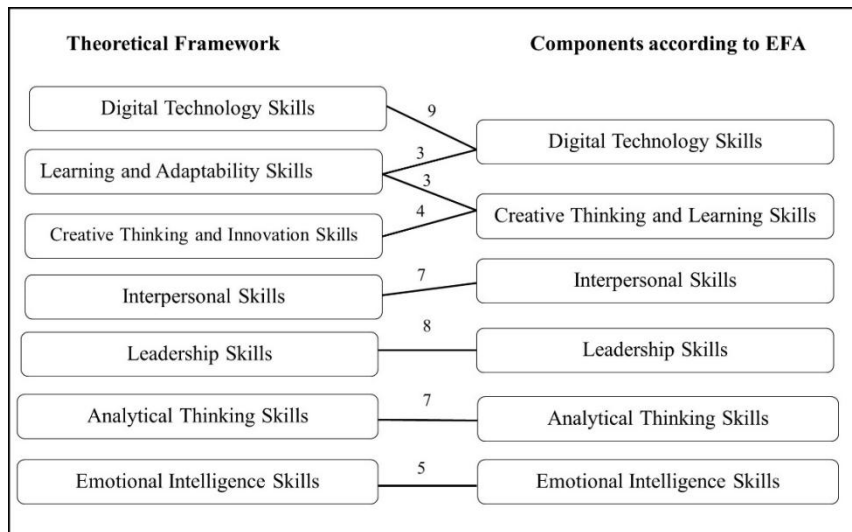


Figure 2. Relationship of items between the categories of theoretical framework and EFA results

The analysis revealed six crucial components of future work skills: digital technology, interpersonal, leadership, creativity and learning, analytical thinking, and emotional intelligence skills. Considering each components digital technology are the first important component, followed by interpersonal and leadership skills, which, emotional intelligence skills although it is the lowest (Table 2).

Table 2. Component weight value

Factor name/ Indicators (Items)	Eigen Value	% of Variance	Variable	Factor Loading
Digital Technology Skills 1–12 (12 Variables)	28.41	56.81	Participation in online remote meetings	.81
			Collaboration with computer systems	.81
			Utilization of digital media creation software	.80
			Communication through technology-mediated means	.79
			Application of digital security measures, such as password protection and identity verification	.77
			Employment of cloud computing technologies	.76
			Exploration of diverse new media	.75
			Collaboration with artificial intelligence and automated systems	.74
			Proper citation and copyright of utilized data	.74
			Adaptation to unknown situations	.59
			Generation of innovative and unconventional ideas	.59
			Engagement in Internet-based learning from others' experiences	.55
Interpersonal Skills 36–42 (7 Variables)	4.36	8.72	Mutual support and collaboration with colleagues	.83
			Demonstration of care and consideration	.82
			Display of compassion and assistance towards others	.77
			Receptiveness to constructive feedback	.76
			Understanding and collaboration with individuals from diverse cultural backgrounds	.75
			Sharing of digital information and communication through appropriate channels	.67
			Participation in online networking communities	.57
Leadership Skills 43–50 (8 Variables)	1.47	3.47	Readiness to provide consultation and create opportunities for others	.78
			Demonstration of leadership qualities	.75
			Continuous support and encouragement for everyone's participation	.74
			Strategic planning and goal-setting	.70
			Conflict management and problem-solving assistance	.69
			Inspiring colleagues	.68
			Behaving appropriately through universally accepted digital media	.66
			Receptiveness to constructive feedback	.61

Creative Thinking and Learning Skills 13–15, 17, 19–20, 23 (7 Variables)	1.38	2.75	Openness to new perspectives	.67
			Creative collaboration with others	.62
			Follow-up of Internet trends to generate new ideas	.61
			Utilization of technology for innovative work development	.60
			Application of digital technology for work enhancement	.58
			Readiness for new work paradigms	.52
			Adaptability for role and responsibility changes	.50
Analytical Thinking Skills 29–30, 32–35 (6 Variables)	1.31	2.62	Ability to establish reasoned relationships	.71
			Utilization of logic in analyzing various hypotheses	.68
			Knowledge and understanding of the subject matter for analysis	.65
			Employment of data linkage in analysis	.65
			Discernment in data filtering	.63
			Interpretation skills	.58
Emotional Intelligence Skills 24–28 (5 Variables)	1.13	2.27	Effective self-regulation and emotion management	.69
			Recognition of others' emotional states	.65
			Self-awareness of personal emotional responses	.62
			Skillful management of interpersonal relationships	.55
			Creation of self-motivation factors	.54

## 5. Discussion and Conclusion

Digital disruption has resulted in significant changes in human resource development to prepare for the evolving demands of skills, knowledge, and attributes required in the 21st-century landscape. Developing personnel with the digital competencies necessary to respond to digital era work requirements should involve knowledge management and exchange for each task, analyzing each job to determine the necessary digital skills, and providing opportunities for staff to participate in choosing development topics. This study highlighted the significance of six key components that contribute to the cultivation of skills aligned with future work requirements: digital technology, interpersonal, leadership, creative thinking and learning, analytical thinking, and emotional intelligence skills. In particular, the high factor loading of digital technology skills indicate the importance of digital technology for future workforce competencies. This is because of the pervasive role of digital technology in everyday life and work for everyone, driving organizations and work processes to become increasingly efficient. The digital technology revolution has led to new activities, services, innovations, and a digital transformation that opens up new opportunities and is widely discussed (Tommaso et al., 2021). This includes IOT, cloud computing, and virtual environments, resulting in the integration of new skills essential for the future of work (Carl & Michael, 2017). Leopold et al. (2024) stated these evolving competencies are vital to the nature of work, addressing both social and technological aspects.

The rapid pace of technological advancements and societal transformations has fundamentally reshaped the future of work. There is an evident need to foster new capabilities to meet external challenges. These demands underscore the need for employees to acquire new skills (Klus & Müller, 2021; Zahidi et al., 2020). These future work elements signify a novel pathway for organizational progress. However, these studies drew upon data from university personnel to facilitate staff adaptation to the forthcoming workforce dynamics and societal transformation. Additionally, the findings indicated that future work skills require collaboration with digital technologies, particularly AI. This is likely influenced by the increasing integration of technology in current work practices, alongside a distinct connection between AI concepts and digitally adaptive organizations (Kitcharoen et al., 2024). Furthermore, continuous learning and adaptation to new developments are imperative for personnel, as supporting self-directed student learning is a fundamental responsibility of the staff in an open university setting. Therefore, personnel must continually adjust to develop work aligned with various relevant contexts. One interesting finding was learning and adaptability skills were grouped and categorized under digital technology and creative thinking and innovation, in the present study, learning and adaptability skills are integral aspects of digital technology skills, given the prevalence of technology in today's world. Learning about technology and adapting to changes in the work environment are crucial. Technology serves as a tool for both work and learning, with clear workflows. Learning enables individuals to understand and utilize technology efficiently. Simultaneously, adapting to changes in the work environment, such as integrating new technologies or collaborating with technology, is essential for effective performance in rapidly changing environments (Christopher et al., 2020; Vargas et al., 2020). Since the data collection process includes subjective judgments for open university, the findings of this study is unique and specific and the criteria set was generic. The next conclusion identifies criteria groups based on work performance.

## 6. Recommendation

Future research is necessary to place greater emphasis on the intellectual property of digital technologies, which plays an increasingly vital role in human daily life, for further analysis within the context of Thai universities. This aims to link essential future work skills to the design of learning management systems that enhance performance and operational efficiency. Additionally, the learning style preferences of staff should be a focal point, with future studies considering other factors related to the characteristics of staff.

## Acknowledgments

The authors would like to express their gratitude for the collaboration of all participants who provided valuable information for this research.

## Authors' contributions

Assoc. Prof. Apinya Sonkanok, Asst. Prof. Dr. Seksan Amatmontree, Dr. Sasiyanai Sanpang and Dr. Apisit Thaoyabut were responsible for study design and revising. Assoc. Prof. Kemmanat Mingsiritham drafted the manuscript and Dr. Sasiyanai Sanpang revised it. All authors read and approved the final manuscript.

## Funding

This research received funded under Knowledge Creation for National Development in 2024.

## Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Informed consent

Obtained.

## Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

## Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

## Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## Data sharing statement

No additional data are available.

## References

- Annica, I., Sandra, S., & Camilla, W. (2020). *Future work skills in higher education*. Haaga-Helia.
- Bakhshi, H., Downing, J., Osborne, M., & Schneider, P. (2017). *The Future of Skills: Employment in 2030*. London: Pearson and Nest.
- Balyer, A., & Öz, Ö. (2018). Academicians' views on digital transformation in education. *International Online Journal of Education and Teaching*, 5, 809–830.
- Burtch, G., Carnahan, S., & Greenwood, B. (2016). Can You Gig It? An Empirical Examination of the Gig-Economy and Entrepreneurship. *Management Science*, 64(1), 5497–5520. <https://doi.org/10.5465/ambpp.2016.15>
- Carl, B., & Michael, A. O. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114, 254–280. <https://doi.org/10.1016/j.techfore.2016.08.019>
- Christopher, A. B., Marie, S., Alan, L., Matthew, B., & Chie, A. (2020). Transformation or evolution?: Education 4.0, teaching and learning in the digital age. *Higher Education Pedagogies*, 5(1), 223–246. <https://doi.org/10.1080/23752696.2020.1816847>
- Chuchu, T., & Nodoro, T. (2019). An examination of the determinants of the adoption of mobile applications as learning tools for higher education students. *International Journal of Interactive Mobile Technologies (IJIM)*, 13(3), 53–67. <https://doi.org/10.3991/ijim.v13i03.10195>

- Cunha, M. N., Chuchu, T., & Maziriri, E. T. (2020). Threats, Challenges, and Opportunities for Open Universities and Massive Online Open Courses in the Digital Revolution. *International Journal of Emerging Technology in Learning (IJET)*, 15(12), 191–204. <https://doi.org/10.3991/ijet.v15i12.13435>
- Drechsler, K., Gregory, R., Wagner, H., & Tumbas, S. (2020). At the Crossroads between Digital Innovation and Digital Transformation. *Communications of the Association for Information Systems*, 47, 521–538. <https://doi.org/10.17705/1CAIS.04723>.
- Ehlers, D. (2020). *Future Skills: The Future of Learning and Higher Education*. Germany: Karlsruhe. <https://doi.org/10.1007/978-3-658-29297-3>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th ed.). New York: Pearson.
- Kitcharoen, P., Howimanporn, S., & Chookaew, S. (2024). Enhancing teachers' AI competencies through artificial intelligence of things professional development training. *International Journal of Interactive Mobile Technologies (IJIM)*, 18(2), 4–15. <https://doi.org/10.3991/ijim.v18i02.46613>
- Klus, M. F., & Müller, J. (2021). The digital leader: what one needs to master today's organisational challenges. *Journal of Business Economics*, 91, 1189–1223. <https://doi.org/10.1007/s11573-021-01040-1>
- Leopold, T. A., Ratcheva, V. S., & Zahidi, S. S. (2024). *The future of jobs: employment, skills, and workforce strategy for the fourth industrial revolution*. World Economic Forum, Switzerland. Retrieved from [https://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2023.pdf](https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf)
- Li, F. (2017). The digital transformation of business models in the creative industries: A holistic framework and emerging trends. *Techovation*, 92–93, 102012. <https://doi.org/10.1016/j.technovation.2017.12.004>
- Lund, S., Madgavkar, A., Manyika, J., Smit, S., Ellingrud, K., & Robinson, O. (2022). *The future of work after COVID-19*. McKinsey Global Institute. Retrieved from <https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-after-covid-19>
- McKinsey. (2021). *Defining the skills citizens will need in the future world of work*. Retrieved from <https://hrday.nl/wp-content/uploads/2022/10/JTB.pdf>
- Nadkarni, S., & Prugl, R. (2020). Digital transformation: a review, synthesis and opportunities for future research. *Management Review Quarterly*, 71, 233–341. <https://doi.org/10.1007/s11301-020-00185-7>
- Nesrin, A., Derya, I., & Muhittin, S. (2021). A Framework for New Workforce Skills in the Era of Industry 4.0. *International Journal of Mathematical, Engineering and Management Sciences*, 6, 771–786.
- Oscar, V. L., Irene, M., Tina, W., & Mathijn, W. (2020). *Telework and ICT-based mobile work: Flexible working in the digital age*. Office of the European Union, Luxembourg.
- SkillSea. (2020). *Future skill and competence need*. Retrieved from [https://researchonline.ljmu.ac.uk/id/eprint/14990/1/D1.1.3%20Future%20Skills%20and%20competence%20needs\\_final%20version\(1\).pdf](https://researchonline.ljmu.ac.uk/id/eprint/14990/1/D1.1.3%20Future%20Skills%20and%20competence%20needs_final%20version(1).pdf).
- Skog, D. A., Wimelius, H., & Sandberg, J. (2018). Digital Disruption. *Business & Information System Engineering*, 60, 431–437. <https://doi.org/10.1007/s12599-018-0550-4>
- Tommaso, C., Martin, K., Silvia, M., & Lucia, P. (2021). Digital technologies, innovation, and skills: Emerging trajectories and challenges. *Research Policy*, 50, 104289. <https://doi.org/10.1016/j.respol.2021.104289>
- Verstegen, L., Houkes, W., & Reymen, I. (2019). Configuring collective digital-technology usage in dynamic and complex design practices. *Research Policy*, 48(8), 103696. <https://doi.org/10.1016/j.respol.2018.10.020>
- Wessel, L., Baiyere, A., Ologeanu, R. T., Cha, J., & Blegind, T. J. (2021). Unpacking the difference between digital transformation and IT-enabled organizational transformation. *Journal of the Association for Information Systems*, 22(1), 102–129. <https://doi.org/10.17705/1jais.00655>
- Zahidi, S., Ratcheva, V. S., Hingel, G., & Brown, S. (2020). *The future of jobs report 2020*. World Economic Forum, Switzerland.

### Copyrights

Copyright for this article is retained by the author, with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).