

RESTRUCTURED WORK AND EMPLOYEES: A SYSTEMATIC LITERATURE REVIEW ON DIGITAL TRANSFORMATION SKILLS FOR SUSTAINABLE EMPLOYMENT

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Abstract Digital transformations (DT) require investment in organizational learning climates in which sustainable employment is key. The challenge is to identify and develop essential employee skills needed to meet the organizational demands posed by DT. So far, research has focused on digital or specific professional skills, leaving the question unanswered as to which specific DT skills are essential; thus, our objective was to identify these skills and to develop a comprehensive DT skills framework. A systematic literature review was conducted to identify and synthesize DT skills. Through template analysis a DT skills framework was developed consisting of five crucial skill dimensions: (1) Digital working skills, (2) Entrepreneurial skills, (3) Collaboration Skills, (4) Communication Skills, (5) Lifelong learning skills, and (6) Evidence-based working skills. Our framework shows that essential DT skills are a combination of digital or technical skills and adaptive skills, inviting HR professionals to align their strategic talent management with digital transformation.

Keywords:
digital transformation, skills, sustainable employment, framework, systematic literature review.

1 Introduction

This study aims to advance theoretical development on digital transformation (DT) skills that essential are for sustainable employment. Rapid and continuous advancements of digital technology, such as increased automation, artificial intelligence (AI), big data, cloud computing, robotics and internet of things (IoT), lead to huge transformations for society, economy, and its organizations (Ivaldi et al., 2022; Trenerry et al., 2021). For organizations to successfully transform, it is important to strongly invest in an organizational learning climate, while for employees, investment in the sustainability of their employment is key. One of the greatest challenges is to identify and develop essential skills that contribute to both the collective learning climate and employment sustainability (Ivaldi et al., 2022). Thus, this study aims to advance theoretical development on digital transformation (DT) skills that essential are for sustainable employment.

Because previous scientific literature has focused predominantly on mapping general 21st century skills, digital competences of citizens, or essential skills for specific professions, it remains largely unclear which employee skills are essential in the context of DT. Hence, the contribution of this study lies in identifying these essential skills and developing a comprehensive DT skills framework. As digital technology has accelerated a blurring of boundaries between industries that lead to a more generic and adaptive skillset (World Economic Forum, 2020), we focus on transversal skill sets rather than skills for specific professions in this study. The following research question is central: *Which DT skills are essential for sustainable employment and how can these skills be synthesized into a DT skills framework?*

2 Theoretical background

The current digital transformation is also being referred to as Industry 4.0, a term that relates to it being considered the fourth Industrial Revolution. As with previous industrial revolutions, this Industry 4.0 has the potential to change many aspects of our lives, be it as citizens, consumers or professionals (Ivaldi et al., 2022). Technologies such as AI, big data, robotics and the Internet of Things will generate an unprecedented capacity for processing, archiving and accessing information, which will impact entire systems (Schwab, 2016). As Frey & Osborne (2017) have demonstrated, every industrial revolution has displaced jobs, companies and entire

industries and replaced them with new jobs (which require new, often more complex skillsets) in new organizations in either new, or dramatically changed industries. Moreover, as the World Economic Forum (2020) points out, this response will depend on organizational learning that includes employees from all levels of the organization to be successful. Thus, Digital Transformation can be defined as: “A fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity* and redefine its value proposition for its stakeholders. (*An entity could be: an organization, a business network, an industry, or society.)” (Gong & Ribiere, 2021, p. 10).

Following this definition, strategic leverage of key resources, such as employees, and their dynamic and digital skills forms the core of DT. The scope of these skills ranges from specific digital skills to adaptive skills. To cope with the dynamics of DT, some authors even argue that adaptive skills become more valuable for employees than digital skills (Foerster-Pastor & Golowko, 2018). However, comprehensive insight on essential digital and adaptive skills is lacking and therefore we aim to unpack what the literature has to offer in terms of insights into these future skills.

3 Research design

A systematic literature review was conducted to identify and synthesize DT skills in a transparent and reliable way, in accordance with the PRISMA 2020 approach (Page et al., 2021). The PRISMA 27-item checklist was used for reporting this review in a transparent and complete manner. The process of this study is visualized in the PRISMA 2020 flow diagram, which was slightly adapted for the purpose of this study (see Figure 1).

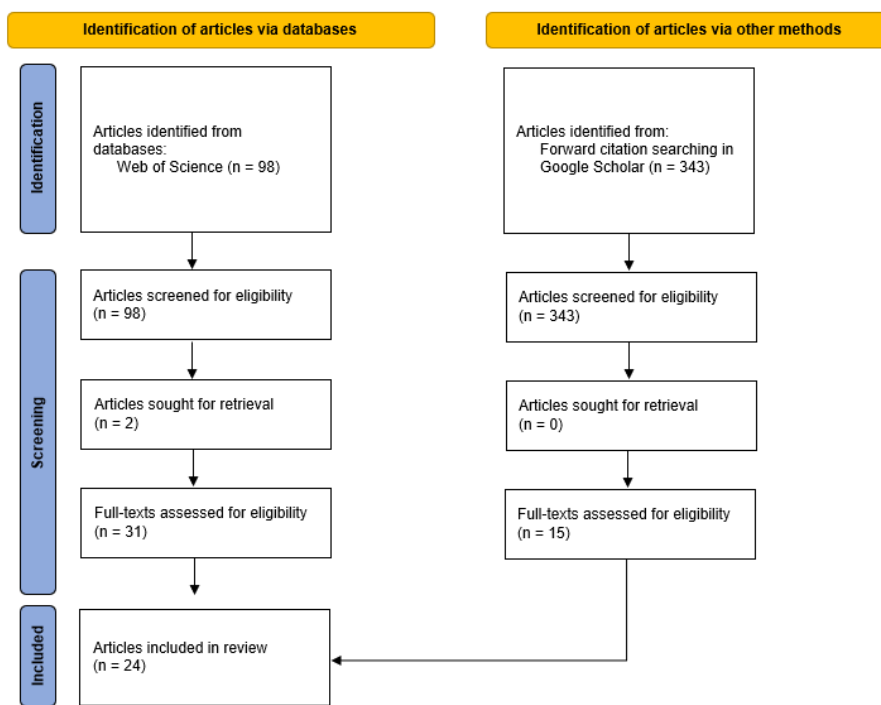


Figure 1: Adapted PRISMA 2020 flow diagram

3.1 Search strategy and selection process

The search strategy consisted of two steps: an advanced search action in Web of Science, followed by a forward citation search in Google Scholar for a selection of articles found in Web of Science.

3.1.1 Step one: selection of articles via Web of Science

For the search action in Web of Science, multiple search terms were combined into one Boolean search operator (see Figure 2). This resulted in an identification of 98 articles. After identification, articles were screened in two stages. In stage one, titles and abstracts of all 98 articles were screened for the following eligibility criteria:

1. includes conceptualizations, definitions and/or measurements of digital transformation skills or a related term, because the goal of this study is to create a digital transformation skills framework based on scientific articles.
2. includes digital transformation skills or related terms that are not too specific for one profession or sector, because the goal is to create a framework that is relevant for a broad array of professions.
3. is published in a peer-reviewed journal, because these journals are regarded as the most reliable source for scientific information.
4. is written in English

Screening was conducted independently by two reviewers and differences in judgements were discussed to reach interrater agreement. This resulted in the exclusion of 67 articles, including two articles that could not be retrieved. For each article, reasons for exclusion were provided. In stage two, the full-texts of the remaining 31 articles were checked, again by two reviewers independently, and differences in judgements were discussed to reach interrater agreement. This resulted in a final inclusion of 21 articles from the Web of Science database.

Abstract of the article contains:			Keywords contain:	
('Digital transformation skills' OR 'Digital transformation competences') OR (('Digital skills' OR 'Digital competences') AND 'Transformation') OR (('Skills' OR 'Competences') AND ('Transformation' OR 'Digitalization')) OR ('21st century digital skills' OR '21st century digital competences') OR (('21st century skills' OR '21st century competences') AND ('Digital transformation' OR 'Digitalization'))	AND		AND	('Competences' OR 'Skills')
		('Framework' OR 'Model' OR 'Review' OR 'Measurement' OR 'Instrument')		

Figure 2: Boolean search operators

3.1.2 Step two: selection of articles via Google Scholar

To be included in the forward citation search in Google Scholar the 21 included papers needed to:

1. include rich definitions of skills or rich descriptions of indicators of skills.
2. have a minimum average of two citations per year. This low minimum was chosen as all articles were published after 2016, and the majority since 2020.

Furthermore, if papers had the same authors, they were only included if they contained different frameworks or models in multiple articles. Based on these criteria six articles from the Web of Science database were selected for inclusion in the forward citation search. In total these six articles were forward cited by 343 papers, which were screened and assessed using the same two-stage process from Step One. This resulted in an inclusion of 3 articles from the Google Scholar database, for a final total of 24 articles included in this study (see Appendix A).

3.2 Analysis and framework development

Template analysis was applied to analyze the concepts used in the articles and to develop a framework of digital transformation skills. Template analysis is a particular style of thematic analysis, in which a coding template is developed based on a subset of data, which is then applied to further data and is revised and refined during this process, leading to a final template (Brooks et al., 2015). The concepts of the most cited article (van Laar et al., 2017) provided the starting point for our coding template. This initial template was applied to the articles, and revised and refined by comparing and adding concepts from the other included articles based on their citation ranking from high through low. The final template was visualized as a framework of digital transformation skills, which is presented in the results section.

4 Results

A framework was developed that contains six central skill dimensions, which in turn consist of 6 skill groups and 45 skills (see Table 1). The skill dimensions are described below.

4.1 Digital working skills

Digital working skills refer to all skills needed to accomplish tasks in a digital environment, and consist of two skill groups. The first, basic digital skills, comprises skills such as handling basic software, hardware and social media needed for everyday tasks. The second, advanced digital skills, includes more specific skills such as programming, developing digital content, and cybersecurity.

4.2 Evidence based working skills

The ability to use the best available evidence is the fifth dimension and consists of three skills groups. The first, information processing, is crucial because employees are confronted with large amounts of information and need to be able to select and use suitable information. The second, data fluency, relates to the mastery of data-related skills, such as data collection, analysis, interpretation, and data ethics. The third, scientific research skills, consists of skills such as conceptual thinking and the skill to formulate testable research questions that are relevant to the organization.

4.3 Entrepreneurial skills

Entrepreneurial skills are required to adequately respond to and take advantage of DT. Two skill groups are distinguished: 1) being open to novelty, and 2) being able to create value. The first enables employees to create something new, and consists of skills such as creativity and innovativeness, spotting opportunities, and taking initiative. The second enables employees to build solutions that effectively add value for stakeholders, and consists of skills such as critical thinking, problem solving, and valuing ideas.

4.4 Lifelong learning skills

Lifelong learning skills are key to employees' adaptability and consist of two skills: 1) self-directed learning, and 2) experiential learning. The first refers to taking control of one's own professional development and can be viewed as a 'meta-competence'. To prevent skill obsolescence, self-directed learners manage their own progression towards self-defined learning goals by taking actions and reflecting upon these actions. The second entails that employees learn by doing and experimenting during their work and learn what works and what does not, which is needed to successfully engage in more agile project work.

4.5 Communication skills

Communication skills are needed to transmit information to others via appropriate traditional and innovative (digital) communication channels, ensuring that the meaning is expressed effectively. Essential skills are the ability to choose and use appropriate channels, storytelling, and applying netiquette.

4.6 Collaboration skills

Collaboration skills refer to both online and offline collaboration skills required in the context of DT. Central to this dimension are skills related to collaborating with different types of professionals, e.g. interpersonal and interdisciplinary skills, negotiation skills, and cultural awareness.

Dimension	Sub group	Skill
Digital work skills	Basic digital skills	Handling hardware
		Handling software
		Handling the internet and social media
		Sharing information and data
		Digital ethics
		Solving basic problems
	Advanced digital skills	Programming
		Digital content creation
		Dealing with laws, copyrights and licences
		Cybersecurity & privacy
Evidence based working skills	Data fluency skills	Data collection
		Data management
		Data analysis
		Data interpretation
		Data application
		Data ethics
	Information processing skills	Formulating research questions
		Searching and selecting information
		Information interpretation and evaluation
		Information management

Entrepreneurial skills	Open to novelty skills	Creativity and innovativeness
		Spotting opportunities
		Sensemaking
		Initiative taking
		Self-efficacy
		Resilience
	Value creation skills	Strategic planning
		Critical thinking
		Problem solving
		Anticipation
		Risk taking
Transformational leadership		
	Self-directed learning	
	Experiential learning	
Lifelong learning skills		
	Training others	
Communication skills		Using appropriate ways to communicate
		Storytelling
		Netiquette
		Digital identity management
Collaboration skills		Negotiation
		Interpersonal skills
		Multidisciplinary skills
		Social intelligence
		Cultural awareness
		Networking

5 Conclusion and discussion

The framework shows that DT skills consist of a combination of digital working skills and adaptive skills, such as entrepreneurial skills. As Table 1 shows, these dimensions consist of several interrelated skills that are relevant for a broad array of professions. These skills increase employability, and as such, sustainable employment.

The framework is an important scientific step in defining and synthesizing essential skills in the context of DT. The primary contributions of this framework are twofold. First, the framework adopts a broad perspective on skills that are relevant for multiple professions and sectors, thus allowing for the identification and emphasis of skills that transcend industries. Second, the framework focuses on a combination of digital working skills and adaptive skills.

5.1 Limitations and future research

The focus on essential DT skills for a broad array of professions and sectors has the consequence that profession specific skills are not included in the framework of this study. Therefore, a suggestion for future research is to build upon this framework by creating different extended versions of it by adding essential skill dimensions for specific professions and sectors. For example, by adding a digital pedagogical skill dimension for teachers or a digital health skill dimension for healthcare professionals.

Furthermore, by defining skill dimensions, skill groups, and specific skills, this study contributed to providing conceptual clarity on DT skills. This is an important precondition for future research aimed at developing scientific instruments to measure or assess DT skills and studying DT skills at the workplace. Therefore, the next step in future research is to operationalize the skills of this DT framework and to develop validated and reliable scientific instruments..

5.2 Practical implications

This study calls upon HR professionals to adapt their strategic talent management to the digital era and to take responsibility for sustainable employment through professional development. This can involve up-skilling, which entails developing relevant skills to add to one's skillset when job requirements change, or re-skilling, which entails developing new skill sets when certain jobs become obsolete and new jobs with different requirements emerge (Santos et al., 2021).

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