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DIGITAL BARRIERS IN DIGITAL TRANSITION AND DIGITAL TRANSFORMATION: LITERATURE REVIEW

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Abstract

Research purpose. The research aimed to identify digital barriers in the digital transition and digital transformation in businesses and industries under the umbrella of human resource management. The topicality of the research relates to the need to identify digital barriers impeding digital transition and transformation that can be addressed through the prism of human resource management policies or that can be related to human resource management.

Design / Methodology / Approach. The research method was the analysis of the keywords and keyword concordances, conducted on the sample of the created corpus of 50 recently published scientific papers, which were analysed using the text analysis instruments *AntConc* and *Voyant Tools*.

Findings. Two digital barrier types were postulated - individual and organisational barriers, which were further spread across five digital barrier areas - human resource, technological, management, business development, and financial ones that were able to accommodate the following barriers: general human resource, staff resistance, psychological, staff digital competences, decision-makers digital competences, internal information exchange, external information exchange, data processing, technical, IT complexity, poor usability, cybersecurity, general management, business structure, business 4.0, industry 4.0, creativity, and costs.

Originality / Value / Practical implications. The created structure of digital barriers provides human resource departments with a global picture of barriers that should be reviewed within their competence areas to ensure the recruitment of specialists capable of conducting specified digital operations and the continuous development of digital competencies of the entire labour force of the organisation. The suggested digital barrier structure can also be used to develop the organisational strategy for the digital transition and digital transformation.

Keywords: Digital barriers; Transformation; Human resources.

JEL codes: M50; M53; M54.

Introduction

Digital transformation of business activities is currently underway at governmental, industrial, business, and personal levels to achieve Business 4.0 and Industry 4.0 outcomes aimed at boosting economic sustainability inclusive of financial, business development, environmental, societal, and human capital aspects. While Business 4.0 concepts pertain to entrepreneurial endeavours employing technological tools of Industry 4.0 to address socio-economic development, Industry 4.0 focuses more on innovations in technologies (Sergi et al., 2022) because Industry 4.0 is the essence of the fourth industrial revolution that creates cyber-physical spaces (David et al., 2022). Therefore, Industry 4.0 innovations are based on artificial intelligence, cloud computing, advanced robotics, the Internet of Things, etc., that are used to create digital ecosystems (Marcon et al., 2022), and their implementation into business activities is the key priority of Business 4.0, which is why digital competences of staff are prioritised (Sergi et al., 2022). Otherwise, the application of Industry 4.0 solutions might be impeded.

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Industry 4.0 is part of the network consisting of a circular economy, competitiveness and stakeholders that aims to increase business sustainability while ensuring client satisfaction (Hallioui et al., 2022). The circular economy also emphasises using digital technologies through business circular models that are expected to expand competitiveness opportunities (Wasserbaur et al., 2022). The use of such technologies under circular economy models also requires a higher level of digital competencies of staff, which cannot be ignored because circular business models in Business 4.0 transform not only some aspects of business activities of organisations – they holistically change business operations which is why the expectations of more advanced digital competences of staff apply not only to specific operations but generally to the entire network of operations of an organisation, including communication, record-keeping, data analysis, etc. Thus, digital competencies should also be approached from a holistic perspective. The reason is that they cover both soft-skill and hard-skill aspects, ensuring work progress in the digital environment (Cimini et al., 2021).

Although the fourth industrial revolution began prior to the COVID-19 pandemic, it was this health crisis that necessitated a more rapid transition to Industry 4.0 solutions and their application to current business models; in other words, it facilitated the transition to Business 4.0 and circular economy operations, including those of smart circular economy. However, a rapid transition requires rapid development of necessary digital competencies of staff, which might be problematic due to various factors, such as time constraints of learning, financial, management and technological gaps, etc. A lack of financial resources might also impede a rapid transition to invest in acquiring new technologies and restructuring business processes, etc. Such factors create barriers in the transition to Business 4.0 and circular economy operations, which impede the digital transformation of organisations.

To be able to lower the negative impact of digitalisation barriers, it is essential to identify them first. This research aimed to identify digital barriers impeding digital transition and digital transformation in organisations concerning human resource management. Digital barriers could be defined in different ways. For example, digital barriers might refer to issues related to the inaccessibility of digital learning materials, issues with digital equipment, and lack of awareness of the constituents of digital barriers (Sanderson et al., 2022). In this research, digital barriers are defined as obstacles related to the creation, access and use of resources in both offline and online digital spaces. The aim was attained through the analysis of scientific sources by application of the keyword frequency and concordance research methods. The outcomes of this research can be used by senior management teams and the managers of business development, human resources, and technological resources in handling overt and possibly covert digital transition and digital transformation barriers in their operations. The fact is, not all digital transition and digital transformation attempts are successful. For example, in 2019, less than 10% of enterprises in China, which is the second largest digital economy in the world, demonstrated positive outcomes of digital transformation, possibly due to the digitalisation paradox, which reveals that investment in digital transformation does not produce the increase in revenues (Guo et al., 2023). This paradox might be attributed to digital transformation and transition barriers, and unless they are identified and overcome, the digitalisation paradox might continue to negatively impact the number of revenues, thus hindering organisational operations' digitalisation.

Literature review

Digital transformation is one of the priorities of the European Union because it facilitates the implementation of green policies, for example, by decreasing greenhouse gas emissions, and prepares citizens for activities in digital spaces, thus, fostering the development of digital competencies across all citizen groups (European Commission, 2022). According to the European Parliament policies, digital transformation opens new opportunities for businesses, helps to reach climate neutrality objectives by 2050, and encourages the development of people's digital competencies, including those pertinent to the workplace (European Parliament, 2023). According to the European Digital Decade Policy Programme 2030, business digital transformation has the potential to benefit more than 90% of small and middle-size businesses and facilitate their transition to basic digital intensity (European Commission, 2022), which ensures the sustainability of such businesses in the competitive marketplace.

Digital transformation is triggered by technological tools (Niu et al., 2023), the impact of which cannot be ignored due to the capacity of such tools to facilitate sustainability and competitiveness at industrial levels, including small and medium-sized enterprises (Chatzistamoulou, 2023), and even micro-enterprises (Niu et al., 2023). The outcomes of digital organisational transformation create new products and services that customers prefer. This puts pressure on all organisations to shift to digital transition and digital transformation to ensure organisational survival in the market with innovative digital market entrants, such as *Amazon.com* (Verhoef et al., 2021).

In the study on the transition to a smart circular economy, which thrives on digital technologies, and constitutes Industry 4.0, Trevisan et al. (2021) identified 45 barriers grouped into eight dimensions: knowledge management, financial, process management and governance, technological, product and material, reverse logistic infrastructure, social conduct, as well as policy and regulatory barriers (Trevisan et al., 2023). The key knowledge management barriers included the lack of knowledge of technologies, environmental issues and economic gains, and competent labour (Trevisan et al., 2023). The financial dimension covered the barriers of the lack of funds and investment into digital technologies and the high costs of new technologies (Trevisan et al., 2023). The barriers to process management and governance incorporated the lack of management support, innovation capacity, integration of cross-departmental operations, the strategy of risk aversion, and longitudinal planning (Trevisan et al., 2023). The technological barriers covered the lack of IT tools, models, infrastructure, protocols, and cybersecurity tools and difficulty conducting data analysis and data integration (Trevisan et al., 2023). As for the product and material barriers, they included the poor quality of materials, low added value, and slow pace of product development (Trevisan et al., 2023). The problems with waste disposal and the selective collection of materials formed obstacles to the reverse logistics infrastructure (Trevisan et al., 2023). The social behaviour barriers covered the concerns over data sharing and employment policies, as well as client behaviour, public interest safeguarding, and change resistance issues (Trevisan et al., 2023). Finally, the policy and regulatory barriers included the lack of governmental support, high taxation and excessive bureaucratic structures, high costs of imported goods and non-challenging environmental targets (Trevisan et al., 2023). Overall, barriers were identified in the areas of management, technologies, funding, human resources, and public policies.

Although there are various types of barriers hindering the transition and creation of digital transformation, those related to the digital competencies of staff might be among the key obstacles. Having conducted the analysis of scientific sources, Gong & Ribiere (2021) concluded that digital transformation rests on the innovative deployment of advanced digital technologies for the purposes of creation and support of a value network for various stakeholders aimed at developing and sustaining organisational identity, which entails a global organisational change in activities, structure, as well as approaches and attitudes. Clearly, such transformation is hardly possible even if available funds and technologies are not supported by staff digital competencies that would ensure the maintenance of current digital operations and create new activities in the digital space.

However, what is digital competence? Digital competence is the capacity to deploy digital technologies by using digital tools to assess problems critically, offer problem-solutions (Süße et al., 2018), conduct daily operations, and create products and services. In one study, Norveel et al. (2022) found that bank employees had a relatively low level of basic digital competencies. This suggests that the digital competencies of staff should be a concern of organisations. In fact, many enterprises claim insufficient digital competencies of staff and view this factor as an impediment in the implementation of Industry 4.0 objectives, which is a barrier in the transition to the digital transformation of Industry 4.0 (Steinlechner et al., 2021), Business 4.0 and circular economy. Therefore, the European Commission emphasises the importance of creating a digital education ecosystem and the development of citizens' digital competencies (European Commission, 2023).

So, who should be responsible for developing proper staff digital competencies at an organisation? It is partly the responsibility of the senior management team, should support the development of digital competencies of staff (Wang et al., 2023) because staff might be incompetent to utilise the latest technologies, which might create unnecessary psychological barriers. The human resource department is also partly accountable for a proper level of digital skills of staff because, on the one hand, the human resource managers should introduce a proper recruiting strategy to ensure the acquisition of required

digital skills by the organisation. However, on the other hand, they should provide regular testing and training of digital competencies staff due to the rapid and complex development of digital technologies.

Considering the importance of staff digital competencies for ensuring the digital transition and digital transformation, the focus of this research was on the identification of digital barriers in the digital transition and digital transformation in businesses and industries under the umbrella of human resource management.

Research Methodology

The research methodology followed the PRISMA principles of systematic literature review (PRISMA, 2023), which according to Page et al. (2021), was designed to provide consistency in reporting and define the minimum requirements for review reporting.

The research method was text analysis, for which a research paper corpus was created. Fifty papers were selected for the analysis. This number of papers was justified by the aim of the research – to identify digital transition and transformation barriers concerning human resources management rather than to explore the constructs of these concepts and develop lexical networks between and within these concepts (see Table 1). The papers were obtained from the platform *ScienceDirect,* positioned by its creator *Elsevier* as a leading platform of more than 2,650 scientific peer-reviewed journals providing full access to papers (Elsevier, 2023a). *Scopus* is another product of *Elsevier*, but it is an abstract and citation database (Elsevier, 2023b), which is why it was not used in this research. The *Google Scholar* platform was not used because it provides access to peer-reviewed papers and non-reviewed papers. The selected papers were published throughout 2017 - 2023 and were selected if their titles included the following keywords related to this research: (1) digitisation and transition / transformation; (2) digital transition; (3) digitisation/digitalisation and its impact / development; (4) challenges / problems / barriers and digital / digitisation (transition); (5) digitalisation / barriers / transition and human resource management. The overall context of these keywords in the title pertains to business, management, economy, industries, sectors, workplace, and human resource management. The range of the keyword contexts did not focus solely on human resource management or workplace in the companies due to the limited number of papers available on such topics.

Table 1. Papers used in the analysis (Source: authors created)

No.	Authors	Paper title
1	Abbate et al. (2023)	The digital and sustainable transition of the agri-food sector
2	Ancillo et al. (2023)	The impact of research and development on entrepreneurship, innovation, digitisation, and digital transformation
3	Andersen et al. (2021)	On digitalisation and sustainability transitions
4	Annosi et al. (2021)	Digitalisation within food supply chains to prevent food waste. Drivers, barriers, and collaboration practices
5	Bansal et al. (2023)	A study of human resource digital transformation (HRDT): A phenomenon of innovation capability led by digital and individual factors
6	Baptista et al. (2020)	Digital work and organisational transformation: Emergent digital/human work configurations in modern organisations
7	Baumle et al. (2023)	The contribution of knowledge intermediation to sustainability transitions and digitalisation: Qualitative insights into four German regions
8	Bui & Le (2023)	Digital capability and creative capability to boost firm performance and formulate differentiated CSR-based strategy
9	Busch et al. (2018)	Opportunities and challenges of digitised discretionary practices: A public service worker perspective
10	Caputo et al. (2023)	Building T-shaped professionals for mastering digital transformation
11	Cerchione et al. (2023)	Blockchain's coming to hospital to digitalise healthcare services: Designing a distributed electronic health record ecosystem.
12	Chen & Thio (2021)	Exploring the drivers and barriers to uptake for digital contact tracing

13	Chen et al. (2023)	Enabling the twin transitions: Digital technologies support environmental sustainability through lean principles.
14	Chirumalla et al. (2023)	Moving from servitisation to digital servitisation: Identifying the required dynamic capabilities and related microfoundations to facilitate the transition.
15	Cirillo et al. (2023)	The adoption of digital technologies: Investment, skills, work organisation
16	Cisarova (2023)	We were innovators, but we gave up: the muted digital transition of local newspapers.
17	Dabbous et al. (2023)	The impact of digitalisation on entrepreneurial activity and sustainable competitiveness: A panel data analysis
18	Dabic et al. (2023)	Future of digital work: Challenges for sustainable human resources management
19	Dalenogare et al. (2023)	Building digital servitisation ecosystems: An analysis of inter-firm collaboration types and social exchange mechanisms among actors
20	Favoretto et al. (2022)	From servitisation to digital servitisation: How digitalisation transforms companies' transition towards services
21	Feliciano-Cestero et al. (2023)	Is digital transformation threatened? A systematic literature review of the factors influencing firms' digital transformation and internationalisation
22	Ferreira et al. (2022)	The interactions of entrepreneurial attitudes, abilities, and aspirations in the (twin) environmental and digital transitions? A dynamic panel data approach
23	Giua et al. (2022)	Smart farming technologies adoption: Which factors play a role in the digital transition?
24	Golab-Andrzejak (2023)	AI-powered digital transformation: Tools, benefits, and challenges for marketers – Case study of LPP
25	Guo et al. (2023)	Does digital transformation improve the firm's performance? From the perspective of digitalisation paradox and managerial myopia
26	Hewitt et al. (2020)	Participatory development of digital support tools for local-scale energy transitions: Lessons from two European case studies
27	Hojnik et al. (2023)	Challenges of demographic changes and digitalisation on eco-innovation and the circular economy: Qualitative insights from companies.
28	Holopainen et al. (2022)	Managing the strategic readiness of industrial companies for digital operations
29	Liu et al. (2023)	How do family firms respond strategically to the digital transformation trend: Disclosing symbolic cues or making substantive changes?
30	Makitie et al. (2023)	Digital innovation's contribution to sustainability transitions.
31	Meske et al. (2020)	Bridging formal barriers in digital work environments – Investigating technology-enabled interactions across organisational hierarchies
32	Nwaila et al. (2022)	The minerals industry in the era of digital transition: An energy-efficient and environmentally conscious approach.
33	Okorie et al. (2023)	Digital transformation and the circular economy: Creating a competitive advantage from the transition towards Net Zero Manufacturing
34	Polakova-Kersten et al. (2023)	Digital transformation in high-reliability organisations: A longitudinal study of the micro-foundations of failure.
35	Pellegrini et al. (2020)	Digital transition and waste management in architecture, engineering, construction, and operations industry
36	Quaranta et al. (2023)	Digitalisation and real-time control to mitigate environmental impacts along rivers: Focus on artificial barriers, hydropower systems and European priorities
37	Qian et al. (2023)	Digitalisation of logistics for transition to a resource-efficient and circular economy
38	Ramachandran et al. (2023)	Barriers and facilitators to the adoption of digital health interventions for COPD management: A scoping review
39	Saarikko et al. (2020)	Digital transformation: Five recommendations for the digitally conscious firm

40	Selimovic et al. (2021)	Digital workplace transformation in the financial service sector: Investigating the relationship between employees' expectations and intentions
41	Setkute & Dibb (2022)	"Old boys' club": Barriers to digital marketing in small B2B firms
42	Sergi et al. (2022)	Creative abilities and digital competencies to transitioning to Business 4.0
43	Shen et al. (2022)	Digital transition and green growth in Chinese agriculture
44	Tavani et al. (2022)	Smartphone assisted fieldwork: Towards the digital transition of geoscience fieldwork using LiDAR-equipped iPhones
45	Teixeira et al. (2022)	Demystifying the digital transition of re-manufacturing: A systematic review of literature
46	Trevisan et al. (2023)	Barriers to employing digital technologies for a circular economy: A multi-level perspective
47	Vuchkovski et al. (2023)	A look at the future of work: The digital transformation of teams from conventional to virtual
48	Wilson & Mergel (2022)	Overcoming barriers to digital government: mapping the strategies of digital champions.
49	Zhang et al. (2017)	From numerical model to computational intelligence: The digital transition of urban energy system
50	Zhong & Ren (2023)	Independent and joint effects of CSR and CSI on the effectiveness of digital transformation for transition economy firms

Seventy-eight per cent of all papers were published in 2022 – 2023, which indicates a growing interest of the scientific community in the topic.

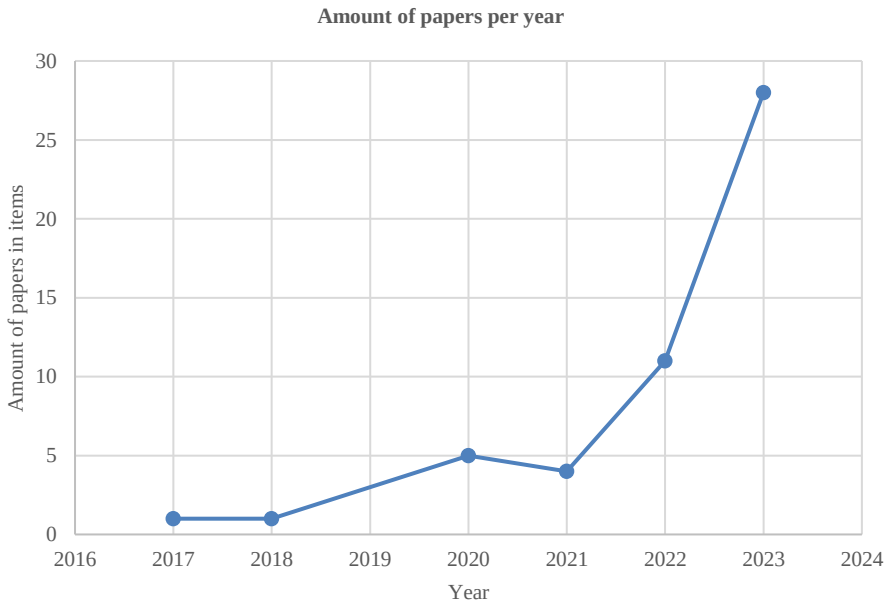


Fig. 1. Number of papers per year (Source: authors created)

The papers were published in 29 journals (see Fig. 1).

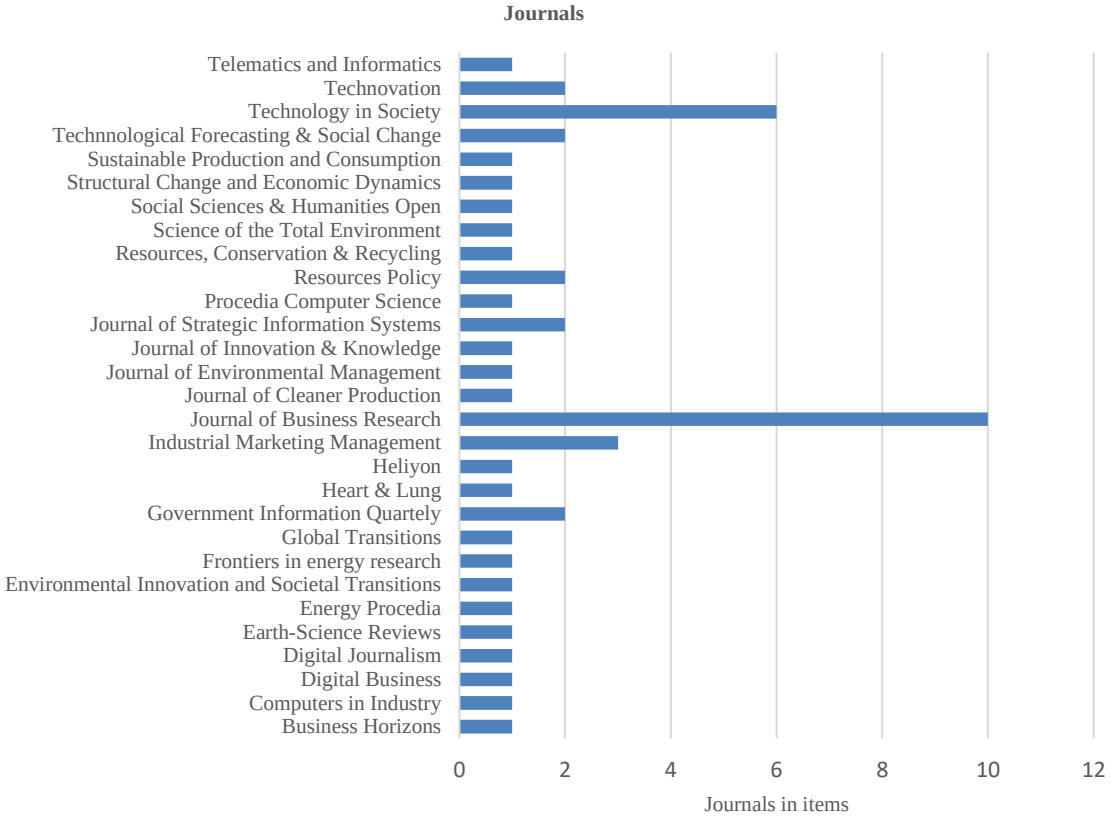


Fig.2. Journals of the selected papers (Source: authors created)

Although nine journals were not found in the Scopus database, retrieved from the section *Scopus Source List* (Scopus, 2023), they were included in the analysis because they were provided by *Science Direct*, which indicated that the journals were indexed with *Scopus*, one such case being the journal *Procedia Computer Science* (ScienceDirect, 2023). Furthermore, according to the *Scimago Journal & Country Rank*, most of these journals are in Scopus Q1, which points to a high quality of selected papers (see Fig. 3)

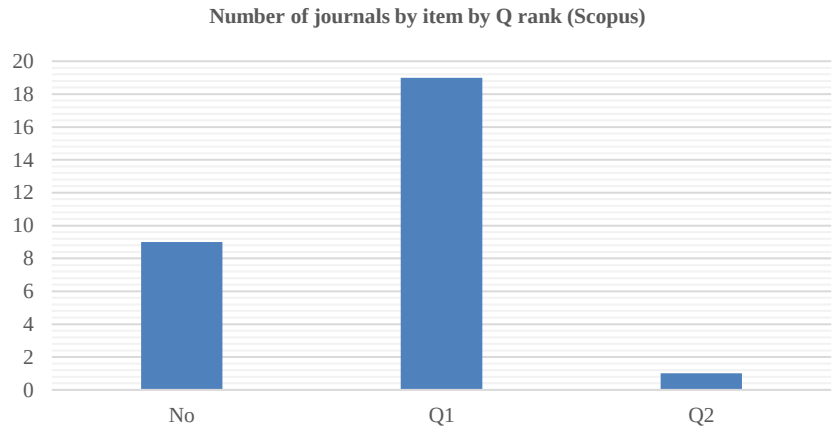


Fig.3. Number of journals per quartile (Source: authors created)

All papers were analysed together because the research aimed to identify barriers related to the digital transition and digital transformation in pertinence to human resource management that is mentioned in scientific literature overall.

Word frequency analysis was run on the open-access text analysis platform *Voyant Tools*, while the word concordance analysis was performed in the text analysis program *AntConc*. Both *Voyant Tools* and *AntConc* are used to create text corpora, determine word frequency based on the word occurrence in the created corpus, and explore the lexical contexts of selected words, referred to as word concordances (Laurence Anthony's Website, n.d.; Voyant Tools, n.d.). However, the visualisation capacity of these instruments differs, which is why they both were used for more effective visualisation of research results.

Research results

To identify digital barriers in digital transition and transformation concerning human resource management, 50 selected papers were loaded onto the *Voyant Tools* and *AntConc* platforms to create one unified text corpus. The resulting corpus included 731,236 words (see Fig. 4).

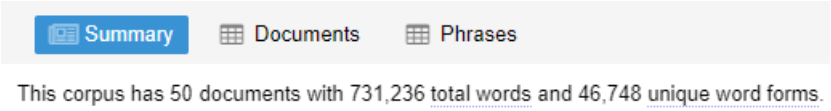


Fig. 4. Corpus created on the platform *Voyant Tools* (Source: authors created)

The keywords were combined into ten lexical tokens. They constituted 0,005% of the entire corpus, and their raw frequency is provided in Fig.5.

Terms

	Term	Count	Trend
1	"digital* transformation"	1324	
2	digitalization*	765	
3	barrier*	614	
4	challenge*	587	
5	"digital* transition"	232	
6	problem*	215	
7	digitization*	135	
8	"human resource*"	103	
9	"human capital*"	91	
10	"human resource management*"	60	

Fig. 5. Frequency of the keywords in the created corpus on *Voyant Tools* (Source: authors created)

The relative frequency of the selected concepts within documents, ranging from 0.000 to 0.016, is provided in Fig. 6.

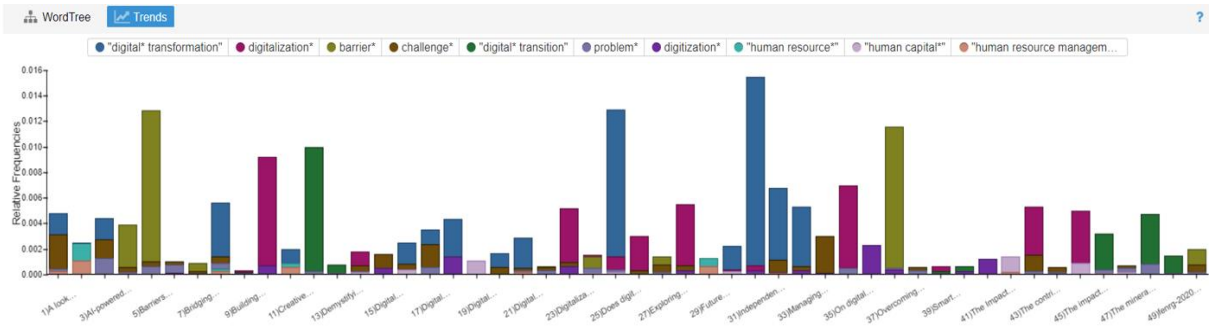


Fig. 6. Relative frequency of the keywords in the created corpus on *Voyant Tools* (Source: authors created)

Within the text analysis theory, the importance of a word in the text is transmitted through its frequency, which is why more crucial concepts are expected to be more frequently used than less important words (Han et al., 2017). This suggests that the selected keywords (see Fig. 5) are not of high importance in the created corpus, which might explain why there is a lack of barrier types in the created corpus.

The concept of the digital transition was mentioned 5,7 times less frequently than the notion of the digital transformation, despite the concept of transition taking up 60% of all the papers that contained the lexical item "transition" or "transformation" in the title. This means that the concept of the digital transition is less frequently addressed than that of digital transformation.

The concepts of difficulty conveyed through the words of barriers, challenges and problems were researched in concordance, an example of which is provided in Fig. 7.

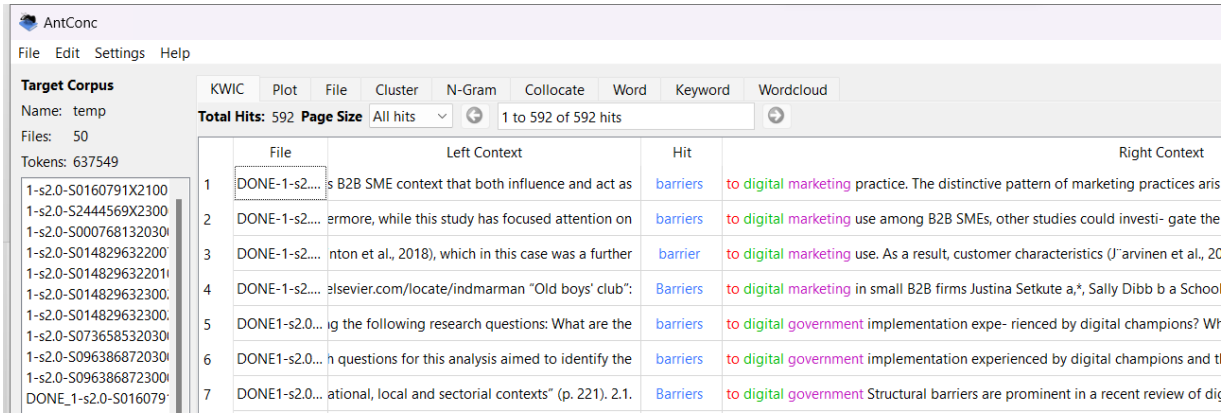


Fig. 7. Concordance sample for *barriers* created in the program *AntConc* (Source: authors created)

The concepts of *barriers*, *challenges*, and *problems* in relation to management, business, entrepreneurship, transition, and transformation in the context of digitisation and digitalisation were identified in 47 out of 50 papers. The analysis resulted in the identification of the following categories: (1) barrier domains: digital and general barriers; (2) barrier types: individual, organisational, individual / organisational, and market-related; (3) barrier specification (see Table 2). Individual barriers referred to the personal competencies of people, while organisational barriers refered to the capacities of organisations. The barrier type *individual / organisational* combined both personal and organisational characteristics.

Table 2. Barriers per papers (Source: authors created)

Papers		Authors created		
Authors	**Lexical context of *barriers, challenges and problems***	**Barrier specification**	**Barrier domains**	**Barrier type**
Vuchkovski et al. (2023)	Lack of technology knowledge among (older) employees	Staff lack of digital knowledge	Digital	Individual / organisational
	Lack of face-to-face communication, decreasing motivation, lower sense of teamwork, work tasks in virtual teams	Psychological	Digital	Individual / organisational
	Barriers to creative work	Creativity	Digital	Organisational
Bansal et al. (2023)	Competition in the market increasing and work in the virtual environment is going to increase, so, organisations should ensure their competitiveness in such environment	Technical and structural	Digital	Organisational
Golab-Andrzejak (2023)	Lack of investment in artificial intelligence	Financial	Digital	Organisational
Ramachandran et al. (2023)	Barriers in the adoption of digital health interventions	Clients' lack of digital knowledge	Digital	Individual
	Barriers in the adoption of digital health interventions from the hospital perspective include the staff lack of digital knowledge	Staff lack of digital knowledge	Digital	Individual / organisational
	Barriers in the adoption of digital health interventions from the hospital perspective include the increased workload	Management	Digital	Organisational
	Barriers in the adoption of digital health interventions from the hospital perspective include the lack of funding	Financial	Digital	Organisational
	Barriers in the adoption of digital health interventions from the hospital perspective include the lack of dedicated and trained staff	Human resource	Digital	Organisational
Cerchione et al. (2023)	Barriers in information access across various organisations, e.g. healthcare system	External information exchange	Digital	Organisational
Meske et al. (2020)	Barriers in information exchange among different levels of employees across an organisation	Internal cross-level information exchange	Digital	Organisational
Caputo et al. (2023)	Employee rejection of digital transformation	Staff resistance	Digital	Organisational
Sergi et al. (2022)	Business 4.0 creates market-entry barriers	Business 4.0	Digital	Organisational
Teixeira et al. (2022)	Industry 4.0 and re-manufacturing problems associated with re-manufacturing systems	Industry 4.0	Digital	Organisational
Polakova-Kersten et al. (2023)	Complexity of IT	IT complexity	Digital	Organisational
Chen & Thio (2021)	Poor usability of DCT creates barriers for users	Poor usability	Digital	Organisational
Setkute & Dibb (2022)	Lack of knowledge regarding digital marketing related to the generational gap	Decision-makers' lack of knowledge	Digital	Organisational

Favoretto et al. (2022)	Data-related issues, such as poor data standardisation and data integration in servitisation	Data-related	Digital	Organisational
	Lack of funds to invest in digitalisation	Financial	Digital	Organisational
Abbate et al. (2023)	Obstacles in the implementation of I4.0 technologies	Technical	Digital	Organisational
Nwaila et al. (222)	Obstacles impeding the implementation of new technologies and data technologies	Technical	Digital	Organisational
	Obstacles impeding the implementation of data technologies	Data processing	Digital	Organisational
Dalenogare et al. (2023)	Security of digital operations and data	Cybersecurity	Digital	Organisational
	Insufficient digital competencies of staff	Staff digital competence	Digital	Organisational
Holopainen et al. (2022)	Lack of interest in customers to accept digital operations of companies	Client digital competences	Digital	Organisational
Bui & Le (2023)	Cultural and physical barriers in doing or expanding business on an international scale that a digital platform can help to lower.	Market-entry	General	Market-related
	Systemic barriers associated with the transition to the use of sustainable (renewable) energy sources	Systemic energy	General	Organisational
Makitie et al. (2023)	Circularity barriers that impede making connections between waste users and waste producers	Client identification	General	Organisational
Okorie et al. (2023)	Barriers in attaining zero-emission level	Green barrier	General	Organisational
Saarikko et al. (2020)	Barriers in finding reliable suppliers and contractors	Supplier general	General	Organisational
Shen et al. (2022)	Entering market barriers for small farms	Market-entry	General	Organisational
Selimovic et al. (2021)	Interpersonal relations of employees affect collaboration and productivity	Interpersonal employee	General	Organisational
Quaranta et al. (2023)	Physical and geographic barriers in construction	Landscape	General	Organisational
Trevisan et al. (2023)	Costs	Financial	General	Organisational
	Dimension barriers: technology, data protection, general management and structural	Organisational lack of knowledge	General	Organisational
	Product development			
	New investment in new ideas			
	Lack of proper infrastructure			
Qian et al. (2023)	Dependency of industries on resources	Resource dependency	General	Organisational
Annosi et al. (2021)	Difficulty entering global supply chain markets	Global market integration	General	Organisational
Wilson & Mergel (2022)	Lack of knowledge of how to manage and do business	Organisational lack of knowledge	General	Organisational
Pellegrini et al. (2020)	Lack of knowledge of how to manage waste	Organisational lack of knowledge	General	Organisational
Dabic et al. (2023)	Vulnerable workers face more barriers in finding employment	Employability of vulnerable groups	General	Market-related

Zhong & Ren (2023)	Weak organisational capabilities impeding the transition to digital transformations	Firm capacity	General	Organisational
Feliciano-Cestero et al. (2023)	Lower barriers for entering markets for competitors	Market competition	General	Organisational
Chirumalla et al. (2023)	Lack of understanding of how to deploy resources	Firm capacity	General	Organisational
	Customer, stakeholder and industry preferences	External	General	Organisational
Andersen et al. (2021)	New products	Market-entry	General	Organisational
Busch et al. (2018)	Technology-related problems to ensure discretionary practices	Discretionary	General	Organisational
Hewitt et al. (2020)	Social acceptance of society of wind turbines	Social acceptance	General	Market-related
	Legal barriers in companies	Legal	General	Organisational
Cirillo et al. (2023)	Cost barriers related to business capacity	Financial	General	Organisational
Baumle et al. (2023)	Management barriers related to balancing innovation and transition approaches	Management	General	Organisational
	Obstacles in knowledge transfer in the region	Organisational lack of knowledge	General	Market-related
Ferreira et al. (2022)	Market entry barriers	Market-entry	General	Organisational
Cisarova (2023)	Understanding barriers between newspapers and technological innovations	Lack of management knowledge	General	Organisational
Ancillo et al. (2023)	Pandemic, climate change and digitalisation	Environment	General	Market-related
Tavani et al. (2022)	Obtaining equipment for specific purposes	Acquisition of technology	General	Organisational
Baptista et al. (2020)	Workplace technologies for digital transformation to boost productivity	Acquisition of technology	General	Organisational
Chen et al. (2023)	Workplace technologies for digital transformation in manufacturing	Use of new technology	General	Organisational
Dabbous et al. (2023)	Measuring performance and competitiveness of the company	Data science	General	Organisational
Hojnik et al. (2023)	Deploying existing resources to meet growing demands of clients	Resource effectiveness	General	Organisational
Liu et al. (2023)	Managing transition to digital transformation, including shifts in strategy, and reducing risks	Digitalisation management	General	Organisational

Having the focus on digital barriers, the research then focused on summarising digital barriers in the program *Power BI* (see Fig.8).



Fig. 8. Digital barriers in the digital transition and digital transformation (Source: authors created)

Overall, 15 organisational, three individual / organisational and one individual barrier emerged (see Fig. 9).

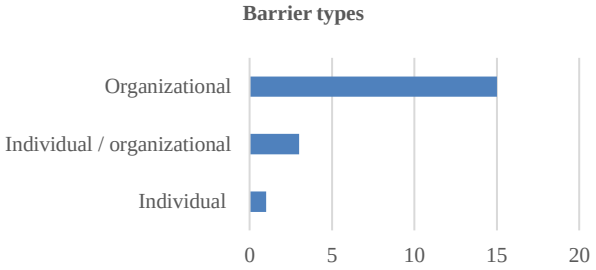


Fig. 9. Summary of barrier types (Source: authors created)

The analysis of barrier specifications identified barrier areas – technological, management, business development, human resources, and financial ones (see Fig. 10).

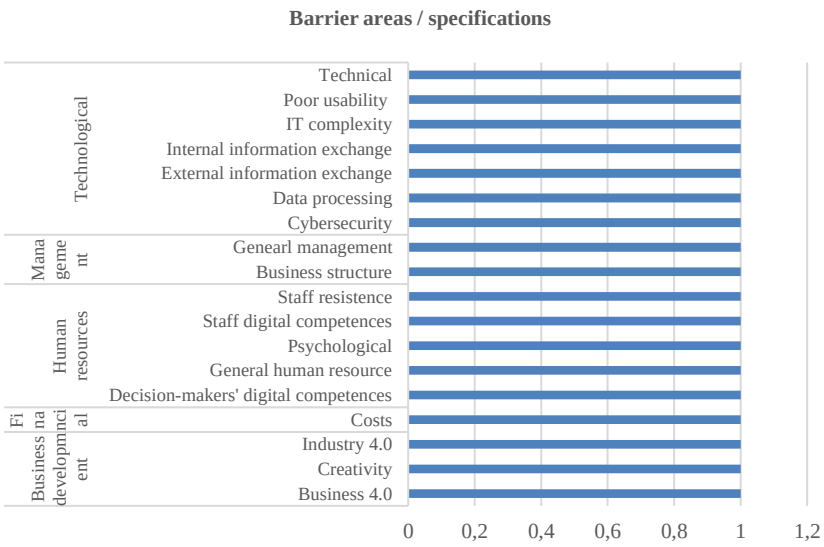


Fig. 10. Barrier areas / specifications (Source: authors created)

Overall, the analysis of scientific literature resulted in the creation of the internal digital barrier structure for an organisation, excluding external barriers, such as clients' digital competence level. External barriers were excluded because just one such barrier was identified in this research, which is an insufficient number to suggest a barrier structure. The resulting structure is provided in Fig. 11.

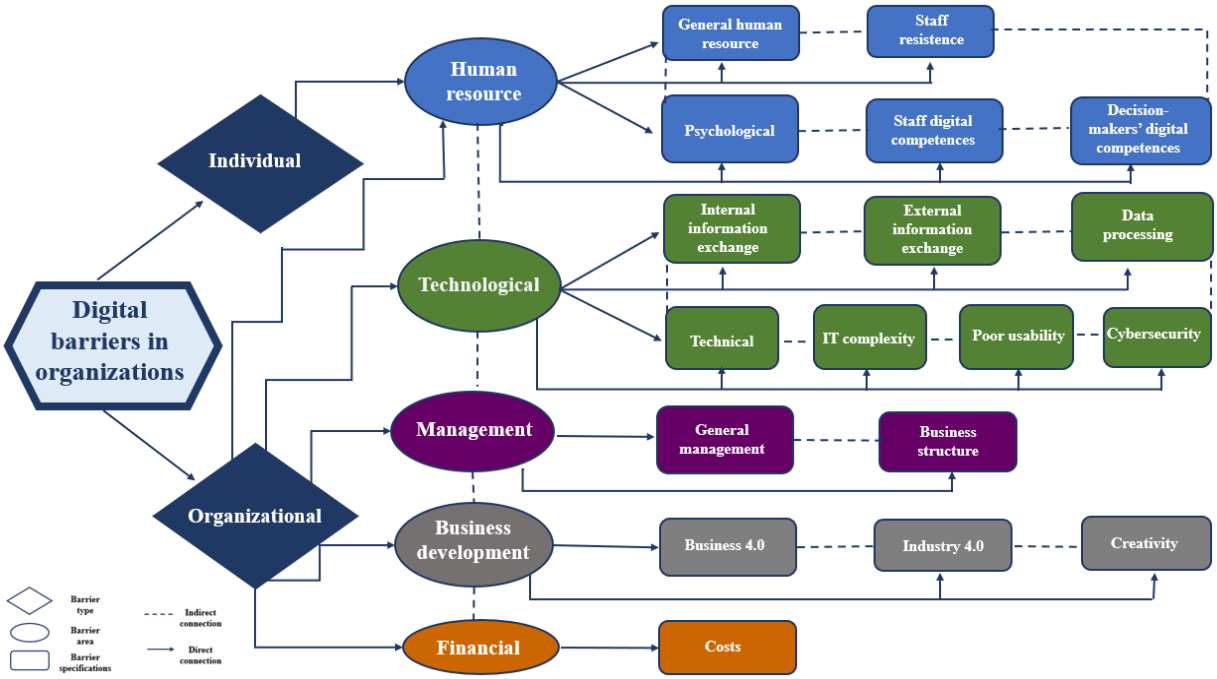


Fig. 11. Digital barrier structure in organisations (Source: authors created)

This structure combines two barrier types (individual and organisational ones) that are further divided across five barrier areas (human resource, technological, management, business development, and financial ones), each of which contains specific barriers (general human resource, staff resistance, psychological, staff digital competences, decision-makers' digital competences, internal information exchange, external information exchange, data processing, technical, IT complexity, poor usability, cybersecurity, general management, business structure, business 4.0, industry 4.0, creativity, and costs), referred to as barrier specifications in this research.

Conclusions

The consequences of the 4th industrial revolution include transitioning to Business 4.0 organisational models functioning in Industry 4.0 contexts. One of the strategic aims of such models and contexts is to increase organisations' productivity, efficiency, and competitiveness. This is expected to happen through the utilisation of innovative technologies of Industry 4.0 (Sergi et al., 2022). Whether modern technologies are welcomed or impeded at an organisation depends on various cross-structural and cross-capacity factors, for example, organisational capacity to invest into new technologies, digital competencies of staff and decision-makers related to the use of new digital technologies, etc. To facilitate the acceptance and deployment of such digital technologies, organisational leaders and staff should be aware of digital barriers. Challenges in digital transformations vary across different types of industries and organisations, such as enterprises that focus on end-consumers and those that are distanced from them, such as asset-intensive companies (Buck et al., 2023), which is why this study aimed to identify general digital organisational barriers, outlined in scientific research, which impede digital transition and digital transformation of various types of organisations under the umbrella of human resource management. To attain this aim, the paper analyses of the recent scientific literature

was conducted, the result of which was the proposal of a digital barrier structure that could be used as a starting point in the design of digital transition and digital transformation strategy or be integrated into a digital transition and digital transformation road map. Earlier, Buck et al. (2023) postulated the corporate need for the identification of digital challenges and digital skills of staff for the inclusion in digital transformation road maps encompassing strategy, recruitment, and business models.

The created digital barrier structure is a multi-layer hierarchical structure that categorises barrier specifications (barrier names) into barrier areas, ultimately divided into barrier types. Barrier areas cover various aspects of organisational activities: human resource, technological, financial, management and business development. While the senior management team can address all barriers through corporate policies at the business strategy and business model levels, ultimately, implementing such policies lies with the human resource department. However, partial responsibility for overcoming some digital barriers lies with individual staff members.

The created structure of digital barriers provides a global picture of barriers that should be considered within the human resource management perspective because the task of human resource departments is to ensure both the recruitment of professionals capable of conducting specific digital operations and the ongoing acquisition of digital competences of the entire labour force of the organisation. This means that human resource departments should be able to contribute to the development of digital transition and digital transformation strategies by informing the senior management team about possible digital barriers within their competence level. The suggested barrier structure can also be used to develop the organisational framework of digital barriers. Earlier, Cirillo et al. (2023) claimed that one of the challenges of integrating new technologies at the workplace related to their diversity makes it implausible to assign them to one common matrix in an organisation. Although this study does not help to create such a matrix, it proposes a structure across which technologies could be spread, ultimately allowing for consistently identifying converging and departing points of technology use.

As with any study, this one also has limitations. One of them relates to a relatively limited number of the analysed papers, which was justified by the task of the research – identification of currently known barriers in the digital transition and digital transformation in human resource management. In the future, the corpus of analysed papers should be expanded to verify the obtained results. Another research limitation pertains to the imbalanced number of publications per year - most papers were published in 2023. This limitation is attributed to the research task, which did not require the identification of a tendency but focused on identifying the most recent facts and opinions expressed in scientific literature. The imbalance of publications was increased by the gap between papers published in 2017 and 2018, which covered only two articles, and the rest of the publications, spanning from 2020 to 2023. The inclusion of 2017 and 2018 papers was justified by the contexts of their discussion – public service and urban energy sector, which contrasted with other selected publications. This imbalance should be addressed in the future by including a relatively even number of papers from a broader range of years. Yet another limitation of the study relates to the source of the analysed papers, which was restricted to only one platform – *ScienceDirec*t, owned by *Elsevier*. *Web of Science*, another well-respected source of scientific references, which is a product of *Clarivate*, was excluded from creating the paper corpus to avoid potential redundancy in results. Because the research task was restricted to identifying barriers, the information available on *ScienceDirect* was considered sufficient. W*eb of Science* should be used in future research to explore the components and interconnections of the identified network concepts. Overall, these methodological constraints were caused by the research task focusing on the surface identification of digital transition and transformation barriers in human resource management rather than exploring deeper structures and networks of conceptual relationships.

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