Reyes-Cornejo, Pablo; Araya-Castillo, Luis; Moraga-Flores, Hugo; Boada-Grau, Joan; Olivares-Brito, César

Article

Scientometric study of digital transformation and human resources: Collaborations, opportunities, and future research directions

Administrative Sciences

Provided in Cooperation with:
MDPI – Multidisciplinary Digital Publishing Institute, Basel

Suggested Citation: Reyes-Cornejo, Pablo; Araya-Castillo, Luis; Moraga-Flores, Hugo; Boada-Grau, Joan; Olivares-Brito, César (2025) : Scientometric study of digital transformation and human resources: Collaborations, opportunities, and future research directions, Administrative Sciences, ISSN 2076-3387, MDPI, Basel, Vol. 15, Iss. 4, pp. 1-17, https://doi.org/10.3390/admsci15040152

administrative sciences

MDPI

Article

Scientometric Study of Digital Transformation and Human Resources: Collaborations, Opportunities, and Future Research Directions

Pablo Reyes-Cornejo [1,*], Luis Araya-Castillo [2], Hugo Moraga-Flores [3], Joan Boada-Grau [4] and César Olivares-Brito [5]

[1] Escuela de Ingeniería Comercial, Facultad de Economía y Negocios, Universidad Santo Tomás, Talca 3460000, Chile
[2] School of Business, Universidad Adolfo Ibáñez, Las Condes 7550000, Chile; luis.araya@uai.cl
[3] Faculty of Economic and Administrative Sciences, University of Concepción, Concepción 4070409, Chile; hmoraga@udec.cl
[4] Department of Psychology, Research Center for Behavior Assessment (CRAMC), Universitat Rovira i Virg, 43007 Tarragona, Catalunya, Spain; joan.boada@urv.cat
[5] Faculty of Engineering and Business, Universidad Católica Silva Henríquez, Santiago 8330225, Chile; colivaresb@ucsh.cl
* Correspondence: pabloreyescornejo@gmail.com

Abstract: While the importance of understanding digital transformation from a Human Resources (HR) perspective is widely acknowledged, a comprehensive analysis of the scholarly landscape remains limited. This study examines the scientific production on digital transformation and HR within the Web of Science database, analyzing bibliometric indicators of production, visibility, impact, and collaboration. The results reveal that digital transformation is a recent, relevant, and transdisciplinary construct that significantly influences talent management strategies and necessitates new skill sets within HR functions. This impact requires organizations to proactively develop digital skills, facilitating a regulated and controlled transition during the implementation of digital strategies. Specifically, organizations must focus on fostering employee adaptability and promoting work–life balance in this rapidly changing environment. Building on these findings, future research could benefit from employing mixed-methods approaches, combining quantitative bibliometric analysis with qualitative case studies to explore the contextual factors influencing the complex relationship between digital transformation and HR, such as organizational culture and leadership styles.

Keywords: digital transformation; human resources; scientometrics; bibliometrics; WoS; digital competencies

Received: 13 February 2025
Revised: 6 April 2025
Accepted: 15 April 2025
Published: 21 April 2025

Citation: Reyes-Cornejo, P., Araya-Castillo, L., Moraga-Flores, H., Boada-Grau, J., & Olivares-Brito, C. (2025). Scientometric Study of Digital Transformation and Human Resources: Collaborations, Opportunities, and Future Research Directions. *Administrative Sciences*, *15*(4), 152. https://doi.org/10.3390/admsci15040152

1. Introduction

Digital transformation (DT) is a multifaceted phenomenon posing significant challenges for organizations across various sectors. Characterized by research contributions from diverse fields, including mathematics, engineering, computer science, social sciences, economics, and behavioral sciences (Li, 2022).

For the purposes of this publication, we will focus on the approach to DT from the perspective of human resources, highlighting the role of individuals in the technological changes occurring in the workplace.

Within this framework, digital transformation fosters performance through strategic innovations that generate value (Hess et al., 2016). These strategic innovations enable organizations to respond to continuously evolving global demands (Matt et al., 2015; Hess et al., 2016; Correani et al., 2020).

In the contemporary business landscape characterized by uncertainty and volatility, organizations confront the critical imperative of adapting to ensure sustained competitiveness, a phenomenon widely recognized as 'digital Darwinism'. This concept elucidates the rapid technological evolution and the consequent pressure exerted on organizations to innovate or risk obsolescence (Kreutzer et al., 2017; Li, 2022).

Digital transformation constitutes an organizational change engendered by technology, yielding economic and social repercussions, thereby stimulating innovation and advancing the development of products with enhanced added value (Vial, 2019; Tomaszewski, 2021; Hanelt et al., 2021).

The technological transformations propelling DT are frequently catalyzed by economic and social shifts that cultivate innovation and facilitate technology transfer (Vial, 2019; Hanelt et al., 2021). Within this transformative process, organizational culture constitutes a significant factor. Through the implementation of novel technologies, agility is enhanced, and processes are optimized (Rogers, 2016; Kudyba, 2020). Furthermore, organizational change necessitates that entities adapt their structures and foster a culture that underpins these transformations (Kane, 2019).

This nexus between DT and culture underscores the necessity for individuals possessing the requisite technological competencies (Kane, 2019; Soto-Acosta, 2020; Nadkarni & Prügl, 2020; Ellström et al., 2022). These competencies empower organizations to coordinate activities effectively, leverage resources, and develop innovative products and services (Routley et al., 2013).

Considering that competencies constitute an inherent attribute of individuals, examining the perceptions and responses of individuals regarding digital transformation is paramount (Teichert, 2019; Martínez-Peláez et al., 2023). This includes leaders and managers, who encounter the challenge of developing strategies that are congruent with the evolving digital landscape (Berghaus & Back, 2016). Organizations that architect flexible structures to realize their strategy are optimally positioned to adapt to digital transformation (Teece, 2010; Verhoef et al., 2021).

From a practical standpoint, a primary consequence involves the automation of repetitive tasks, thereby necessitating a greater emphasis on human capabilities such as creativity, empathy, judgment, intuition, interpersonal sensitivity, and problem-solving skills (Soto-Acosta, 2020).

Digital transformation encompasses a fundamental transformation in the mechanisms through which companies generate value, propelled by a cultural transformation in alignment with the organizational strategy, with the objective of fostering agility within the organizational structure to respond effectively and efficiently to evolving environmental dynamics (Rogers, 2016).

In summary, the following authors (Table 1) have made significant contributions to the study of DT:

Table 1. Leading authors in DT research.

Author	Main Findings
(Vial, 2019)	Digital transformation (DT) has become recognized as a strategic phenomenon, wherein technology constitutes only a component of a complex process enabling organizations to respond to potentially instantaneous environmental shifts, thereby generating alterations in value creation. This necessitates modifications to the organizational structure, organizational culture, leadership, and the competencies of personnel.
(Hanelt et al., 2021)	Ambiguity persists regarding the precise definition and scope of DT, although a clear correlation exists between DT and organizational change. These authors posit that DT is initiated by the integration of digital technology, thereby facilitating the evolution towards flexible organizational structures.
(Hess et al., 2016)	Strategy is paramount to the success of DT, thereby necessitating the engagement of managers. Managers are tasked with overseeing the application of DT strategies through the analysis of technology utilization, alterations in value creation, structural modifications, and financial considerations. The authors assert that the initial phases of DT implementation are characterized by a significant degree of uncertainty.
(Verhoef et al., 2021)	Digital transformation (DT) is not an intrinsic objective but rather a multidisciplinary phenomenon occurring in response to changes induced by technology, encompassing three distinct stages: typification, digitization, and digital transformation. Each stage necessitates specific conditions with respect to digital resources, organization, structure, and metrics. Organizations that undertake DT enhance agility, establish networks, and facilitate information management.
(Nadkarni & Prügl, 2020)	Digital transformation (DT) is a phenomenon underpinned by diverse theoretical foundations, for which there is limited quantitative empirical evidence. DT is enabled by technology but not determined by it. It is a construct comprising two primary dimensions: technology and actor. Furthermore, each dimension consists of several sub-dimensions. Within the technology dimension: change environment, technological capacity, value creation and capture, and market environment. Within the actor dimension: transformative leadership, managerial and organizational skills, culture, and work environment.
(Ogrean & Herciu, 2021)	Digital transformation (DT) encompasses the domain of digital technologies and their applications. Consequently, DT is not an ultimate goal but rather a means to attain digital economies, foster economic growth, enhance the quality of life, promote sustainable development, and ensure sustainability.

There is a consensus that DT is as much about people as it is about technology (Erceg & Zoranović, 2022; He et al., 2023) in a change process that requires teams to move beyond habitual practices (Teece et al., 2016).

The change process demands a significant effort from the entire company, making the reformulation of a business strategy fundamental for success (Sebastian et al., 2017; Erceg & Zoranović, 2022).

The growing body of literature on digital transformation (DT) highlights the significant interest in its impact (Vial, 2019; Baiyere et al., 2020; Broz et al., 2020; Chawla & Goyal, 2022).

The objective of this review is to map the academic landscape, to provide insights into the challenges and opportunities, and to identify future directions for both researchers and practitioners in the field of digital transformation and human resource management.

To this end, this article addresses the following research questions:

1. What are the key publication trends in the field of digital transformation and human resource management?
2. What are the most influential studies on digital transformation and human resource management based on citation analysis, and what are their main contributions and theoretical findings?
3. Which countries and institutions host the leading researchers in this field?
4. In which research networks do the main authors participate in?
5. Which scientific journals contribute most significantly to the body of knowledge on this topic?
6. What are the promising future research avenues for digital transformation and human resources?
7. What are the practical implications of current research on digital transformation and human resource management for HR professionals and organizational leaders when informing their strategies, decision-making, and implementation efforts?

This study not only maps the scientific landscape of this interdisciplinary area but also enables academics to identify and pursue future lines of research.

2. Materials and Methods

This research employs a bibliometric analysis (Shang et al., 2015; Wang et al., 2020; Hernández-Perlines et al., 2023) to assess the quality, impact, and trends of scholarly output on the intersection of digital transformation (DT) and human resources (HR). Bibliometric analysis is a well-established method for evaluating scientific research through quantitative indicators (Nalimov & Mul'chenko, 1971; Mingers & Leydesdorff, 2015; Araya-Castillo et al., 2022).

Data were retrieved from the Web of Science Core Collection (WoS) database, encompassing the SSCI, ESCI, SCI, BKCI-SSH, A&HCI, CPCI-SSH, BKCI-S, and CPCI-S indexes. The study focuses its search on the online database of the Web of Science (WoS), which is one of the most recognized and accepted platforms by the scientific community and by evaluation and research agencies.

The following search string was used, searching within the title, abstract, and author keywords (TS): TS = ("Digital Transformation*") AND TS = ("human resources" OR "people management" OR "personnel management" OR "human capital").

Within the realm of academic research on digital transformation, the application of the truncation symbol ("") to the term "Digital Transformation" is deemed essential to ensure the comprehensiveness of the search. This practice enables the inclusion of diverse terminological variations, thereby optimizing the identification of pertinent studies addressing the core concept of digital transformation (Hood & Wilson, 2001).

Furthermore, when exploring the intersection of digital transformation and human capital management, the term "human resources" emerges as a central component. The search strategy is expanded by incorporating synonyms such as "people management",

"personnel management", and "human capital", linked by the Boolean operator "OR". This measure is warranted by the terminological variations found in the literature and the necessity to cover diverse conceptual perspectives within employee management (Hood & Wilson, 2001).

Lastly, within the context of bibliometric and scientometric studies, limiting the search to the title, abstract, and author keywords (TS) fields is grounded in their capacity to provide a succinct representation of the core content of the articles. These fields are of primary importance for indexing in academic databases, thereby ensuring a greater likelihood of identifying the literature most relevant to the research subject.

The search, conducted on 5 February 2024, encompassed the period from 1975 to 2023. This initial search yielded 279 records. Subsequently, the dataset was refined to include only peer-reviewed articles published in indexed journals up to 31 December 2023, to ensure a consistent timeframe for analysis. This refinement excluded 8 articles under review, 2 book chapters, 1 editorial, 1 meeting abstract, and 1 retraction. The final dataset comprised 266 documents, which have collectively garnered 1938 citations.

Following retrieval, a two-stage filtering process was applied. First, duplicates were removed. Second, articles focusing on DT outside the realm of HR (e.g., computer science, mathematics, business sciences) and opinion pieces were excluded. This process resulted in a final sample of 266 scientific articles.

While WoS is a widely used database, it is important to acknowledge its inherent limitations. The database exhibits a known bias towards English-language publications and may underrepresent regional journals with lower impact factors. Furthermore, coverage of social science disciplines in WoS may be less comprehensive compared to natural and exact sciences. These limitations should be considered when interpreting the findings of this study.

The analysis proceeded in three stages. First, descriptive statistics were generated to map key concepts and their frequency of occurrence. Second, cluster analysis was performed to identify thematic areas within the research landscape (Bornmann & Marx, 2013; Araya-Castillo et al., 2021; Barrueto-Mercado et al., 2024). Finally, a social network analysis, utilizing graph theory, was conducted to visualize and analyze collaboration patterns among authors and institutions. This analysis was performed using VOSviewer software (version 1.6.20).

3. Results

This section presents the key findings of bibliometric analysis, organized according to the research objectives. These findings provide valuable insights for the design of digital transformation (DT) strategies tailored to the specific needs of human resource management (HRM).

Figure 1 illustrates the temporal distribution of publications on the intersection of DT and HRM. The first publications in this area appeared in 2019. The dataset comprises 266 articles, accumulating a total of 1938 citations. The highest number of publications (111) occurred in 2023, indicating a recent surge in research interest. An exponential growth trend is evident, closely approximated by the equation $y = e^{0.5185x}$, with a strong fit ($R^2 = 0.9838$). (See Figure 1).

Figure 2 illustrates that the number of citations per year for the concepts of "Digital Transformation" and "Human Resources" is incipient in 2019, followed by a sustained and exponential growth until 2023, reaching 1160 citations.

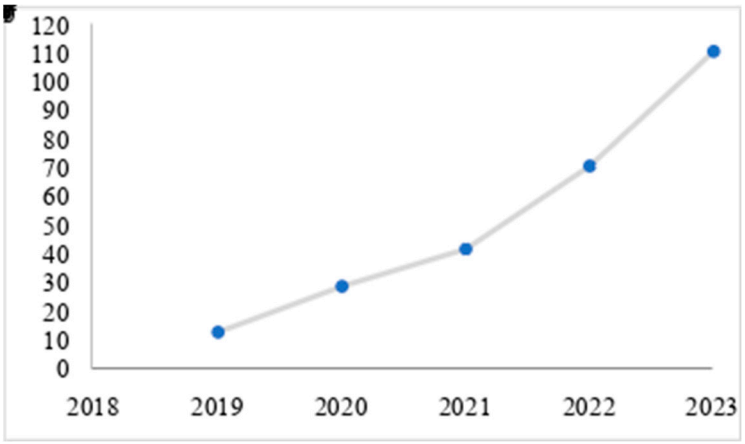

Figure 1. Publication growth. Source: authors' elaboration.

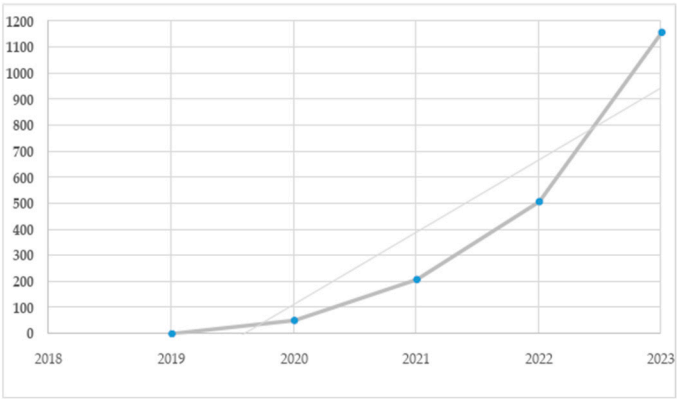

Figure 2. Citations per year. Source: Web of Science.

Table 2 presents the distribution of citations across the 266 articles in the dataset, which collectively received 1938 citations. A substantial portion of the articles (79, representing 29.7%) received no citations. Of the cited articles, the majority (132, or 49.62%) received between 1 and 10 citations. Forty-seven articles (17.67%) received between 11 and 50 citations. Seven articles (2.63%) received between 51 and 100 citations, and one article (0.38%) received more than 100 citations.

Table 2. General citation structure.

Number of Appointments	Number of Items	Items (%)
More than 100	1	0.38%
Between 50 and 100	7	2.63%
Between 10 and 50	47	17.67%
Between 1 and 10	132	49.62%
0 appointments	79	29.70%
Total	266	100%

Source: Web of Science Data (2024).

While several authors have contributed significantly to the field, Suzanna El Massah and Mahmoud Mohieldin (2020) stand out with respect to the Hirsch index (Bornmann & Marx, 2013). Their article, published in Ecological Economics (Q1), has garnered 114 citations, representing 5.88% of the total citations for this body of research. This influential work explores the contribution of technology to the development of human capabilities, focusing on skills and competencies within a social-organizational context.

The second most cited article, with 82 citations (4.23% of the total), was authored by Francesco Caputo et al. (2019) and published in Management Decision (Q3). This study examines the impact of the digital revolution on business innovation, emphasizing the crucial role of soft skills and the use of big data in enhancing business performance. The authors highlight the importance of soft skills, such as creativity, effective communication, and problem-solving, in leveraging the opportunities presented by digital technology.

Table 3 presents the 10 most influential articles, ranked by total citations. These 10 articles collectively account for 32.1% of all citations, indicating a high concentration of influence within this field.

Table 3. Most influential articles.

R	*Authors*	*Year*	*Title*	*Magazine*	*TC*
1	El Massah, S., and Mohieldin, M.	2020	Digital transformation and localizing the Sustainable Development Goals (SDGs)	Ecological Economics	114
2	Caputo, F., Cillo, V., Candelo, E., and Yipeng, L.	2019	Innovating through digital revolution The role of soft skills and Big Data in increasing firm performance	Management Decision	82
3	Trenerry, B., Chng, S., Wang, Y., Suhaila, Z. S., Lim, S. S., Lu, H. Y., and Oh, P. H.	2021	Preparing Workplaces for Digital Transformation: An Integrative Review and Framework of Multi-Level Factors.	Frontiers in Psychology	67
4	Chen, C. L., Lin, Y. C., Chen, W. H., Chao, C. F., and Pandia, H.	2021	Role of Government to Enhance Digital Transformation in Small Service Business	Sustainability	64
5	Vuksanović Herceg, I., Kuč, V., Mijušković, V. M., and Herceg, T.	2020	Challenges and Driving Forces for Industry 4.0 Implementation.	Sustainability	61
6	Malik, N., Tripathi, S. N., Kar, A. K., and Gupta, S	2022	Impact of artificial intelligence on employees working in Industry 4.0 led organizations	International Journal of Manpower	55
7	Ivančić, L., Vukšić, V. B., and Spremić, M.	2019	Mastering the Digital Transformation Process: Business Practices and Lessons Learned	Technology Innovation Management Review	51
8	Huong, T. T. L., and Thanh, T. T.	2022	Is digitalization a driver to enhance environmental performance? An empirical investigation of European countries	Sustainable Production and Consumption	50
9	Flechsig, C., Anslinger, F., and Lasch, R.	2022	Robotic Process Automation in purchasing and supply management: A multiple case study on potentials, barriers, and implementation.	Journal of Purchasing and Supply Management	40
10	Blanka, C., Krumay, B., and Rueckel, D.	2022	The interplay of digital transformation and employee competency: A design science approach.	Technological Forecasting and Social Change	38

Note: R = Rank; TC = Total Citations. Source: Authors' elaboration.

Author Productivity and Influence:

Table 4 presents the 10 most influential authors. Suzanna El Massah (Zayed University) is the most influential author, with two publications garnering 121 citations (6.24% of the

total). Notably, one of these articles also ranks among the top 25 most influential articles based on h-index. Mahmoud Mohieldin (Cairo University), who co-authored one article with El Massah, is the second most influential author, with 114 citations for that single publication.

Table 4. Most influential authors in digital transformation and human resources.

R	*Authors*	*Institution*	*TP-TD*	*TC-TD*	*(%)*	*HA*	*TP-A*	*TC-A*	*T25*
1	Massah, Suzanna El	*Zayed University*	2	121	6.24%	8	18	292	1
2	Mohieldin, Mahmoud	*Cairo University*	1	114	5.88%	6	15	212	1
3	Candelo, Elena	*University of Turin*	1	82	4.23%	12	28	716	1
4	Caputo, Francesco	*University of Naples Federico II*	1	82	4.23%	22	47	1.097	1
5	Cillo, Valentina	*Link Campus University*	1	82	4.23%	14	30	1.128	1
6	Liu, Yipeng	*Zhejiang University of Technology*	1	82	4.23%	32	134	2.993	1
7	Chng, Samuel	*Singapore University of Technology & Design*	1	68	3.51%	8	24	397	1
8	Lim, Sun Sun	*Singapore Management University*	1	68	3.51%	15	44	722	1
9	Lu, Han Yu	*Jinan University*	1	68	3.51%	8	26	222	1
10	Peng Ho Oh	*Australian Catholic University*	1	68	3.51%	1	2	68	1

Note: R = Author Rank; TP-TD = Total Publications in the Dataset; TC-TD = Total Citations in the Dataset; HA = Author h-index; TP-A = Total Publications; TC-A = Total Citations; T25 = Number of Top 25 Publications. Source: Authors' elaboration based on Web of Science data (2024).

Table 5 presents the most productive authors, defined as those with two or more publications. Suzanna El Massah leads with a PC-SR of 60.50 and a TC-A of 292. Iva Vuksanovic Herceg follows with a PC-SR of 41.50 and a TC-A of 84. Hang Nguyen has a PC-SR of 1.67 and a TC-A of 5.

Table 5. The most productive authors in digital transformation and human resources.

R	**Authors**	**University**	**TP-SR**	**TC-SR**	**PC-SR**	**Tt (%)**	**HA**	**TP-A**	**TC-A**
1	Hang Nguyen	*Thai Nguyen University*	3	5	1.67	1.13%	-	4	5
2	Massah, Suzanna El	*Zayed University*	2	121	60.50	0.75%	8	18	292
3	Herceg, Iva Vuksanovic	*University of Belgrade*	2	83	41.50	0.75%	2	5	84
4	Zemtsov, Stepan P.	*Russian Presidential Academy of National Economy & Public Administration*	2	62	31.00	0.75%	10	33	378
5	Jiang, Kangqi	*Shantou University*	2	33	16.50	0.75%	8	13	170
6	Gilch, Phyllis Messalina	*University of Bayreuth*	2	29	14.50	0.75%	1	2	29
7	Li, Xin	*Shanghai University of Finance & Economics*	2	23	11.50	0.75%	6	9	201
8	Rivza, Peteris	*Latvia University of Life Sciences & Technologies*	2	23	11.50	0.75%	4	35	99
9	Xu, Qiong	*Central South University*	2	23	11.50	0.75%	7	12	220
10	Rivza, Baiba	*Latvia University of Life Sciences & Technologies*	2	23	11.50	0.75%	7	100	197

Note: R = Author Rank; HA = Author h-index; TP-A = Total Publications; TC-A = Total Citations. Source: Authors' elaboration based on Web of Science data (2024).

Journal Productivity and Influence:

Table 6 presents the 10 most productive journals, defined as those publishing 10 or more articles on this topic. These journals collectively published 55 articles, representing 20.7% of the total publications, and received a total of 506 citations, averaging 9.2 citations per article. The h-index for this journal set is 11. "*Sustainability*" is the most productive journal, with 25 publications, and also the most influential, with 304 citations. However, "*Frontiers in Psychology*" has the highest average citation rate per article (17.2). "*Corporate Social Responsibility and Environmental Management*" has the highest 5-year impact factor (10.6).

Table 6. Journals publishing research on digital transformation and human resources.

R	Magazines	N	Tt (%)	TC-TD	PC-TD	H-TD	FI 5Y	Q
1	*Sustainability*	25	9.40%	304	12.16	10	4.0	Q2
2	*Frontiers in Psychology*	5	1.88%	86	17.20	3	4.3	Q1
3	*Finance Research Letters*	4	1.50%	41	10.25	2	8.9	Q1
4	*Corporate Social Responsibility and Environmental Management*	3	1.13%	25	8.33	1	10.6	Q1
5	*Financial and Credit Activity Problems of Theory and Practice*	3	1.13%	15	5.00	2	0.7	Q3
6	*IEEE Access*	3	1.13%	6	2.00	2	4.1	Q2
7	*Journal of Chinese Human Resources Management*	3	1.13%	2	0.67	1	1.6	Q4
8	*Quality Access to Success*	3	1.13%	17	5.67	2	0.5	Q4
9	*Scientific Papers series Management Economic Engineering in Agriculture and Rural Development*	3	1.13%	8	2.67	2	0.9	Q3
10	*Systems*	3	1.13%	2	0.67	1	2.5	Q2

Note: R = Journal Rank; N = Number of Publications in Dataset; PC-TD = Average Citations per Publication in Dataset; H-TD = h-index in Dataset; TC-TD = Total Citations in Dataset; FI 5Y = 5-Year Impact Factor; Q = Journal Quartile. Source: Authors' elaboration based on Web of Science data (2024).

Institutional Productivity and Influence:

Table 7 presents the 10 most productive institutions, defined as those with three or more publications in the dataset. These institutions account for 18.42% of the total publications, indicating a relatively low concentration of institutional output. The Ministry of Education and Science of Ukraine is the most productive, with 12 publications. However, the University of Zagreb is the most influential in terms of total citations, with 160. The Egyptian Knowledge Bank has the highest average number of citations per publication (27.2).

Collaboration Network Analysis:

Table 8 presents the collaborative network among institutions that published at least one article during the observation period. Of the 492 institutions identified, 31 (6.3%) have co-authored publications, forming four distinct clusters. Cluster 1 exhibits the highest degree of collaboration, with 12 institutions, while Cluster 4 has the lowest, with 5 institutions.

Table 7. Author affiliations.

R	Institutions	Country	NP	TT (%)	TC-TD	PC-TD	H-TD
1	*Ministry of Education Science of Ukraine*	Ukraine	12	4.51%	35	2.9	4
2	*University of Zagreb*	Croatia	6	2.26%	160	26.7	4
3	*Egyptian Knowledge Bank*	Egypt	5	1.88%	136	27.2	4
4	*Plekhanov Russian University of Economics*	Russia	5	1.88%	9	1.8	2
5	*Jinan University*	China	4	1.50%	48	12.0	3
6	*Thai Nguyen University*	Vietnam	4	1.50%	1	0.3	1
7	*Vietnam National University Ho Chi Minh City*	Vietnam	4	1.50%	8	2.0	2
8	*National Economics University Vietnam*	Vietnam	3	1.13%	61	20.3	2
9	*University of Foscari Venice*	Italy	3	1.13%	44	14.67	3
10	*Shanghai University of Finance Economics*	China	3	1.13%	25	8.3	1

Note: R = Institution Rank; TC-TD = Total Citations in Dataset; PC-TD = Average Citations per Publication in Dataset. Source: Authors' elaboration based on Web of Science data (2024).

Table 8. Clusters of Co-Authorship.

Cluster 1	Cluster 2	Cluster 3	Cluster 4
Atlantic Science and Technology Academic Press (atlantic sci & technol acad pr)	*K.G. Razumovsky Moscow State University*	*Moscow Automobile and Road Construction (moscow automobile & rd constru)*	*Donetsk National Technical University*
Autonomous Nonprofit Org Publishing	*Lomonosov Moscow State University (lomonosov moscow state univ)*	*Moscow Humanitarian Economic University*	*Kuban State Agrarian University*
Bauman Moscow State Technical University	*Moscow Institute of Aviation Technology*	*Moscow State Technical University of Civil Aviation*	*Plekhanov Russian University*
Capital University Economics and Business	*Moscow Polytech University*	*Moscow State University Civil Engineer*	*State University Management*
Financial University under the Government of the Russian Federation	*Russian State Social University*	*Plekhanov Russian University Economics (plekhanov russian univ econ)*	*Vladivostok State University Economics*
HSE University	*Russian University Cooperative*	*Ulyanovsk State University*	
I.M. Sechenov First Moscow State Medical University	*St Petersburg State University Economics*		
Ministry Finance of the Russian Federation	*Voronezh State University*		
Moscow Metropolitan Governance			
National University of Science and Technology MISiS			
North Eastern Federal University			
University Sumatera Utara			

Source: Authors' elaboration based on Web of Science data (2024), using VOSviewer software.

Figure 3 presents a network visualization of institutional co-authorship, with each of the four clusters represented by a distinct color. In Cluster 1 (red), all member institutions have 12 co-authorships. Russian State Social University has the highest number of co-authorships (13) in Cluster 2 (green). In Cluster 3 (blue), Plekhanov Russian University of

Economics leads with six co-authorships. Finally, in Cluster 4 (yellow), State University of Management has the highest number of co-authorships (4).

Figure 3. Graph of the institutions with the highest number of co-authorships. Source: Own made with VOSviewer.

Geographic Distribution of Research:

Table 9 presents the 10 most productive countries, defined as those with more than eight publications in the dataset. These 10 countries account for 60.15% of the total publications across 65 countries. Collectively, they have an h-index of 19, with an average of 6.53 citations per publication and a total of 1.044 citations (53.9% of all citations). China is the most productive country (49 publications) and the most influential in terms of total citations (325), also exhibiting the highest h-index (11). However, Germany has the highest average number of citations per publication (11.5).

Table 9. Countries/regions of author affiliation.

R	Countries/Regions	NP	Tt (%)	TC-TD	PC-TD	h-TD
1	People's Republic of China (peoples r china)	49	18,421%	325	6.63	11
2	Russia (russia)	30	11,278%	131	4.37	5
3	Vietnam (vietnam)	18	6,767%	100	5.56	4
4	Italy (italy)	15	5,639%	171	11.40	6
5	Ukraine (ukraine)	14	5,263%	41	2.93	5
6	Germany (germany)	12	4,511%	138	11.50	6
7	Romania (romania)	11	4,135%	76	6.91	6
8	Spain (spain)	9	3,383%	65	7.22	5
9	Brazil (brazil)	8	3,008%	60	7.50	3
10	Portugal (portugal)	8	3,008%	45	5.63	2

Note: R = Country Rank; NP = Number of Publications; TC-TD = Total Citations in Dataset; PC-TD = Average Citations per Publication in Dataset. Source: Authors' elaboration.

Table 10 presents a co-authorship network analysis, identifying countries with at least one publication co-authored with another country. The analysis includes 56 countries grouped into nine clusters. Cluster 1 exhibits the highest degree of collaboration, comprising nine countries. Conversely, Cluster 9 has the lowest, with only three countries. Cluster 4 also shows a relatively low level of collaboration, with five countries. Clusters 2 and 3, as well as Clusters 5 and 6, and Clusters 7 and 8, each have the same number of countries.

Figure 4 presents a network visualization of co-authorship among countries, with each cluster represented by a distinct color. In Cluster 1 (red), Indonesia has the highest number of co-authorships (8) and exhibits connections with most other clusters. Romania leads Cluster 2 (green) with eight co-authorships. Italy is the most collaborative country in Cluster 3 (blue) with nine co-authorships. Canada leads Cluster 4 (yellow) with six co-authorships. In Cluster 5 (purple), England and Ukraine are the most collaborative, each with four co-authorships. Germany leads Cluster 6 (light blue) with nine co-authorships. France is the most collaborative in Cluster 7 (orange) with five co-authorships. Russia leads Cluster 8 (brown) with nine co-authorships. Finally, China dominates Cluster 9 (light green) with 12 co-authorships.

Table 10. Clusters of country co-authorship.

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9
India	*Denmark*	*Chile*	*Brazil*	*Australia*	*Estonia*	*Egypt*	*Iraq*	*People's Republic of China*
Indonesia	*Hungary*	*Czech Republic*	*Canada*	*Croatia*	*Finland*	*France*	*Russia*	*Singapore*
Latvia	*Iceland*	*Italy*	*Iran*	*England*	*Germany*	*Slovenia*	*Spain*	*South Korea*
Iithuania	*Ireland*	*Japan*	*Netherlands*	*Poland*	*Sweden*	*United Arab Emirates*	*Turkey*	
Malaysia	*Romania*	*Scotland*	*New Zealand*	*Ukraine*	*Switzerland*			
Pakistan	*Serbia*	*Thailand*	*Portugal*					
Saudi Arabia	*Slovakia*	*United States*						
Taiwan								
Vietnam								

Authors' elaboration.

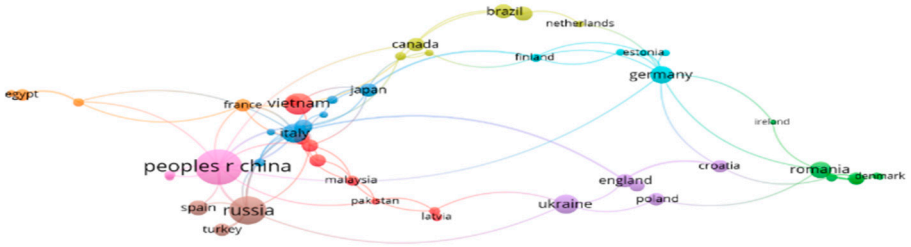

Figure 4. Network visualization of country co-authorship. Source: Authors' elaboration using VOSviewer software 1.6.20.

Keyword Analysis:

Table 11 presents the clusters of keywords based on their co-occurrence frequency. In Cluster 1 (red), "Digitalization" is the most frequent keyword (17 occurrences). In Cluster 2 (green), "Human Capital" is the most frequent (20 occurrences). "Human Resources" is the most frequent keyword in Cluster 3 (blue) with 14 occurrences. In Cluster 4 (yellow), the keyword "0" is the most frequent with 16 occurrences. This requires further investigation to understand its meaning in this context. In Cluster 5 (purple), "big data" is the most frequent keyword (9 occurrences). Finally, "digital transformation" is the most frequent keyword in Cluster 6 (light blue) with 32 occurrences.

Table 11. Keyword co-occurrence clusters.

Cluster	Key Words
Cluster 1	*Automation; Change Management; COVID-19; Digitalization; Digitization; Firm Performance; Human Resource Management; Industry 4.0-SMES-Sustainability.*
Cluster 2	*Artificial Intelligence; China; Digital Technologies-Digitalisation; Human Capital; Innovation; Labour Market; Russia.*
Cluster 3	*Barriers; Digital Economy; Digital Maturity-Digital Technology; Human Resources; Human Resources Management.*
Cluster 4	*0; Higher Education-Industry 4; Skills; Technology.*
Cluster 5	*Big Data; Human Resource; Sustainable Development; Vietnam.*
Cluster 6	*Digital Transformation; Technological Innovation.*

Source: Web of Science data (2024).

Figure 5 presents a visualization of keyword co-occurrence, based on 977 keywords, of which 35 occur at least four times. The visualization comprises six clusters: Cluster 1 (red)

contains 10 keywords; Cluster 2 (green) contains eight keywords; Cluster 3 (blue) contains six keywords; Cluster 4 (yellow) contains five keywords; Cluster 5 (purple) contains four keywords; and Cluster 6 (light blue) contains two keywords.

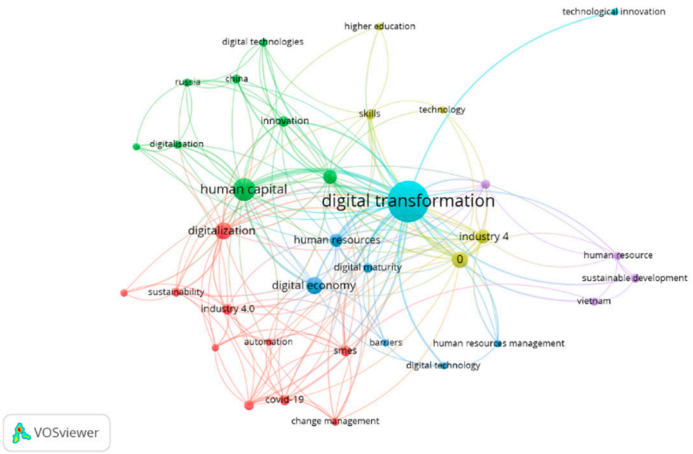

Figure 5. Keyword co-occurrence map in digital transformation and human resources research. Source: Authors' elaboration using VOSviewer software.

Table 12 presents the 10 most frequently used author keywords. "Digital Transformation" appears most frequently (125 occurrences), followed by "Human Capital" and "Digitalization". These three keywords highlight the key themes of this research area: human capital development and the processes of digitalization and digital transformation.

Table 12. Most frequent author keywords.

N°	*Key Words*	*Occurrence*
1	*Digital Transformation*	125
2	*Human Capital*	39
3	*Digitalization*	22
4	*Digital Economy*	22
5	*0*	20
6	*Industry 4*	15
7	*Artificial Intelligence*	15
8	*Human Resources*	13
9	*Innovation*	9
10	*Industry 4.0*	9

Source: Web of Science data (2024).

4. Discussion and Conclusions

Regarding the limitations of this study, it is acknowledged that bibliometrics, with its inherent focus on quantitative metrics, often overlooks qualitative contributions and nuanced interpretations of research quality. Consequently, future research may benefit from exploring systematic reviews of the literature, which would facilitate an objective and systematic integration of empirical study results to determine the current state of knowledge within a specific research domain (Cabrerizo et al., 2010).

Furthermore, the Web of Science (WoS) has historically demonstrated a pronounced focus and robust coverage in the domains of natural sciences, engineering, and biomedical research. This has resulted in the underrepresentation of the social sciences and humanities (SSH) within WoS coverage. Notably, certain disciplines within the humanities rely heavily on formats such as books and book chapters, which are not as comprehensively indexed by WoS. Similarly, the breadth and depth of thematic coverage for journals in SSH may be

comparatively limited within this database (Garfield, 2002). Additionally, WoS coverage exhibits a clear dominance of English-language journals, which are overrepresented at the expense of other languages. This linguistic bias may disadvantage research produced in non-English speaking regions and distort the representation of global research output (Ammon, 2001). Moreover, both WoS and Scopus present accuracy issues concerning the assignment of corresponding authorship. Inaccurately indexed author names or affiliations can result in the erroneous attribution of publications and citations, potentially skewing metrics such as the h-index or institutional rankings. Finally, a systematic increase in the number of citations over time is observed due to the expanding length of reference lists. Consequently, recently published works may accumulate a higher number of citations simply due to the increased volume of publications and citations, rather than an inherently greater impact compared to older works (Leydesdorff & Ivanova, 2021).

The concentration of citations among a limited number of authors may inadvertently exclude valuable perspectives. Therefore, it is essential to promote the dissemination of less visible works through increased methodological rigor, content specificity, or publication in lower-impact journals, as suggested by Chawla and Goyal (2022). Furthermore, given this concentration of influence, the integration of junior researchers and the incorporation of less explored geographical contexts are crucial. The significant influence of certain institutions raises questions about their collaboration networks and resource availability, warranting further investigation. Similarly, the prominent role of certain countries necessitates a deeper analysis of the impact of public policies on digital transformation (DT) research.

This research delves into the intersection of DT and human resources (HR), revealing significant theoretical and practical contributions to the field. Although the observed exponential growth in publications is encouraging, it does not guarantee practical application within organizations, particularly in developing regions. This growth aligns with previous findings that highlight the positive impacts of DT on profits, cost reduction, and efficiency (Hanelt et al., 2021; Tomaszewski, 2021). This study reveals limited participation by Spanish-speaking authors in DT and HR research, suggesting a need for increased theoretical and practical development in Spanish-speaking contexts. This research contributes by summarizing existing theoretical and practical advancements, enabling an analysis of DT challenges within the social, economic, and political context of these regions. The incorporation of data from additional databases could provide a more comprehensive representation of Spanish-language research on DT.

From a theoretical perspective, this study analyzes the development and evolution of the specialized literature. In practical terms, it highlights the strategic role of digital competencies as key facilitators in DT processes. This approach enables the understanding of how the implementation of change management plans, aimed at aligning organizational culture with strategic objectives of innovation and agility, is directly influenced by these competencies.

The analysis of publication trends reveals a growing interest in the role of soft skills within DT-driven change processes, as well as the importance of digital competencies for successful adoption of new technologies. The most influential studies provide practical guidelines to facilitate these processes, emphasizing the relevance of individual, group, and organizational factors from a systemic perspective, and identifying existing research gaps related to employee-related factors. Among the most prominent journals identified in this study are Sustainability, Frontiers in Psychology, and Finance Research Letters.

In the global context, countries with higher scientific production in this area tend to have strategies that link public policies with technology-based productive efficiency, reflected in higher R&D spending. These countries, characterized by their focus on innovation and the production of high value-added goods and services, perceive DT as a competi-

tive advantage. Scientific collaboration networks, predominantly among industrialized countries, reflect this concentration of efforts and resources.

The findings of this research have significant practical implications for organizations. Firstly, the identification of the most relevant digital competencies enables the design of specific training programs for employees, optimizing the DT process. These plans seek to align organizational culture with the strategic objectives of innovation and agility, essential elements in the current organizational context. Secondly, this study highlights the need to develop a validated psychometric instrument to measure the development of digital competencies in Spanish-speaking contexts, overcoming the limitations of existing qualitative assessments.

Finally, the literature review provides guidance for articulating DT processes with a focus on aligning personnel competencies with organizational strategy. Additionally, it emphasizes the importance of public policies that promote research and knowledge transfer, driving efficiency and the retraining of human capabilities in both the public and private sectors. It is recommended that future research explore the impact of DT on various dimensions of work–life quality, such as wage compensation, occupational safety and health, interpersonal relationships, work climate, workload, and technostress (Wang et al., 2023). Furthermore, the findings of this study should be interpreted considering the temporal framework of its analysis, given the dynamic nature of this field.

Organizations can utilize the findings of this study to identify the most relevant digital competencies for their needs and to design specific training programs to develop these competencies in their employees. The findings of this study should be interpreted in consideration of the analyzed timeframe, given that the field of digital transformation and human resources is in constant evolution.

Author Contributions: P.R.-C. conducted the theoretical review, formulated the study design, interpreted the findings, and drafted the manuscript. H.M.-F. advised on the methodology and executed the data collection. L.A.-C. Thesis advisor. J.B.-G. Thesis advisor. All authors have read and agreed to the published version of the manuscript. C.O.-B. revised the wording and style of the article.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in the study are included in the article; additional queries may be addressed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

Ammon, U. (2001). *The dominance of English as a language of science: Effects on other languages and language communities*. De Gruyter Mouton. [CrossRef]

Araya-Castillo, L., Hernández-Perlines, F., Millán-Toledo, C., & Ibarra Cisneros, M. A. (2022). Bibliometric analysis of studies on family firms. *Economic Research-Ekonomska Istraživanja*, *35*(1), 4778–4800. [CrossRef]

Araya-Castillo, L., Hernández-Perlines, F., Moraga, H., & Ariza-Montes, A. (2021). Scientometric analysis of research on socioemotional wealth. *Sustainability*, *13*(7), 3742. [CrossRef]

Baiyere, A., Salmela, H., & Tapanainen, T. (2020). Digital transformation and the new logics of business process management. *European Journal of Information Systems*, *29*, 238–259. [CrossRef]

Barrueto-Mercado, E., Rubio, A., Araya-Castillo, L., & Moraga, H. (2024). Dimensions and dynamics of bibliometric and scientometric research on brand personality in the "hospitality, leisure, and tourism" sector. *Interscience*, *49*(10), 587–595.

Berghaus, S., & Back, A. (2016). Stages in digital business transformation: Results of an empirical maturity study. In *MCIS proceedings* (pp. 1–12). Association for Information Systems Electronic Library (AISeL).

Bornmann, L., & Marx, W. (2013). Vorschläge für standards zur anwendung der szientometrie bei der evaluation von einzelnen wissenschaftler(inne)n im bereich der naturwissenschaften. *Zeitschrift für Evaluation*, *12*(1), 103–127.

Broz, T., Buturac, G., & Parežanin, M. (2020). Digital transformation and economic cooperation: The case of Western Balkan countries. *Zbornik Radova Ekonomskog Fakulteta u Rijeci*, *38*(2), 697–722. [CrossRef]

Cabrerizo, F. J., Alonso, S., Herrera-Viedma, E., & Herrera, F. (2010). q2-Index: Quantitative and qualitative evaluation based on the number and impact of papers in the Hirsch core. *Journal of Informetrics*, *4*(1), 23–28. [CrossRef]

Caputo, F., Cillo, V., Candelo, E., & Liu, Y. (2019). Innovating through digital revolution: The role of soft skills and Big Data in increasing firm performance. *Management Decision*, *57*, 2032–2051. [CrossRef]

Chawla, R. N., & Goyal, P. (2022). Emerging trends in digital transformation: A bibliometric analysis. *Benchmarking: An International Journal*, *29*, 1069–1112. [CrossRef]

Correani, A., De Massis, A., Frattini, F., Petruzzelli, A. M., & Natalicchio, A. (2020). Implementing a digital strategy: Learning from the experience of three digital transformation projects. *California Management Review*, *62*, 37–56. [CrossRef]

Ellström, D., Holtström, J., Berg, E., & Josefsson, C. (2022). Dynamic capabilities for digital transformation. *Journal of Strategy Management*, *15*, 272–286. [CrossRef]

Erceg, V., & Zoranović, T. (2022). Knowledge management and digital business transformation. *Strategic Management*, *27*(2), 57–63. [CrossRef]

Garfield, E. (2002). The meaning of the impact factor. *International Journal of Clinical and Health Psychology*, *3*, 363–369.

Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C. (2021). A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change. *Journal of Management Studies*, *58*, 1159–1197. [CrossRef]

He, Z., Huang, H., Choi, H., & Bilgihan, A. (2023). Building organizational resilience with digital transformation. *Journal of Service Management*, *33*(4), 147–171. [CrossRef]

Hernández-Perlines, F., Araya-Castillo, L., Millán Toledo, F., & Ibarra Cisneros, M. A. (2023). Bibliometric analysis of studies on socioemotional wealth. *European Research on Management and Business Economics*, *29*, 100218. [CrossRef]

Hess, T., Benlian, A., Matt, C., & Wiesböck, F. (2016). How German media companies defined their digital transformation strategies. *MIS Quarterly Executive*, *15*, 103–119.

Hood, W. W., & Wilson, C. S. (2001). The literature of bibliometrics, scientometrics, and informetrics. *Scientometrics*, *52*, 291–314. [CrossRef]

Kane, G. (2019). The technology fallacy: People are the real key to digital transformation. *Research Technology Management*, *62*, 44–49. [CrossRef]

Kreutzer, R. T., Neugebauer, T., & Pattloch, A. (2017). Best practices beim aufbau einer digital business leadership. In *Digital business leadership* (pp. 235–277). Springer Fachmedien Wiesbaden.

Kudyba, S. (2020). COVID-19 and the acceleration of digital transformation and the future of work. *Information Systems Management*, *37*, 284–287. [CrossRef]

Leydesdorff, L., & Ivanova, I. (2021). The measurement of "interdisciplinarity" and "synergy" in scientific and extra-scientific collaborations. *Journal of the Association for Information Science and Technology*, *72*, 387–402. [CrossRef]

Li, L. (2022). Digital transformation and sustainable performance: The moderating role of market turbulence. *Industrial Marketing Management*, *104*, 28–37. [CrossRef]

Martínez-Peláez, R., Ochoa-Brust, A., Rivera, S., Félix, V. G., Ostos, R., Brito, H., Félix, R. A., & Mena, L. J. (2023). Role of digital transformation for achieving sustainability: Mediated role of stakeholders, key capabilities, and technology. *Sustainability*, *15*(14), 11221. [CrossRef]

Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business & Information Systems Engineering*, *57*, 339–343. [CrossRef]

Mingers, J., & Leydesdorff, L. (2015). A review of theory and practice in scientometrics. *European Journal of Operational Research*, *246*(1), 1–19. [CrossRef]

Nadkarni, S., & Prügl, R. (2020). Digital transformation: A review, synthesis and opportunities for future research. *Management Review Quarterly*, *71*(2), 233–341. [CrossRef]

Nalimov, V. V., & Mul'chenko, Z. M. (1971). *Information model of the process of the development of science* (B. S. Levine, Trans.). Foreign Technology Division.

Ogrean, C., & Herciu, M. (2021). Digital transformation as strategic shift—A bibliometric analysis. *Studies in Business and Economics*, *16*, 136–151. [CrossRef]

Rogers, D. L. (2016). *The digital transformation playbook: Rethinking your organization for the digital age*. Columbia Business School Publishing.

Routley, M., Phaal, R., & Probert, D. (2013). Exploring industry dynamics and interactions. *Technological Forecasting and Social Change*, *80*, 1147–1161. [CrossRef]

Sebastian, I. M., Moloney, K. G., Ross, J. W., Fonstad, N. O., Beath, C., & Mocker, M. (2017). How big old companies navigate digital transformation. *MIS Quarterly*, *16*, 197–213.

Shang, G. Z., Saladin, B., Fry, T., & Donohue, J. (2015). Twenty-six years of operations management research (1985–2010): Authorship patterns and research constituents in eleven top rated journals. *International Journal of Production Research*, *53*(20), 6161–6197. [CrossRef]

Soto-Acosta, P. (2020). COVID-19 pandemic: Shifting digital transformation to a high-speed gear. *Information Systems Management*, *37*, 260–266. [CrossRef]

Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, *43*, 172–194. [CrossRef]

Teece, D. J., Peteraf, M., & Leih, S. (2016). Dynamic capabilities and organizational agility. *California Management Review*, *58*, 13–35. [CrossRef]

Teichert, R. (2019). Digital transformation maturity: A systematic review of literature. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, *67*, 1673–1687. [CrossRef]

Tomaszewski, A. (2021). Can digital transformation be measured from a strategic perspective? Some evidence based on content analysis in the banking and clothing industries. *E-Mentor*, *90*, 53–63. [CrossRef]

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, *122*, 889–901. [CrossRef]

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144. [CrossRef]

Wang, X., Liu, Z., Li, J., & Lei, X. (2023). How organizational unlearning leverages digital process innovation to improve performance: The moderating effects of smart technologies and environmental turbulence. *Technology in Society*, *75*(C), 102395. [CrossRef]

Wang, X., Xu, Z., & Škare, M. (2020). A bibliometric analysis of Economic Research-Ekonomska Istra zivanja (2007–2019). *Economic research-Ekonomska istraživanja*, *33*(1), 865–886. [CrossRef]