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PSYCHOLOGICAL IMPACTS OF DIGITALIZATION ON WORKERS: A BIBLIOMETRIC INVESTIGATION

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ABSTRACT

The rapid advancement of digital technologies has significantly transformed the business landscape, affecting both organizational operations and employee experiences. As companies worldwide strive to leverage digital technologies to remain competitive, they undergo multifaceted changes, including the creation of strategic infrastructure, supportive leadership, redesigning business processes, and enhancing technological capabilities. However, the psychological impact on employees is often overlooked. While offering benefits like increased productivity and flexibility, digitalization also introduces challenges such as blurred boundaries between work and private life, increased stress, reduced motivation, and increased anxiety regarding technological adoption and job security. This study provides a comprehensive overview of the psychological implications of digital transformation, presenting statistical patterns through bibliometric analysis to offer a holistic perspective. In the bibliometric analysis carried out on 765 articles in the Web of Science (WoS) database between 2014 and 2023, the most influential authors in the field, the most cited articles, the most influential journals, institutions, and countries, as well as collaboration networks were examined to determine the intellectual structure in the field. According to the analysis results, intense interest has been shown in research on the effects of digitalization on the psychology of employees, especially after the COVID-19 pandemic. This study is a pioneering study for researchers in examining the effects of digitalization on the psychology of employees and will help them gain ideas about what kind of research can be done in the future.

Keywords: *Digital Transformation, Psychological Impact, Workplace Digitalization, Bibliometric Analysis*

INTRODUCTION

The rapid development of digital technologies and their adaptation to the business world have not only affected working environments and ways of doing business but also deeply affected employees' experiences in business life. All sectors and companies around the world are in a race to benefit from digital technologies as much as possible to maintain their competitiveness and survive (Kraus et al., 2021). During the digitalization process, institutions are subject to multifaceted changes. The main elements of digitalization in institutions are seen as making simultaneous and rapid progress on various issues, such as creating a strategic infrastructure that supports the digitalization process, demonstrating a supportive leadership approach, redesigning business processes, strengthening the technological infrastructure, improving employees' competencies and skills, and making the working environment more flexible. However, institutions often ignore the psychological effects of digitalization on employees.

In the digital world where we are constantly online, many elements such as learning, communicating, socializing, ways of doing business, and behaviours and attitudes have begun to change (Ancis, 2020). Digital technologies have gone beyond a mere means of communication and have begun to shape the emotional bonds and functional obligations we feel in business lives. While digitalization transforms businesses into more competitive, agile, and technology-oriented structures, it also creates uncertainty and anxiety about changes in employees. With digitalization, the boundaries between working and private life have become blurred and interdependent, and the balance between business and private life has begun to change. Although digitalization offers corporate benefits such as increasing productivity, improving business operations, encouraging flexibility in working life, facilitating work adaptation, organizing business processes, popularizing remote working, and supporting data-oriented management, it also causes various psychological problems such as increasing time pressure on employees, limiting face-to-face interaction, increasing technology addiction, and disrupting work-life balance (Palumbo et al., 2022).

The human mind, perception, behaviour and value judgments are reshaped by digital technologies (Atrill-Smith, 2019; Ancis, 2020). The tight working pace in work environments where digital technologies are used extensively, multitasking, increasing working hours, and losing the concept of overtime, loss of distinction between work and private life, anxiety about not being able to learn complex technologies, and fear of being unemployed have begun to bring about significant changes in the psychology of employees (Dragano and Lunau, 2020). Being constantly online and having to get used to new digital technologies increases employees' stress levels, reduces their motivation, makes them feel powerless and inadequate, and does not leave employees with their own freedom (Cascio and Montealegre, 2016). As a result, it has become inevitable to understand how employee psychology is reshaped under the influence of today's digitalization-oriented working environment.

The aim of this study is to reveal the effects of digitalization initiatives on the psychology of employees through bibliometric analysis. Although previous studies have examined the impact of digitalization on employee psychology from different perspectives, this study is pioneering in that it offers a holistic perspective by revealing statistical patterns through bibliometric analysis. The remainder of this paper is structured as follows: First of all, literature information about digital transformation and its psychological effects on employees. Second, information about the methodology of the bibliometric analysis and its techniques is provided. Third, the bibliometric analysis results are presented. Finally, discussions and suggestions are presented based on the bibliometric findings.

Impact of Digitalization on Worker Psychology

Although digital technologies have positive effects on employees and the business world, they can also have negative consequences. In particular, understanding how employee psychology changes and shapes under the influence of digitalization have become increasingly important. Today, human beings live in a new, ever-increasingly connected digital world, where interaction between humans and machines merges into a common global cyberspace (Dunn, 2021). The cyber psychology perspective has also emerged to re-understand and interpret the human mind, perception, and behaviour under the influence of digital technologies (Atrill-Smith, 2019; Ancis, 2020).

Although technology is often seen as the saviour of humankind, positivist approaches to cyber psychology that develop under technological determinism argue against the utopian and constantly positive reception of technology and advocate for revealing the social and psychological disadvantages of technology (Harley et al., 2018). Therefore, many studies conducted so far in business life support this perspective by including the benefits that digitalization brings to the business world and employees, as well as the disadvantages it brings.

The digital transformation process also closely affects employee psychology in businesses. When employee psychology is mentioned, the first thing that comes to mind is a discipline that deals with various issues, such as emotions, thoughts, behaviours, attitudes, communication, and motivations of employees in the work environment (Furnham, 2012; Arnold, 2005). The psychology of employees at work is an area that should be closely monitored during change and transformation processes and supported to adapt to change (Herold et al., 2008).

The digital transformation process also involves radical changes that can have negative effects on the psychology of business employees. In this context, it is critical for institutions to focus on the psychology of their employees in digital transformation processes, eliminate their concerns and fears, reduce their stress, increase their motivation and make them feel safe and valuable for both the success of digital transformation and corporate sustainability (Trenerry et al., 2021; Caligiuri et al., 2020; Reis and Melão, 2023).

The work we use multiple digital devices and applications in our work environment can produce multidimensional psychological consequences. For example, as a result of the widespread use of remote working, psychological conditions such as feelings of loneliness and isolation, disruption of work-life balance, lack of motivation, and increase in stress levels may occur in employees (Irawanto et al., 2021; Knigt et al. 2022). While the spread of digital communication tools and platforms strengthens collaboration by enabling instant communication between employees in different locations, such tools can also reveal difficulties such as decreased emotional bond between employees, insincerity, and misunderstandings (Morrison-Smith and Ruiz, 2020). Constantly interacting with digital devices, being exposed to a constant data flow, and having to manage this flow instantly can cause effects such as low

energy, lack of concentration, and lack of motivation in employees (Matli, 2020; Durmuş et al., 2022). In addition, employees may have various concerns about cyber security on digital platforms and the psychological consequences of such concerns. For example, being under the threat of data breaches and cyberattacks can cause various psychological states, such as stress, anxiety, fear, helplessness, restlessness, and distraction, in employees (Solove and Citron, 2017; Alawida et al., 2022).

Research Methodology

Bibliometric analyses have begun to attract considerable attention in recent years in the fields of management and organization. There are various factors behind this interest, such as the development of various bibliometric software, the increase in the availability and accessibility of databases containing qualified scientific studies, such as Scopus and Web of Science (WoS), and the processing of large amounts of scientific study data in the field of management and organization to reveal progress and forward-looking trends in different subjects (Donthu et al., 2021).

In this study, bibliometric analysis is used to evaluate the psychological effects of the digitalization process on the workforce at a global scale. In bibliometric analyses, bibliographic data from scientific studies are analysed to reveal various findings, such as trends in the field, collaboration models, journal and author performances, and current research topics (Verma & Gustafsson, 2020; Donthu et al., 2021). In this study, the keywords and database from which the data would be drawn were first decided. After the first query results, to increase the quality of the study, various limitations, such as publication language, publication years, and journal index information, were imposed on the dataset. The query results were then examined in detail, and unsuitable studies were eliminated. In the next stage, the dataset was analysed and performance and bibliometric outputs were presented.

Sampling and Data Selection Criteria

In this study, the WoS database, which includes quality journals and articles in the field, was selected to understand the psychological effects of digitalization on employees. The WoS database is widely preferred by researchers in bibliometric studies because it works with publishers with high impact factors on an international scale and contains studies that shape the field (Falagas et al., 2008).

In order to understand the psychological effects on employees while collecting data through WoS, a comprehensive keyword group was created, including the words “Psychological Impact", “Cyber Psychology”, “Digital Psychology”, “Psychology”, “Addiction”, “Anxiety”, “Well-Being”, “Resilience”, “Stress”, “Technostress”, “Motivation”, “Self-Disclosure”, “Work-Life Balance”, “Burnout”, “Adaptation”, “Resistance”, “Overload”, “Satisfaction”, “Isolation”, “Depression”, “Uncertanity”, “Fatigue”, “Exhaustion”, “Engagement” and “Communication”. The words "Digitalization", "Digital Transformation", "Technological Change", "Industry 4.0" and "Remote Work" were chosen as keywords related to digitalization and digital transformation. Finally, to evaluate employees, the search was limited to the keywords "Employee", "Worker" and "Staff". Studies containing at least one of each of these three keyword groups in the title, abstract, and keywords sections appeared in the first search.

In the search made using the TS (Topic Search) operator, various limitations were used to better reveal the quality of the study, trends in the field, and future perspectives. First, English was chosen as the language of publication. Afterwards, 2014-2023 was chosen as the publication year. The reason why we restricted the publication year was that there were one or two publications before 2014. Articles, reviews, and early access papers were selected as the document type. To identify the highest-quality publications in the field, the index information in the publications is limited to the Social Science Citation Index (SSCI), Science Citation Index (SCI), and Art and Humanities Index (AHCI). As a result of these limitations, 983 articles were accessed. In the final stage, each of these 983 articles was carefully reviewed, and articles that were not related to the effects of digitalization on employee psychology were removed from the dataset. As a result, 765 articles were obtained to be used for the bibliometric analysis.

Data Analysis Process

Thanks to the various software packages used in bibliometric analyses, such as Gephi, Leximancer, and VOSviewer, both performance analysis and scientific mapping can be performed. Performance analysis is a form of analysis that includes more defining features of the field. Through these analyses, the history

and profiles of studies, researchers, institutions, and countries in a field are tried to reveal (Donthu et al., 2021). The most examined metrics in performance analyses are the productivity of journals, authors, institutions, and countries by years. In addition, information such as citations per publication and the h-index were used to reveal the impact and power of publications in the field (Cobo et al., 2011; Donthu et al., 2021). In the scientific mapping method, structural connections between research components and the intellectual structure of the research field are investigated through various citation analyses, co-word analyses, co-authorship analyses, or bibliometric coupling (Cobo et al., 2011; Ramos-Rodríguez & Ruíz-Navarro, 2004). In this study, both performance analyses and scientific mapping were conducted. For the analyses, the Bibliometrix package developed by Aria and Cuccurullo (2017) for R statistical software is used.

BIBLIOMETRIC ANALYSIS RESULTS

Performance Analysis

Descriptive Statistics

The descriptive statistical information about the studies examined is given in Table 1. According to the information given, 717 of the 765 studies published between 2014 and 2024 were research articles and 48 were review articles. Articles are, on average, 2.32 years old, and their annual growth rate is approximately 16%. The average number of citations for these studies was 19. It can be said that the tendency to write joint articles is generally high, and international cooperation is especially high in this field (32.16%). Accordingly, it can be concluded that relevant topics tend to grow, and the interest of researchers tends to increase.

Table 1. Descriptive Statistics

	Description	Results
Main Information About Data	Timespan	2014:2024
	Sources (Journals, Books, etc)	292
	Article	717
	Review	48
	Annual Growth Rate %	15.57
	Average age of documents	2.32
	Average citation count per document	18.96
	References	43349
	Keywords Plus (ID)	1551
	Author's Keywords (DE)	2548
Author Information	Authors	2379
	Authors of single-authored docs	54
	Single-authored docs	56
	Co-Authors per Doc	3.4
	International co-authorships %	32.16

The number of articles produced by year is given in Table 2. According to the table given, it can be seen that the studies have increased exponentially, especially during and after the pandemic period. During the pandemic period, digital technologies have become an integral part of our lives and institutions have entered a rapid digitalization process, which has led to an increase in scientific studies on the subject during this period. The effects of digitalization in the business world are not limited to business processes only, it has also had a significant impact on the psychological health of employees. Remote working, social isolation, limited physical interaction, anxiety about the future, fear of unemployment, anxiety about making mistakes in the digital environment and concerns about not being able to adapt to the digitalization process have also triggered serious psychological problems. In this context, it can be said that it will be inevitable to conduct new studies that will reveal the effects of digitalization on the psychology of employees in a more comprehensive way in the coming years.

Table 2. Annual Scientific Production

Year	Articles
2014	8
2015	4
2016	5
2017	7
2018	20
2019	30
2020	59
2021	124
2022	217
2023	291

Information about the distribution of journals that have examined the psychological effects of digitalization on employees is given in Table 3. When Table 3 is examined, the number of journals publishing 10 or more studies on this subject is 9. On the other hand, the number of journals with 3 or fewer publications is 254. According to this result, most of the works that affect the field of study come from a small set of journals. There may be various reasons that cause this situation. There may be authors who publish regularly in certain journals. The main reasons for this situation are that there are journals in the field that regularly publish articles on the subject, and pioneering authors in the field generally send their articles to the journals in which they have previously published, and thus the journals attract more publications.

Table 3. Source Impact

Total Articles	Journals
1	182
2	54
3	18
4	11
5	7
6	6
7	2
8	1
9	2
10	1
11	2
15	1
17	1
18	1
49	1
52	1
83	1
765	254

Most Productive Authors

Table 4 examines the most productive authors and their impact on the field. The table is arranged according to corrected article numbers. The value obtained by dividing each article by the number of authors is called as the corrected article number. According to Table 4, Ghislieri C and Sivunen A are the authors with the most publications, with 5 articles each. It is seen that the authors in the table mostly published their works after the COVID-19 pandemic period. Publications published after the pandemic also have a significant impact on the field. For example; Toscano F and Zappala S have received 484 citations each for their works published since 2020. When compared with the publication criteria of the authors, it can be said that the citations received by the studies are high, even though a short period of time has passed. In addition, although not included in the table, authors named Allen TD, Shockley KM and Golden TD received 817, 790 and 649 citations with 3, 3 and 1 articles, respectively. The publication year of the works of these authors is 2015. It is expected that these articles, which are the first publications in the field, will receive many citations.

Table 4. Most Productive Authors

#	Authors	Articles	Articles Fract.	H index	G index	Total Citations	PY start
1	Rodriguez-Modrono P	3	2.00	2	3	91	2020
2	Salamon E	2	2.00	2	2	43	2018
3	Varzaru AA	2	2.00	1	1	2	2022
4	Ghislieri C	5	1.50	5	5	171	2018
5	Blanchard AL	2	1.50	2	2	43	2021
6	Sivunen A	5	1.45	3	5	70	2021
7	Toscano F	4	1.45	4	4	484	2020
8	Zappala S	4	1.45	4	4	484	2020
9	Klumpp M	4	1.34	1	2	8	2022
10	Ruiner C	4	1.34	1	2	8	2022
11	Chatterjee S	4	1.33	4	4	125	2022
12	Chaudhuri R	4	1.33	4	4	125	2022
13	Dobrowolska M	4	1.33	3	4	30	2020
14	Szulc JM	2	1.33	2	2	15	2022
15	Wang Y	3	1.31	1	3	81	2021
16	Chin T	4	1.28	4	4	76	2019
17	Molino M	4	1.25	4	4	161	2018
18	Walker M	2	1.20	2	2	10	2021
19	Li Y	3	1.17	2	3	10	2022
20	Moran RCD	2	1.13	1	1	3	2023

Leading Journals

The most productive journals are given in Table 5. When Table 5 is examined, it is seen that the most productive journal is “Sustainability” and 83 articles have been published in this journal since 2018. In addition, it is understood that this journal received the highest number of citations along with the number of publications. Also, “International Journal of Environmental Research and Public Health” and “Frontiers in Psychology” stand out as the second and third most productive journals in this field, with 51 and 49 articles, respectively. The years when the first studies were published in the top three journals were 2018 and 2019. In this respect, although the studies published here are not the first in the range discussed, it can be said that they are among the most influential studies in the field. Considering the number of citations, it can be said that there are a small number of articles and highly cited articles in “Technological Forecasting and Social Change”, “Journal of Applied Psychology” and “Journal of Business Research”.

Table 5. Most Productive Journals

#	Source	Total Articles	First Publication Year	Total Citations	H index	G index
1	Sustainability	83	2018	1631	17	39
2	International Journal of Environmental Research and Public Health	51	2019	864	17	28
3	Frontiers in Psychology	49	2018	502	9	21
4	Journal of Business Research	18	2020	735	13	18
5	Work-A Journal of Prevention Assessment & Rehabilitation	17	2014	129	4	11
6	International Journal of Manpower	15	2016	281	9	15
7	Technological Forecasting and Social Change	11	2019	622	6	11
8	Employee Relations	10	2019	62	4	7
9	Computers & Industrial Engineering	9	2020	336	7	9
10	PLOS One	9	2018	62	4	7
11	International Journal of Production Research	8	2020	124	6	8
12	Technology in Society	8	2021	196	5	8
13	Journal of Organizational Change Management	7	2018	47	4	6
14	Frontiers in Public Health	7	2022	18	3	4
15	Computers in Human Behavior	6	2014	258	6	6
16	Journal of Applied Psychology	6	2021	416	6	6
17	IEEE Transactions on Engineering Management	6	2020	77	4	6
18	Behavioral Sciences	6	2021	18	2	4
19	Information Technology & People	6	2022	10	2	2
20	Personnel Review	6	2022	25	2	4

Prominent Countries and Institutions

To examine the productivity of countries, the corresponding author's country and the citation information these countries receive are given in Table 6. According to Table 6, USA is at the top with the most corresponding authors. In addition, USA had the highest number of citations with 2584 in terms of total number of citations and ranked first in terms of average number of citations with 25.84. The second, third and fourth countries in the ranking were Germany, Italy and China, respectively. These countries have published more publications than other countries, with a total of 50 or more publications. At the bottom of the table is Croatia, which has 6 publications. There are Hungary, Russia, Slovakia, South Africa and Turkey, which are not included in the table, with a number of articles equal to Croatia. The average citation numbers of these countries were 132.83, 17.83, 6.33, 3.33 and 19.33, respectively.

Table 6. Most Productive Countries

#	Country	Articles	Single Country Paper	Multi Country Paper	Multi Country Paper Ratio	Total Citations	Average Article Citations
1	USA	100	79	21	0.21	2584	25.84
2	Germany	75	64	11	0.15	1023	13.64
3	Italy	55	38	17	0.31	1430	26
4	China	50	26	24	0.48	523	10.46
5	France	34	10	24	0.71	423	12.44
6	Poland	32	25	7	0.22	315	9.84
7	United Kingdom	32	19	13	0.41	931	29.09
8	Spain	30	24	6	0.20	572	19.07
9	Australia	24	18	6	0.25	898	37.42
10	Finland	21	14	7	0.33	459	21.86
11	Sweden	21	15	6	0.29	339	16.14
12	Netherlands	20	6	14	0.70	244	12.2
13	India	19	9	10	0.53	698	36.74
14	Romania	17	15	2	0.12	145	8.53
15	Brazil	15	8	7	0.47	145	9.67
16	Norway	14	10	4	0.29	352	25.14
17	Japan	13	10	3	0.23	104	8

18	Canada	12	6	6	0.50	219	18.25
19	Korea	12	9	3	0.25	48	4
20	Switzerland	11	6	5	0.46	289	26.27
21	Austria	10	8	2	0.20	398	39.8
22	Portugal	10	8	2	0.20	216	21.6
23	Malaysia	9	7	2	0.22	58	6.44
24	Belgium	6	4	2	0.33	101	16.83
25	Croatia	6	3	3	0.50	16	2.67

The most productive universities are given in Table 7. University of Turin, Bucharest University of Econ Studies and Tampere University are among the most productive universities in terms of the number of publications. It is also noteworthy that the most productive universities are located in European countries, excluding Japan. It appears that the countries hosting the most productive institutions are ranked differently from the list of the most productive countries. The main reason for this is that some institutions focus on studies related to digitalization. Although America has a high number of universities and academicians, it does not rank first in hosting the most productive institutions. In the USA, it is more common for institutions to work according to areas of interest without focusing on specific subjects. Additionally, according to Table 7, the top 10 most productive universities have 20.7% of the studies in the field, with a total of 159 studies. This shows that there is a serious clustering in the field regarding the subject.

Table 7. Most Productive Institutions

#	Affiliations	Total Articles	Country
1	University of Turin	21	Italy
2	Bucharest University of Econ Studies	20	Romania
3	Tampere University	19	Finland
4	Silesian Tech University	17	Poland
5	University of Occupation and Environmental Health	17	Japan
6	University of Jyvaskyla	16	Finland
7	Tilburg University	13	Holland
8	University of Birmingham	13	England
9	Bi Norwegian Business School	12	Norway
10	University of Aveiro	11	Portugal
11	University of Ghent	11	Belgium
12	University of Tokyo	11	Japan
13	Ludwig Maximilians University of Munchen	10	Germany
14	University of Bologna	10	Italy
15	University of Gothenburg	10	Sweden
16	University of Hohenheim	10	Germany
17	University of Zagreb	10	Croatia
18	Chalmers University of Technology	9	Sweden
19	Financial University under the Government of the Russian Fed	9	Russia
20	Free University of Berlin	9	Germany
21	University of Calabria	9	Italy
22	University of Cologne	9	Germany
23	University of Delaware	9	USA
24	University of Queensland	9	Australia
25	Yonsei University	9	South Korea

Scientific Mapping Analysis

Keyword Analysis and Co-occurence of Keywors

Table 8 examines to what extent keywords and concepts as bigrams and unigrams are prominent in the publications. According to the analysis results, double phrases such as "covid-19 pandemic" and "digital transformation" were used with the highest frequency. This reveals the impact of global pandemic and digitalization on research in recent years. Among singular words, "performance" and "impact" are the two most used words. Accordingly, it shows that the performance of institutions and individuals is intensively

examined by researchers. Concepts such as "mental health" and "job satisfaction" are also among the frequently used words. This situation reveals that the psychological states of employees and their satisfaction at work are the focus of research area. Additionally, keywords such as "digital technologies", "human resources" and "remote workers" highlight the importance of digitalization and remote working models in the modern business world.

Table 8. Most Frequent Words (Bigrams and Unigrams)

#	Words (Bigrams)	Freq	Words (Unigrams)	Freq
1	covid- pandemic	287	performance	143
2	digital transformation	261	impact	126
3	mental health	112	management	96
4	job satisfaction	109	model	73
5	digital technologies	90	satisfaction	64
6	work-life balance	64	stress	53
7	human resource	61	work	53
8	remote workers	61	health	51
9	structural equation	56	innovation	50
10	technological change	54	communication	49
11	job demands	53	job-satisfaction	49
12	future research	50	technology	49
13	digital technology	49	resources	48
14	social media	49	future	47
15	communication technologies	42	information	47
16	equation modeling	39	workplace	43
17	supply chain	38	telework	40
18	artificial intelligence	37	employees	37
19	study contributes	36	engagement	36
20	job performance	34	metaanalysis	35
21	emotional exhaustion	32	framework	34
22	communication technology	31	home	32
23	life satisfaction	31	consequences	31
24	online survey	31	knowledge	31
25	human resources	30	job	30

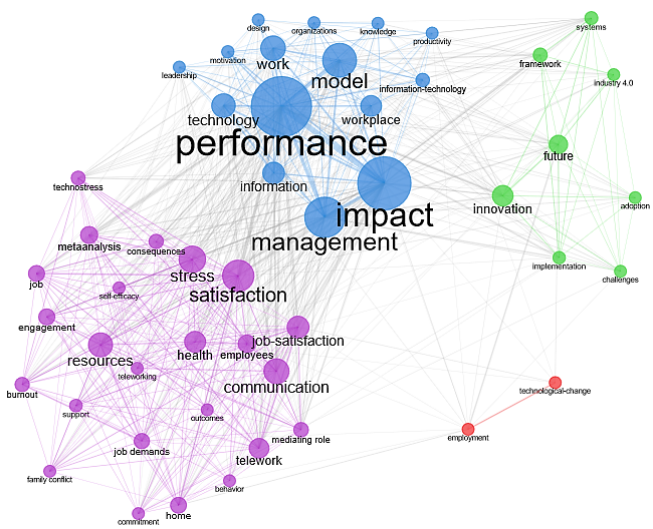

Figure 1. Co-occurrence Network from Keyword Plus

Figure 1 shows the co-occurrence frequencies and relationships of the keyword. Co-occurrence network of keywords refers to a method used to visualize the relationships of the most frequently co-occurring keywords in a research field (Su and Lee, 2010). These networks are used to identify relationships between keywords and present these relationships visually. Different colors in Figure 1 represent specific

clusters of keywords and the relationships between these clusters. This figure also allows us to visually understand how the topics researchers focus on is connected to each other.

In Figure 1, the largest and most central words in the blue cluster are "performance", "impact", "management" and "model", and there is a dense network of relationships between these terms. This shows that these keywords are frequently used together and the connections between them are strong. Accordingly, it can be said that the articles in the blue cluster focus on the effects of digital transformation on business life such as business models, performance, working environment, ways of doing business and leadership. The purple cluster contains words such as "stress", "satisfaction", "communication", "resources", "health", "telework" and "employees". Accordingly, it can be said that the articles in the purple cluster discuss the effects of digitalization on employees from different perspectives such as health, motivation, stress, communication, self-efficacy and burnout. The green cluster highlights future research trends and innovative approaches to the field with terms such as "future", "innovation" and "industry 4.0". The red cluster includes the terms "employment" and "technological change" and addresses the effects of digitalization on employment.

Citation Analysis and Co-citation Network

Figure 2 shows the co-citation network of the sources from which the articles are fed. The sources are clustered in 3 groups. The most prominent elements of the red cluster are "Journal of Applied Social Psychology", "Journal of Organizational Behavior", "Academy of Management Journal" and "Journal of Management". It can be said that the main focus of this cluster is management and organization. The second cluster is the green cluster, and prominent journals in this cluster include "Journal of Business Research", "Sustainability", "Journal of Information Management", "Information Systems Research", "MIS Quarterly" and "Computers in Human Behavior". When the publications in the green cluster were examined, it was seen that mostly the technical and infrastructure elements of digitalization were discussed and their effects on employees were investigated. In the blue cluster, resources containing production and economy-oriented publications such as "International Journal of Production Economics", "Journal of Cleaner Production" and "International Journal of Production Research" come to the fore. In this regard, it can be said that the research field is nourished by studies examining the effects of digitalization on management, organization, production, economy, technological infrastructure and human behavior.

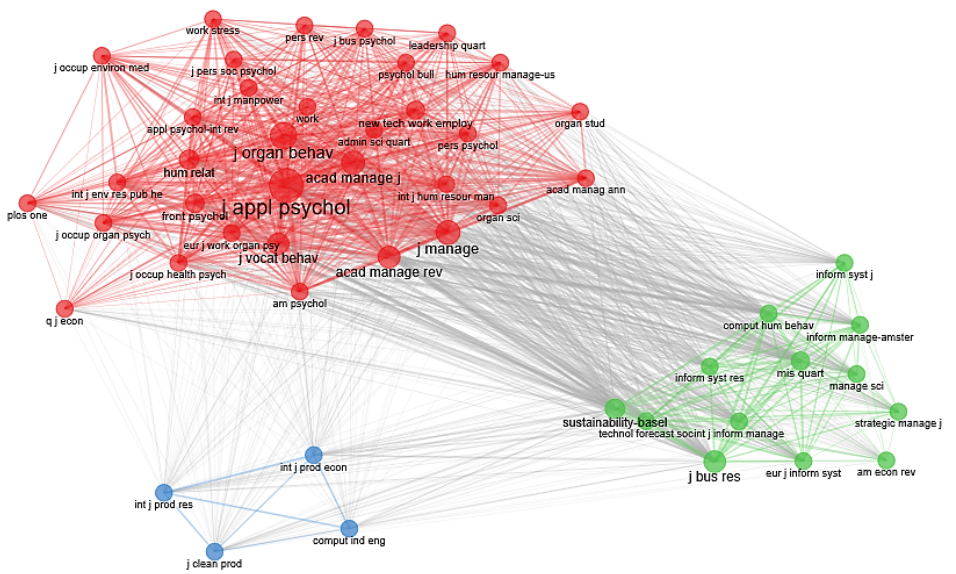

Figure 2. Sources Co-citation Network

Figure 3 shows the network of authors co-cited in articles examining the psychological effects of digital transformation on employees. This method provides an important tool for understanding how authors and their work are related in the scientific literature and which authors are influential in similar areas of research. Authors with the same color in Figure 3 are likely to have been cited in similar articles and therefore focus on similar research topics. According to the figure, the author co-citation network is

divided into four clusters. In the red cluster, there are OECD publications and anonymous publications, as well as authors such as Acemoğlu D., Brynjolfsson E., and Frey CB. When the works of these authors are examined, it is seen that they focus more on the effects of digitalization in the new economic order and they are among the pioneering works in digital transformation. In the green cluster, it is seen that authors such as Gajendran RS., Allen TD., Wang B., Shockley KM. focus on topics such as telecommunication, telework, remote working and innovative business models in their publications. In the blue cluster, authors such as Bakker AB., Podsakoff PM., Venkatesh V., Sonnentag S., and Schaufeli WB come to the fore and in their works, they discuss the effects of digitalization in the field of management and organization from a psychological perspective and changes in the way of doing business. In the purple cluster, authors such as Grant AM., Hackman JR., and Parker SK attract attention and their works include basic organizational behavior topics such as leadership, organizational structure and employee climate.

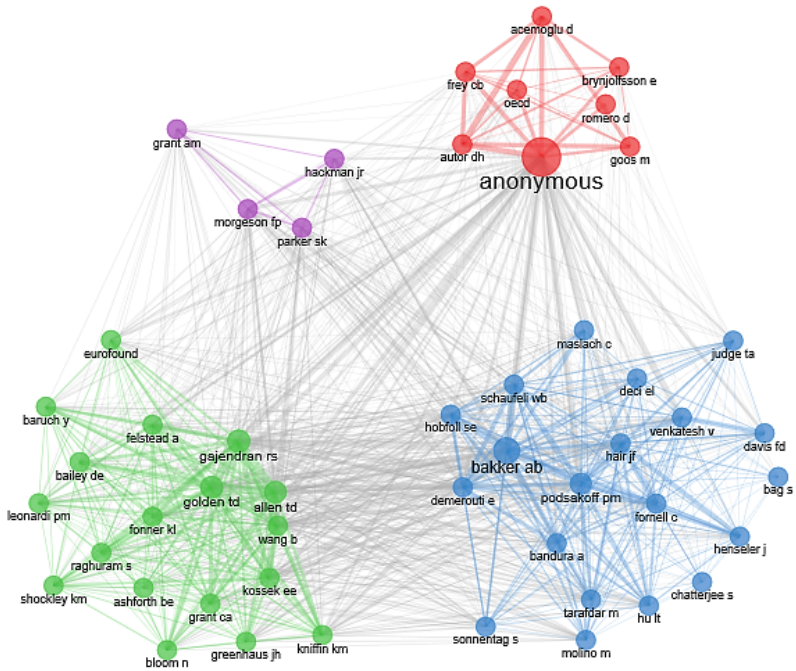

Figure 3. Author Co-citation Network

Table 9 shows the 20 most cited sources from the article data set examining the effects of digitalization on employee psychology. The study by Allen, Golden, and Shockley (2015) evaluating the effectiveness of telework comes first and has received 649 citations in total and is at the top with an average value of 64.90 citations per year. Wang et al.'s (2021) study on effective remote working during the COVID-19 pandemic ranks second with an average value of 130.25 citations per year, emphasizing the importance of remote working during the pandemic and its effects on new work designs. Horváth and Szabó (2019), which ranks third with an average annual citation value of 84.83, examined the driving forces and obstacles of Industry 4.0 in their study and examined the aspects in which international, medium-sized and small businesses differ. Pandey and Pal (2020), who are in the fourth place, appear to discuss the effects of digitalization on employees and the economy from various aspects such as work distribution, shaping of collaborations, regulation of work follow-ups, techno-stress, communication and motivation. In the fifth place, Galanti et al. (2021) examined the effects of rapid digitalization and remote working during the COVID-19 pandemic on issues such as employees' productivity, stress levels, engagement. According to this table, the high number of citations received by articles on a global scale shows that there is intense interest in studies on the impact of the digitalization process on employee psychology. In particular, research on remote working, digital transformation and Industry 4.0 has an important place in the academic literature. These studies have examined in depth the effects of digitalization on business processes and the psychological states of employees, significantly increasing the knowledge in these areas.

Table 9. Most Global Cited Sources

#	Paper	Total Citations	TC per Year	Normalized TC
1	Allen, T. D., Golden, T. D., & Shockley, K. M. (2015). How effective is telecommuting? Assessing the status of our scientific findings. Psychological science in the public interest, 16(2), 40-68.	649	64,90	3,88
2	Wang, B., Liu, Y., Qian, J., & Parker, S. K. (2021). Achieving effective remote working during the COVID-19 pandemic: A work design perspective. Applied psychology, 70(1), 16-59.	521	130,25	14,82
3	Horváth, D., & Szabó, R. Z. (2019). Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities?. *Technological forecasting and social change*, *146*, 119-132.	509	84,83	7,22
4	Pandey, N., & Pal, A. (2020). Impact of digital surge during Covid-19 pandemic: A viewpoint on research and practice. *International journal of information management*, *55*, 102171.	429	85,80	9,74
5	Galanti, T., Guidetti, G., Mazzei, E., Zappalà, S., & Toscano, F. (2021). Work from home during the COVID-19 outbreak: The impact on employees' remote work productivity, engagement, and stress. *Journal of occupational and environmental medicine*, *63*(7), e426-e432.	303	75,75	8,62
6	Nagy, J., Oláh, J., Erdei, E., Máté, D., & Popp, J. (2018). The role and impact of Industry 4.0 and the internet of things on the business strategy of the value chain—the case of Hungary. *Sustainability*, *10*(10), 3491.	286	40,86	7,57
7	Charalampous, M., Grant, C. A., Tramontano, C., & Michailidis, E. (2019). Systematically reviewing remote e-workers' well-being at work: A multidimensional approach. *European journal of work and organizational psychology*, *28*(1), 51-73.	251	41,83	3,56
8	Amankwah-Amoah, J., Khan, Z., Wood, G., & Knight, G. (2021). COVID-19 and digitalization: The great acceleration. *Journal of business research*, *136*, 602-611.	226	56,50	6,43
9	Birkel, H. S., Veile, J. W., Müller, J. M., Hartmann, E., & Voigt, K. I. (2019). Development of a risk framework for Industry 4.0 in the context of sustainability for established manufacturers. *Sustainability*, *11*(2), 384.	194	32,33	2,75
10	Frank, M. R., Autor, D., Bessen, J. E., Brynjolfsson, E., Cebrian, M., Deming, D. J., ... & Rahwan, I. (2019). Toward understanding the impact of artificial intelligence on labor. *Proceedings of the National Academy of Sciences*, *116*(14), 6531-6539.	176	29,33	2,50
11	Bartsch, S., Weber, E., Büttgen, M., & Huber, A. (2021). Leadership matters in crisis-induced digital transformation: how to lead service employees effectively during the COVID-19 pandemic. *Journal of service management*, *32*(1), 71-85.	158	39,50	4,49
12	Veile, J. W., Kiel, D., Müller, J. M., & Voigt, K. I. (2020). Lessons learned from Industry 4.0 implementation in the German manufacturing industry. *Journal of Manufacturing Technology Management*, *31*(5), 977-997.	146	29,20	3,31
13	Toscano, F., & Zappalà, S. (2020). Social isolation and stress as predictors of productivity perception and remote work satisfaction during the COVID-19 pandemic: The role of concern about the virus in a moderated double mediation. *Sustainability*, *12*(23), 9804.	137	27,40	3,11
14	Contreras, F., Baykal, E., & Abid, G. (2020). E-leadership and teleworking in times of COVID-19 and beyond: What we know and where do we go. *Frontiers in psychology*, *11*, 590271.	135	27,00	3,06
15	Balsmeier, B., & Woerter, M. (2019). Is this time different? How digitalization influences job creation and destruction. *Research policy*, *48*(8), 103765.	133	22,17	1,89
16	Allen, T. D., Merlo, K., Lawrence, R. C., Slutsky, J., & Gray, C. E. (2021). Boundary management and work-nonwork balance while working from home. *Applied Psychology*, *70*(1), 60-84.	131	32,75	3,73
17	Kaasinen, E., Schmalfuß, F., Özturk, C., Aromaa, S., Boubekeur, M., Heilala, J., ... & Walter, T. (2020). Empowering and engaging industrial workers with Operator 4.0 solutions. *Computers & Industrial Engineering*, *139*, 105678.	130	26,00	2,95
18	Obrenovic, B., Du, J., Godinic, D., Tsoy, D., Khan, M. A. S., & Jakhongirov, I. (2020). Sustaining enterprise operations and productivity during the COVID-19 pandemic:"Enterprise Effectiveness and Sustainability Model". *Sustainability*, *12*(15), 5981.	126	25,20	2,86
19	Bennett, A. A., Campion, E. D., Keeler, K. R., & Keener, S. K. (2021). Videoconference fatigue? Exploring changes in fatigue after videoconference meetings during COVID-19. *Journal of Applied Psychology*, *106*(3), 330.	125	31,25	3,56
20	Newlands, G. (2021). Algorithmic surveillance in the gig economy: The organization of work through Lefebvrian conceived space. *Organization Studies*, *42*(5), 719-737.	119	29,75	3,39

Collaboration Network of Authors, Countries and Institutions

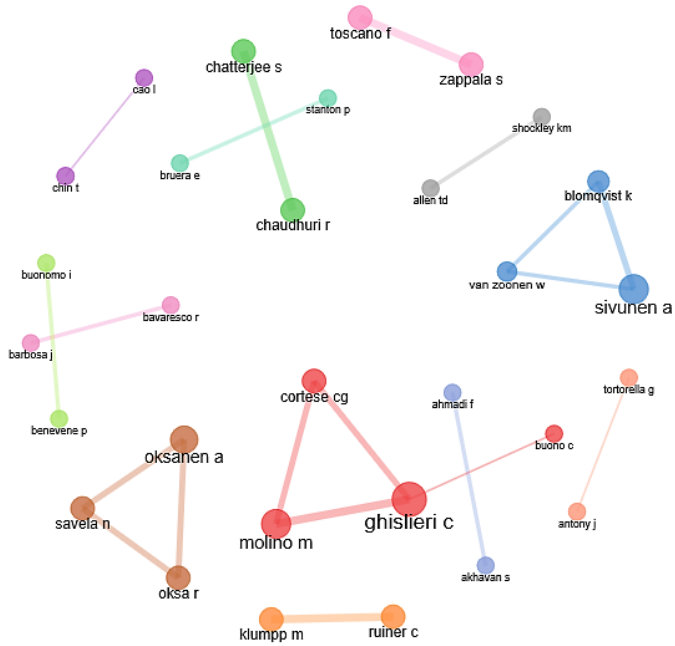

Figure 4. Author Collaboration Network

Collaboration networks are used to reveal collaborations between authors, countries and institutions in a particular field of study (Farooq, 2022). While each node in the collaboration network figures represents a country, institution and author, each edge represents the cooperation between bilateral groups, and the edge thickness is directly proportional to the strength of the relationship between the bilateral groups (Umar et al. 2022). Figure 4 shows collaborations between leading authors in the field. The color coding in the figure represents the groups of authors studying different aspects of digitalization on employee psychology. When the figure is examined, it is seen that there are small but strong collaborations between authors, which shows that large-scale author collaborations in the field are not yet fully developed.

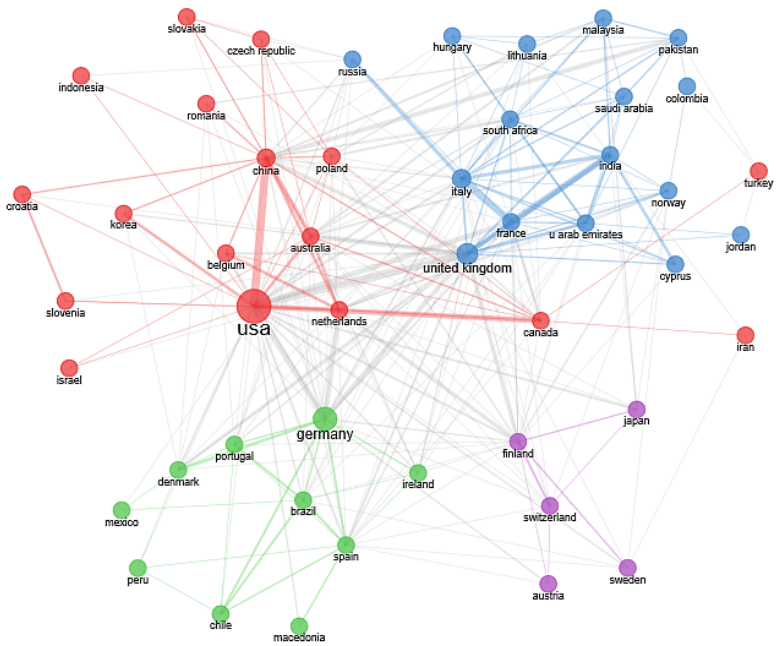

Figure 5. Country Collaboration Network

The collaboration network between countries is given in Figure 5. According to this figure, collaboration between countries is divided into 4 groups. In the red cluster, there are strong collaborative relations between China, Australia, the USA, Canada and the Netherlands. In the blue cluster, the collaboration between the UK, France, Italy, India and Russia is very intense. Also, it can be said that there are not very strong collaborations between the countries in the green and purple clusters.

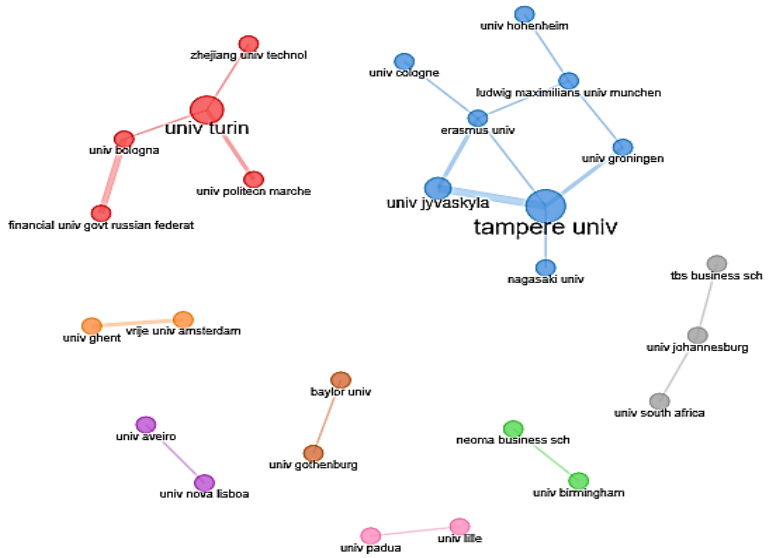

Figure 6. University Collaboration Network

Figure 6 shows the collaborations between universities. The strongest collaboration is seen between Tampere University and the University of Jyväskylä within the blue cluster. Both of these universities are located in Finland. In the same cluster, there are also universities from European countries such as Germany, the Netherlands and Italy. Within the red cluster, there is strong cooperation between the Marche Polytechnic University, the University of Turin and the University of Bologna, and these universities are located in Italy. Other clusters appear to be smaller. In general, it is seen that collaborations between universities consist of institutions within the same country or in the same geographical region. Various factors such as geographical proximity and convenience, national or regional research policies and incentives, regional consortiums, cultural similarities or the need to meet common needs specific to the region may be effective in the intensification of collaborations between universities within the borders of the same country or among universities in the same geographical region.

CONCLUSION

This study reveals the general trends and distribution of articles in the WoS database on the psychological effects of digitalization on employees between 2014 and 2023. According to the bibliometric analysis outputs, it is seen that a total of 765 articles were published in the 10-year period and the majority of these articles are research articles. The fact that the studies are 2.32 years old on average reveals that research in this field is relatively new and rapidly developing. The annual growth rate of 16% shows that the interest in digitalization and employee psychology is constantly increasing. Additionally, it was determined that the articles received an average of 19 citations and international collaborations were high at 32.16%.

The increased presence of digital technologies in business life during and after the COVID-19 pandemic period has led to a significant increase in the number of articles after 2019. This increase is due to the widespread use of digital technologies and the emergence of some psychological effects on employees. In particular, articles focusing on the effects of remote working and digital transformation on employees' work-life balance, motivation, job stress, well-being, burnout levels and general satisfaction have increased in number (e.g. Galanti et al. 2021; Toscana and Zappala 2020; Allen et al. 2021; Bellmann and Hübler, 2021). The fact that digital technologies have become an integral part of the business world during the pandemic has enabled these issues to take more place in research. The rapid digital

transformation of businesses during the pandemic period and the fact that countries are increasingly focusing on digitalization policies will enable us to see rapid increases in the number of articles in the coming years and will keep the interest in the research field high.

In the dataset, certain journals and authors were found to have a significant impact in the research field. Sustainability, International Journal of Environmental Research and Public Health and Frontiers in Psychology journals stand out as the most productive journals. Additionally, authors such as Ghislieri C. and Sivunen A. have been among the most prolific authors. Most of the articles in the research field were published after the COVID-19 pandemic period, and it is noteworthy that the articles published after pandemic quickly reached a high number of citations. As a result, it is understood that studies on the psychological effects of digitalization on employees attract academic attention and provide important findings.

When we look at the collaborations between authors, countries and institutions in this field, it is seen that collaborations are mostly concentrated within the same country borders or the same geographical region. Collaboration networks among authors reveal the existence of groups of researchers and interdisciplinary studies focusing on specific topics. Likewise, collaboration networks between countries and institutions demonstrate interaction and knowledge sharing between academic communities in similar geographical areas. The development of larger-scale collaborations in the coming years may make it easier to understand what kind of psychological effects digitalization initiatives have on employees on a global scale and may help develop solutions against psychological negativities on a global scale.

As a result, it has become clear that more international cooperation is needed for a more comprehensive understanding of the effects of digitalization on the business world and employee psychology. Bringing together researchers and institutions from different countries to expand and deepen research on this subject could be an important step in finding solutions to common problems encountered in the global business world. In this way, the quality of research on the psychological effects of digitalization on employees can increase and the literature in this field can become richer and more diverse.

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