A BIBLIOMETRIC REVIEW ON TECHNOSTRESS: PERFORMANCE AND SCIENTIFIC APPROACH

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ABSTARCT

The purpose of this paper is to put forward a quantitatively backed explanation of the research done on technostress, the emergence of the concept, and its inclusion in the research domain. This paper builds on bibliometric and network analysis to evaluate a sample of 639 articles related to technostress published during 2004-2022. Biblioshiny is being used to do the descriptive statistics and science mapping approaches using network analysis and co-citation analysis was performed with the help of VOS viewer. An integrated approach of using co-citation analysis and content analysis of most co-cited articles unveiled four underlying research streams including Information and technology overload and social media fatigue, different perspectives of technostress and concepts and models to predict Technostress, technostress in the organizations, and finally, the various approaches to study technostress. The study is consequential for various organizational practitioners, researchers, and policymakers as they can use the multi-dimensional themes and areas discussed in the paper to strengthen the policies to ensure the minimization of technostress and its harmful effects.

Keywords: Bibliometric, Network Analysis, Performance Analysis, ICT, Technostress

Paper type: Research paper

INTRODUCTION

The work and application of technology-based devices induce apprehension and tension in users. The user's interaction with digital devices and computers can be burdensome, decrease confidence, and discomfort at a psychological point. This situation of uneasiness toward information and communication technology devices leads to psychological effects such as

discomfort using technical devices, reduced confidence, and less openness to using them. Such conditions could result in less technology acceptance and a phobia of using computers.

Many empirical studies established that ICTs have caused increased stress amongst employees due to persistently working on technical skills, expectations to work 24*7 hours, and availability of smart devices resulting in a higher work pace (Ayyagari et al., 2011; Ragu-Nathan et al., 2008; Wang et al., 2008). Technostress implies "stress experienced by end users in organizations as a result of their use of ICTs" (Ragu-Nathan et al., 2008). The definition proposed by (Ragu-Nathan et al., 2008) includes five dimensions of technostress specifically

(i) *Techno-overload*: user's ability to work quicker and extended.

(ii) *Techno-invasion*: ICT's ability to occupy user's personal lives. (iii) *Techno-complexity*: Inadequacy of users to match their current skills with ICT's complex features. (iv) *Techno-insecurity*: user's insecurity with own replacement due to better ICT automation. (v)*Techno-uncertainty*: user uncertainty due to constant changes and upgradation in ICTs.

Thus, the term *technostress* denotes negative stress instigated by technology (techno). (Tarafdar et al., 2019)justified that when this technostress is left unconsidered, it can be harmful to the user's well-being and cognitive abilities. The Techno stressors like techno insecurity, overload, complexity, invasion, and uncertainty contribute to negative outcomes including lack of productivity, burnout, and inadequate well-being (Maier, Laumer, Weinert, et al., 2015; Ragu-Nathan et al., 2008; Sanjeeva Kumar, 2024; Tarafdar et al., 2007). (Brod, 1984) coined the term "technostress" in the 1980s and defined it as "a modern disease of adaptation caused by an inability to cope with new technologies healthily" (p.16). Technostress harms the quality of online learning (Saleem et al., 2024), and digital well-being (Cazan et al., 2024). The concept of technostress is based on the transactional theory of stress and coping (Folkman et al., 1986). The COVID-19 pandemic has propelled numerous businesses and industries to run online around the world. The application of information and communication technologies (ICT) is more frequent than ever to ease business and buffer the operations for work-from-home employees, and remote e-workers (Dhomane & Mathew, 2021). This model raised the innovation of multiple technologies to boost the economy, reduce physical contact, and maintain business operations as before. (Taser et al., 2022) found that technostress impedes the employee's emotions who are working remotely by reducing social interaction, which leads to loneliness. This loneliness affects the employee's workflow levels negatively. During the pandemic, work from home gradually changed to working from anywhere developing high technostress and high job insecurity (Umair et al., 2023).

RESEARCH OBJECTIVES

The researchers' overarching aim is:

Q1. To conduct a bibliometric analysis on "Techno-stress"

(a) Performance assessment

(b) Scientific mapping.

METHODS, MATERIALS COLLECTIONS AND SELECTION

Methods

According to (Leblanc-Proulx, 2018), bibliometric analysis is one of the most effective tools to systematically encapsulate the ongoing trends, characteristics, and future developments related to any specific subject, especially from the point of view of academic literature. Such analysis helps in preparing a structured and apparent overview of relevant, popular, and impactful literature for authors and their creativity, publications with high impact, locating journals publishing quality content, and leading institutions and countries. (Gaviria-Marin et al., 2018). As Raan, (2014) said research performance assessment includes the counting of the total number of citations of scientific papers, i.e., how many times a particular research work is cited by fellow researchers. Citation analysis of the performance of particular research can be done with the help of citation analysis, keyword frequency analysis, and counting and comparing the number of research works published according to countries, authors, universities, and journals. (Didegah et al., 2012).

In the first part, the research performance assessment conducted by the authors for this paper aims to measure the quantitative as well as qualitative contribution (Muñoz et al., 2017). In the second part, scientific mapping is done to chart out the relationships of various authors with each other (Small, 1999). This has been done to find out the hidden patterns from the plethora of publications and interpretations of these specific patterns. Visualization methods have been used to make the interpretation interesting and easy to understand.

Material Collection

In this study, the authors have used the Web of Science (WoS) database for their research purpose. The bibliometric data related to Technostress were retrieved from the WoS database which the authors used as a scientific search engine. There are many reasons which make this database far superior to its competitors. Even though competing databases like Scopus are considered more comprehensive, the fact that WoS only includes those journals that are indexed by the ISI (International Scientific Indexing) makes it more selective (Yong-Hak, 2013). JCR or Journal Citation Report, which is also run by the parent organization of WoS – Thompson Reuters, has the impact scores of all the journals indexed by WoS making it more synergistic between both tools. However, this criteria of being selective is limited to the quality of outlets only, irrespective of the research topic areas. The WoS can present the relevant metadata to the bibliometric researchers which is essential for carrying out this type of analysis, i.e., references, abstracts, number of citations, lists of authors and their collaborators, journal impact factor, countries and institutions (Carvalho et al., 2013). All this information is also regularly updated and formatted. This helps in avoiding data homogeneity issues because of using multiple databases (Mariani & Borghi, 2019) and duplication issues (Dwivedi et al., 2011). Hence, the authors used the WoS database as it is the most influential, consists of the highest quality journals, contains more reliable and standardized records from a broad variety of disciplines, and hence, can be said to be the most appropriate database for bibliometric analysis.

Selection

To search the publications from WoS databases, an initial search of keywords for publications from 2004 to 2022 was done. The terms "technostress" OR "techno-stress" OR "technological stress" OR "technology stress" OR "IT stress" OR "ICT stress" or (technolog* anxiety" were used as keywords to retrieve the relevant data or publications wherein these words were used in title, abstracts, or keywords. This helped in removing the irrelevant publications. Those articles which did not make any significant contribution to the topic of technostress were filtered at this stage. The authors considered only those articles which were written in English. It was done according to the recommendation by (Tian et al., 2018) Who stated that the predominance of English in scholarly research makes it most appropriate for bibliometric analysis. Double-blind peer-reviewed journals were considered to ensure the reliability of the data. Only journal articles were considered and conference proceedings, book reviews, book chapters, reprints, consultant reposts, newspaper articles, and extended abstracts were not taken into consideration. As suggested by (Shashi et al., 2020) and (Leblanc-Proulx, 2018), two exclusion and one inclusion criteria were followed for the final selection of the articles. All three criteria were followed progressively. The first exclusion criteria were to narrow down the number of articles based on their abstract if they were relevant to technostress or not. Two researchers read the abstracts simultaneously and a review by the third researcher was taken in cases of uncertainty. Then the researchers took the whole content of the paper as a basis for exclusion. The shortlisted papers according to the first criteria were read as a whole and then the irrelevant papers were sorted out. The final inclusion criteria were to include those research papers that could not be found by the search string but were relevant to the topic and were cited by the papers in the database. Thus, the final sample consisting of "Full Record and Cited References" comprised 639 relevant articles and were downloaded by using the command "save for other file formats" export function. The "Tab-delimited (window) function was also used and the data was further analyzed with the help of Biblioshiny and VOS viewer.

PERFORMANCE ANALYSIS

The total research papers related to Technostress published during this time can be seen in Figure 1. It can be seen from the chart there were not many numbers of published articles in the period between 2000-2005. 2005 showed a little upward trend but still, the numbers are very few for "technostress" to be considered as a popular topic. From the year 2008 onwards, a spike in interest of the researchers can be felt as the number of published articles grew significantly at that time. 2008 saw around 300% increase in publications than its preceding year, 2007. 2009-2012 did not have any noticeable publication. Since then, there has been a steady rate of publications on the concerned topic. 2016-2017 saw a further spike in the number of publications which was not maintained over the next two years, i.e., 2018-2019. 2020 again shows an upward trend whereas 2021 records the highest number of publications in the topic. The growing number of publications in 2020-2021 can be easily attributed to the aftermath of the havoc created by Covid 19. The overall trend shows an annual growth rate of 9.93%. The trend suggests that globally, stress related to the overuse of technology is gaining the interest of researchers and this trend can be expected to continue in the coming future as well.

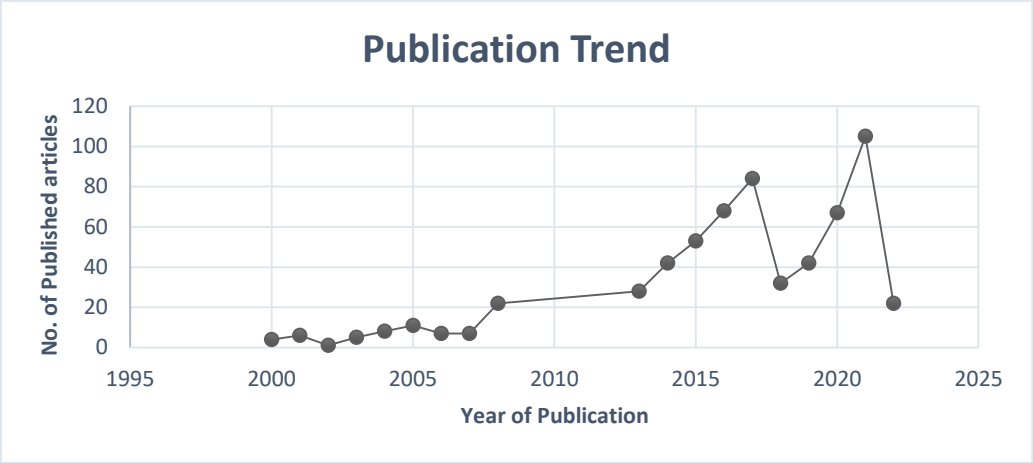

Figure 1. Publication Trend/Years
Source: WoS Database

Country and Region Analysis

The total number of publications during the considered timeline is 639 featuring publications from 68 countries. Out of these, 16% of countries have one publication each. The USA comes out as the publication leader with 285 mentions followed by China with an impressive number of 178. Germany is also an outstanding contributor with 109 mentions. Since developed countries are much more techno-savvy than their developing counterparts, stress due to technology is very common and widespread. Hence, the interest of researchers is also more in these areas as such stress can ultimately lead to a decline in productivity as well. Most of the contributions can be attributed to European nations. If the numbers are collated for the Asian subcontinent, China, South Korea, and India can be found in the Top 10 countries publishing about technostress. The penetration of technology in these countries is phenomenal and as these countries have large populations as well, so number of users is also more when compared to their American or European counterparts. Covid-19 has boosted the use of technology like never before and consequently the related ill-effects are also rising. Though Korea is only second to China in publishing research related to technostress, the actual number tells a very different story. The number of publications is just one-third when compared to China whereas India has published only 25% of the numbers of China. However, all these numbers will see a surge in the coming future as the unprecedented increase in the use of technology is going to bring another epidemic of technology-related stress to users. (Camacho & Barrios, 2022).

The top 10 contributors i.e., USA, China, Germany, South Korea, Italy, UK, India, Austria, and Finland contribute 62.83% of the total publications. Europe contributes around 34% of the total publications by the Top 10 countries whereas Asia comes a close second with around 33%. North American countries contribute about around 32% of that number. If we investigate the contribution of African nations, a lot is left to be desired. Their contribution amounts to a meager 1% of the total mentions. The interesting observation in Table 1. is that the Top 5 nations according to the number of publications are the same as those in terms of total citations. Publications from the USA have a huge number of citations. The UK can gain

one spot when the comparison is made based on citations. Even though Singapore has only 10 publications, in terms of citations, it makes a huge impact with an average of 77 average article citations.

Table 1. Number of Citations and Publications

Rank	Country	Frequency	Rank	Country	Total Citations	Average Article Citations
1	USA	285	1	USA	4512	37.29
2	China	178	2	China	3315	38.55
3	Germany	109	3	Germany	1753	35.06
4	South Korea	66	4	South Korea	1007	30.52
5	Italy	53	5	UK	775	36.90
6	UK	53	6	India	416	15.41
7	India	50	7	Canada	371	18.55
8	Austria	43	8	Austria	348	24.86
9	Finland	40	9	Italy	338	13.52
10	Canada	38	10	France	329	19.35
11	France	35	11	Sweden	324	29.45
12	Japan	35	12	Spain	311	22.21
13	Spain	30	13	Finland	237	13.17
14	Sweden	30	14	Singapore	231	77.00
15	Australia	26	15	Norway	214	35.67
16	Russia	26	16	Japan	211	13.19
17	Malaysia	25	17	Switzerland	178	19.78
18	Pakistan	17	18	Israel	142	28.40
19	Brazil	16	19	Australia	140	12.73
20	Netherlands	14	20	Argentina	108	15.43

Source: Authors' work based on the VOSviewer Analysis

Author-Analysis

The data shows the contribution of 1310 authors in the selected 639 articles. This makes an average of 2 papers per author. However, only one article has been published by almost 68% of total authors which suggests people are still slow to catch up on the topic of technostress as far as research publications are considered. The 10 most popular and productive authors can be listed as follows in Table 2.

Table 2. Performance of Authors

Rank (number of articles)	Authors	Articles	Rank (citations)	Authors	Total no of citations	Avg (Citations)
1	Tarafdar, M.	25	1	Tarafdar, M.	2222	88.88
2	Maier, C.	15	2	Tu, Q.	1571	224.4
3	Turel, O.	15	3	Ragu-Nathan, T. S	1441	240.16
4	Weitzel, T.	13	4	Maier, C.	1192	79.46
5	Laumer,S.	12	5	Ragu-Nathan, B. S	1187	395.66
6	Riedl, R.	12	6	Weitzel, T,	1162	89.38

7	Lee, J.	11	7	Laumer, S.	1145	95.41
8	Tams, S.	11	8	Lee, Y. K	816	163.2
9	Grover, V.	10	9	Chang, C. T	814	203.5
10	Brooks, S.	8	10	Cheng, Z.H	814	203.5

Source: Authors' work based on the VOSviewer Analysis

The most published author is Tarafdar, M. with 25 articles followed next by Maier, C. (15) and Turel, O. (15). Among the 10 most published authors, the last position is secured by Brooks with 8 publications. But if we try to assess the impact of the publications, the top 10 list can throw some surprises. Only 4 of the top-ranked publishers in terms of number of publications can be found in the top 10 of total citations index. Ragu-Nathan, T.S. has the highest average number of citations with an impressive average of 395.66. It can be said that researchers from Asia can churn out quality papers.

Institutions-Analysis

684 institutions have contributed to the literature on Technostress. Out of these, 56.72% of institutions have contributed only 1 article each, and 27.48% have 2 publications each. Around 20% of the contributions come from the top 10 affiliations. It can be said that only a few key institutions are regularly publishing articles related to technostress. If we analyze the Top 20 contributing institutions, the contribution from Asian institutions cannot be ignored. There are 6 Asian institutions with many papers amongst the top 20 contributing Institutions with three of them being in the Top 10. Institutions from the USA can also be attributed to contributing a lot of literature related to technostress. The highest-ranked University in the List is Nanyang Technological University (19) with a total number of 8 publications. But these papers have a good number of citations, hence the researchers have been able to maintain the quality of the papers. Only 4 Institutions, Nanyang Technological University (19), City University of Hong Kong (54), Yonsei University (73), and University of Science and Technology of China (94) are from the Top 100 QS Ranks. Interestingly, all of these are from the Asian sub-continent. It can be summarized in Table 3 that Top Asian Institutions are conducting comparatively more research as far as the topic of technostress is concerned.

Table 3. Institutions Performance

Rank	Affiliations	Country	Articles	QS Rank (2023)
1	University of Science and Technology of China	China	21	94
2	Lancaster University	UK	18	146
3	California State University, Fullerton	USA	17	-
4	University of Bamberg	Germany	14	-
5	Tampere University	Finland	12	415
6	The University of Applied Sciences	Austria	12	-
7	City University of Hong Kong	China	11	54
8	Johannes Kepler University Linz	Austria	10	350
9	The University of Toledo	USA	10	1001-1200
10	Yonsei University	S Korea	10	73
11	Alpen-Adria-Universität Klagenfurt	Austria	9	-

12	Hefei University of Technology	China	9	-
13	Qingdao University	China	9	-
14	San Francisco State University	USA	9	-
15	Catholic University of the Sacred Heart (Università Cattolica del Sacro Cuore)	Italy	9	511-520
16	Clemson University	USA	8	801-1000
17	Middle Tennessee State University	USA	8	-
18	Nanyang Technological University	Singapore	8	19
19	Jyvaskyla University	Finland	8	347
20	University of Southern California	USA	8	134

Source: Authors' work based on the VOSviewer Analysis

Journal Analysis

Journal analysis helps in getting a clear picture related to the representation by journals as they are representative of the discipline or multidisciplinary and inter-disciplinary context of the topic. A total of 639 articles were published in 308 different journals. The top 20 journals are listed below in Table 4.

Table 4. Journal Analysis

Rank (No of articles)	Sources	Articles	Rank (Citation)	Sources	Number of Citations
1	Computers In Human Behavior	49	1	Computers In Human Behavior	3701
2	International Journal of Environmental Research and Public Health	17	2	Journal Of Management Information Systems	1195
3	Information Technology & People	15	3	Information Systems Journal	1164
4	Sustainability	12	4	European Journal Of Information Systems	550
5	Information Systems Journal	10	5	Information Systems Research	465
6	Behaviour & Information Technology	9	6	Information & Management	462
7	Frontiers In Psychology	9	7	Journal Of the Association for Information Systems	442
8	Information & Management	9	8	Telematics And Informatics	348
9	Computers & Education	8	9	International Journal of Environmental Research and Public Health	328
10	Journal Of the Association for Information Systems	8	10	Computers & Education	304

11	Telematics And Informatics	8	11	International Journal of Information Management	266
12	Communications Of the Association for Information Systems	7	12	International Journal of Psychology	246
13	Internet Research	7	13	Communications Of the Association for Information Systems	239
14	Journal Of Management Information Systems	7	14	Journal Of The Association For Information Science And Technology	222
15	Cognition Technology & Work	6	15	Media Psychology	216
16	International Journal of Information Management	6	16	Information Technology & People	212
17	Journal Of Business Research	6	17	Communications Of The Acm	186
18	AMCIS 2017 Proceedings	5	18	Applied Psychology-An International Review-Psychologie Appliquee-Revue Internationale	184
19	European Journal of Information Systems	5	19	Internet Research	173
20	Information Systems Frontiers	5	20	MIT Sloan Management Review	172

Source: Authors' work based on the VOS viewer Analysis

The top 20 journals have published 1/3rd of the total publications (212 articles). Around 33% of the journals have published only 1 article each and around 30% have published 2 articles each. *Computers in Human Behavior* emerges as the Top contributing journal with a total of 49 publications followed by the *International Journal of Environmental Research and Public Health* (17 articles), *Information Technology & People* (15 articles), *Sustainability* (12 articles), and *Information Systems Journal* (10 articles). These journals cover a very wide and diverse range of topics. *Computers in Human Behavior* dedicates itself to covering the topics related to the use of computers with a psychological perspective. It is considered one of the top-ranked journals of psychology. The journal is known for exploring topics like the impact of technology on the psychology of individuals, and their psychological impacts on the personality, cognition, etc. of the users. Thus, the topic of technostress fits well within the scope of the Journal. *International Journal of Environmental Research and Public Health* covers topics related to environmental health and public health. It links scientific disciplines like computer science with public health and quality of life. It is very comprehensive with a broad coverage of a large spectrum of related topics. *Information Technology & People* publish articles that explore the ramifications of the use of Information Technology on people in society or as individuals working in an organization. The benefits, as well as the constraints both, make up the part of the articles published in this journal. *Sustainability* publishes cross-

disciplinary articles related to scientific predictions and assessment of their impact. *Information Systems Journal* concerns itself with articles discussing the problematic and investigative phenomena that are urgent and related to organization, management, and social areas. If we investigate the number of citations scored by Journals, Computers in Human Behavior (3701) scores the highest citations followed by Journal of Management Information Systems (1195) and Information Systems Journal (1164). Computers In Human Behavior can be said to be the most influential journal as it not only published the greatest number of articles but has also scored highest in the terms of number of citations.

Articles' Citation Analysis

The number of citations achieved by the articles can easily give an idea of the impact of the study, its relevance in the field of study, the quality of the study, and its theoretical contributions. According to (Culnan, 1986) and (Furrer et al., 2008), the higher the number of citations received by an article, the higher its impact. The selected articles contained a total of 21,036 cited references. The top 20 cited articles are summarized in Table 5 below.

Table 5. Total Citations per Authors

Rank	Total Citations	Title	Author(s)	Country of the first author	Journal / Book	TC/Y
1	465	The Consequences of Technostress for End Users in Organizations: Conceptual Development and Empirical Validation	(Ragu-Nathan et al., 2008)	US	Information Systems research	33.21
2	394	The dark side of smartphone usage: Psychological traits, compulsive behavior, and technostress	(Y. K. Lee et al., 2014)	Taiwan	Computers in Human Behavior	49.25
3	361	The Impact of Technostress on Role Stress and Productivity	(Tarafdar et al., 2007)	UK	Journal of Management Information System	24.06
4	251	Information and communication technology overload and social networking service fatigue: A stress perspective	(A. R. Lee et al., 2016)	Korea	Computers in Human Behavior	41.83
5	240	The effects of technostress and switching stress on discontinued use of social networking services: a study of Facebook use	(Maier, Laumer, Weinert, et al., 2015)	Germany	Information Systems Journal	34.28
6	239	Giving too much social support: social overload on social networking sites	(Maier, Laumer, Eckhardt, et al., 2015)	Germany	European Journal of Information System	34.14
7	201	Understanding Employee Responses to Stressful Information Security Requirements: A Coping Perspective	(D'Arcy et al., 2014)	USA	Journal of Management Information System	25.12

8	190	Do you get tired of socializing? An empirical explanation of discontinuous usage behaviour in social network services	(S. Zhang et al., 2016)	China	Information & Management	31.66
9	176	Shinrin-Yoku (Forest Bathing) and Nature Therapy: A State-of-the-Art Review	(Hansen et al., 2017)	USA	International Journal of Environmental Research and Public Health	35.2
10	160	Technostress: negative effect on performance and possible mitigations	(Tarafdar et al., 2015)	UK	Information Systems Journal	22.85
11	151	Does personal social media usage affect efficiency and well-being?	(Brooks, 2015)	USA	Computers in Human Behavior	21.57
12	140	Empirical investigation of Facebook discontinues usage intentions based on SOR paradigm.	(Luqman et al., 2017)	China	Computers in Human Behavior	28
13	138	Impact of digital surge during Covid-19 pandemic: A viewpoint on research and practice	(De et al., 2020)	India	International Journal of Information Management	69
14	128	Technostress creators and job outcomes: theorizing the moderating influence of personality traits	(Srivastava et al., 2015)	France	Information Systems Journal	18.28
15	123	The dark side of technologies: Technostress among users of information and communication technologies	(Salanova et al., 2013)	Spain	International Journal of Psychology	12.30
16	117	The technostress trifecta - techno eustress, techno distress, and design: Theoretical directions and an agenda for research	(Tarafdar et al., 2019)	UK	Information Systems Journal	23.4
17	113	Exploring the effect of overload on the discontinuous intention of social media users: An S-O-R perspective	(Cao & Sun, 2018)	China	Computers in Human Behavior	28.25
18	108	On the biology of technostress: literature review and research agenda	(Riedl, 2012)	Austria	Database for Advances in Information System	12
19	108	Antecedents and effects of social network fatigue	(Ravindran et al., 2014)	Singapore	Journal of Association of Information Science and Technology	13.5
20	104	Interrupting the Workplace: Examining Stressors in an Information Technology Context	(Galluch et al., 2015)	USA	Journal of the Association for Information Systems	14.85

Source: Authors' own work based on the VOSviewer Analysis

The most cited article is "The Consequences of Technostress for End Users in Organizations: Conceptual Development and Empirical Validation" published by (Ragu-Nathan et al., 2008) in the journal Information Systems Research. Around 25% of the articles are published in the journal Computers in Human Behavior. All these have a high number of citations as well. One surprising entry in this list is a very recent journal titled "Impact of Digital Surge during Covid-19 Pandemic: A Viewpoint on Research and Practice" by (De' et al., 2020) published in 2021. It can be said that this article has proved its relevance in the concerned area in a very short period with an average citation of 69.

Keywords Analysis

According to (Tian et al., 2018), keywords not only provide an idea about the content of the article but also provide a basic summary of the methods, objectives, and results of the research work done. The more frequently a keyword appears, the more attention that topic receives. A total of 1,647 different keywords were identified in the 639 documents used for analysis. The most frequently cited 20 keywords can be summarized as follows.

Table 6. Keyword Frequency Distribution

Keyword	Frequency
Technostress	233
Stress	46
Social media	29
Information overload	25
Job satisfaction	24
Covid-19	23
Technostress	22
Work-family conflict	15
Technology	14
Technostress creators	14
Strain	13
Productivity	12
Technological stress	12
Coping	11
Social overload	11
Anxiety	10
Burnout	10
Performance	9
Communication overload	9
Mental health	9

Source: Authors' work based on the VOS viewer Analysis

It can be concluded by examining the list of frequently used words that technostress is closely related to an overload of information and being social via social media and might lead to conflict and stress as well. Productivity is also impacted by technostress and might lead to anxiety and burnout.

SCIENCE MAPPING ANALYSIS

Network analysis was used to carry out the science mapping. Several software tools with varying features have been developed in recent years to conduct network analysis. We use a VOS viewer to perform science mapping analyses. VOS viewer offers "a low-dimensional visualization in which objects are located in such a way that the distance between any pair of objects accurately reflects their similarity"(Van Eck & Waltman, 2007). Co-citation frequency and patterns provide information about knowledge domains because higher co-citation frequencies between articles indicate stronger relationships and groups of highly co-cited articles represent collective knowledge (Feng et al., 2015; Liu et al., 2015). Co-citation occurs when both A and B (articles, authors, or journals) are cited by C (article, author, or journal)(Leblanc-Proulx, 2018). Co-citation analysis can be either two ways namely by assessing authors and secondly with journals to classify and find the connections between authors, journals, articles, and nations. The present study executed scientific mapping in two ways: (a) Co-citation -authors and (b) Co-citation -references.

Co-citation analysis of cited authors

From the data set comprising of 639 articles the cited references data was processed, and the researchers obtained a pool of 15,305 cited authors. This pool was further narrowed down to authors with at least 30 citations, yielding 80 authors who were cited 6076 times. Each cluster includes at least a few prime technostress researchers whose contributions are of utmost significance to the field of technostress.

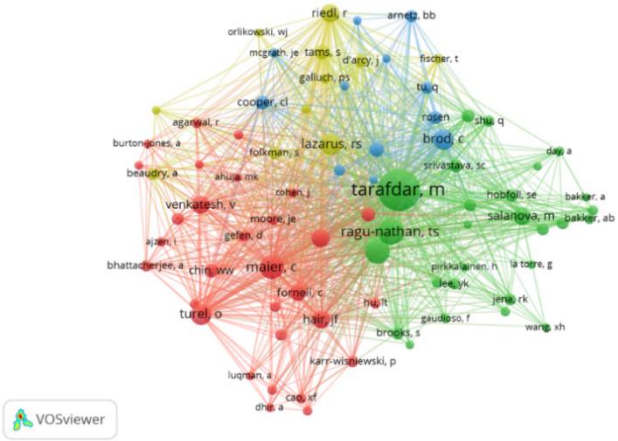

Figure 2. Co-citation analysis of cited authors
Source: WoS Visualisation: VOSviewer

Figure 2 depicts the four main clusters identified, as well as the fact that "Tarafdar" and "Maier" are the highest co-cited authors (630 co-citations), followed by "Tarafdar" and "Ragu-Nathan" (613 co-citations), "Tarafdar" and "Ayyagari," 609 co-citations), and "Tarafdar" and "Turel" (524 co-citations).In cluster 2, for example, Tarafdar's work aims at the factors creating technostress and their effect on individual performance and technology-driven innovations and overall performance, which had a significant influence on the works of authors such as Srivastava or Salanova, both of whom are visually close to Tarafdar." Similarly,

the work of other prominent cluster 2 authors such as Ragu-Nathan and Ayyagari is inextricably linked to the Tarafdar.

Co-citation analysis of cited references

The researchers used co-citation analysis, which "is a unique method for studying the cognitive structure of science"(Surwase et al., 2011). With a minimum of 15 citations, 124 articles are cited 21036 times. This reduced sample was used for the co-citation analysis. Figure 3 depicts how the most regularly co-cited articles are linked within a single cluster. The co-citation analysis of cited references created four clusters explicitly:

Cluster 1 researchers have presented a comprehensive theoretical, conceptual, and empirical perspective on informational and technological overload. Researchers covered in Cluster 1 have a complete perspective on Informational and technological overload, a seemingly crucial concept in technostress. (Beaudry & Pinsonneault, 2005, 2010; Cao & Sun, 2018; Chin et al., 2003; Podsakoff et al., 2007; Turel, 2015; Venkatesh et al., 2012) in their research have tried to shed light on the various psychological and behavioral consequences of technostress. Other authors such as (Brooks, 2015; Turel et al., 2011; Turel & Serenko, 2012) have discussed the concept of technological addiction in their studies. They have discussed how this addiction is distracting the workers from their primary and official tasks (Dhir et al., 2018; Eppler & Mengis, 2004; Luqman et al., 2017; Y. Zhang et al., 2020).

Cluster 2 researchers have placed different perspectives, concepts, and models for predicting technostress. Different researchers have tried to study the various perspectives of the technostress like (Hobfoll, 1989) in his study has mentioned current conceptualizations. (Tarafdar et al., 2014) study the technostress by integrating literature from sales, technostress, and social cognitive theory. (Ayyagari et al., 2011; Day et al., 2012; La Torre et al., 2019) has studied the impact of technostress on well-being and personal life. Some other studies (Nimrod, 2018) in their research have developed a scale, which was designed to measure technostress. (Pirkkalainen et al., 2018) developed a "technostress trifecta"—techno eustress, techno distress, and information systems design principles for technostress.

Cluster 3 is primarily concerned with the relationship between technostress and organizational structure. The studies in Cluster 3 attempted to examine the relationship between the role of organizational structure in technostress by utilizing various variables such as the level of innovation, technology, and centralization in a specific organization. (Compeau & Higgins, 1995) discovered that individuals with self-efficacy traits have a lower organizational impact on technostress. In their study, (Tarafdar et al., 2010; Tu et al., 2005) discovered that organizations can help to overcome technostress by enabling better technical literacy and technical support.

Cluster 4 is mostly concerned with different approaches that different researcher have used in their studies. (Galluch et al., 2015) In their study used the transactional model of stress as the theoretical framework, to scrutinize the effect of ICT on stress. Other biological measures such as stress hormone levels and cardiovascular activity are important predictors of human health, making them an important component to design stress perceptions. (Tams et al., 2018) In their study have developed a mediated moderation model explaining why older

people may be more affected by the negative impacts of the technostress as compared to younger people.

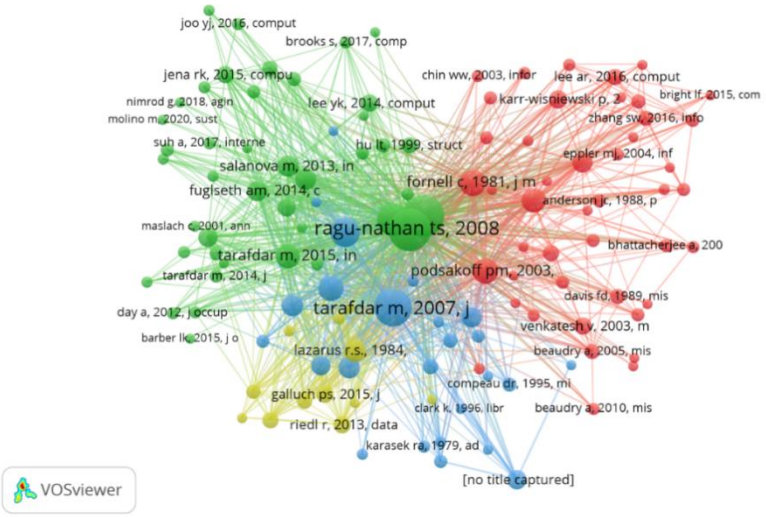

Figure 3. Co-citation analysis of cited references
Source: WoS Visualisation: VOSviewer

CONCLUSION

To begin with, the study surpasses a systematic review of the literature on technostress by using bibliometric analysis to determine the most impactful and consequential works and authors based on their work's citations and co-citations. Furthermore, using article co-citation analysis, the study has identified four clusters of articles focusing on specific aspects of technostress. (Information and technological overload and social media fatigue; various concepts, viewpoints, and models to predict technostress; organization and technostress; and different approaches to study technostress). These research areas range from different perspectives and concepts used to study technostress (Cluster 2) to different approaches to investigating technostress (Cluster 4), while also considering technology and information overload, social media fatigue (Cluster 1), and the relationship between organizational factors and technostress (Cluster 3). This portrayal of the literature considers establishing collaborative research projects with other researchers, research centers, and institutions, based on similar research goals and objectives. Furthermore, this work successfully linked current research themes to new as well as understudied themes. We used a standard process to identify these "research gaps" and "dead spots", in which the researchers thoroughly examined each theme and connected its content to the existing literature.

THEORETICAL AND PRATICAL IMPLICATIONS

Theory

Significant theoretical contributions are also expected from this paper for a few reasons. First, bibliometric and network approaches are being employed by this study to identify the highly significant articles, institutions, scholars, and countries based on the tally of articles published and citations received. Second, academic scholars and technostress researchers will be able

to quickly locate researchers, institutions, and nations who are researching specific research topics and areas. As a result, researchers with similar interests can share ideas, work together on collaborative research projects, and discuss their findings with the lead authors and researchers from the concerned areas. Third, the findings of this research may help businesses and government agencies identify the best technostress research institutions and centers for research projects related to technostress. Finally, the editors of journals organizing regular and special issues on technostress-related topics can identify and invite prominent scholars and organizations.

Policy Development and Managerial Practice

The concerned study provides numerous prospects to public officials, institutions, and professionals, as most of them are struggling to tackle the side effects of technostress, especially in the post-COVID-19 era. This research demonstrates managers with differing viewpoints and schools of thought that help them comprehend the impacts of workplace technostress. Such information is crucial for managers because it enables them to recognize the consequences of technostress on employee productivity levels. Based on the information provided by this piece of research, several developmental projects can be initiated related to access to technological stress insights, and adopt various policies that will help them reduce or eliminate the level of technostress and benefit the health and well-being of their employees.

LIMITATION AND FUTURE RESEARCH

To examine the consequences, various theories have been used like the coping theory, the theory of planned behavior (TPB), and the theory of acceptance (TAM). Nevertheless, specific criteria have been used to choose all the concerned articles. To verify the chosen search string and the academic database, the established criteria were to restrict the initial search to articles published in the WoS database and ignore other databases like Scopus, ABI/Inform, and Business Source Complete. But one of the most prevalent issues in bibliometric analysis is that the researchers use specific keywords for carrying out their search, like the authors did in this case and it is very much possible that another string of keywords and keyword combinations could have resulted in a different dataset. Further, the researchers used network analysis and VOS viewer software to conduct co-citation analysis. However, other techniques and software, such as Gephi, could be used. Finally, analyses of co-citations for both articles and researchers produced four research clusters.

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