

Digitalization Landscape Evolution in Business Research: VOSviewer and R-Tool Bibliometric Review, (2018 – 2022)

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Abstract

Digitalization as an emerging trend of improving organizational efficiency and value creation, presents enormous opportunities and challenges to the business world. This study seeks to uncover predominant and emerging trends in digitalization in both developed and emerging economies based on data from scopus database over a five (5) period from 2018 to 2022. A comprehensive bibliometric analysis was made by analyzing contributions and relationships among authors, institutions, countries and journal publications on digitalization. A total of 1,171 journal publications were obtained from scopus database and bibliometric analysis was performed with VOSviewer 1.6.18 and R 4.2.1 tools. It revealed that 3420 Authors have authored documents with an annual growth rate of 28.78% with international co-authorships collaborations of 25.7%. Authors “Parida V” and “Sjodin D” were the most publishers and made most bibliographic coupling, “Russian Federation”, “Germany”, and “United Kingdom” were the top publishing and collaborated countries. The most co-cited authors and journals were “Parida, V.” and “Brynjolfsson, E.” and “Journal of Business Research” and “Industrial Marketing Management” respectively. The publications have proven interdependency and strong network across different jurisdictions and economies indicating their strong impact on digitalization drive across the world and the need to collaborate more effectively as the surest way for achieving a globally digitalized economy in the future as a collective goal.

Keywords: Bibliometric, Digitalization, Scopus, VOS Viewer, Co-authorship, Bibliographic coupling, Co-citation.

I. INTRODUCTION

Digitalization is an evolving trend for all economies to help improve economic sustainability, increase competition, and market dominance and in the long run become economically sufficient. Digitalization is how digital technologies are deployed to do business in a digitalized business environment through changing business processes to create value. The growth of the digitalization process that leads to the entire business transformation into new opportunities is digital transformation (Gobble, 2018). The integration of digital technologies into work processes creates lot of opportunities and challenges for economies and businesses. In this modern age, it is without doubt that we all live in an ever-changing digital society with a more demanding use of digital technologies for the digitalization

of our daily activities to effectively achieve a complete digital transformation of our daily lives (Al-Zubi, 2021; Crittenden et al., 2019; Kwilinski et al., 2020; Serpa et al., 2020; Serpa & Ferreira, 2020).

Digitalization of a country, an economy or business is to automate economic or business activities and smoothen work processes faster and easier, the alteration of business processes with information technology. This will help increase economic output and increase revenue and profit, as much for organizations and businesses. Digitalization helps firms to optimize current business processes through efficient restructuring of processes which creates value to the business and improves customer value, satisfaction and experience (Björkdahl, 2020; Pagani & Pardo, 2017). Digitalization of business work processes creates value addition to the business’s products

and services by improving customer satisfaction and creating customer loyalty. However, the cost of automation of activities is still a bottleneck on developing countries since it is very expensive to digitalize an economy and improve on economic activities. Countries and businesses rather resort to phase-by-phase automation of economic activities and business processes to gradually achieve full digitalization in the long run without financial distress. At the business and firm level, digitalization has cost most businesses to fold up due to their inability to catch up with the ever-evolving technological economic environment. Very truly, there is an increasing influence of digital technology on businesses information management and decision making which is not only improving an organizational performance but also how people or workers think (Almeida et al., 2020; Beckers et al., 2017; Branca et al., 2020; Endres et al., 2020; Pagani & Pardo, 2017; Sá et al., 2021).

The need to transform business processes digitally is primarily engineered by rapid growth of electronic commerce and the influx of numerous digital technologies into our daily lives like online payment systems, cryptocurrencies and cloud computing, which have become a world-wide adoption and makes it compelling to adopt or be flashed out of business (Ng & Wakenshaw, 2017; Serpa & Ferreira, 2020). The eruption of stiff competition among businesses has moved from traditional walk-in sales and purchases to digital platforms with intense digital transformation of business processes where only digitalized businesses are the one calling the shot and leading the market share (Vasilev et al., 2020).

Digital insurgency is indoctrinating consumers behaviour, customer satisfaction and loyalty. Customers gradually move towards digital stores patronage and have become increasingly well informed about the digital space participation for their services and products (Sá et al., 2021; Serpa et al., 2020). This evolution enables customers to also create awareness and value for the businesses by making product and services reviews for other customers and prospective buyers to assess product and service quality (Beckers et al., 2018; Kannan & Li, 2017; Verhoef et al., 2017). If businesses are unable to adopt digital technologies to help digitalized to better serve customers' needs, then they will become outdated in business because they will no more be attractive to customers and will be taken over by only businesses that have adopted these modern technologies (Ciasullo & Lim, 2022; Kannan & Li, 2017; Kuusisto, 2017; Mostaghel et al., 2022; Parviainen et al., 2017).

There are several articles published on digitalization and its transformation of business processes across the globe in different fields and economies that seek to educate and inform the world about the rapid evolution and the need to digitalize. This study used bibliometric analysis to study and analyzed the current literature on digitalization and drew some important inferences on authors network, country collaborations, and frequently cited documents. This paper constructed and visualized the network to present intellectual structure and emerging trends using

VOSviewer and R software (Donthu et al., 2020; Donthu et al., 2021). Consequently, this paper seeks to address the following research questions.

- What is the evolutionary landscape of digitalization research?
- How influential and impactful are digitalization research works?
- What is the structure and relationships among digitalization research efforts?

II. METHODOLOGY

The study conducted a bibliometric analysis on Digitalization as a modern evolution trend in two stages. The stage 1 was conducted to assess the performance analysis of the elements, which looked at the contributions of the various elements (authors, country, institutions, and documents) to the research. The stage 2 assessed the science mapping which looked at the relationships between and among all the elements in the various literature such as bibliometric coupling, co-authorship and co-citations relationships (Andersen, 2019; Bretas & Alon, 2021; Donthu et al., 2021; Donthu et al., 2020).

➤ *Data Collection and Analysis*

The scopus database was used to extract the data set for the bibliometric analysis, which is one of the databases widely used for this type of research alongside web of science (Del Barrio-Garcia & Prados-Peña, 2019; Muñoz-Leiva et al., 2015; Rodríguez-López et al., 2020). An extensive literature search on digitalization was performed using scopus database with top rated eleven (11) journals in the field of human resource management as source titles on July 14, 2022. A total result of 12,416 documents journal articles were initially obtained and were further limited to years 2018 to 2022 in the field of social sciences, business management and economics and with publications in English. This further resulted in a limited result of 643 journal articles.

A further search for journal articles was done by scopus using the identified keyword “Digitalization” and 25,657 documents were obtained. The search was further limited to years 2018 to 2022 for all open access documents in the field of social sciences, business management and economics and with journal publications in English. This resulted in a limited result of 1,171 journal articles on digitalization. The following steps are the methodological approach towards the identification of the digitalization keyword and the output of the keyword search.

• *Step 1: Scopus Journal Search*

✓ *12,416 Document Results*

SRCTITLE ("Human Resource Management Journal (UK)" OR "British Journal of Industrial Relations" OR "Human Resource Management (USA)" OR "Industrial Relations" OR "Work, Employment and Society" OR "Economic and Industrial Democracy" OR "European Journal of Industrial Relations" OR "Human

Resource Management Review” OR “*ILR Review*” OR “*Industrial Law Journal*” OR “*Industrial Relations Journal*”).

- *Step 2: Scopus Journal Limited Search*

- ✓ *643 Document Results*

SRCTITLE ("Human Resource Management Journal (UK)" OR "British Journal of Industrial Relations" OR "Human Resource Management (USA)" OR "Industrial Relations" OR "Work, Employment and Society" OR "Economic and Industrial Democracy" OR "European Journal of Industrial Relations" OR "Human Resource Management Review" OR "ILR Review" OR "Industrial Law Journal" OR "Industrial Relations Journal") AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "ECON")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j"))

- *Step 3: Scopus Keyword General Search*

- ✓ *25,657 Document Results*

TITLE-ABS-KEY ("digitalisation")

- *Step 4: Scopus Keyword Limited Search*

- ✓ *1,171 Document Results*

TITLE-ABS-KEY ("digitalisation") AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "ECON")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j"))

- *Analytical Tools*

The 643 journal articles were analyzed using the R tool for the performance analysis by observing the extent of publications and collaborations on digitalization among various authors and publishers. The VOS viewer tool was used for the science mapping to identify the “digitalization” as one of the desired author keywords by network and overlay visualization for bibliometric analysis and investigation. Bibliometric analysis was conducted with these journal articles published on digitalization in scopus database with the VOS viewer and R tool software (Del Barrio-Garcia & Prados-Peña, 2019; Muñoz-Leiva et al., 2015).

III. BIBLIOMETRIC ANALYSIS

The approach to bibliometric analysis was conducted in two phases, namely the performance analysis which is

the widespread of digitalization research across countries, institutions and authors. It further detailed the contributions of the elements of analysis (authors, country, institutions, and documents) and the science mapping which looked at the relationships between and among all the elements (Donthu et al., 2020).

- *Performance Analysis*

The performance analysis explained the contributions each of the elements of analysis made to the digitalization research. This descriptive analysis showed how the authors, countries, institutions, and journals contributed to the research field. These contributions are shown in the summary information of the data set, the most impactful authors, sources, institutions, and countries as indicated in the tables below.

The main information in table 1 below indicated that from 2018 to 2022, a total of 1,171 documents were obtained with an annual growth rate of publications of 28.78% per the search criteria and with average citations per document at 9.755. An average of 3.23 documents were co-authored by 3,420 authors with international co-authorships collaboration of 25.70%. This is an indication that digitalization is increasingly attracting international research interest among authors and research institutions to help provide insight into the digitalization concept and its importance.

The annual scientific production showed the yearly distribution of the publications of the 1171 journal articles in figure 1 above. Most publications were made in the year 2021 with 400 publications followed by 2020 with 285. This means that digitalization has gained much attention over the years at an increasing rate of publication each year. As at mid-year 2022, there has been 220 publications so far, signaling that more publications would be made by the end of the year, indicating more interest in exploring digitalization by researchers.

Many authors have made great impact with their publications over the period with the top 20 authors having 96 publications which received 3,872 total citations. The most impactful author, “*Parida V*” had 19 (20%) publications and attracted 835 (22%) citations out of 20 authors. The next author was “*Sjödin D*” with 9 (0.09%) publications and 253 (0.07%) attracted citations (Table 2). The top 20 sources had 209 publications and 3,624 citations. In Table 3, the top 5 most impactful source journals had 91 (43.54%) total publications out of the top 20 journal publications of 209 with 1,909 (52.64%) out of 3,624 total citations. The top 3 most impactful sources are the “*Journal of Open Innovation: Technology, Market, And Complexity*”, “*Journal of Business Research*” and “*Technological Forecasting and Social Change*”. The “*Journal of Open Innovation: Technology, Market, And Complexity*” had 31 (14.83%) out of the 209 publications with 254 citations received, representing the most impactful and influential journal since it had the highest number of publications. The “*Journal of Business Research*” and “*Technological Forecasting and Social Change*” all had 17 (8.13%) publications each with 1301

and 210 of citations respectively. The top 20 most impactful institutions had a total of 66 articles and 1106 citations. “Copenhagen business school” from Denmark had 5 (7.58%) publications with 35 (3.16%) citations and total link strength of 4 (Table 4), followed by “Linköping university” from Sweden with 4 (6.06%) publications and 56 (5.06%) citations. However, “Durham university” from United Kingdom and “Karlstad university” from Sweden had only 3 (4.55%) of top 20 publications with 311 (28.12%) and 273 (24.68%) citations impact respectively.

Majority of the authors came from “Germany” with 81 (15.43%) articles published followed by “Sweden” and “United Kindom” with 59 (11.24%) articles each out of the top 20 countries’ total of 525 articles with the top 5 constituting 292 (55.62%) including “Finland and Ukraine” (Table 5), but the most impactful top 20 countries had 1,308 documents and 19,593 citations with the top 5 countries having 661 (50.54%) documents, 10,774 (54.99%) citations and 581 (43.13%) link strength.

The top 3 are “Russian Federation”, “Germany”, and “United Kingdom” with 187 (14.3%), 142 (10.86%) and 137 (10.47%) documents published and 855 (4.36%), 2,390 (12.20%), and 2,849 (14.54%) citations received respectively (Table 6).

The top 20 most locally cited documents summed to 172 while globally cited documents summed to 2,356 out of which the top 5 were 81 (47.09%) and 1212 (51.44%). The top 3 locally cited documents came from “Kohtamäki M, 2019, J Bus Res”, “Warner Ksr, 2019”, “Long Range Plann” and “Sklyar A, 2019, J Bus Res” with 21 (12.21%), 20 (11.63%), 19 (11.05%) citations but with 193, 316, and 171 global citations respectively. The most globally cited document came from “Verhoef Pc, 2021, J Bus Res”, “Warner Ksr, 2019, Long Range Plann” and “Kraus S, 2020, Int J Entrep Behav Res” with 318 (26.24%), 316 (26.07%) and 214 (17.66%) global citations and 8, 20 and 4 local citations (Table 7).

Table 1 Description of Data Set

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2018:2022
Sources (Journals, Books, etc)	469
Documents	1171
Annual Growth Rate %	28.78
Document Average Age	1.58
Average citations per doc	9.755
References	63355
DOCUMENT CONTENTS	
Keywords Plus (ID)	1525
Author's Keywords (DE)	3811
AUTHORS	
Authors	3420
Authors of single-authored docs	167
AUTHORS COLLABORATION	
Single-authored docs	178
Co-Authors per Doc	3.23
International co-authorships %	25.7

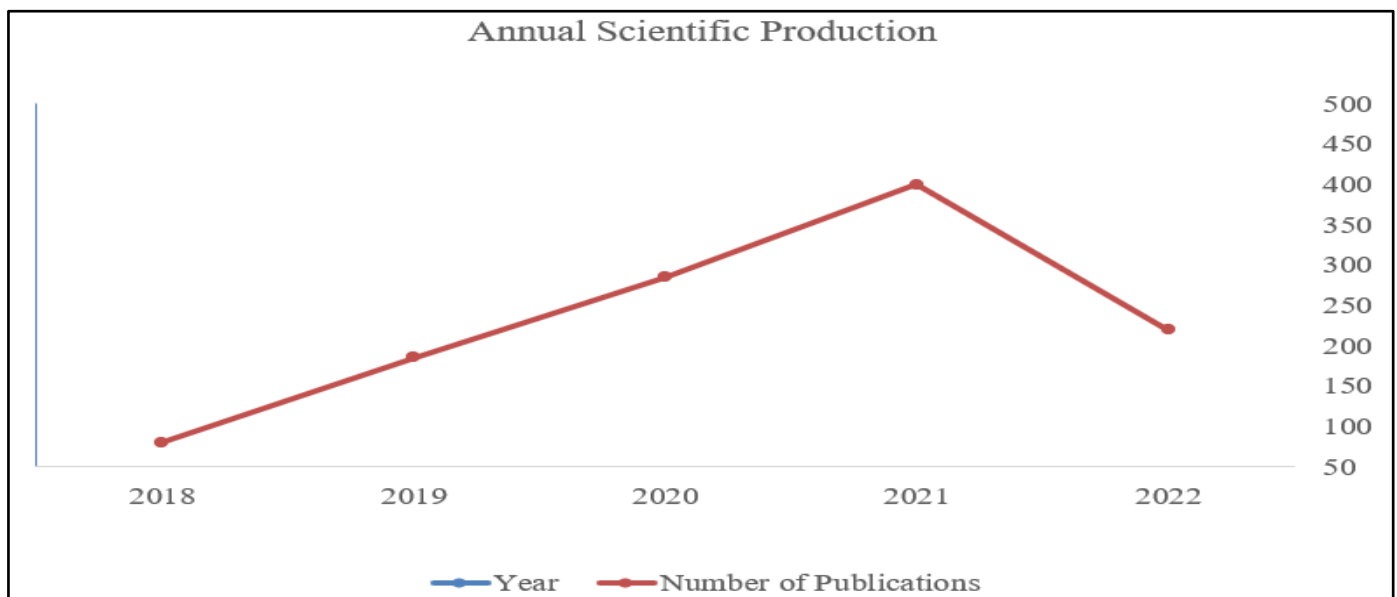


Fig 1 Annual Scientific Production

Table 2 20 Most Impactful Authors

Rank	Author	h_index	g_index	m_index	TC	NP	PY_start
1	Parida V	13	19	2.6	835	19	2018
2	Sjödin D	7	9	2.333	253	9	2020
3	Kraus S	6	6	2	358	6	2020
4	Wincent J	6	6	1.5	321	6	2019
5	Caputo A	4	4	1.333	115	4	2020
6	Kohtamäki M	4	4	1	320	4	2019
7	Kowalkowski C	4	5	1	431	5	2019
8	Oghazi P	4	5	0.8	282	5	2018
9	Srai Js	4	4	1	102	4	2019
10	Bouncken RB	3	4	1	106	4	2020
11	Gebauer H	3	3	0.75	236	3	2019
12	Kamalaldin A	3	3	1	86	3	2020
13	Linde L	3	3	1	117	3	2020
14	Lorentz H	3	3	0.75	77	3	2019
15	Naveed N	3	3	0.6	51	3	2018
16	Neittaanmäki P	3	3	0.6	51	3	2018
17	Pesch R	3	3	0.75	27	3	2019
18	Rubanov P	3	3	0.75	41	3	2019
19	Ruiz-Alba JL	3	3	1	35	3	2020
20	Senarak C	3	3	1	28	3	2020

Table 3 20 Most Impactful Sources

Rank	Sources	h	g	m	TC	NP	PY_start
1	Journal Of Open Innovation: Technology, Market, And Complexity	9	14	2.25	254	31	2019
2	Journal Of Business Research	12	17	2.4	1301	17	2018
3	Technological Forecasting and Social Change	8	14	1.6	210	17	2018
4	Economic Annals-xxi	5	6	1	61	15	2018
5	Technology Innovation Management Review	5	8	1.25	83	11	2019
6	Technology In Society	6	10	1.2	136	10	2018
7	Business Informatics	5	8	1	68	10	2018
8	Problems And Perspectives In Management	4	6	0.8	43	10	2018
9	Entrepreneurship And Sustainability Issues	6	9	1.5	138	9	2019
10	International Journal of Energy Economics and Policy	3	6	0.75	50	9	2019
11	International Journal of Economics and Business Administration	3	6	0.75	39	9	2019
12	International Journal of Recent Technology and Engineering	3	4	0.75	23	8	2019
13	Industrial Marketing Management	6	7	2	372	7	2020
14	International Journal of Production Economics	6	7	2	247	7	2020
15	Polish Journal of Management Studies	4	7	0.8	122	7	2018
16	Administrative Sciences	4	7	0.8	91	7	2018
17	Finance: Theory And Practice	2	4	0.5	19	7	2019
18	Production Planning and Control	6	6	1.5	162	6	2019
19	Futures	6	6	1.5	122	6	2019
20	Foresight And STI Governance	4	6	0.8	83	6	2018

h-h-index, g-gindex, PY-start- Publication year-start

Table 4 20 Most Impactful Institutions

Rank	Organization	Countries	Documents	Citations	Total Link Strength
1	Copenhagen Business School	Denmark	5	35	4
2	Linköping University	Sweden	4	56	1
3	Financial University	Russia	4	1	0
4	Lucian Blaga University of Sibiu	Romania	4	6	0
5	Warsaw University of Technology	Poland	4	70	2
6	Karlstad University	Sweden	3	273	8
7	Kazan National Research Technological University	Russia	3	5	0
8	University of Vaasa	Finland	3	34	3

9	University of Vaasa	Finland	3	47	2
10	Stockholm School of Economics	Sweden	3	22	2
11	Southwest State University	Russia	3	4	0
12	Durham University	United Kingdom	3	311	1
13	Luleå University of Technology	Sweden	3	19	3
14	University of Jyväskylä	Finland	3	51	3
15	Silesian University of Technology	Poland	3	5	3
16	Silesian University of Technology	Poland	3	5	3
17	Financial University Under the Government of the Russian Federation	Russia	3	32	0
18	Peter The Great St. Petersburg Polytechnic University	Russia	3	17	2
19	Peter The Great St. Petersburg Polytechnic University	Russia	3	62	2
20	International Institute for Applied Systems Analysis (IIASA)	Austria	3	51	3

Table 5 20 Corresponding Authors' Country

No.	Country	Articles	SCP	MCP	Freq	MCP_Ratio
1	Germany	81	66	15	0.069	0.185
2	Sweden	59	33	26	0.05	0.441
3	United Kingdom	59	28	31	0.05	0.525
4	Finland	52	32	20	0.044	0.385
5	Ukraine	41	36	5	0.035	0.122
6	Italy	28	19	9	0.024	0.321
7	Norway	22	18	4	0.019	0.182
8	Poland	21	18	3	0.018	0.143
9	Switzerland	21	12	9	0.018	0.429
10	Netherlands	19	11	8	0.016	0.421
11	Spain	16	12	4	0.014	0.25
12	Austria	15	9	6	0.013	0.4
13	Hungary	14	12	2	0.012	0.143
14	Malaysia	13	8	5	0.011	0.385
15	USA	12	7	5	0.01	0.417
16	China	11	4	7	0.009	0.636
17	Czech Republic	11	8	3	0.009	0.273
18	France	10	6	4	0.009	0.4
19	Indonesia	10	10	0	0.009	0
20	Serbia	10	6	4	0.009	0.4

Table 6 20 Most Impactful Countries

Rank	Country	Documents	Citations	Total Link Strength
1	Russian Federation	187	855	41
2	Germany	142	2390	112
3	United Kingdom	137	2849	191
4	Finland	99	2685	131
5	Sweden	96	1995	106
6	Ukraine	86	186	25
7	Italy	61	974	85
8	United States	57	1343	107
9	Norway	54	1215	76
10	Switzerland	54	1046	93
11	Poland	49	408	33
12	Spain	46	585	49
13	India	36	349	36
14	Netherlands	36	767	45
15	Australia	31	310	47
16	Austria	29	275	32
17	China	29	275	46
18	France	27	787	59

19	Czech Republic	26	197	23
20	Romania	26	102	10

Table 7 20 Most Cited Documents

Rank	Document	DOI	Year	LC	GC	LC/GC Ratio (%)	NLC	GLC
1	Kohtamäki M, 2019, J Bus Res	10.1016/j.jbusres.2019.06.027	2019	21	193	10.88	26.25	12.22
2	Warner Ksr, 2019, Long Range Plann	10.1016/j.lrp.2018.12.001	2019	20	316	6.33	25.00	20.01
3	Sklyar A, 2019, J Bus Res	10.1016/j.jbusres.2019.02.012	2019	19	171	11.11	23.75	10.83
4	Bouwman H, 2018, Digit Poli Regul Govern	10.1108/DPRG-07-2017-0039	2018	12	108	11.11	13.33	4.88
5	Kamalaldin A, 2020, Ind Mark Manage	10.1016/j.indmarman.2020.02.004	2020	9	66	13.64	21.92	4.82
6	Verhoef Pc, 2021, J Bus Res	10.1016/j.jbusres.2019.09.022	2021	8	318	2.52	39.51	49.92
7	Tronvoll B, 2020, Ind Mark Manage	10.1016/j.indmarman.2020.02.005	2020	8	101	7.92	19.49	7.37
8	Sjödín D, 2020, J Bus Res	10.1016/j.jbusres.2020.01.009	2020	8	96	8.33	19.49	7.01
9	Balsmeier B, 2019, Res Policy	10.1016/j.respol.2019.03.010	2019	7	76	9.21	8.75	4.81
10	Schwarz Müller T, 2018, Manag Rev	10.5771/0935-9915-2018-2-114	2018	7	99	7.07	7.78	4.47
11	Caputo A, 2021, J Bus Res	10.1016/j.jbusres.2020.09.053	2021	6	59	10.17	29.63	9.26
12	Sklyar A, 2019, J Mark Manage	10.1080/0267257X.2019.1600572	2019	6	37	16.22	7.50	2.34
13	Stoekli E, 2018, Electron Mark	10.1007/s12525-018-0304-7	2018	6	44	13.64	6.67	1.99
14	Hänninen M, 2018, Baltic J Manage	10.1108/BJM-04-2017-0109	2018	6	72	8.33	6.67	3.25
15	Saarikko T, 2020, Bus Horiz	10.1016/j.bushor.2020.07.005	2020	5	45	11.11	12.18	3.28
16	Srai Js, 2019, J Purch Supply Manage	10.1016/j.pursup.2018.07.001	2019	5	62	8.06	6.25	3.93
17	Ojala A, 2018, J World Bus	10.1016/j.jwb.2018.05.001	2018	5	73	6.85	5.56	3.30
18	Joensuu-Salo S, 2018, Adm Sci	10.3390/admsci8030031	2018	5	41	12.20	5.56	1.85
19	Kotarba M, 2018, Found Manag	10.2478/fman-2018-0011	2018	5	70	7.14	5.56	3.16
20	Kraus S, 2020, Int J Entrep Behav Res	10.1108/IJEBR-04-2020-0214	2020	4	214	1.87	9.74	15.62

LC=Local Citations, GC=Global Citations, NLC=Normalized Local Citation, NGC=Normalized Global Citation

➤ Science Mapping

The science mapping establishes the relationship between and among all elements of the analysis by identifying the thematic groups in digitalization research within the period under review (Cornelius & Persson, 2006; López-Herrera et al., 2012). This looked at the network and overlay visualization using the VOS viewer software. These relationships are the authors network, bibliographic coupling and co-citations among authors, documents and sources and countries. The following are the various relationships established by the study among the various elements of the study.

The co-authorship network is the relationship and collaboration among authors and countries in publishing documents. The co-authorship network formed among authors with a minimum of 2 authors per document had 260 (7.80%) authors meet the threshold out of 3,335

authors. A total of 18 (6.92%) large networks was formed from the threshold with the authors, “Parida V.” the most co-author having 22 (3.55%) documents, 835(8.21%) citations and 45 link strength. Author “Sjodin D.” the second highest co-author had 11 (1.77%) documents, 253 (2.49%) citations and 27 link strength (Figure 2). However, 115 countries in the study had the biggest network of 63 out of 66 networks with co-authorship of 1,658 networked documents with a minimum of 2 documents criteria. The “Russian Federation”, “Germany” and “United Kingdom” were the top 3 highest co-author countries with 187 (11.28%), 142 (8.56%) and 137 (8.26%) all networked documents co-authored respectively. These 3 top countries also had total citations of 855(3.80%), 2,390(10.63%), 2,849(12.67%) and link strengths of 41, 122, 191 respectively (Figure 3). This shows that there were more collaborations between countries than authors.

Bibliographic coupling occurs when at a time that two different documents all reference a third document, document referencing. The occurrence by documents with a minimum of 5 citations criteria, had 451 documents, 10,613 citations and 23,158 link strengths. The 3 most coupled documents were “Verhoef P. C. (2021)”, “Warner K. S. R. (2019)” and “Kraus S.” with 318 (3%), 316(2.98%) and 214(2.02%) citations respectively. They also had link strengths of 330(1.42%), 468(2.02%) and 180(0.78%) respectively with 396 large connections (Figure 4). Bibliographic coupling by source with a minimum threshold of 5, had 54 journal sources with 502 documents, 4,836 citations and 10,688 link strengths. The 2 major coupled journal sources were “Journal of Open Innovation: Technology, Market, and Complexity” and “Economic Annals-xxi”. They had total documents of 33(6.57%) and 27(5.38%), citations of 254(5.25%) and 61(1.26%) respectively. Their total link strength was 481(4.50%) and 123(1.15%) with 50 large connections (Figure 5). Bibliographic coupling of authors stood at 478 with 407 having large connections with a minimum criterion of 1 document and 20 citations. The 478 authors had total documents of 667, 29,081 citations and 287,668 link strengths. The top 2 coupled authors were “Parida V.” And “Sjodin D.” They had 22 (3.30%), 835(2.87%) and 11(1.65%), 253(0.87%) documents and citations respectively. They also had 13,317(4.63%) and 7,316(2.54%) link strengths to their credit (Figure 6).

Co-citation is the reverse of bibliographic coupling, when two (2) documents all have been cited by the same third document, what is being cited. This occurrence for cited references had a total of 126 with 970 and 6,948 citations and link strength respectively by setting a minimum of criteria of 5 cited references. The top 2 cited references are “Eisenhardt, K.M., Building Theories From Case Study Research (1989) Academy Of Management Review, 14 (4), Pp. 532-550” and “Gioia, D.A., Corley,

K.G., Hamilton, A.L., Seeking Qualitative Rigor In Inductive Research: Notes On The Gioia Methodology (2013) Organizational Research Methods, 16 (1), Pp. 15-31” received 29(2.99%) and 21(2.16%) citations and 180(2.59%) and 160(2.30%) link strengths.

The other 3 became third “Barney, J., Firm Resources And Sustained Competitive Advantage (1991) Journal Of Management, 17 (1), Pp. 99-120”, “Coreynen, W., Matthyssens, P., Van Bockhaven, W., Boosting Servitization Through Digitization: Pathways And Dynamic Resource Configurations For Manufacturers (2017) Industrial Marketing Management, 60, Pp. 42-53” and” Nambisan, S., Lyytinen, K., Majchrzak, A., Song, M., Digital Innovation Management: Reinventing Innovation Management Research In A Digital World (2017) MIS Quarterly, 41 (1), Pp. 223-238” had 19 (1.96%) citations each but with 134(1.93%), 209(3.01%) and 139(2.00%) total link strengths respectively. Co-citation by sources had a total of 696 journal sources co-cited with 24,099 and 986,208 citations and link strengths respectively. The topmost 2 source journals “Journal of Business Research” and “Industrial Marketing Management” had 555(2.30%), 534(2.22%) citations with 29,344(2.98%) and 28,440(2.88%) total link strengths. The minimum criteria set for these results is 10 with 694 large connections out of 66 networks (Figure 8). Co-citation by author had minimum criteria set for 10 authors which had 1,396 authors but limited to 1,000 with a total 23,835 citations and 1,547,492 total link strength. The topmost 2 authors “Parida, V.” and “Brynjolfsson, E.” had 270(1.13%) and 161(0.68%) citations and 29,108(1.88%) and 6,161(0.40%) total link strengths (Figure 9).

Below are the graphical presentation of the co-authorship, bibliographic couplings and co-citations from Figure 7 to Figure 9.

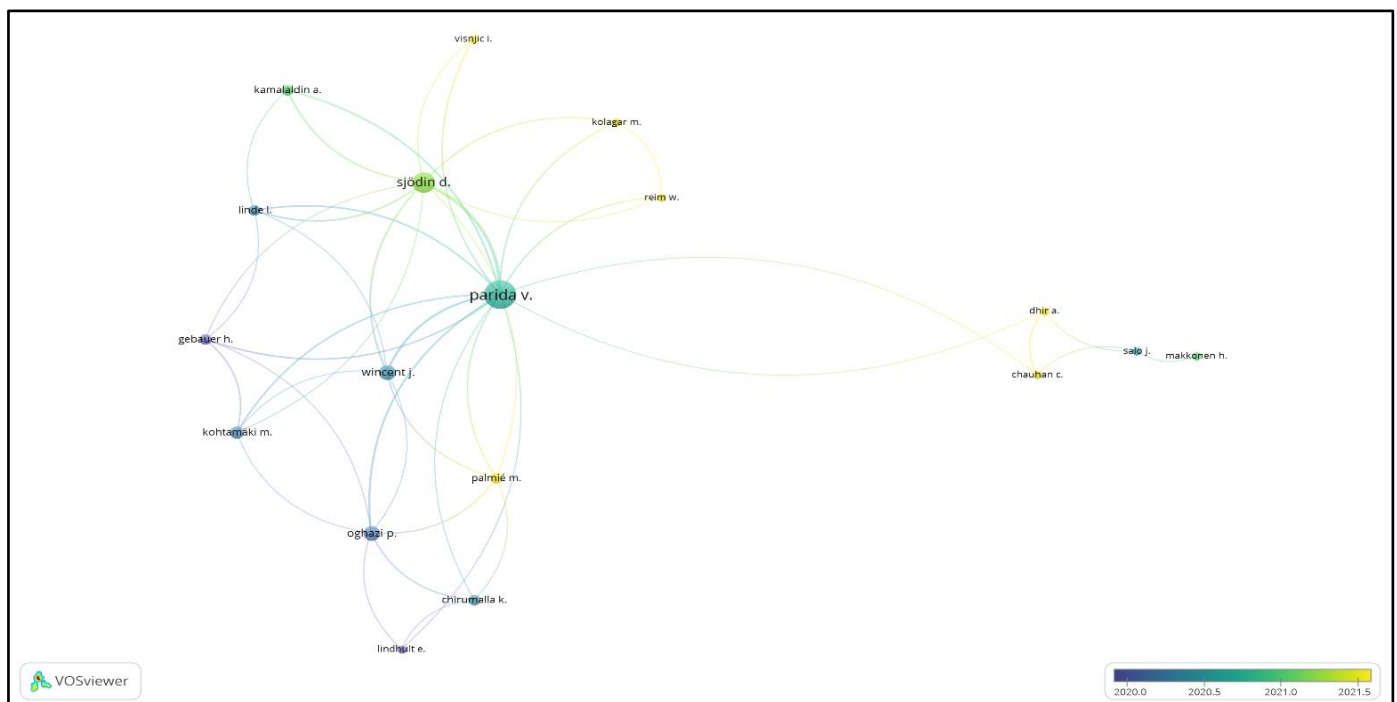


Fig 2 Co-Authorship (Authors Biggest Network 18 Out of 260)

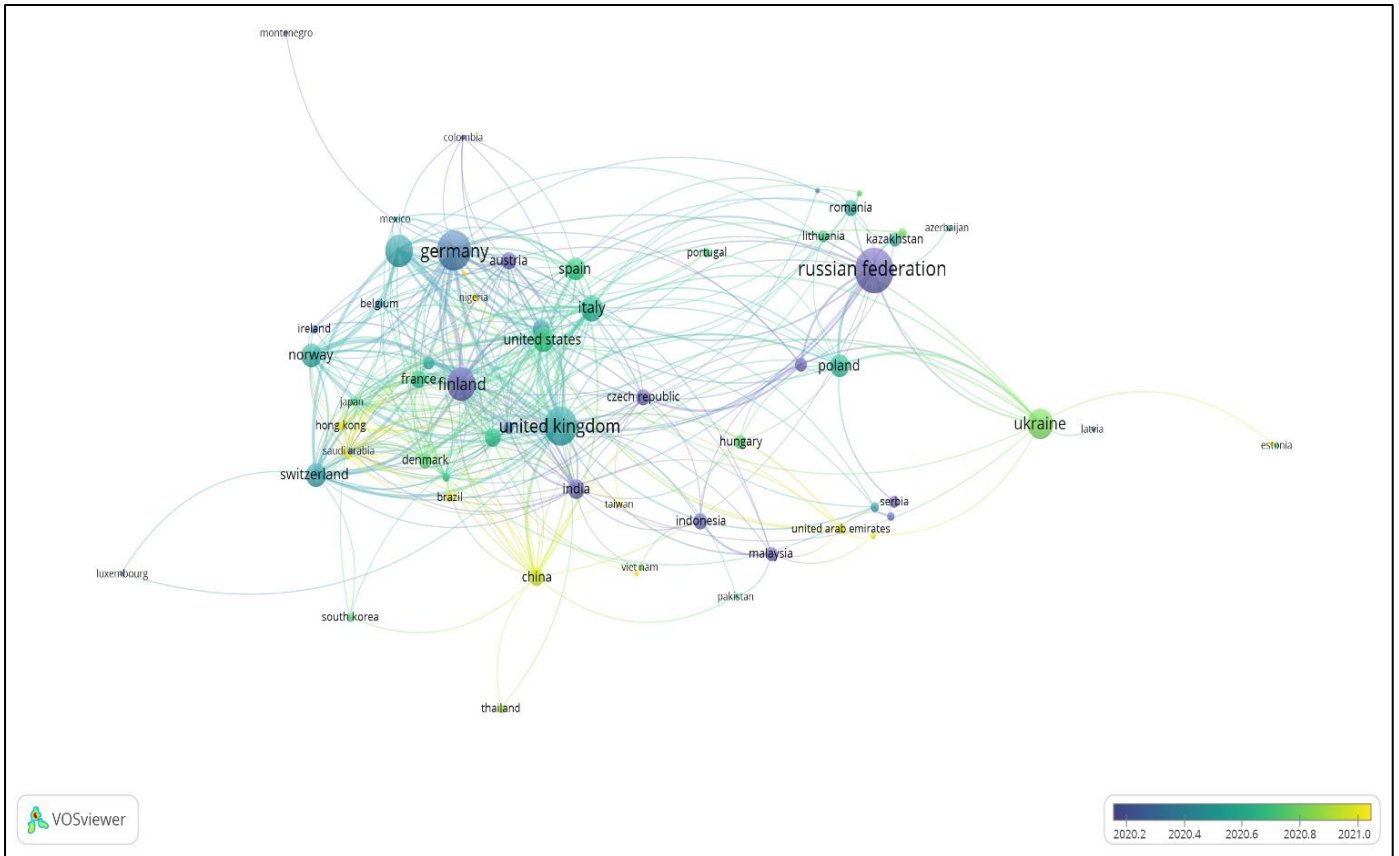


Fig 3 Co-Authorship (Country Biggest Network 63 Out of 66)

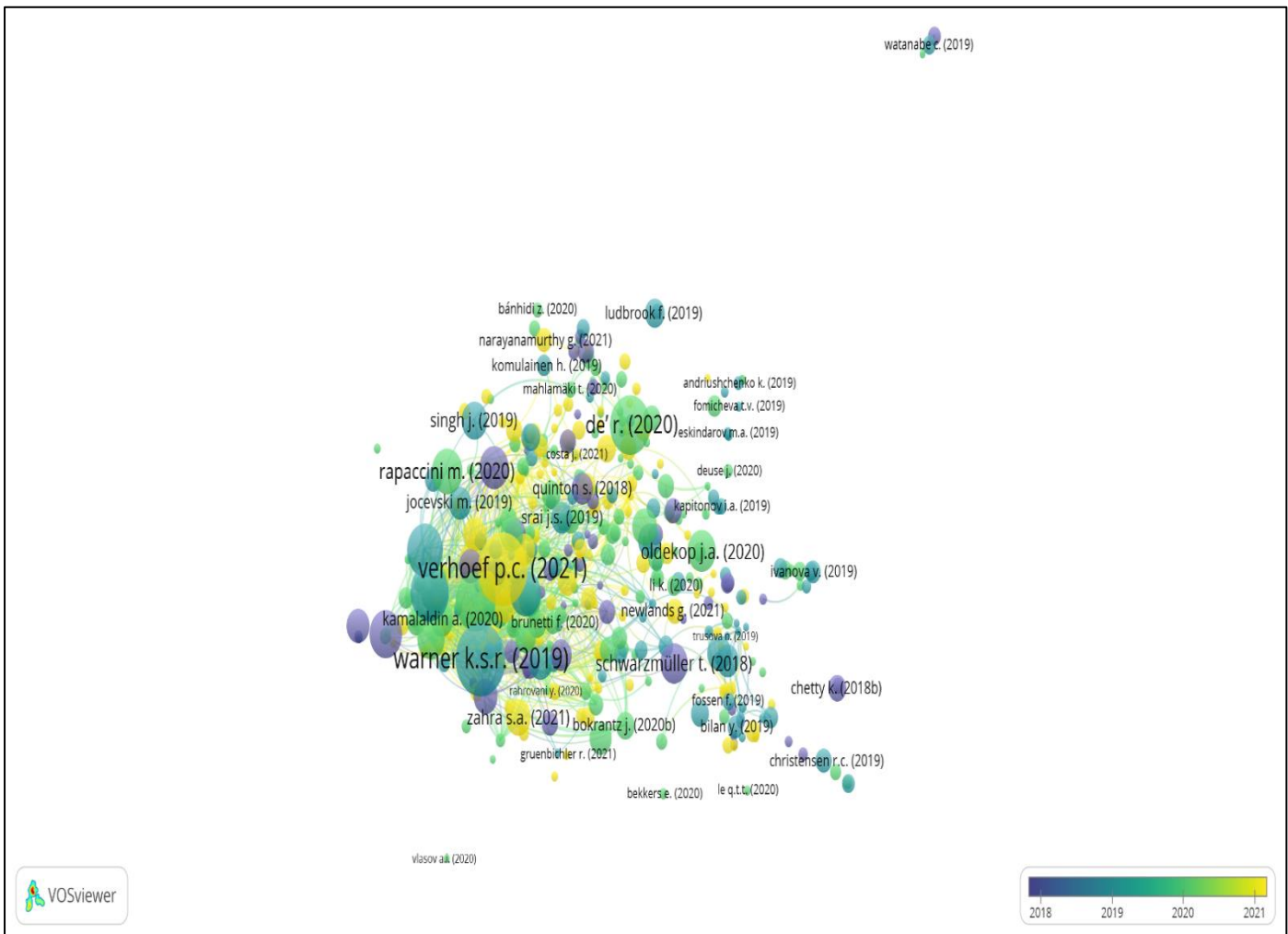


Fig 4 Bibliographic Coupling (Documents (Min Citations Per Document=5, 451 out of 1170 Met the Criterion, 396 Large Connections))

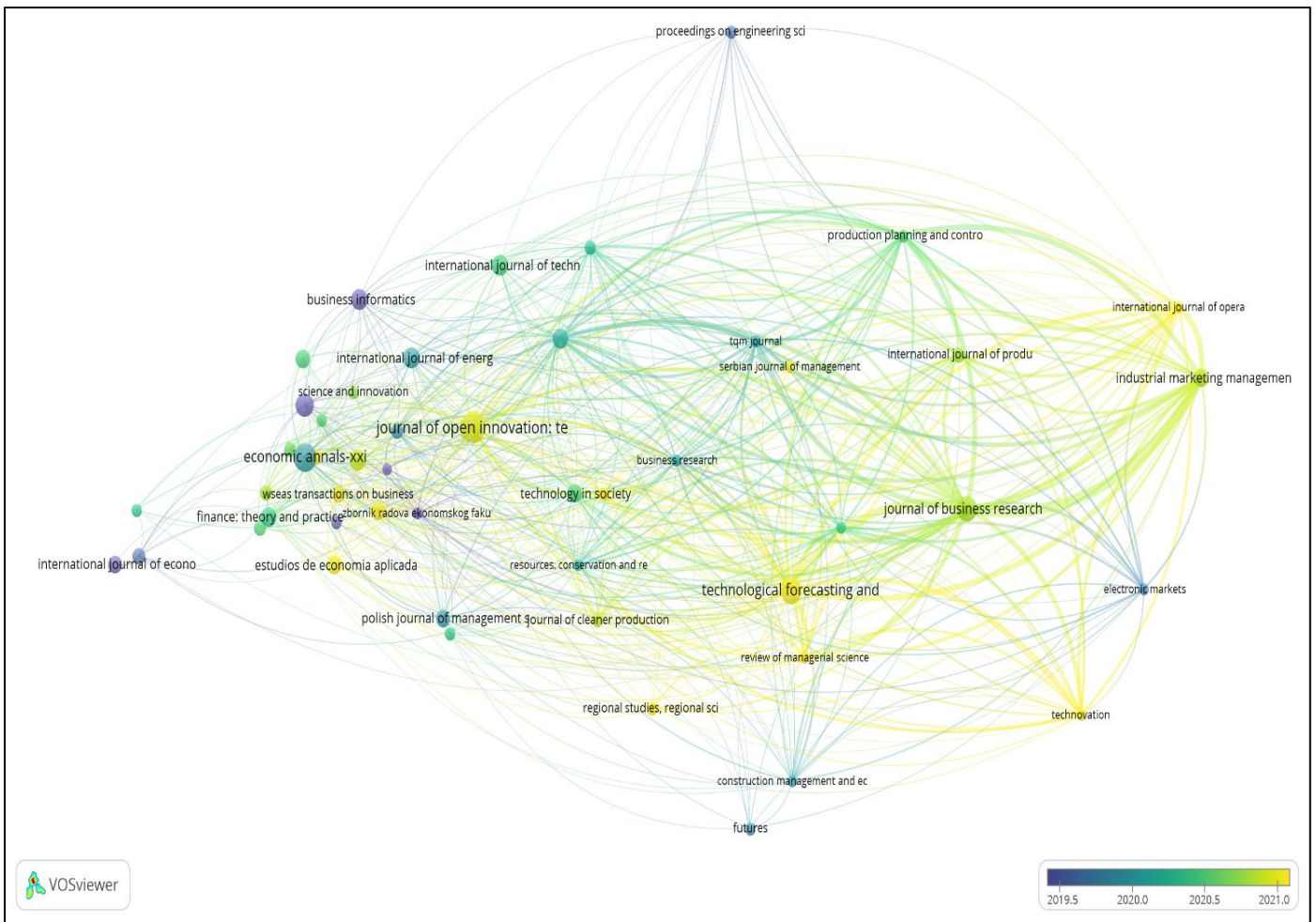


Fig 5 Bibliographic Coupling (Sources (Min Per Source =5, 54 Out of 468 Met the Criterion, 50 Large Connections))

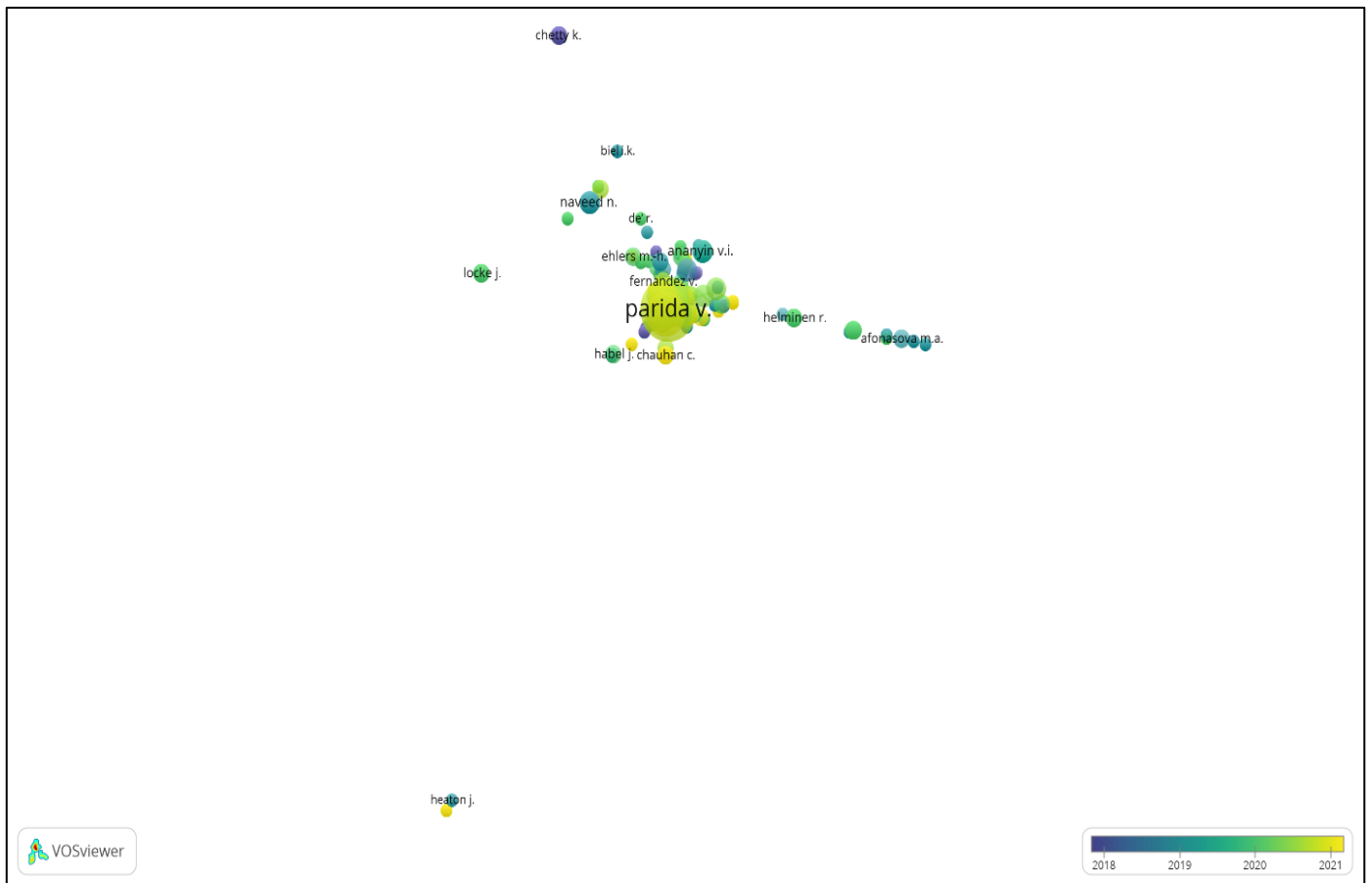


Fig 6 Bibliographic Coupling (Authors Min Document=1 Min Citation=20, 478 out of 3335 Met Criteria, 407 Large Connections)

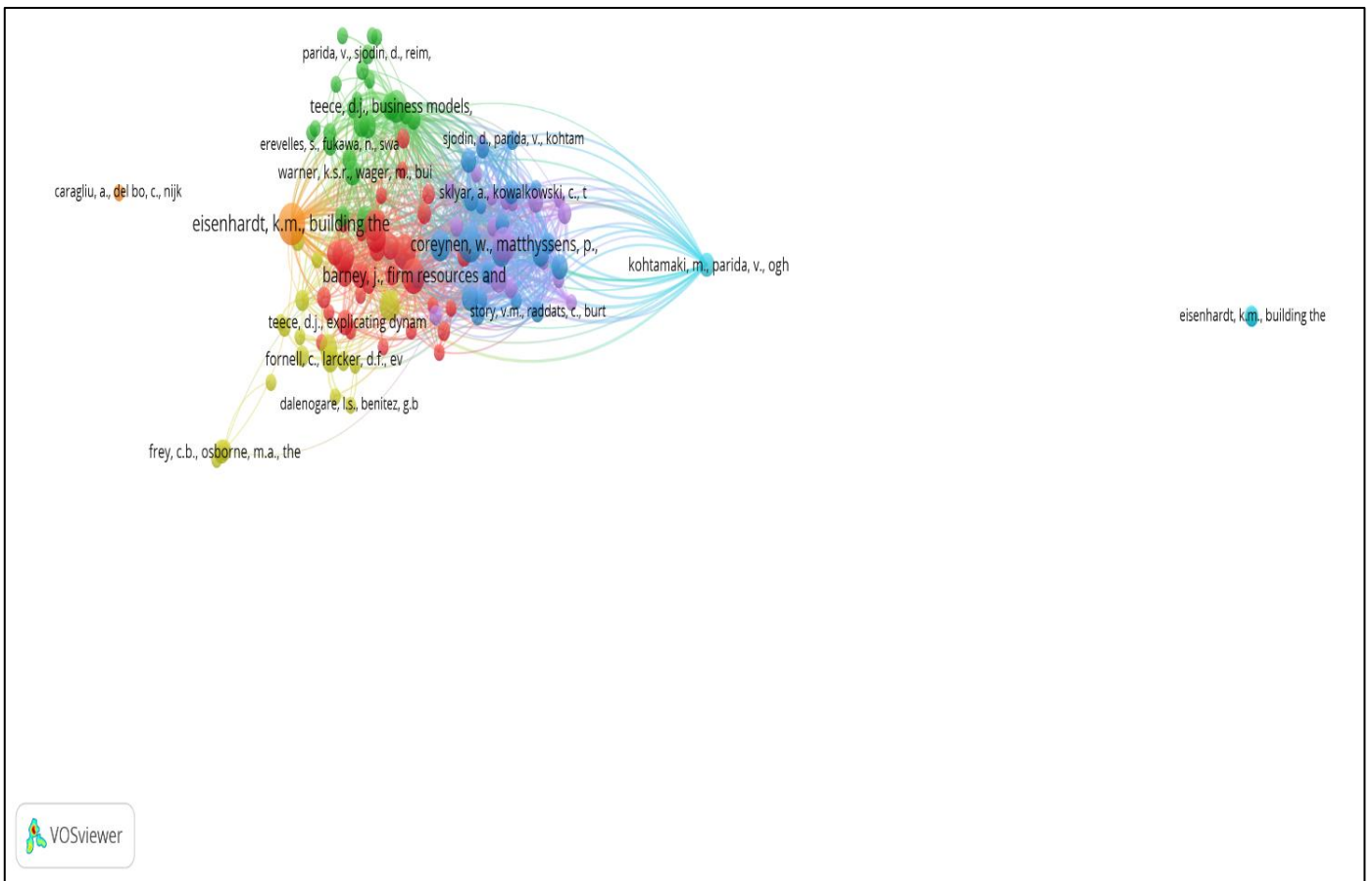


Fig 7 Co-Citation (Cited References Min Citation=5, 126 Out of 63149 Met Criterion, 120 Large Connections)

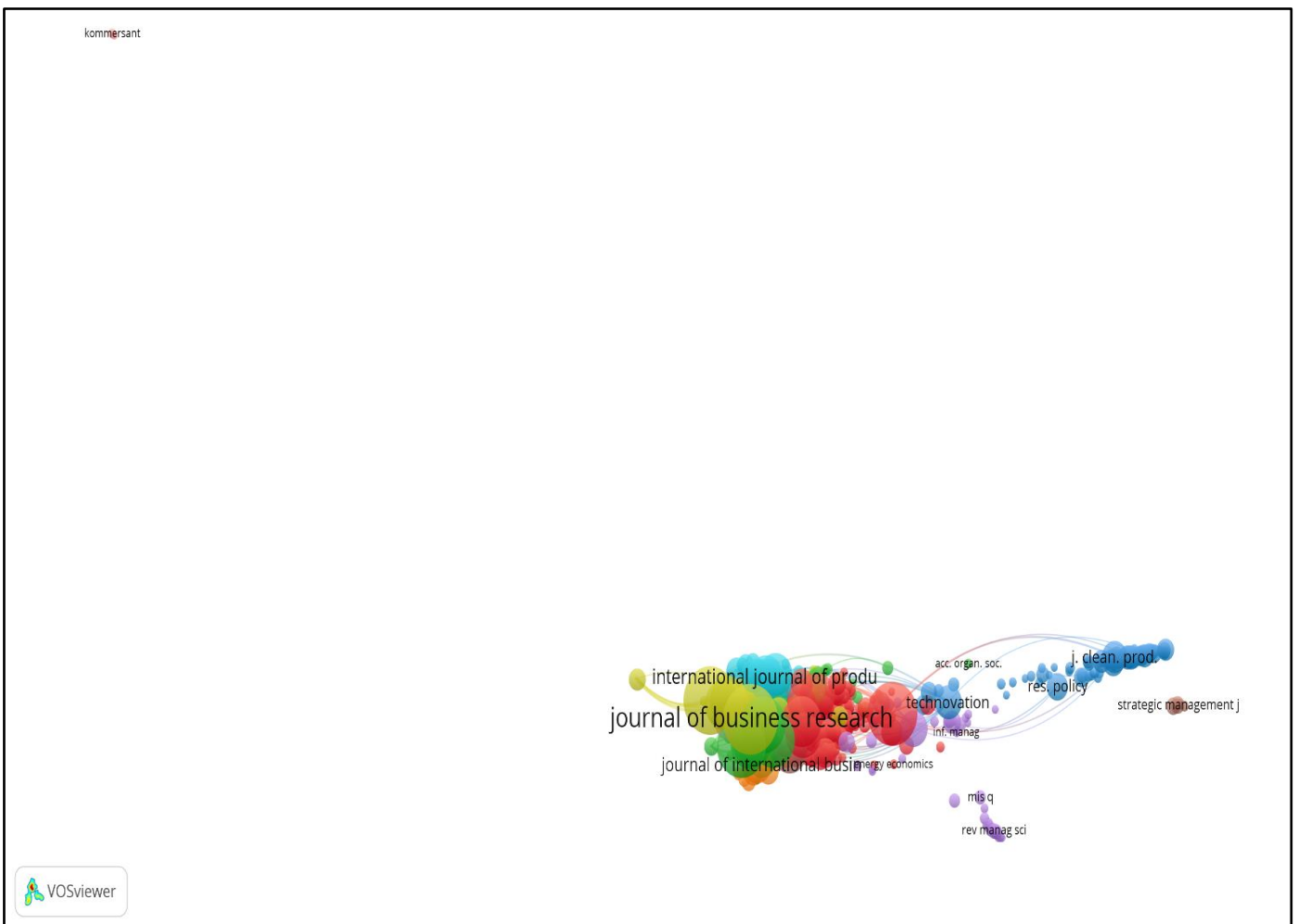


Fig 8 Co-Citation (Cited Sources Min Citation=10, 696 Out of 27105 Met Criterion, 694 Large Connections)

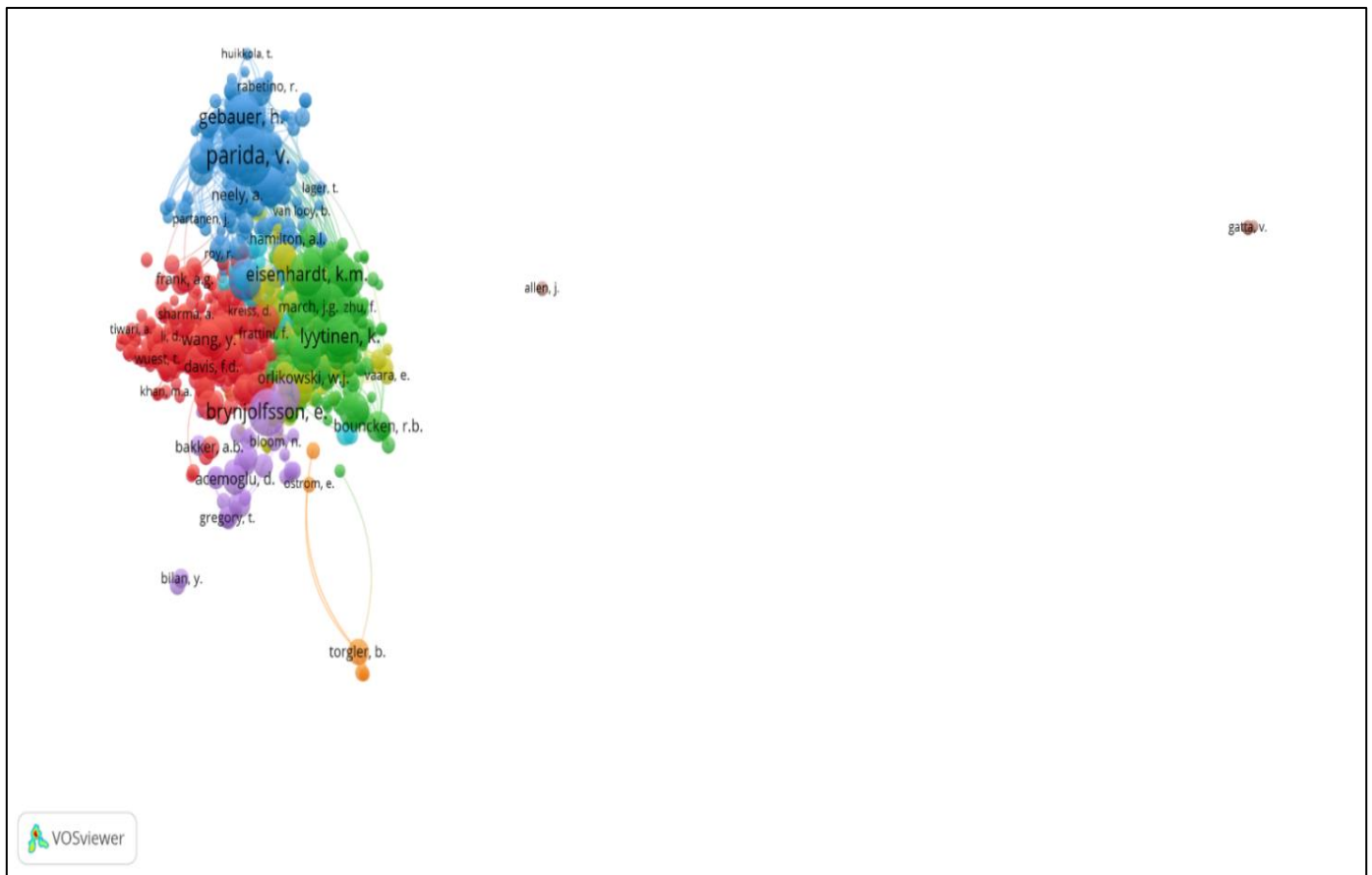


Fig 9 Co-Citation (Cited Authors Min Citation=10, 1396 Out of 72474 Met Criterion, 1000 Selected Connections)

IV. DISCUSSIONS AND CONCLUSION

This section discussed the results and the relationship of each of the elements under the performance analysis and science mapping. The meaning and implication of contributions and relationships were all discussed.

The study focused on giving insight into researches on Digitalization through bibliometric analysis using VOS viewer and bibliometric R-tool to conduct on performance analysis and science mapping of all elements in the data set. A total of 1,171 journal articles on digitalization with annual growth rate of publications of 28.78% between 2018 to 2022 were obtained from scopus and used for the analysis. The analysis on performance analysis centered on the contributions of the authors, countries, institutions and journals and the science mapping showed centered on relationships in co-authorship, bibliographic coupling and co-citations.

The performance analysis showed that authors “Parida V” and “Sjödin D” made the most impact as well as made the most bibliographic coupling of documents. The top 3 most journal sources were “*Journal of Open Innovation: Technology, Market, And Complexity*”, “*Journal of Business Research*” and “*Technological Forecasting and Social Change*” in the order of their impact. The top 2 institutions that had the most impact in publications were “*Copenhagen business school*” from Denmark, “*Linköping university*” from Sweden. Most of the authors emanated from “*Germany*”, “*Sweden*” and “*United Kindom*” whiles “*Russian Federation*”, “*Germany*”, and “*United Kingdom*” were countries with

the largest impact with documents publications. This means that digitalization sources, institutions, and countries of publication and well as the authors all are centered in the European economy and few from the Asian economy. This has created digitalization research dominance around these economies within the period more than any other continent. This signals a fast growing digitalization needs and solutions from these economies for the world economy.

Additionally, the most locally cited documents were “*Kohtamäki M, 2019, J Bus Res*”, “*Warner Ksr, 2019*”, “*Long Range Plann*” and “*Sklyar A, 2019, J Bus Res*” while “*Verhoef Pc, 2021, J Bus Res*” and “*Warner Ksr, 2019, Long Range Plann*” were the most globally cited journal sources that had most citations to their credit. This means these documents and journals have created a lot of impact on digitalization in the world by providing a baseline or steppingstone for other research documents to stand on and strive.

The science mapping showed that “*Russian Federation*”, “*Germany*” and “*United Kingdom*” were the most collaborated co-author countries. The documents “*Verhoef P. C. (2021)*”, “*Warner K. S. R. (2019)*” and “*Kraus S.*” did the most bibliographic coupling, while the journal sources “*Journal of Open Innovation: Technology, Market, and Complexity*” and “*Economic Annals-xxi*” also did the most bibliographic coupling. The most co-cited references were “*Eisenhardt, K.M., Building Theories From Case Study Research (1989) Academy Of Management Review, 14 (4), Pp. 532-550*” and “*Gioia, D.A., Corley, K.G., Hamilton, A.L., Seeking Qualitative*

Rigor In Inductive Research: Notes On The Gioia Methodology (2013) Organizational Research Methods, 16 (1), Pp. 15-31” while the journal sources “*Journal of Business Research*” and “*Industrial Marketing Management*” were most co-cited. The authors “*Parida, V.*” and “*Brynjolfsson, E.*” also were the most co-cited authors in the study. All co-citations were very relevant to the work they were cited in since the more co-citation received the more relevant the element.

The extent of the collaboration among these countries in the digitalization research has also contributed greatly to shaping the world’s digitalization drive. The science mapping revealed an extensive collaboration among these countries (“*Russian Federation*”, “*Germany*” and “*United Kingdom*”) and the wide range of coupling and cross-referencing that existed among countries, journals and authors revealed the robustness of the digitalization research works released within the period and their relevance to the research community and industry. The strength in the collaboration within the period under review shows how significantly these collaborative research works have shaped theory and practice of the digital world.

The above bibliometrics analysis has demonstrated the depth of digitalization research efforts and the impact these efforts have made in the digital world within the period 2018 to 2022 by producing robust research documents and materials to help the research community and industry to growth. This analysis pointed out the various contributions for the authors, journals, institutions and countries through their research efforts to the digitalization drive in the world through their individual and collaborative efforts which has been very significant to the growth of the digital economy and the world at large.

FUTURE RESEARCH AGENDA

The research is limited to journal articles obtained from scopus database between 2018 and 2022 with business and economic journals which have given the above results. Further research can therefore be conducted into the area of digitalization from other databases such as Web of Science, Google Scholar, SAGE and any others to ascertain different research materials. The current time frame and journal article and journal articles can also be expanded to explore several other fields. Bibliometric analysis can also be extended to include co-authorship by organization analysis and bibliographic coupling by organization and country analysis to explore their relationships for business advancement. This will help explore further shared interests in academic research in the desired field (Donthu et al., 2021; Verhoef et al., 2021).

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