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Bibliometric analysis of an international journal publishing on wood science with mapping method

Nadir ERSEN[1,*], İlker AKYÜZ[2] and Kadri Cemil AKYÜZ[2]

[1,*)] *Forestry Dept. Artvin Vocational School, University of Artvin Çoruh, 08000 Artvin, Türkiye*
[2)] *Forest Industry Engineering Dept. Faculty of Forestry, Karadeniz Technical University, 61100 Trabzon, Türkiye*
Corresponding Author: nadirersen20@artvin.edu.tr

Abstract
This study aims to reveal the bibliometric profile of documents in an international journal in the field of wood science. For this purpose, Drvna Industrija journal was chosen as the journal and two bibliometric methods were used: performance analysis and science mapping. Within the scope of performance analysis, the publication trends of the journal, the most cited articles, the most productive countries, organizations and authors were determined with the help of data obtained from the Web of Science database on February 01, 2024. With the mapping method, a graphic version of co-authorship, citation, bibliographic coupling, co-occurrence of authors' keywords, co-occurrence of terms in the abstract field and co-citation were obtained. Vosviewer software was used to visualize the data. The scope of the study consisted of 633 documents published in the Drvna Industrija journal between 2008 and 2023. Based on the data obtained, the highest number of documents was published in 2016. Authors from 49 different countries and 6 continents contributed to the journal. When the cooperation of the countries was examined, the countries that cooperated the most with other countries were Turkey and Slovenia. The organization that contributed the most to the journal was the University of Zagreb, and it was determined that this university had the strongest bibliographic coupling network with Mendel University in Brno. The majority of the studies in the journal were conducted as a result of team research. It has been observed that Bioresources is the source that cites Drvna Industrija journal the most, and the self-citation rate of the journal is also quite high. 2024 different keywords were used in the journal, and the most used keyword is wood. Trending topics in Drvna Industrija journal are heat-treated wood, artificial neural network, oriented strand board and decay resistance, in recent years. Finally, the most frequently used co-occurrence of term in the abstract field of documents in the journal was the paper term. Therefore; this research is a study that provides an overview of the leading trends and researchers of the journal during the period under review.
Keywords: Bibliometric analysis, vosviewer, visualization, web of science.

Introduction

In the process of knowledge transfer and sharing, field-specific scientific journals such as the journal within the scope of the study are needed. Scientific (academic) journals are an important channel for announcing the research carried out by researchers to the relevant scientific public and providing benefits in communication and receiving contributions/criticisms. Although the purposes of scientific journals are all common, their qualities differ (Kozak 2003). Although many methods have been developed to determine the qualities of scientific journals, the most frequently used of these methods are bibliometric analysis methods (Hotamışlı and Erem 2014). Bibliometric analysis methods allow us to have more detailed information about the depth and prevalence of the journal (Erbaşı et al. 2017).

Additionally, these methods can be useful for editorial boards in terms of making strategic decisions on the further development of journals (Mokhtari et al. 2020).

The Drvna Industrija Journal is a scientific journal hosting research in the field of wood and wood products. The Journal Drvna Industrija started its publication life in 1950 with a single issue, and it is an open access scientific journal that has been published with the same name continuously from this date. The first publisher of the journal was the General Directorate of the Wood Industry of Croatia. Currently, its publisher is the Faculty of Forestry and Wood Technology of the University of Zagreb and is financially supported by the Croatian Ministry of Science and Education and the Croatian Chamber of Forestry and Wood Technology Engineers. The first editor-in-chief of the journal was Dr. Stjepan Frančišković. Currently, the editor in chief of the journal was Prof. Ružica Beljo Lučić, its assistant editor in chief was Assistant Prof. Josip Miklečić and its technical editor was Associate Prof. Zoran Vlaovic. The journal was rated excellent by the Editorial Board of the Croatian Ministry of Science, Education and Sports in 2006 and was included in 10% of the best journals in Biotechnical Sciences. It is indexed in databases such as Science Citation Index Expanded, Scopus, CAB Abstracts, Compendex, Environment Index, GeoBase, DOAJ (URL-1 2024). According to Scopus and Clarivate Analytics, its Cite Score is 2.0 in 2022 (Scopus 2024), and its impact factor is 1.1 in 2022, respectively (Clarivate 2024).

There are different examples of bibliometric reviews for journals. The first study using the bibliometric approach was published by Cole and Eales in 1917 and they examined the studies published in the field of anatomy (Cole and Eales 1917). There are very few studies on bibliometric analysis of journals publishing on wood and wood products. Bozic (2005) analyzed the articles in the Forestry and Wood Science Technology journal in terms of years, number of authors, citations, self-citations and structure of the articles during 1950-2004. Generally, there are studies on bibliometric analysis of forestry journals in the literature. Hazarika et al. (2003) for Indian Forester journal; Perez et al. (2004) for ten leading forestry journals in China; Miah et al. (2008) for forestry journals published from Chittagong University, Bangladesh; Malesios and Arabatsiz (2012) for forestry journals; Cailou et al. (2016) for the journal of forestry harmful plant research in China; Szewcyzkiewicz et al. (2017) for journals published by the Forest Research Institute; Peiro (2018) for the Open Access forestry research and engineering international journal; Plutino et al. (2019) for the peer-reviewed forestry journals in Italy; Uribe-Toril et al. (2019) and for Forest journal; Wang et al. (2022) for journal of plant ecology; Santillan-Fernandez et al. (2023) for Mexican journals publishing in the field of forestry; used bibliometric analysis to examine the development and increasing influence of journals in the academic literature. Moreover, there are also studies on bibliometric analysis of research on wood and wood products. For instance, Bartol and Mrzlikar (2010) carried out a bibliometric analysis of the publications of researchers from the department of wood science and technology of the biotechnical faculty between 1980 and 2009. Peteh et al. (2015) conducted a biometric analysis of the studies of 169 active researchers registered at the Slovenian Research Agency in the fields of forestry, wood and paper technology. Pyzhev (2021) aimed to conduct a bibliometric analysis of publications on the Russian forest industry during 1995-2020 using Russian (Scientific Electronic Library eLIBRARY.ru) and international (Scopus and Web of Science) databases. Dos Santos et al. (2023) identified studies on wood forest products through the Scopus database and conducted a bibliometric analysis of the studies.

In this study, it was aimed to identify the publication trends of journal between 2008 and 2023, the most cited articles, most productive countries, and organizations, which have published in the Drvna Industrija journal. Moreover, it was developed a graphical representation of co-authorship, bibliographic coupling, co-citation, the co-occurrence of authors' keywords and co-occurrence of terms in abstracts field through Vosviewer software.

Material and Methods

Bibliometric analysis method was adopted in the analysis of the data obtained within the scope of the research. Bibliometric analysis is an approach that uses a range of quantitative methods to measure, track and analyze scientific literature. Bibliometric studies analyze and classify bibliographic material by framing representative summaries of existing literature. (Donthu et al. 2020; Rojas-Sanchez et al. 2023).

There are two main uses of bibliometric methods: performance analysis and science mapping. Performance analysis aims to evaluate the research and publication performances of individuals and institutions. Science mapping aims to reveal the structure and dynamics of scientific fields (Zupic and Cater 2015). Performance analysis focuses on the contributions of research constituents, whereas science mapping focuses on the relationships among research constituents (Cucari et al. 2023).

This study also has some limitations. The first limitation of the study is that it is a journal publishing on wood and wood products. Drvna Industrija was chosen within the scope of this study. Becasuse it has a long publishing background in wood and wood products research with 74 years of history. The fact that the Drvna Industrija journal selected in this study was selected based on the WOS database is among the limitations of the study. Today, there are databases such as Web of Science (WOS), Google Scholar, Scopus, Pubmed and Medline used to bibliometric analysis studies (Airyalat et al. 2019; Villatte et al. 2020). There are some reasons for using the WOS database: i) it has been stated in previous systematic literature review studies that WOS is a reliable database for bibliometric research (Zupic and Cater 2015), ii) WOS database is a citation index where the lack of data is very low compared to other databases, iii) WOS database works more effectively in Vosviewer analysis (Kahraman 2022).

In the data in this research, dating between 2008 and 2023 was extracted from WOS database on February 01, 2024. A search was done by typing "Drvna Industrija" in the search engine from the relevant website of the WOS database, and as a result of the search, a data set containing a total of 633 studies was created. Considering the scope of the bibliometric analysis, firstly, information about the number of documents and citations by years, leading authors, countries and institutions, the most cited documents by years and the degree of cooperation in the documents were given.

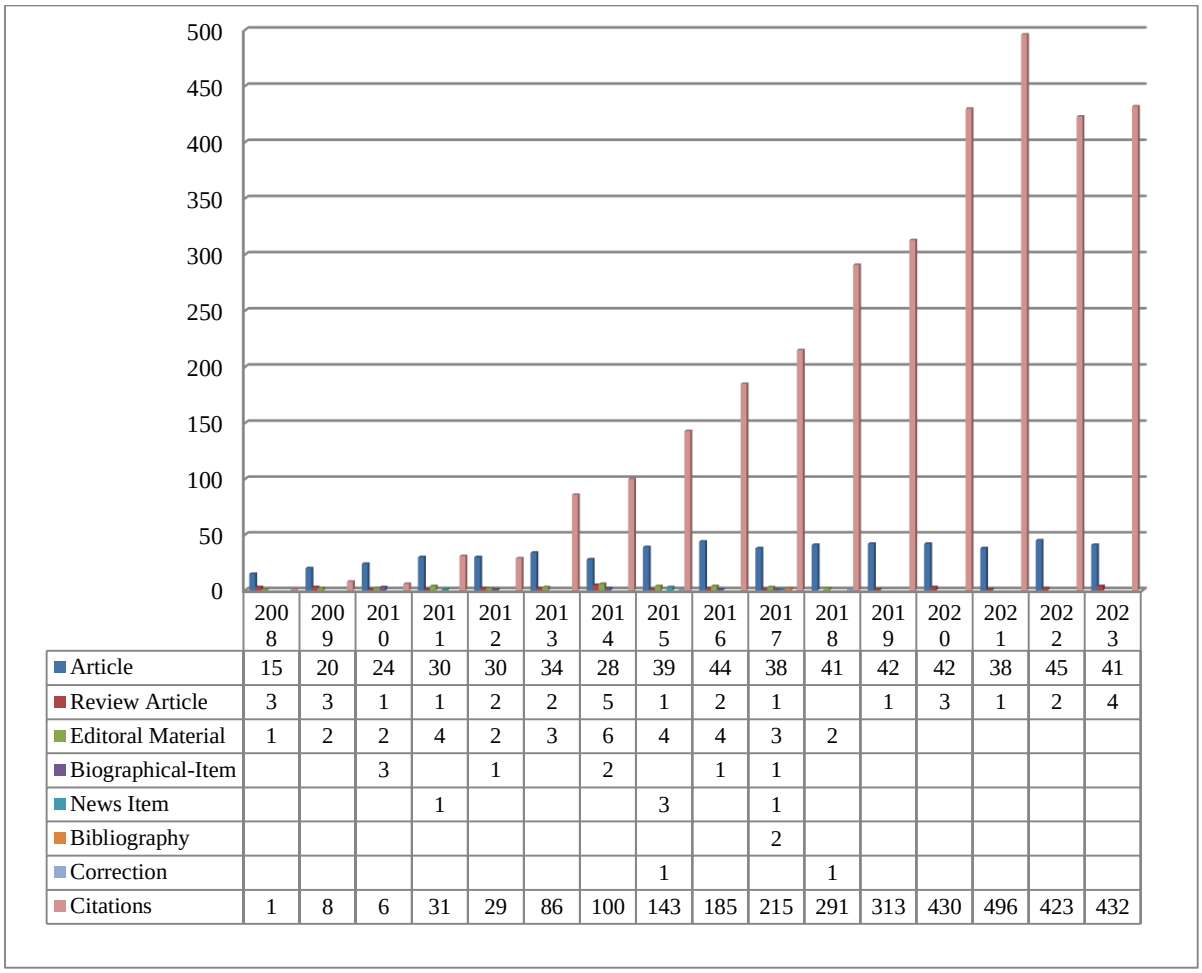
Vosviewer software was used to analyze the results in more detail. All information was exported in “txt” format to analyze the data with Wosviewer, one of the visualization mapping methods. Vosviewer is a computer program developed by Van Eck and Waltman (2010) to create, visualize and explore bibliometric maps of journals or studies and is freely available to users (Van Eck 2011). Vosviewer can be used for analyzing all kinds of bibliometric network data, such as co-authorship, co-occurrence, citation, bibliographic coupling or co-citation, by utilizing in units of analysis such as author, organization, country, document, key word, abstract, sources and references (Van Eck and Valtman 2022).

Results

Characteristics of Documents in the Journal Drvna Industrija

The Journal Drvna Industrija was started to be scanned in WOS (Web of Science) database in 2008. The distribution of publication types by years was examined from 2008 to 2023 and it is seen that the journal has made significant progress over time. Figure 1 shows the distribution of publication type by years. As seen in Figure 1, there were 633 documents published in Drvna Industrija from 2008 to 2023, 551 of them were articles, 33 of them were editorial materials, 32 of them were review articles, and 17 of them were biographical-items, news items, bibliography and corrections. The highest number of documents

was published in the journal in 2016, and the highest number of articles was published in 2022. There were a total of 3201 citations to documents in Drvna Industrija. The year with the most number of citations was 2021 with 496 citations. The average number of citations per document (ACPD) is 5.05.



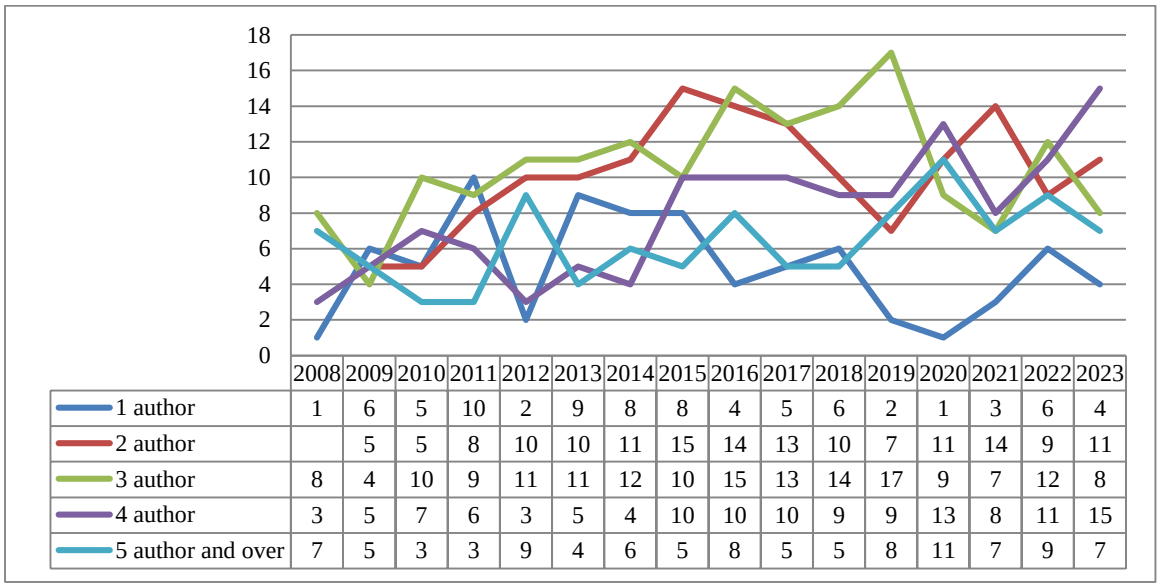
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Article	15	20	24	30	30	34	28	39	44	38	41	42	42	38	45	41
Review Article	3	3	1	1	2	2	5	1	2	1		1	3	1	2	4
Editoral Material	1	2	2	4	2	3	6	4	4	3	2					
Biographical-Item			3		1		2		1	1						
News Item				1				3		1						
Bibliography										2						
Correction								1			1					
Citations	1	8	6	31	29	86	100	143	185	215	291	313	430	496	423	432

Figure 1. Annual distribution of documents published in the Journal Drvna Industrija and citations

When the number of authors of the documents published in Drvna Industrija is analyzed, the number of authors in the documents varies between 1 and 8. 633 documents in Drvna Industrija were written by a total of 1092 authors. 13% of the documents have one author, 24% of them have two authors, 27% of them have three authors and 20% of them have four authors and 16% of them have five authors and over (Figure 2). The degree of cooperation in the documents was calculated with the following formula (1) (Subramanyam 1983).

$$C = \frac{N_m}{N_m + N_s} \quad (1)$$

where, C is degree of collaboration in the discipline, Nm is number of multi-authored documents and Ns is number of single authored documents. The C value was calculated as 0.87. The higher the C value, the higher the level of cooperation. The degree of collaboration calculated in the study shows that research in Drvna Industrija is predominant by team research. It is seen that the degree of collaboration varies from 0.72 to 0.98 in terms of the years.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1 author	1	6	5	10	2	9	8	8	4	5	6	2	1	3	6	4
2 author		5	5	8	10	10	11	15	14	13	10	7	11	14	9	11
3 author	8	4	10	9	11	11	12	10	15	13	14	17	9	7	12	8
4 author	3	5	7	6	3	5	4	10	10	10	9	9	13	8	11	15
5 author and over	7	5	3	3	9	4	6	5	8	5	5	8	11	7	9	7

Figure 2. Annual distribution of documents in terms of the number of authors

Examining the most cited publications in a journal will assist in identifying the most popular and influential publications in the journal. The most cited publications in the documents in Drvna Industrija by years are given in Table 1. 3 documents in Drvna Industrija have been cited more than 35 times. The first one is the document titled "Sustainable Development and Green Buildings" prepared by Sinha et al. (2013). In this document, the relationship between green building and sustainable development practices has been tried to be determined. The document titled "Specific Heat Capacity of Wood" published in 2014 has the same number of citations as the first-ranked document and this document provides an overview of research on the specific heat capacity of wood based on temperature and moisture content (Radmanovic et al. 2014). The third document with 39 citations is the document titled "Effect of Thermal Modification of Oak Wood on Sawdust Granularity", which deals with the results of granulometric analysis of thermally modified oak wood and unmodified oak wood chips and it was published by Dzurenda et al. (2010).

Table 2 shows the twenty countries and organizations that contributed the most documents to the journal and number of citations in Drvna Industrija. The ranking in Table 2 is based on the number of documents. Leading countries are Turkey (138 documents), Croatia (130 documents), Slovenia (80 documents), Poland (63 documents) and Slovakia (60 documents) in terms of documents. The majority of the top 20 countries are European countries. It is seen that German, American and Italian authors do not contribute much to the journal. Another remarkable result is that Turkish scientists are also productive. Regarding the average of citations per document, the ranking altered and the top five countries are as follows: Greece (10.86), Italy (9.86), Ukraine (9.40), Slovakia (9.20) and Germany (8.15). Finally, in terms of the h-index, Croatia (16) is the leading country. The five countries following this country are Slovakia (15), Slovenia (13), Poland (12), Turkey (10) and the Czech Republic (9). Considering the productivity in Drvna Industrija, it is seen that the most productive institution in the journal is the University of Zagreb with 126 documents. University of Ljubljana is in second ranking with 73 documents. Technical University Zvolen is third with 56 documents is in rank. The fourth and fifth ranked organizations are Bartın University (35 documents) and Poznan University of Life Sciences (32 documents), respectively.

Table 1. The most cited documents by years.

Years	Documents	Citations
2008	Development of Innovative Particleboard Panels	35
2009	Effect of Feed Speed and Wood Species on Roughness of Machined Surface	34
2010	Effect of Thermal Modification of Oak Wood on Sawdust Granularity	39
2011	Motivating Employees of Slovenian and Croatian Wood-industry Companies in Times of Economic Downturn	31
2012	Determination of Fire and Burning Properties of Spruce Wood	31
2013	Sustainable Development and Green Buildings	40
2014	Specific Heat Capacity of Wood	40
2015	Qualitative Indicators of Company Employee Satisfaction and Their Development in a Particular Period of Time	23
2016	Chemical Composition of Straw as an Alternative Material to Wood Raw Material in Fibre Isolation	34
2017	Evaluation of Factors in Buying Decision Process of Furniture Consumers by Applying AHP Method	23
2018	Determinants of Job Satisfaction in the Spanish Wood and Paper Industries: A Comparative Study across Spain	22
2019	Assessment of Efficacy and Effectiveness of Some Extracted Bio-Chemicals as Bio-Fungicides on Wood	22
2020	Engineering the Properties of Eco-Friendly Medium Density Fibreboards Bonded with Lignosulfonate Adhesive	19
2021	Chemical and Structural Characterization of Poplar and Black Pine Wood Exposed to Short Thermal Modification	19
2022	Particles from Residue Wood-Based Materials from Door Production as an Alternative Raw Material for Production of Particleboard	5
2023	Utilization of Scots Pine (Pinus sylvestris L.) Timber with Defects in Production of Engineered Wood Products	3

Regarding h-index, The University of Zagreb has an h-index of 16. Other organizations with an h-index over 10 are Technical University Zvolen and University of Ljubljana. Finally, considering the average of citations per document, the organizations with the highest value are Fahrenheit University (10.40) and Gdansk University of Technology (10.40) operating in Poland, followed Technical University Zvolen (9.73), Warsaw University of Life Sciences (8.19) and University of Forestry Bulgaria (7.78). Although Fahrenheit University and Gdansk University of Technology are at the 15th and 16th ranks of the list with 10 and 10 documents, respectively, they stand out with an average of 10 citations per document.

Mapping Analysis of Journal Using Vosviewer

In this section of the study, maps were created and interpreted on the bibliographic data by choosing co-authorship, bibliographic coupling, co-citation analysis, and co-occurrence of keyword options as well as the text data. To achieve this purpose, the Vosviewer software was used, which visualizes the bibliographic data and developed by Nees Jan van Eck and Ludo Waltman (2010). First, network maps were created related to co-authorship of the authors and co-authorship of the countries. Co-authorship analysis examines interactions among researches in a research field (Donthu et al. 2021). Co-authorship analysis also allows visualization on the basis of institutions and countries where authors work (Zupic and Cater 2015). Figure 3 demonstrate a network map of co-authors of the authors in Drvna Industrija

whereas a network map of co-authors of the countries is demonstrated in Figure 4. To create a map of author co-authorship network; the minimum number of documents of an author was chosen 5 whereas minimum number of citations of an author was 1. It was observed that 70 of 1093 authors met these conditions and a network map of 54 authors who are linked with each other was created. In studies with a large number of data, it is widely used to determine a lower limit to obtain leaner results (Arslan 2022). In Figure 3, each color represents a cluster. The size of the bubbles in the map depends on the number of documents of the authors (Rejeb et al. 2022).

Table 2. Top 20 countries and organizations publishing the most documents and number of citations in Drvna Industrija.

Countries	A	C	C/A	H	TLS	Organizations	A	C	C/A	H
Turkey	138	460	3.33	10	9	University of Zagreb	126	831	6.60	16
Croatia	130	858	6.60	16	63	University of Ljubljana	73	541	7.41	12
Slovenia	80	624	7.80	13	51	Technical University Zvolen	56	545	9.73	15
Poland	63	473	7.51	12	14	Bartın University	35	151	4.31	8
Slovakia	60	552	9.20	15	42	Poznan University of Life Sciences	32	232	7.25	9
Czech Republic	38	223	5.87	9	14	Karadeniz Technical University	22	54	2.45	5
Iran	38	133	3.50	6	8	Mendel University in Brno	20	101	5.05	5
Serbia	22	92	4.18	6	23	University of Belgrad	19	85	4.47	6
USA	13	87	6.69	4	6	Warsaw University of Life Sciences	16	131	8.19	7
Germany	13	106	8.15	6	2	Islamic Azad University	14	32	2.29	4
Hungary	11	21	1.91	3	3	Kahramanmaraş Sütçü İmam University	13	57	4.38	5
Bosnia Herceg	11	69	6.27	4	8	University of Tehran	12	62	5.17	5
Bulgaria	9	70	7.78	4	3	Bülent Ecevit University	12	58	4.83	5
Austria	7	23	3.29	3	12	Czech University of Life Sciences Prag	11	75	6.82	6
Greece	7	76	10.86	4	0	Fahrenheit University	10	104	10.40	6
Italy	7	69	9.86	5	4	Gdansk University of Technology	10	104	10.40	6
Chile	5	9	1.80	2	0	Karabük University	10	39	3.90	4
Lithuania	5	15	3.00	2	0	Düzce University	10	54	5.40	4
Macedonia	5	19	3.80	2	3	University of Forestry Bulgaria	9	70	7.78	4
Ukraine	5	47	9.40	4	2	Istanbul University-Cerrahpaşa	9	27	3.00	3

Note: Since the English spelling of Türkiye has changed, Turkey and Türkiye are treated as a single country
A: the number of document, B: the number of citation, C/A: average citations per document, H: h-index, TLS: total link strength

In addition, the proximity of the circles to each other indicates the cooperation between the authors (Göksu 2021). As a result of the analysis, 54 authors were divided into 7 clusters: red cluster (with 10 authors), green cluster (with 9 authors), blue cluster (with 9 authors), yellow cluster (with 8 authors), purple cluster (with 8 authors), turquoise cluster (with 5 authors), and orange cluster (with 5 authors). As seen in Table 1, the authors with the highest total link strength (TLS) were found to be; Sefc, Bogoslav (TLS=36) Pervan, Stjepan (TLS=35), Oblak, Leon (TLS=33), Grbac, Ivica (TLS=29) and Prekrat, Silvana (TLS=28). Pervan, Stjepan collaborates with 11 authors, followed Oblak, Leon (with 10 authors), Klaric, Miljenko (with 10 authors). The total link strength and total number of links of 54 authors are 354 and 142, respectively.

The co-authorship network map of the countries shown in Figure 4 was created based on the following criteria: i) both number of documents of a country and citations of country are 1, ii) the threshold is 45, iii) the largest set of connected countries is 34. 34 countries were divided into 8 clusters, highlighting those led by Croatia (black cluster and with 3 countries), Turkey (green cluster and with 6 countries), Poland (yellow cluster and with 4 countries), Czech Republic (turquoise cluster and with 3 countries), Iran (purple cluster and with 4 countries), USA (blue cluster and with 4 countries), Slovenia (red cluster and with 7 countries) and Austria (orange cluster with 3 countries). Croatia, which has the highest number of documents and total link strength in Drvna Industrija, cooperates with 14 countries. However, the country that cooperates most with other countries is Slovenia with 20 links. The five countries with the highest total link strength are Croatia (TLS=66), Slovenia (TLS=60), Slovakia (TLS=43), Serbia (TLS=24) and Czech Republic (TLS=18), while the top five countries in terms of number of links are Slovenia (with 20 links), Croatia (with 14 links), Turkey (with 12 links), Austria (with 12 links) and Slovakia (with 10 links).

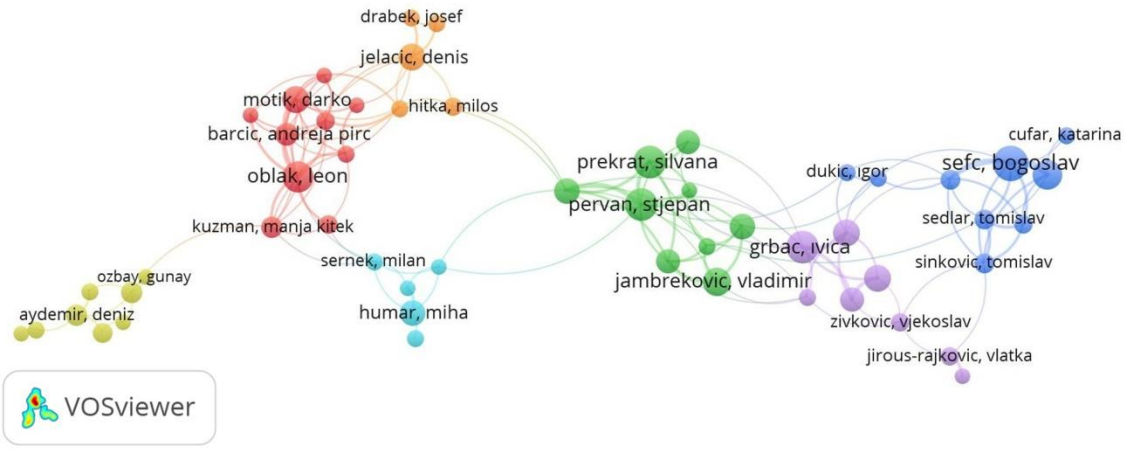


Figure 3. Network map of co-authors publishing in Drvna Industrija.

Second, bibliographic coupling is done to map the connection between documents, authors, organizations and countries. Bibliographic coupling occurs when two different scientific studies (A and B) refer to the same study (E and/or F) together. The strength of the coupling reflects the strength of the relationship between studies (Egghe and Rousseaus 2002).

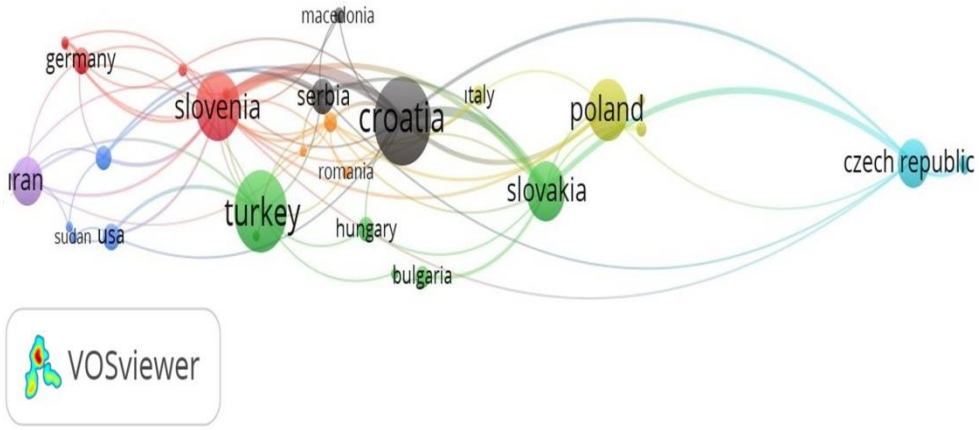


Figure 4. Network map of co-author of countries publishing in Drvna Industrija.

Figure 5 depict the density map of bibliographic coupling of documents in the journal. The threshold was set to at minimum fifteen citations per document, 60 documents met the threshold out of which 17 documents had the largest set of connections. The density around the document, Radmanovic (2014), Dzurenda (2010a), Skaljic (2009), Despot (2008) and Miklecic (2016) is the denser areas.

The network map in Figure 6 depicts authors with more than 5 documents in Drvna Industrija and the most productive authors with the 70 strongest bibliographic links among these authors. In Figure 6, authors publishing in Drvna industrija form 7 different clusters of bibliographic coupling and authors with the highest link strength in clusters are: Jug Matija (cluster 1 with red color, TLS=456), Barcic Andreja Pirc (cluster 2 with green color, TLS=940), Spanic Nikola (cluster 3 with blue color, TLS=1110), Sefc Bogoslav (cluster 4 with yellow color, TLS=1038), Zupcic Ivica (cluster 5 with purple color, TLS=995), Cicekler Mustafa (cluster 6 with turquoise color, TLS=309) and Dziurka Dorota (cluster 7 with orange color, TLS=258). The advantage of Figure 6 is the graphical mapping of authors that link or aggregate those with similar research profiles (Merigo et al. 2018). In addition, it is seen that the clusters in the figure are less scattered and the circles are close to each other. The fact that the cluster is less or not scattered and the circles are close to each other means that the authors in the related clusters are more likely to be cited in similar researches (Göksu 2021). The red cluster is more in the center.

Figure 7 display that organizations publishing in the journal consist of 6 clusters with 5 threshold values of document of an organization. It is seen that the organizations publishing in the journal are clustered in six different groups. The ranking of bibliographic coupling network clusters of organizations is as follows: red cluster (13 organizations), green cluster (6 organizations), blue cluster (5 organizations), yellow cluster (5 organizations), purple cluster (2 organizations) and turquoise cluster (2 organizations). The University of Zagreb (126 documents, 792 citations and TLS=2070) and the University of Ljubljana (73 documents, 512 citations and TLS=1640) in the red cluster are in the first two ranks among the organizations. Technical University Zvolen (56 documents, 545 citations and TLS=1262) is in the third rank in the turquoise cluster. The University of Zagreb, which has the highest number of documents and citations and the total link strength, has a higher the bibliographic coupling link with University of Ljubljana, the Technical University of Zvolen and University of Belgrad. It can be said that the strongest bibliographic coupling network was established with the University of Zagreb and Mendel University in Brno.

When the minimum number of documents and citations of a country is selected as 1, the network map of the 49 countries with the highest connection with each other is shown in Figure 8. The country with

the highest number of bibliographic coupling was Croatia with 858 citations, followed Slovenia, Slovakia, Poland and Turkey. Croatia, the country with the highest number of bibliographic coupling, is in the red cluster. Other countries in the red cluster: Austria, Italy, Macedonia, Portugal, Serbia, South Korea, and Spain. In other words, the countries in the red cluster of Croatia are in a closer relationship. The countries with the most connections with other countries are Turkey and Slovenia (38 links).

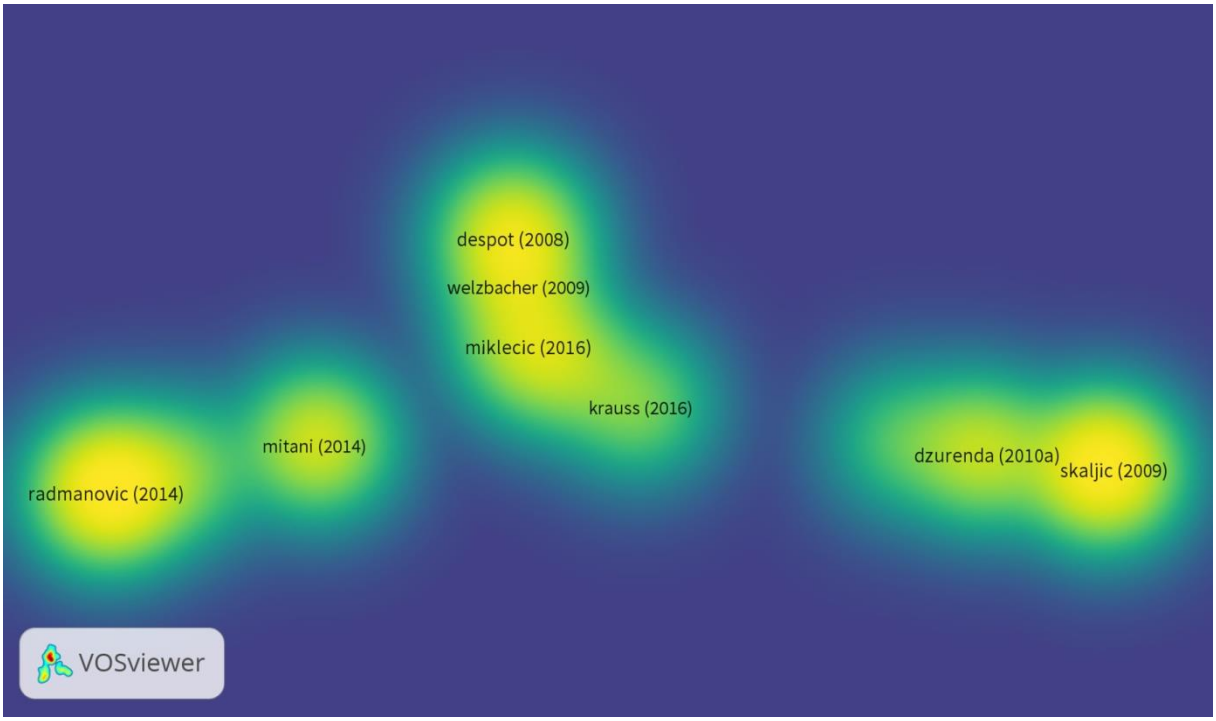


Figure 5. Density map of bibliographic coupling of documents published in Drvna Industrija.

Another important analysis is the co-citation analysis of the documents in the journal. Co-citation analysis refers to the link between two studies cited by the same study (Van eck and Waltman 2022). It is one of the most effective and common tools used to identify studies of central importance in scientific research in a specific field (Zitt and Bassecoulard 1994). In this context, the intellectual structure of the journal was analyzed and the sources used in the documents in the journal were identified. The network map of the source co-citations by documents in the journal are display in Figures 9. In addition, Table 3 indicates knowledge of top 10 cited sources by documents in Drvna Industrija. To create the network map of source co-citation, minimum number of citations of a source as selected as 5 and of the 6769 sources, 354 meet the threshold. Therefore, 11 clusters, 11703 links and 73074 total link strength were determined from 354 sources. The top 10 sources are cited a total of 2882 times in the documents in Drvna Industrija, including self-citations. The most cited journal is Bioresources, followed by Holzh Roh Werkst, Drvna Industrija (self-citations), Wood Science and Technology and Forest Product Journal. Five journals have more than 5000-total link strength with the journal in the scope of the study.

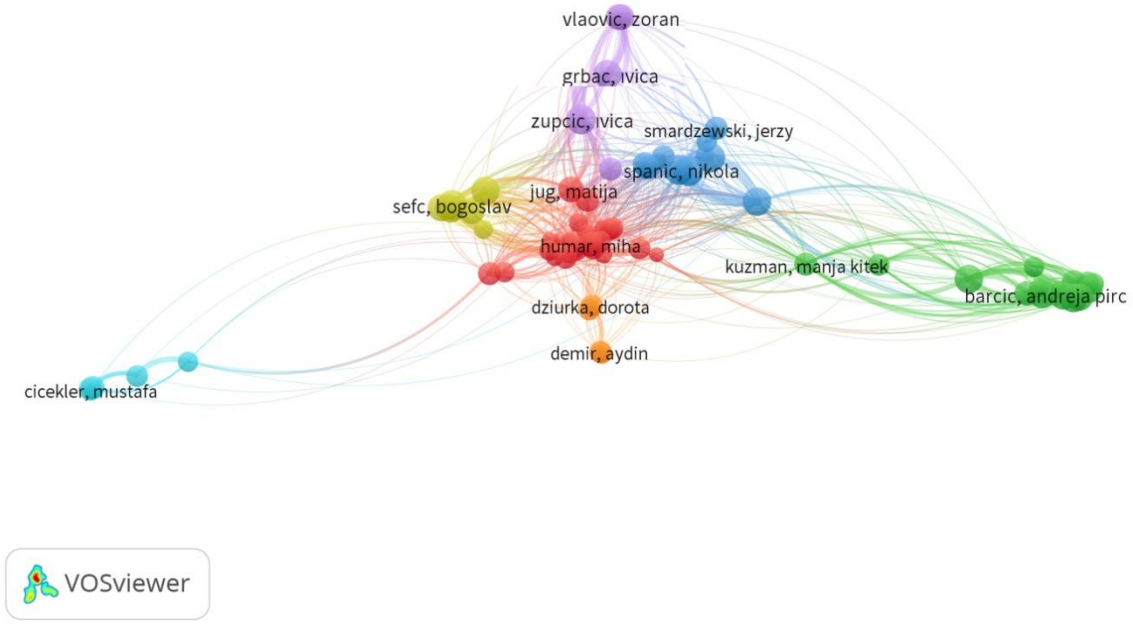


Figure 6. Network map of bibliographic coupling of authors publishing in Drvna Industrija

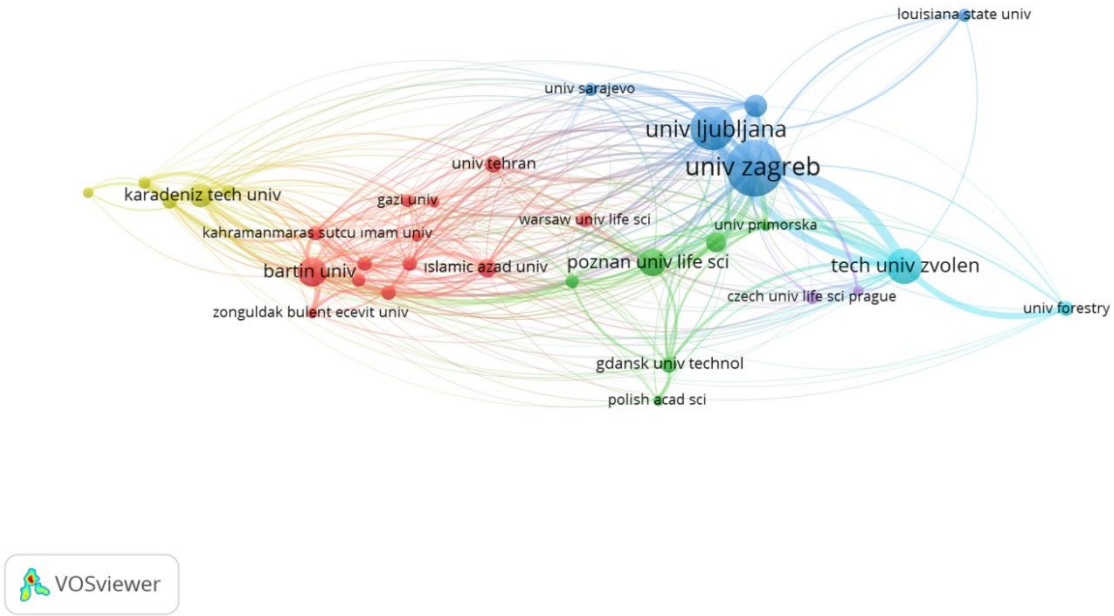


Figure 7. Network map of bibliographic coupling of organizations publishing in Drvna Industrija

The journal with the highest total link strength is again Bioresources, followed by Holzh Roh Werkst, Wood Science and Technology, Holzforschung, Drvna Industrija and Forest Product Journal. Considering links of resources, the source that is most linked to other journals is Drvna Industrija (with 331 links), followed Bioresources (with 318 links), Forest Prod. J. (with 292 links), Holz rod werkst (291 with links).

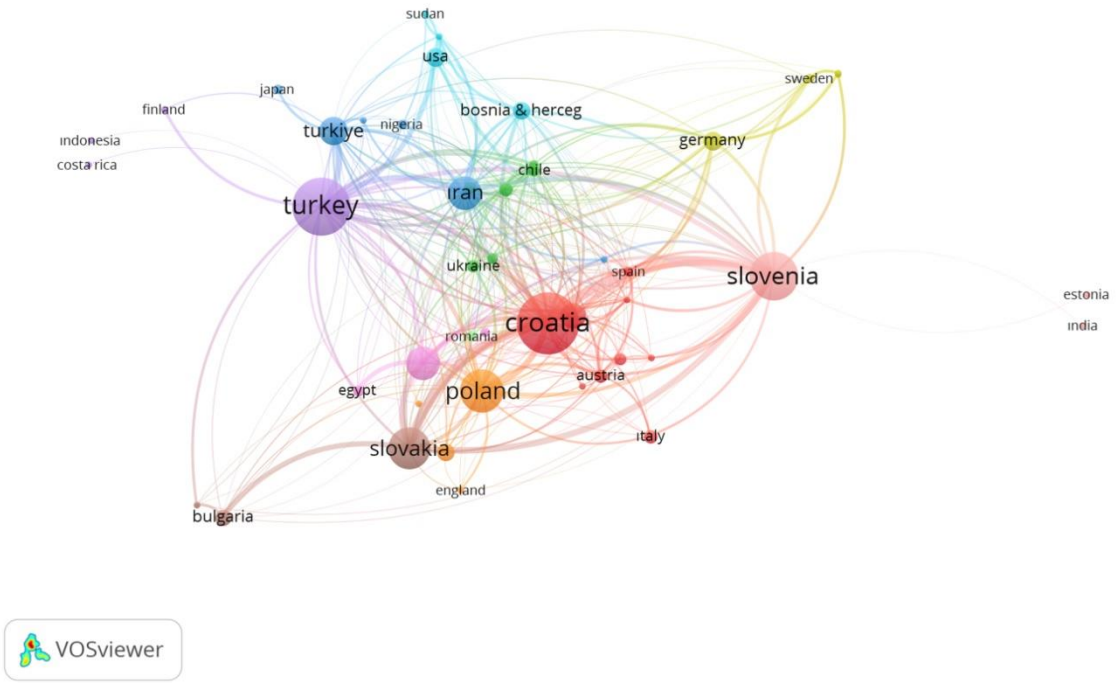


Figure 8. Network map of bibliographic coupling of countries publishing in Drvna Industrija

Table 3. Top 10 cited sources by documents in Drvna Industrija.

Sources	C	TLS
Bioresources	460	9533
Drvna Ind.	415	5618
Holzh Roh Werkst	409	7248
Wood Sci. Technol.	314	5740
Forest Prod. J.	280	4437
Holzforschung	276	5659
Wood Fiber Sci.	206	3782
Eur. J. Wood and Wood Prod.	195	3919
Wood Res-Slovakia	166	3109
Thesis	161	2463

C: citations, TLS: total link strength

The last analysis carried out in line with the purpose of the research is on co-occurrence analysis. Co-occurrence was performed in the keyword and summary analysis unit and the results were mapped. Figure 10 depicts the co-occurrence analysis of keywords used by the authors in the documents that publish in Drvna Industrija. While performing the analysis, the minimum number of co-occurrences of a keyword was 4, and 90 keywords were identified from 2024 keywords that met this threshold. However, the 88 keywords with the highest total link strength were presented by visualizing. The co-occurrence refers to the frequency of a keyword appearing with other keywords. As can be seen in Figure 10 and Table 4, wood (29 occurrences) is the most frequently used keyword, followed mechanical properties (22 occurrences), furniture (18 occurrences), modulus of elasticity (17 occurrences), plywood (17 occurrences) particleboard (17 occurrences).

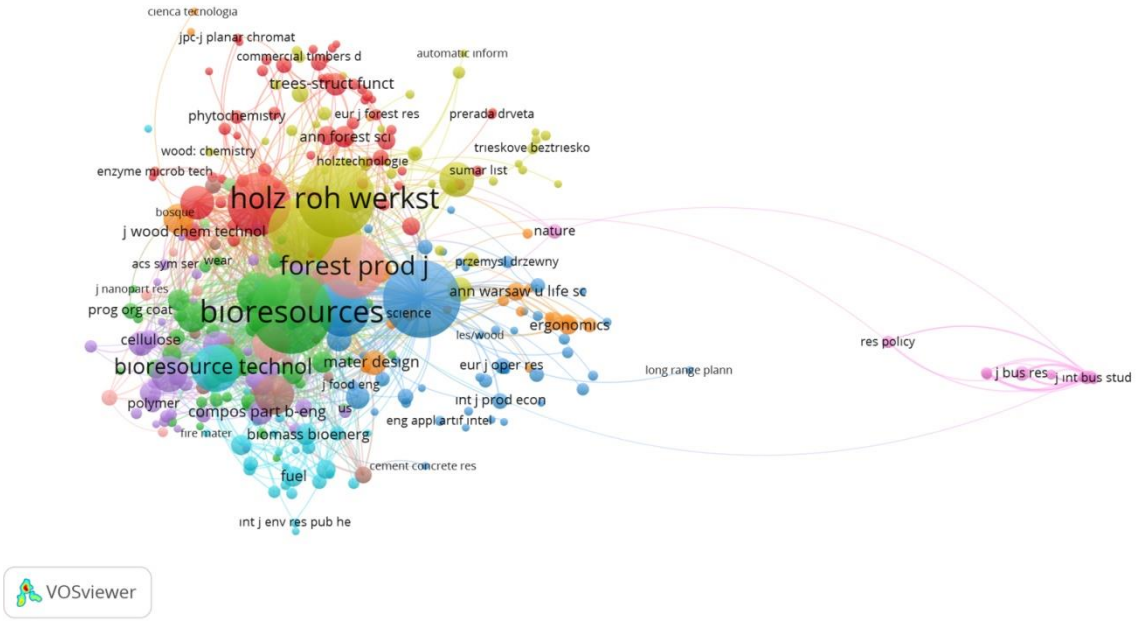


Figure 9. Network map of source co-citation by documents in Drvna Industrija.

These results indicate the scope of Drvna Industrija that links with topics in wood and wood-based products and technological properties. 88 keywords were grouped into 12 clusters with red, green, blue, yellow, purple, turquoise, orange, brown, pink, light pink, light green and light blue colored circle. Wood, which is the most used keyword by authors in documents, has the largest link in the map, followed modulus of elasticity, plywood, moisture content and particleboard. Regarding total link strength, the keyword with the highest total link strength is modulus of elasticity (TLS=32), followed wood (TLS=30), particleboard (TLS=26), mechanical properties (TLS=25), and plywood (TLS=24).

When the average citation scores of the keywords were analyzed, motivation (20.75), chemical composition (18), contact angle (14.8), sanding (13.5), ftır (12.83), numerical analysis (12.67), thermal modification (12.6), chemical modification (11.75), brinell hardness (10.5), junile wood (10.25) and temperature (10) were the most impact keywords. These keywords are cited more than any other keywords and made a significant to increase the impact of the Journal Drvna Industrija (Figure 11).

With Figure 12, it was tried to reveal which keywords the studies in Drvna Industrija focused more on in recent years. The dark colors represent old topics, whereas the lighter colors represent recently discussed topics. Trending topics are heat-treated wood, artificial neural network, oriented strand board and decay resistance, in recent years.

Figure 13 illustrates a visualized version of the analysis of co-occurrence of terms in the abstract field of documents. The minimum number of repetitions of a term was determined as 25 and of the 11252 terms, 84 terms meet this threshold value. Out of terms 84, the most relevant 50 terms were selected. The terms in the abstract fields of document shown in Figure 14 consist of 2 clusters with red and green colored circle. Paper and property are leading the red and green colored clusters and they have the largest network in the map. Other significant terms in the red cluster are method, research, aim, product and production, while other significant terms in the green cluster are sample, strength and temperature. As seen in Figure 13, the green cluster consists of terms used especially in experimental studies, while the red cluster consists of terms used in studies related to secondary data and survey method. As stated in

Table 4, the most frequently used term among 50 terms is paper (178 occurrences), followed property (166 occurrences), method (160 occurrences) and research (140 occurrences).

Table 4. Top 10 keywords and terms used in documents and abstract fields of documents in Drvna Industrija.

Keywords	Occurrences	Terms	Occurrences
Wood	29	Paper	178
Mechanical properties	22	Property	166
Furniture	18	Method	160
Modulus of elasticity	17	Research	140
Plywood	17	Sample	128
Particleboard	17	Strength	118
Heat treatment	15	Aim	111
Physical properties	13	Temperature	105
Beech wood	12	Product	95
Moisture content	12	Degress c	93

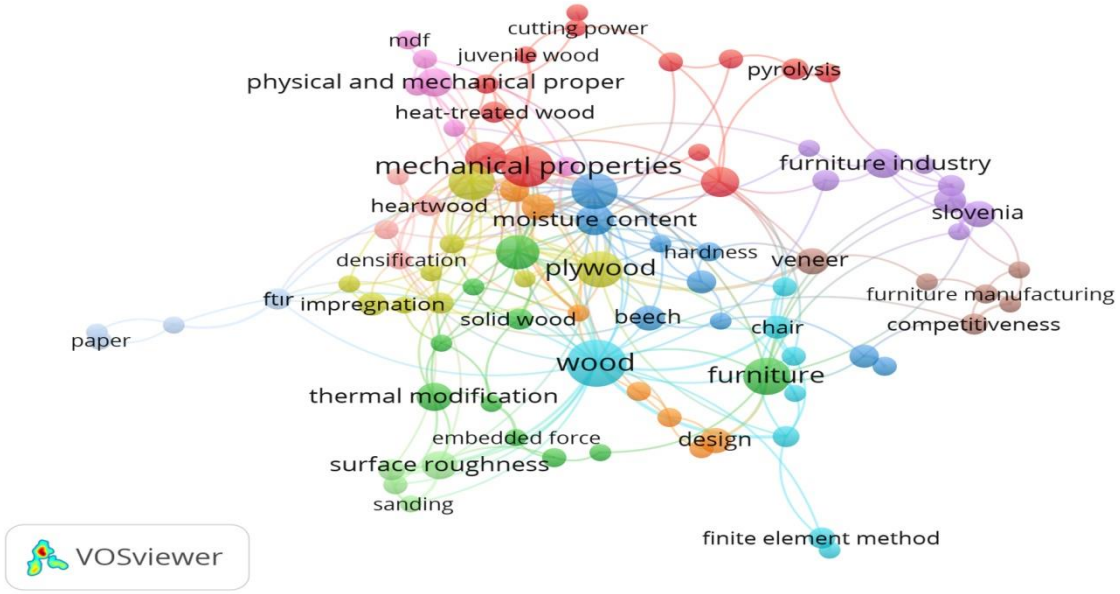


Figure 10. Network map of co-occurrence of keywords used in documents published in Drvna Industrija.

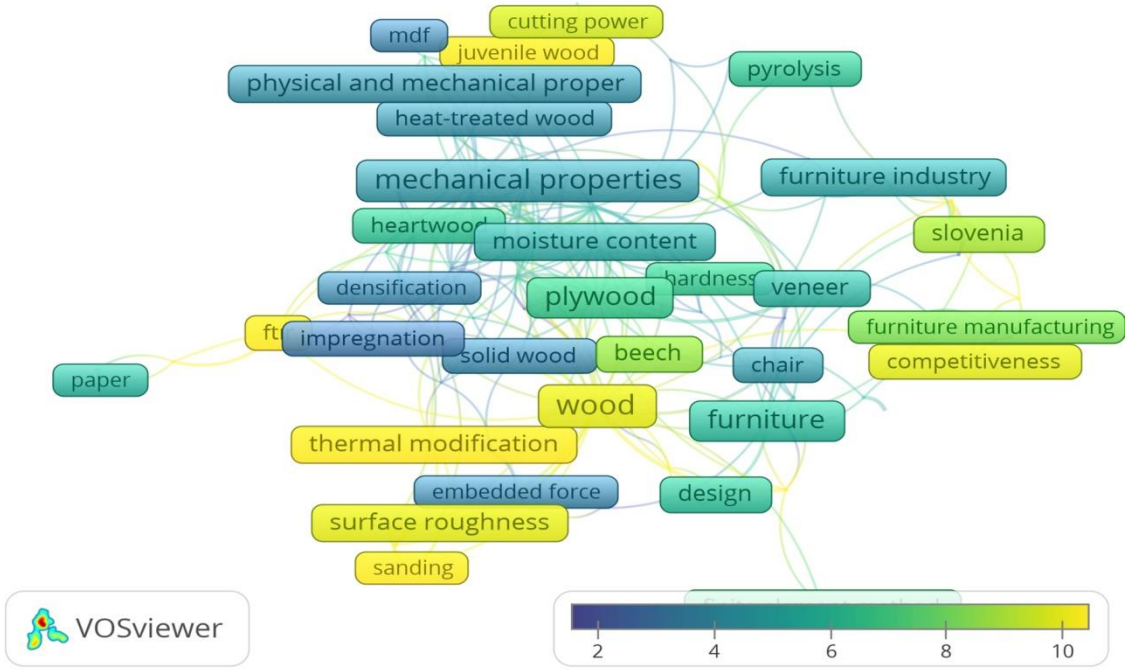


Figure 11. Network map of the citation impact of keywords.

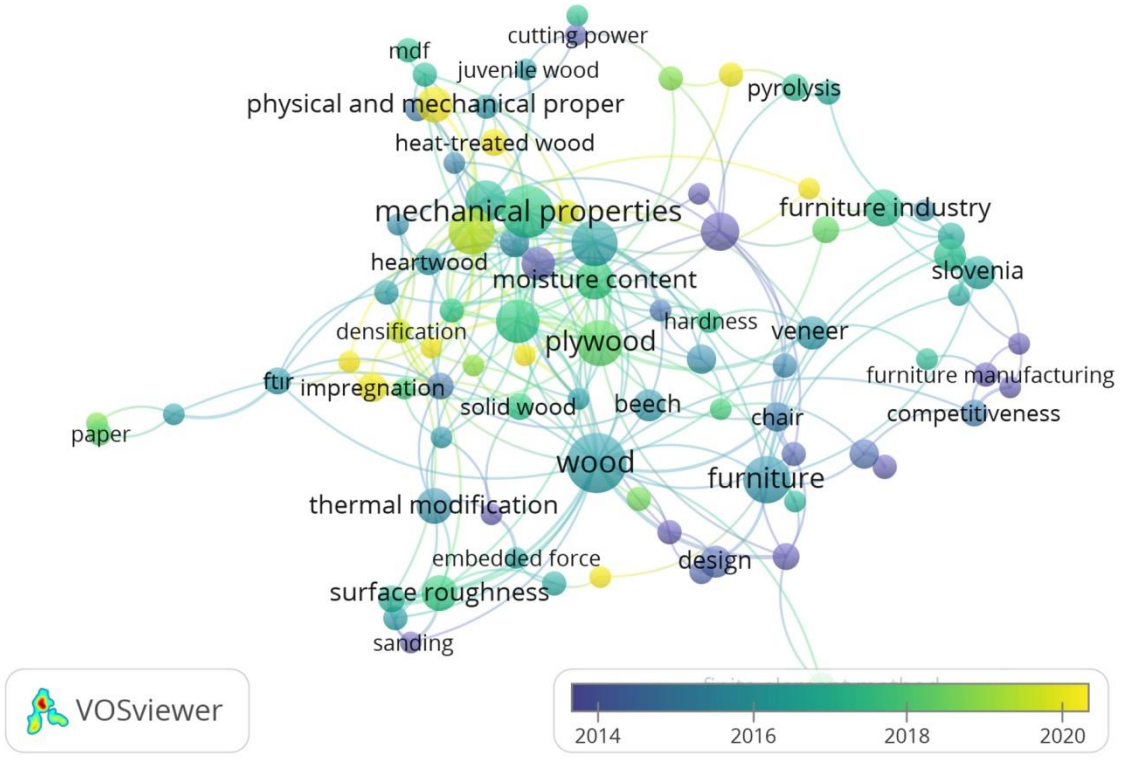


Figure 12. Network map of the time-based co-occurrence of keywords used by the authors in the documents.

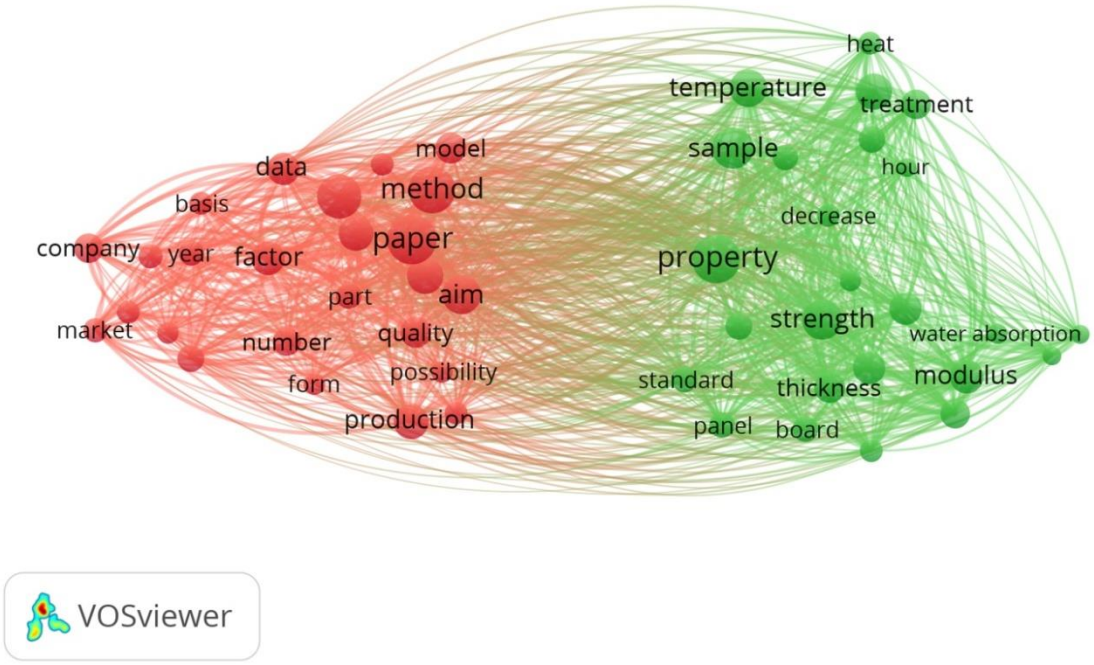


Figure 13. Network map of co-occurrence of terms in abstracts field of documents.

Conclusions

In the Drvna Industrija journal focuses on the wood and wood products field and it has been published continuously at regular intervals since 1950. It has been scanned in the Web of Science database since 2008. The aim of this study is to create a bibliometric profile of all scientific documents published by the journal since the year it started to be scanned in the web of science database.

By using the Web of Science database, 633 documents were collected and analyzed. According to the analysis results, the publication in journal showed an increasing trend in recent years and the most articles were published in 2022. The 633 documents published in Drvna Industrija between 2008 and 2023 were written by 1092 different authors who contributed to the journal from 49 different countries and 6 continents and there is an average of 0.58 articles per author. This result shows that teamwork is dominant in the studies carried out. Considering the citation status of the journal, the increasing trend in the journal's citations has been relatively rapid and the journal received 65% of its total citations in the last five years. It is seen that the sources cited for the publications in Drvna Industrija are generally journals that publish on wood and wood products. It has been observed that Bioresources is the source that cites journal the most. The self-citation rate of the journal was also quite high. It is seen that Croatian authors are the most productive and countries close to Croatia generally publish more in the journal. When examined on an organizational basis, it is also seen that University of Zagreb has contributed the most to the journal. 35% of the organizations in the top 20 are Turkish, 20% are Polish, 10% are Czech, and 10% are Iranian. It is a remarkable result that no organizations from America, Germany, Italy and Austria are included in the top 20. 2024 different keywords were used in the journal, and the most used keyword is wood. Trending topics in journal are heat-treated wood, artificial neural network, oriented

strand board and decay resistance, in recent years. Finally, 11252 different terms in the abstract field were used and the most frequently used co-occurrence of term in the abstract field of documents in the journal was the paper term.

There are a very limited number of studies on bibliometric analysis of journals that publish specifically on wood and wood products. This study answered an existing gap in the literature. Additionally, the study may be useful for editorial boards in making strategic decisions on the further development of the journal.

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