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Komal Gupta  
komalgpt555@gmail.com

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**An analysis of the co-occurrence of keywords on  
the topic sustainable development of libraries: A  
Scientometrics analysis**

Komal Gupta

Librarian at Kunwar's Global School, Deva Road Lucknow.

[Komalgpt555@gmail.com](mailto:Komalgpt555@gmail.com)

7991911663

**Abstract**

**Purpose:** The aim of this study is to investigate the co-occurrence of keywords related to the sustainable development of libraries. VOSviewer, one of the analysis tools used in this paper, can assess complex networks depending on the degree of connectedness between projects. The concept of sustainable library development is gaining popularity all over the world, and keyword co-occurrence analysis is an effective method for determining how certain research trends are developing fields. In addition, efforts are made to calculate the growth rate of literature, look at the top 10 publishers, nations, and languages with the highest number of pieces.

**Methodology:** Every piece of writing on sustainable development that was published between 2001 and 2020 is included in this study. Data are gathered via the Web of Science (WoS) database. The statistically examined data were presented along with analyses, conclusions, and interpretations in both graphical and written representations. Data analysis and the presentation of statistical information are done using Vosviewer, Microsoft Word, Excel, and the results are displayed in the form of figure, tables, charts, and bar graphs.

**Findings:** In the period from 2001 to 2020, the growth rate of papers rises. The data show that 138 publications, or 16.99%, were published in 2020. The People's Republic of China has the most library publications on the topic of sustainable development of libraries, and Elsevier topped the list of the top 10 publishers with 184 articles. Most of the material is written in English language. While creating maps of co-occurrence of keyword using VOSviewer, terms like "identification," "sustainability," "expression," "sustainable development," and "libraries" appear more frequently.

**Originality:** The data used to determine the output of literature about the sustainable development of libraries was taken from Web of Science, one of the biggest and most reliable databases. The information is unique and has not been published anywhere else.

This paper will give readers knowledge of the literary productivity, the top 10 countries, and the languages with the most articles and graphical illustrations of the *co-occurrence* of keywords.

**Keywords:** sustainable development, libraries, environment, literature, growth rate, Web of Science, VOSviewer.

## **1. Introduction**

Because it is a natural rule that you cannot remain in one place for an extended period of time, the entire world is always changing. People have a propensity to alter in response to their surroundings. Why not libraries if everything are evolving towards a greater self? Libraries are undergoing a lot of changes as well, including virtual libraries, digital libraries, mobile libraries, and more. This modification also includes the addition of the terms "green libraries" and "sustainable development of libraries". The definition of sustainable development is the process by which we meet the needs of the present generation while ensuring that future generations have access to sufficient resources to meet their own needs. As everyone is well aware, there are numerous environmental problems plaguing our planet today, including solid waste management, deforestation, water pollution, global warming, ozone layer depletion, and many others. Therefore, we have a responsibility to preserve our ecosystem for future generations so that they may breathe clean air and we won't hear any complaints about not attending to their requirements. Our libraries have a significant role to play in protecting the environment. In order to meet the demands of its clients, our large, expensive libraries use a lot of energy. The libraries can be built so that they scarcely have an impact on the environment. We may create a green library by selecting a suitable location for the building, using natural materials and biodegradable items, conserving resources like water, energy, paper, etc., and being responsible for recycling waste materials. Globally, the

idea of a "green library" is gaining traction, indicating that people are interested in the idea of libraries being developed sustainably. The publication of articles on the subject of the sustainable growth of libraries during 2001 to 2020 is the exclusive focus of the present work.

## **2. Review of literature**

Lis (2018) investigate the top research-related thematic areas that are concerned with sustainable enterprises / organisation. High-frequency keywords are clustered and their co-occurrences are studied, and the research environment in the selected main areas is examined. The most recent themes in the field are listed and examined at the end.

Khalid (2021) evaluated literature covering the years 2000 to 2020, selected from the LISA, LISTA, and Scopus, Web of Science, and Google Scholar databases. The study offers a comprehensive report to assist Pakistani library executives and educational policy makers in using SD efforts more successfully in accordance with the contextual requirements of the institutes. By incorporating sustainability into the LIS curriculum, the findings of this study also contributed to the advancement of the sustainability agenda in LIS.

Singh and dixit (2021) examined the sustainable strategies used by selected state university libraries in Lucknow, Uttar Pradesh, India. The survey technique is the foundation of the research study. With the use of questionnaire tools, it was done in the libraries of selected state universities in an effort to learn more about the green initiatives implemented in libraries.

Dutta and Chaudhary (2009) attempted to look into the sustainability knowledge and awareness of university library administrators in Kolkata, India. For that, a descriptive research design utilising a survey approach was used in the study. This research included sixteen library administrators from five universities in Kolkata as its study population.

### **3. Objectives**

- ❖ To examine Year wise growth rate of literature on sustainable development of libraries.
- ❖ To evaluate the document's linguistic content for the same subject
- ❖ To identify the top 10 publishers who come up with the greatest number of works on a given topic.
- ❖ To identifying the top 10 nations with the maximum number of articles.
- ❖ To analyse the co-occurrence of all keyword, authors keyword and keyword plus with the help of VOSviewer tool.

### **4. Research methodology**

This study includes each piece of literature published between 2001 and 2020 on the subject of sustainable development in libraries. The Web of Science database is used to collect data. The statistically analysed data were provided along with analyses, findings, and interpretations in both graphical and textual formats. MS- Excel sheet and MS-word is used to analyse data and present statistical information, which is then shown in the form of tables, charts, and bar graphs.

### **5. Scope and limitations**

The Web of Science database is used to gather information on the literature that has been published on the topic of the sustainable development of libraries between the years of 2001 and 2020. This study uses the network visualisation tool VOSviewer to ascertain the co-occurrence of keywords. All keywords, authors' keywords, and keyword plus were the unit of analysis. Co-occurrence networks were built and visualised using the full counting method.

## 6. Data analysis and Interpretation

Data was gathered from the Web of Science database, subsequently examined using statistical tools including Microsoft Excel and VOSviewer, and then displayed as tables, charts, graphs, and figures, among other formats.

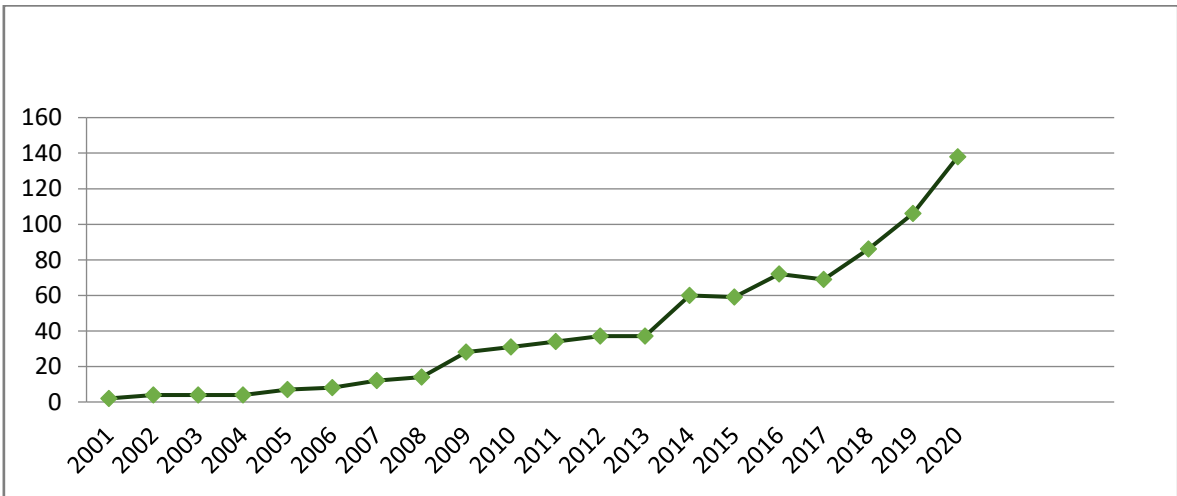
### 6.1 Year wise growth rate of literature

The growth rate of papers improves throughout the years of 2001 and 2020, as seen in table 1, starting with the year 2001 the strength was only 2 after that in 2002 ,2003,2004 the strength was 4 (0.49%) followed by 2005 with 7(0.86%),2006 with 8 (0.99%),2007 with 12 (1.48%) ,2008 with 14 (1.72%), 2009 with 28 (3.45%), 2010 with 31 (3.82%),2011 with 34 (4.19%) , 2012 and 2013 with 37 (4.56%),2014 with 60 (7.39%) and so on . The maximum number of papers as per the data is shown in 2020 with 138 (16.99%).

**Table 1: Year wise growth rate**

S.No.	Year	Frequency of articles	Average
1.	2001	2	0.24%
2.	2002	4	0.49%
3.	2003	4	0.49%
4.	2004	4	0.49%
5.	2005	7	0.86%
6.	2006	8	0.99%
7.	2007	12	1.48%
8.	2008	14	1.72%
9.	2009	28	3.45%

<b>10.</b>	2010	31	3.82%
<b>11.</b>	2011	34	4.19%
<b>12.</b>	2012	37	4.56%
<b>13.</b>	2013	37	4.56%
<b>14.</b>	2014	60	7.39%
<b>15.</b>	2015	59	7.27%
<b>16.</b>	2016	72	8.87%
<b>17.</b>	2017	69	8.49%
<b>18.</b>	2018	86	10.59%
<b>19.</b>	2019	106	13.05%
<b>20.</b>	2020	138	16.99%
	<b>TOTAL</b>	<b>812</b>	<b>100.00%</b>



**Figure 1: Year wise growth rate**

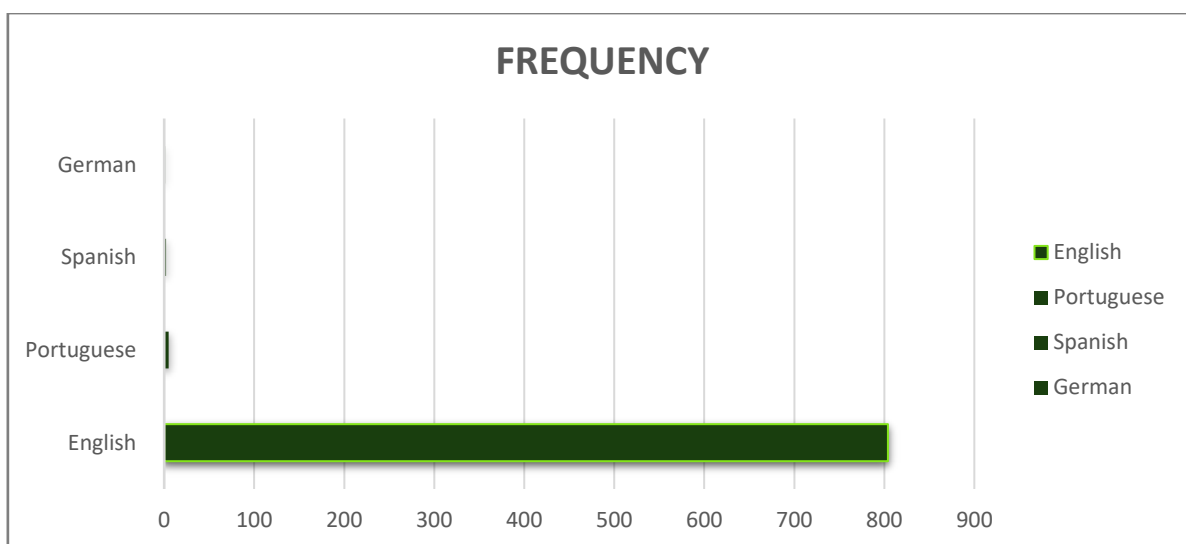
## 6.2 Language wise analysis of articles

As seen in table 2, there were five languages used for the papers. The language with the highest frequency was English, with 804 (99.01%) occurrences. Portuguese comes next on the list with a frequency of 5 (0.62%), then Spanish 2 (0.25%), German 1 (0.12%).



**Table 2: Language wise analysis of articles**

S.No.	Language	Frequency of articles	Average
1.	English	804	99.01%
2.	Portuguese	5	0.62%
3.	Spanish	2	0.25%
4.	German	1	0.12%
	<b>Total</b>	<b>812</b>	<b>100.00 %</b>



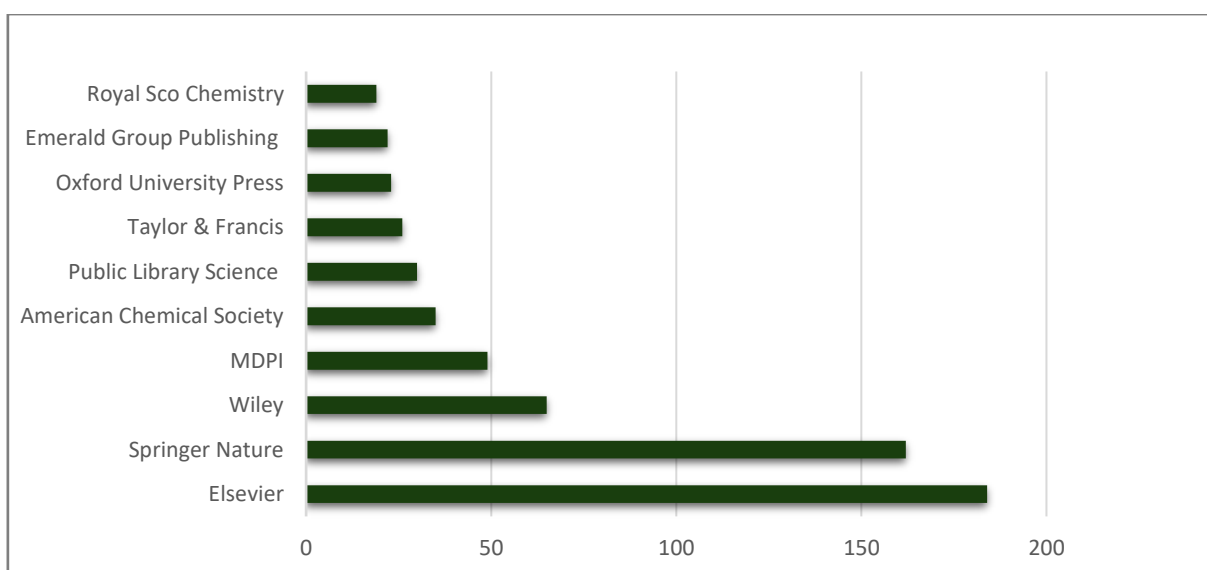
**Figure 2: Language wise analysis of articles**

### 6.3 Top 10 publishers with the maximum articles

The information in table 3 makes it very evident that there are a total of 10 publishers. Elsevier has 184 articles, followed by Springer Nature with 162 , Wiley 65 ,Mdpi with 49,American chemical society with 35, Public library science with 30 ,Taylor & Francis with 26, Oxford university press 23,Emerald Group Publishing with 28 and Royal Sco Chemistry with 19 articles.

**Table 3: Top 10 publishers**

S.No.	Publishers	Frequency of articles
1.	Elsevier	184
2.	Springer Nature	162
3.	Wiley	65
4.	MDPI	49
5.	American Chemical Society	35
6.	Public Library Science	30
7.	Taylor & Francis	26
8.	Oxford University Press	23
9.	Emerald Group Publishing	22
10.	Royal Society Chemistry	19



**Figure 3: Top 10 publishers**

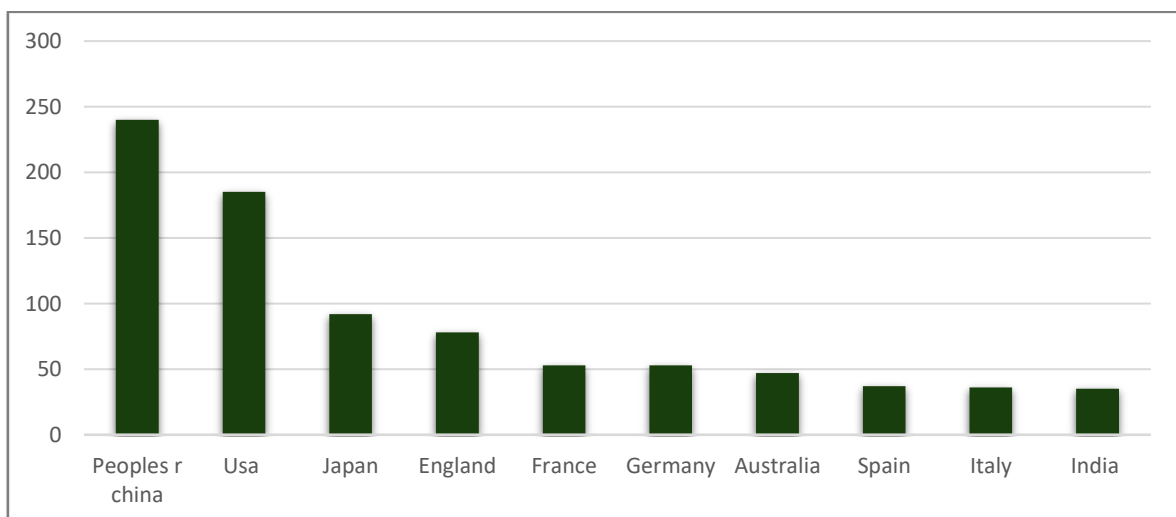
#### 6.4 Top 10 nations with the maximum articles

Table 4 shows the results of the analysis of data from ten different countries. Peoples Republic of China has the most publications on the topic of sustainable development for

libraries, with 240, followed by the USA with 185, Japan with 92, England with 78, France and Germany with 53, Australia with 47, Spain with 37, Italy with 36, and India with 35.

**Table 4: Top 10 nations with the maximum articles**

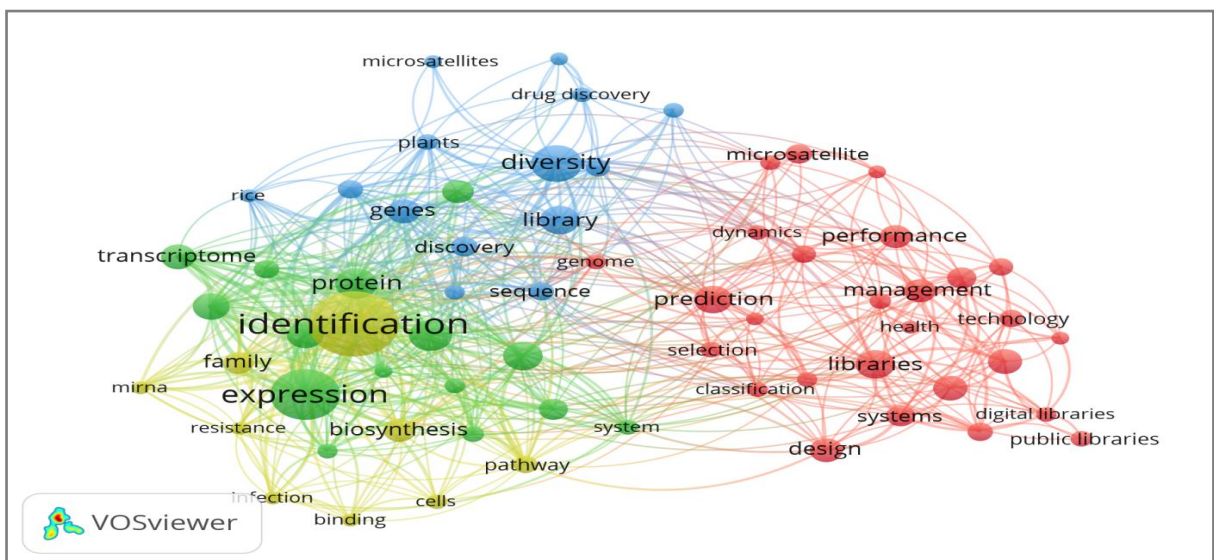
S.No.	Countries	Frequency of articles
1.	Peoples r china	240
2.	USA	185
3.	Japan	92
4.	England	78
5.	France	53
6.	Germany	53
7.	Australia	47
8.	Spain	37
9.	Italy	36
10.	India	35



**Figure 4: Top 10 nations with the maximum articles**

### 6.5 Co- occurrence of all keywords

According to the co-occurrence analysis shown in figure 5 using VOSviewer, the minimum number of keyword occurrences was set at 10, and 65 out of the 5756 keywords fall inside this range. The keyword identification appears 73 times with a total link strength of 144, followed by "expression" with 53 occurrences and 125 total link strength, diversity with 35 occurrences and 61 total link strength, gene expression occurs 29 times with 55 link strength, protein coming about 28 times with 62 total link strength, the keyword library occurs 26 times with 38 total link strength, and "sustainable development" arising 22 times with 22 total link strength.

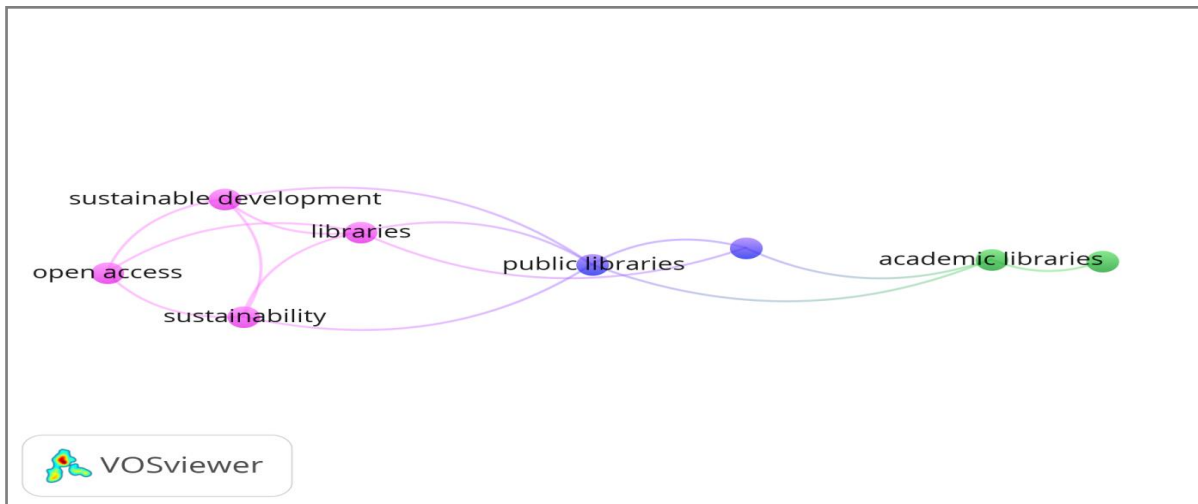


**Figure: 5 Co-occurrence analyses of all the keywords through VOSviewer**

## 6.6 Co- occurrence of authors keywords

Figure 6 from the authors' keyword analysis shows that 25 out of the 2783 keywords match the criteria for inclusion. The minimum amount of times a keyword must appear was set at 5. Figure 6 only representing the largest set of connected items which include 8 items instead of all items. The keyword Transcriptome is mentioned 20 times with a total link strength of 2, followed by sustainable development (19 times) with a total link strength of 6 and

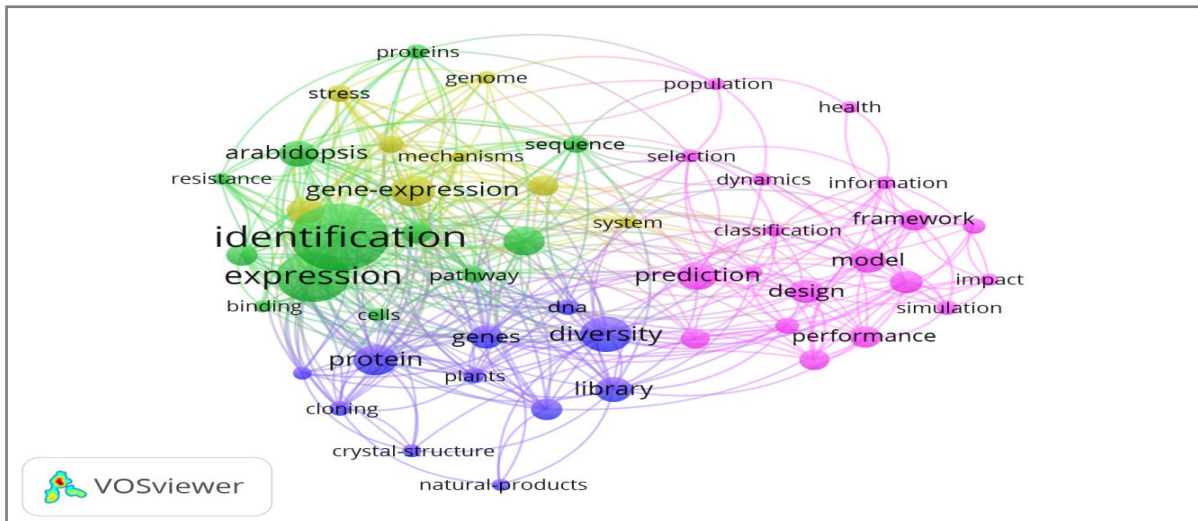
microsatellites (14 times) with a total link strength of 9, public libraries occur 12 times, sustainability occurs 10 times, with 4 total link strengths, and so forth.



**Figure: 6 Co-occurrence analyses of authors keywords through VOSviewer**

### **6.7 Co- occurrences of KeyWord Plus**

The unit of analysis, keyword plus, reveals that 50 out of 3271 keywords meet the threshold for inclusion. Ten times was chosen as the minimum number of times a keyword must appear. The term identification appears 72 times with a total link strength of 118, followed by the keyword expression, which appears 51 times with a total link strength of 99, diversity, which appears 34 times, proteins, which appears 28 times, libraries, which appears 23, and continuing on.



**Figure: 7 Co-occurrence analyses of keywords plus through VOSviewer**

## 7. Findings

- ❖ The growth rate of papers accelerates between the years 2001 and 2022. The most papers published, 138 (16.99%), are in the year 2020, according to the data.
- ❖ Most of the literature is written in English, with 1164 (99.06%), followed by Portuguese, Spanish, German, and Japanese.
- ❖ The top 10 publishers list was headed by Elsevier with 184 articles then Springer nature with 162, Wiley with 65 and many others.
- ❖ The People's Republic of China is the nation with the most publications on the subject of sustainable development of libraries, followed by the United States, Japan, England, and many other nations.
- ❖ The word identification appears 73 times, has total link strength of 144, is followed by the term expression, and many other keywords, according to the co-occurrence analysis of all the keywords.
- ❖ The co-occurrence analysis of the author's entire keyword list revealed that the keyword Transcriptome is mentioned 20 times with a total link strength of 2, followed by

sustainable development (19 times) with a total link strength of 6, and microsatellites (14 times) with a total link strength of 9, among many other keywords.

- ❖ The keyword identification appears 72 times with a total link strength of 118, according to the co-occurrence analysis of keyword plus. It is followed by the keyword expression, which appears 51 times with total link strength of 99 among other keywords.

## **8. Conclusion**

The idea of sustainable library development is becoming more and more popular throughout the globe, and the growing number of publications on same topic can be used to gauge how much interest people have in a specific subject. As this study was carried out to determine the researchers' understanding of the idea of sustainable growth of libraries through the availability of literature in the database from the years 2001 to 2020. It was evident that this concept's production level has increased in comparison to its early years, which suggests that public knowledge of this particular idea is growing and that more people are becoming aware in the creation of environmentally friendly libraries in society. The frequency of keyword co-occurrence may help in determining the primary fields of study. A lot of emphasis has been paid to keywords like "identification," "sustainability", "expression," "sustainable development," and "libraries" because of the amount of times they occur. Finding the majority of researchers' current areas of interest may be aided by an investigation of the co-occurrence of keywords.

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