Bibliometric analysis of Scientific Reports

Abstract

Scientific Reports is an Open Access international journal, which has very high Impact Factor (4.997). The main aim of this paper is to perform the bibliometric analysis of Scientific Reports in years 2011-2022 in terms of various bibliometric indicators related with the number of publications and citations as well as international and national collaboration. Moreover, this paper provides an insight into the most frequently published countries and universities in Scientific Reports. The list of top authors who published the greatest number of documents can also be found in this paper. Furthermore, this paper reflects the list of top 10 funded agencies which funded the greatest number of documents in Scientific Reports. A detailed analysis also shows the most frequently used keywords in Scientific Reports. Next, this paper also sheds light on the research areas and scientific disciplines indicating the fields with the greatest number of published documents in Scientific Reports.

In particular, it has been turned out that Scientific Reports publishes mainly articles, which obtained a significantly number of citations per publication indicating the strong impact of this journal for scientific community. Scientific Reports publishes the greatest number of documents related with Natural Sciences as well as Medical and Health Sciences, especially: Biological Sciences, Clinical Medicine and Basic Medicine. My analysis also shows that USA and China published the greatest number of documents in this journal. Additionally, it is worth noting that Chinese Academy of Sciences is the most productive university in this journal. Therefore, it was found that expression, identification, growth and activation are the most frequently used keywords in Scientific Reports. Finally, it is worth to add that there exists some strong relationships between the particular indicators, especially: if the percentage of documents which have first or corresponding author affiliated in the selected country increases, the percentage of documents which have international and national co-authors decreases and increases, respectively. Based on my findings it can be also seen that the percentage of documents which have international co-authors is rather weak related with the percentage of documents in Top 10% the best documents and the number of citations per publication.

Keywords

Scientific Reports, publications, citations, international and national collaboration, bibliometric analysis

Introduction

Scientific Reports is a peer-reviewed, Open Access journal, which celebrates in year 2023 the 12th anniversary since published its first issue in year 2011. The publisher of Scientific Reports is Springer Nature. In particular, this journal is assigned to Multidisciplinary Sciences category in the Journal Citation Reports. It means that in Scientific Reports can be found papers from various disciplines, i.e. natural sciences, psychology, medicine and engineering. Interestingly, this journal is the 5th most-cited journal in the world, with very large number of citations. Moreover, Scientific Reports obtains widespread attention in policy documents and the media. In particular, documents which were published in this journal are very popular (about 427 999 mentions in the news based on Altmetrics). Furthermore, it is worth noting that about 129 414 061 downloaded documents was observed in year 2021. It is also worth highlighted that scientists from 197 world countries published their articles in Scientific Reports. This journal is indexed in many scientific databases, such as: Web of Science, PubMed, PubMed Central, Scopus, Dimensions, Google Scholar, DOAJ and SAO/ NASA ADS, while the documents in

Scientific Reports are published under a Creative Commons Attribution 4.0 International License. It means that users can share (copy, distribute and transmit) and remix (adapt) their documents including the commercial purposes. This journal is devoted to datasets and research related with sharing and reuse of scientific data, including experimental and observational datasets, as well as computational or curated data.

The Chief Editor of Scientific Reports is Dr Rafal Marszalek, while Editorial Board includes 9,000 members from more than 80 countries. The acceptance rate of Scientific Reports was equal 49% in year 2021, because this journal publishes only original and the highest quality papers. In year 2021, the median time between submission and first editorial decision was equal 18 days, while the median time between submission and first post-review decision was equal 59 days. It is also worth to add that the median time between submission and acceptance of manuscript was equal 133 days. In this place, it is worth to mention that authors of accepted documents must pay an article-processing charge (APC) in this journal. In particular, APC for scientists from USA, Canada, Central America, South America, Mainland China, Hong Kong, Taiwan, Macau and Japan is equal $2390, while APC for scientists from United Kingdom as well as Europe & Rest of the World are equal £1890 and €2090, respectively [1].

It is well known that a significantly number of bibliometric analyses of the selected journals was shown in the last years, especially through the celebration of their anniversary since published its first issue. In particular, it was found that scientists very often perform the bibliometric analyses which were associated with various scientific disciplines, such as: chemistry and biology [2-4], information and computer sciences, including intelligent systems [5-8], economics and management sciences [8-12] and other sciences [13-16]. These bibliometric analyses mainly focus on the analysis of the selected journal in order to provide an insights into the number of publications and citations as well as the most frequently used keywords, top countries, universities and authors.

The main purpose of this paper is to obtain the bibliometric analysis of Scientific Reports in years 2011-2022. In order to present an insights into the various research areas, disciplines, countries and universities, a significantly number of bibliometric indicators was calculated, especially: the number of publications, citations, the percentage of international/national collaboration. It is also worth noting that my results can help researchers, publisher and administrators obtained an overview about Scientific Reports from different perspectives.

Methods

In order to obtain the bibliometric analysis of Scientific Reports in years 2011-2022, I used an analytical tool – InCites [17, 18]. Firstly, I downloaded information about various bibliometric indicators related with this journal, such as: the number of publications, the number of citations, the number of citations per publication, the percentage of documents cited at least one, Category Normalized Citation Impact (CNCI), the percentage of documents in which author is affiliated as the first/corresponding author, the percentage of documents which have international, national and industrial co-authors, the number of highly cited documents, the percentage of documents which were published in Top 10%/Top 1% the best documents in Scientific Reports in years 2011-2022. Next, I depicted the list of top authors who published the greatest number of documents in Scientific Reports. Therefore, I also performed the list of top countries and universities in which scientists published the greatest number of documents. Information about the research areas, scientific disciplines, funding agencies were downloaded from InCites. Collaborations of 10 universities of technology, including Gdańsk University of Technology and 2 other universities (University of Gdańsk and Medical University of Gdańsk) in terms of CNCI and the number of documents were also performed in this paper. In order to obtain a more detailed picture, I also collected information about Impact Factor, Article Influence Score and Immediacy Index of Scientific Reports. These data were

retrieved on 13-14 April 2023. Next, I also downloaded information about population and income the top countries which published the greatest number of documents in Scientific Reports. These data were retrieved on 11 April 2023 based on the World Bank Data [19]. All results were analyzed in Microsoft Excel using the pivot tables and charts.

To determine the most frequently used keywords in documents which were published in Scientific Reports, I downloaded the list of publication based on the Web of Science database and then, I used VosViewer software, which allows the visualization of co-occurrence maps and co-citation networks at the country-, organization- and author-level [20]. Firstly, I calculated the most frequently used keywords plus for all publications and then, I determined the total strength of the co-occurrence links with other keywords. It is worth highlighted that the keywords with the greatest total link strength were selected. I used a full counting method assuming that the minimum number of occurrences of keywords plus was equal to 170, while in the case of the selected years, I used the assumption that the minimum number of occurrences of keywords plus is equal 28 (in years 2013-2022) and 5 (in years 2011-2012). Therefore, it is worth to add that I selected the normalization of the association strength and I divided keywords into 3 clusters.

Definition of some bibliometric indicators [1, 17, 18, 21]:

- *Immediacy Index* indicates how quickly articles in a journal are cited. In particular, this indicator presents the average number of citations per publication in the published year.
- *Eigenfactor Score* calculation is based on the number of times articles from the journal published in the past five years have been cited in the JCR year, but it also considers which journals have contributed these citations so that highly cited journals will influence the network more than lesser cited journals. It is worth to mention that references from one article in a journal to another article from the same journal are removed, so that *Eigenfactor Scores* are not influenced by journal self-citation.
- *Article Influence Score* reflects the average influence of a journal's articles over the first five years after publication. In particular, this indicator is calculated by multiplying the *Eigenfactor Score* by 0.01 and dividing by the number of articles which were published in the selected journal. Moreover, it is also worth to add that value of *Article Influence Score* is normalized as a fraction of all articles in all publications. This measure is roughly analogous to the *5-Year Journal Impact Factor* in that it is a ratio of a journal's citation influence to the size of the journal's article contribution over a period of five years.
- *Category Normalized Citation Impact (CNCI)* is the average number of citations per publication normalized by the selected publication year, research area and type of documents.
- *Journal Normalized Citation Impact (JNCI)* is a similar indicator to the Category Normalized Citation Impact, but instead of normalizing for subject area or field, it normalizes for the journal, in which the document is published.
- *Impact Factor* is defined as the total number of citations received by all types of documents which were published during the two previous years, divided by the total amount of articles and reviews published over the same two years.

Results and Discussion

Analysis of Impact Factor, Article Influence Score and Immediacy Index in Scientific Reports

From scientists point of view, it is interesting to know how is the value of Impact Factor of journal in which they want published their documents. Hence, **Fig. 1A** reflects the values of Impact Factor, including Impact Factor

without self-citations in years 2012-2021. According to **Fig. 1A**, it can be seen that Impact Factor increased from 2.927 in year 2012 to 4.997 in year 2021. On the other hand, Impact Factor without self-citations also obtained very high values, especially: in the range of 2.771 in year 2012 and 4.784 in year 2021. Moreover, it is worth to add that Journal Normalized Citation Impact is equal 1.001 in year 2022, while in the earliest years, these values were in the range of 1.000-1.002.
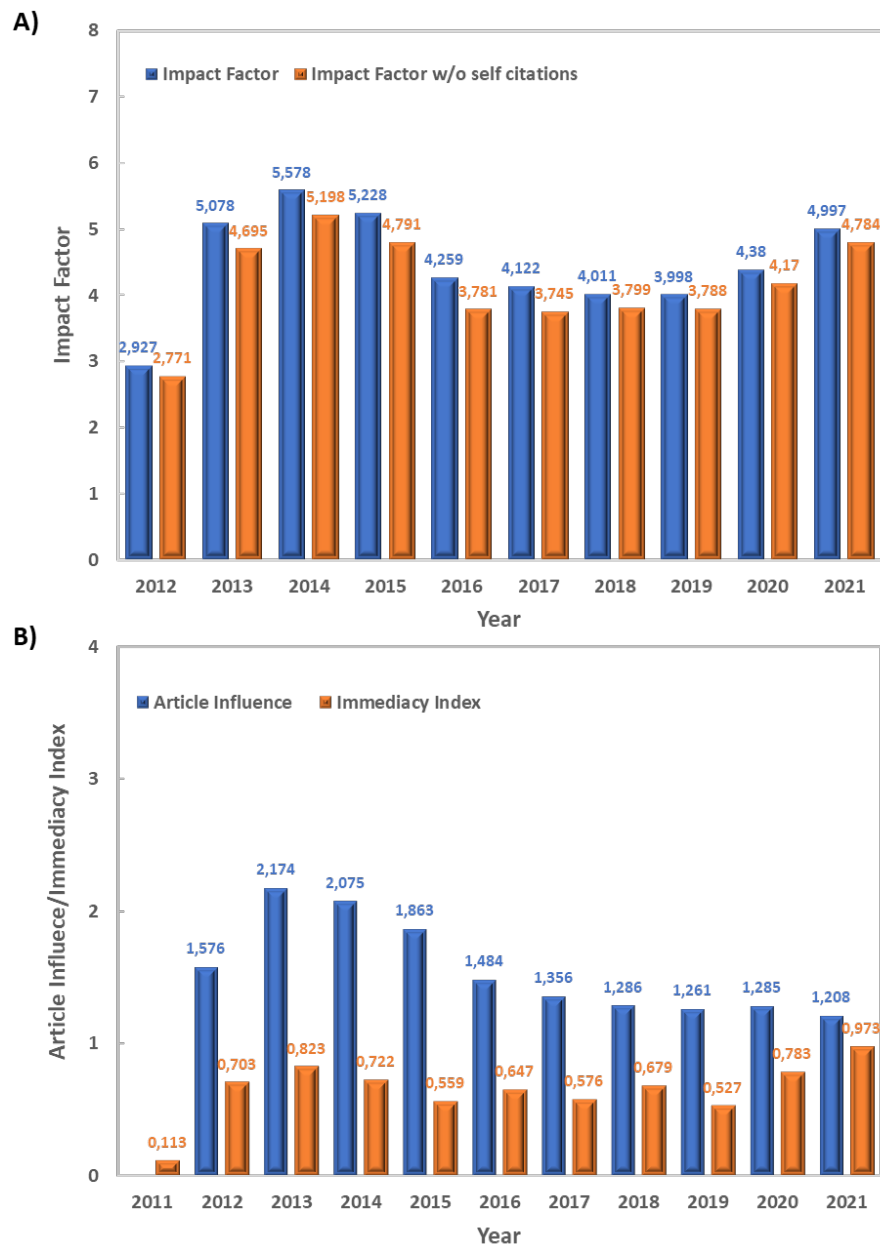
A)

B)

Fig. 1 Comparison of **(A)** Impact Factor (blue color) with Impact Factor without self-citations (orange color), **(B)** Article Influence Score (blue color) and Immediacy Index (orange color) for Scientific Reports as a function of years.

Then, in order to provide an overview of the influence of a journal's articles, I calculated the Article Influence Score (**Fig. 1B**). Based on **Fig. 1B**, it can be seen that the values of this indicators changes in years 2012-2021. The greatest value of Article Influence Score was observed in year 2013 (2.174), while the lowest value of this indicator was observed in year 2021. From scientists and publisher point of view, it is relevant to know how quickly articles in a journal are cited. Hence, I also calculated the Immediacy Index for Scientific Reports as a function of

years (**Fig. 1B**). In particular, it has been turned out that values of these indicators increased from 0.113 in year 2011 to 0.973 in year 2021. It means that the average number of citations per publication in the published year increased in the last years.

Analysis of types and the number of documents which were published in Scientific Reports

According to InCites, it has been turned out that scientists published 171 030 documents in Scientific Reports in years 2011-2022. Based on **Fig. 2**, it can be seen that in year 2011, scientists published 205 documents in Scientific Reports, while in year 2022, scientists published 20 559 documents. My results show that the trend in the number of documents in years 2011-2022 is increasing. The significantly growth of number of publications in years 2015-2016 can be explained by the huge interests of concepts related with this journal. Therefore, this growth can be explained by fact that scientists received more research grants in various projects, such as: H2020, FP7 [22]. In order to provide a detailed overview about the selected types of documents which were published in Scientific Reports in years 2011-2022, I also calculated some bibliometric indicators (the number of publications, the number of citations, the number of citations per publication, the percentage of documents cited at least one) for all types of documents in this journal. As can be seen in **Fig. 2 inset** and **Tab. 1**, the greatest number of documents were articles (164 597). These documents constitutes 96% of all documents which were published in Scientific Reports in years 2011-2022. The second position obtained correction materials (5955, 4% of all documents), while the third position received other types of documents (478), such as: reviews (219 documents), editorial materials (54 documents), letters (16 documents), data paper (1 document), retracted publications (188 documents). Interestingly, data paper obtained the greatest number of citations per publication (26). In the case of articles, 90.4% documents were cited at least one and the average number of citations per publication is equal 18.5.
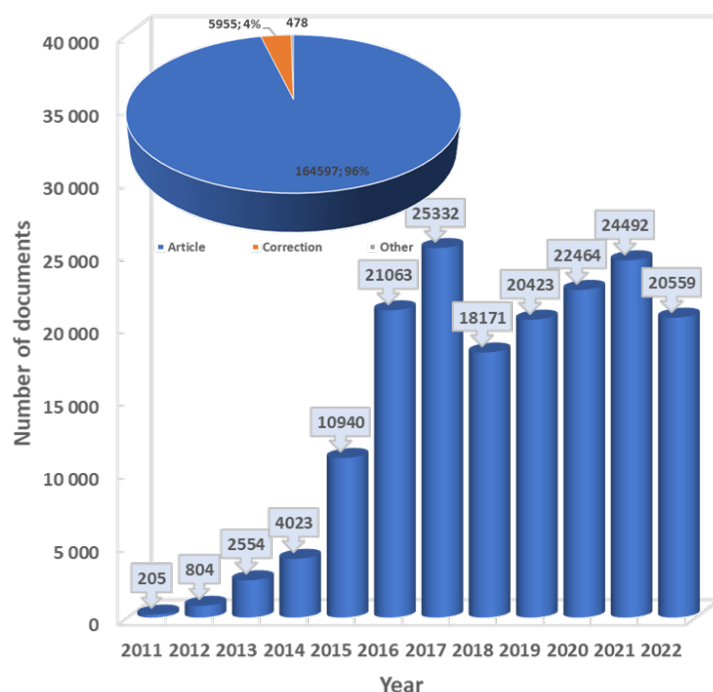

Fig. 2 Number of documents which were published in Scientific Reports in years 2011-2022. **Inset** shows the number of documents as a function of various types of documents.

Tab. 1 Number of documents, citations, citations per publication and the percentage of documents cited for the selected types of documents which were published in Scientific Reports.

Type of document	TP	TC	TC/TP	% Docs Cited
Article	164 597	3 048 830	18,5	90,4
Correction	5 955	3 788	0,6	26,4
Review	219	3 523	16,1	90,9
Retracted Papers	188	869	4,6	41,0
Editorial Material	54	565	10,5	57,4
Letter	16	39	2,4	81,3
Data Paper	1	26	26,0	100,0

Abbreviations: TP – the number of publications, **TC** – the number of citations, **TC/TP** – the number of citations per publication, **% Docs Cited** – the percentage of documents cited at least one.

Analysis of indicators related with citations in Scientific Reports

It is well known that citations are related with the impact of academic publications. Hence, in order to provide an overview about the indicators, which are very relevant from research assessment and evaluation perspectives, I calculated the values of various indicators, such as: the number of citations, the number of citations per publication, CNCI, the number of highly cited papers and the percentage of documents cited at least one. According to **Fig. 3A**, it can be seen that the average number of citations per publication for documents which were published in Scientific Reports is equal 17.88. Interestingly, if we take account only documents which obtained at least 1 citation, it can be seen that the average number of citations per publication is equal 20.28. **Fig. 3A** also performs that in the first three years (2011-2013), the analyzed documents obtained the greatest number of citations per publication (in the range of 58.9-74.7). On the other hand, the number of citations per publication decreased in years 2012-2022. If we take account the values of CNCI in years 2011-2022 (**Fig. 3B**), it can be seen that the greatest value of CNCI (4.82) was observed in year 2016, while the lowest value of CNCI (2.24) was observed in year 2012. According to my results, it can be also seen that in years 2011-2021, CNCI is greater than the average world value (1.00). Therefore, it is worth to add that the average value of CNCI is equal 1.16. Analysis of documents cited at least one (**Fig. 3C**) shows that the average percentage of documents cited at least one is equal 88.15. Interestingly, in years 2011-2020, this value was greater than 90%, while in years 2021-2022, these values are smaller and equal 84% and 41%, respectively. Based on my results (**Fig. 3D**), it can be also seen that the documents which were published in Scientific Reports in years 2011-2022 received 3 057 640 citations. It is also worth noting that self-citations represent 4.1% of all citations in this journal. Interestingly, some documents which were published in Scientific Reports obtained very large number of citations. These documents (950) were assigned as highly cited papers, as can be seen in **Fig. 3E**. In particular, the greatest number of highly cited papers (>100) were published in years 2016, 2017 and 2021. In order to obtain a more detailed picture about highly cited papers, I performed the titles of documents which received at least 750 citations in Scientific Reports in years 2011-2022 in **Tab. 2**.
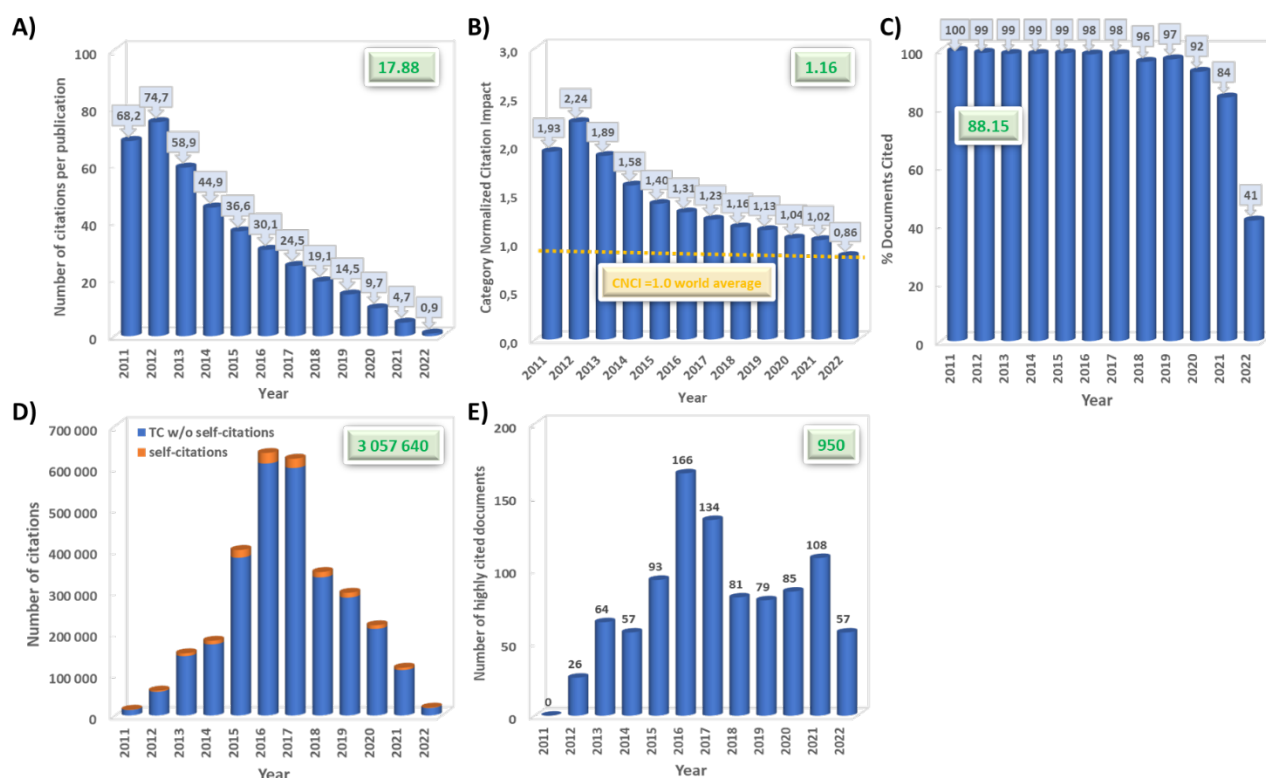
Fig. 3 (A) Number of citations per publication, **(B)** Category Normalized Citation Impact, **(C)** The percentage of documents cited at least one, **(D)** Number of citations, including self-citations and **(E)** Number of highly cited documents which were published in Scientific Reports in years 2011-2022.

According to **Tab. 2**, it can be seen that the greatest number of citations (6 382) obtained an article entitled "Lead Iodide Perovskite Sensitized All-Solid-State Submicron Thin Film Mesoscopic Solar Cell with Efficiency Exceeding 9%", which was published in year 2012. The second position in terms of the greatest number of citations received an article entitled "Insight on Tafel slopes from a microkinetic analysis of aqueous electrocatalysis for energy conversion", which was published in year 2015 (1 519 citations), while the third position obtained an article entitled "RASTtk: A modular and extensible implementation of the RAST algorithm for building custom annotation pipelines and annotating batches of genomes", which was published also in year 2015 (1 300 citations). Furthermore, it is also worth noting that 11 documents which were published in Scientific Reports obtained more than 750 citations, including 4 documents with more than 1000 citations. Therefore, it is worth to add that these mentioned papers are multi-authored papers. The number of authors for these documents is in the range of 3-16. The greatest number of authors (16) has an article entitled "RASTtk: A modular and extensible implementation of the RAST algorithm for building custom annotation pipelines and annotating batches of genomes".

Tab. 2 List of the most cited documents (>=750 citations) in Scientific Reports.

Rank	Article Title	Year	TC
1	Lead Iodide Perovskite Sensitized All-Solid-State Submicron Thin Film Mesoscopic Solar Cell with Efficiency Exceeding 9%	2012	6 382
2	Insight on Tafel slopes from a microkinetic analysis of aqueous electrocatalysis for energy conversion	2015	1 519
3	RASTtk: A modular and extensible implementation of the RAST algorithm for building custom annotation pipelines and annotating batches of genomes	2015	1 300
4	Identification of individual and few layers of WS2 using Raman Spectroscopy	2013	1 002

5	Relativistic GW calculations on CH3NH3PbI3 and CH3NH3SnI3 Perovskites for Solar Cell Applications	2014	975
6	Ingested plastic transfers hazardous chemicals to fish and induces hepatic stress	2013	964
7	Magnetic light	2012	858
8	Why is anatase a better photocatalyst than rutile? - Model studies on epitaxial TiO2 films	2014	795
9	Defects activated photoluminescence in two-dimensional semiconductors: interplay between bound, charged, and free excitons	2013	772
10	A stable solution-processed polymer semiconductor with record high-mobility for printed transistors	2012	763
11	Formation of oxygen vacancies and Ti3+ state in TiO2 thin film and enhanced optical properties by air plasma treatment	2016	751

Abbreviations: TC – the number of citations.

To identify the number of documents with a certain number of citations in Scientific Reports, I also consider several specific citation thresholds. In general, as can be seen in **Fig. 4**, the greatest number of documents obtained 1 citation (11 278 documents), followed by 2 citations (9 131 documents) and 3 citations (8 168 documents). Interestingly, 48 070 documents (28.1% of all documents) were cited more than 20 times, while 20 261 documents (11.8% of all published documents in Scientific Reports) don't received any citations.
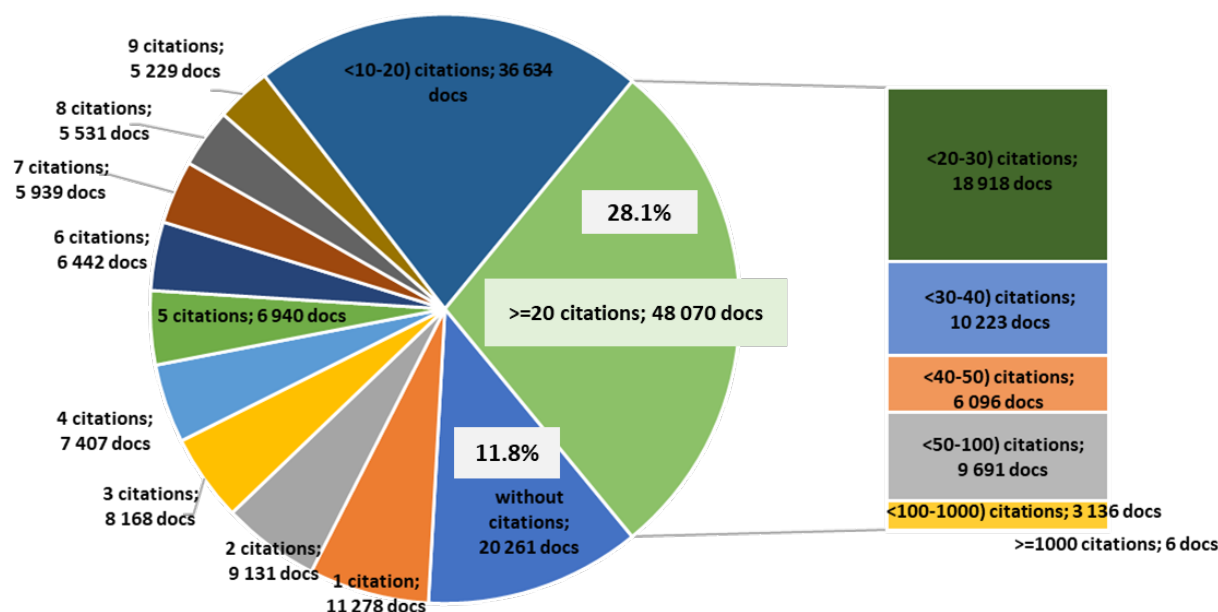

Fig. 4 Number of documents which were published in Scientific Reports in years 2011-2022 as a function of number of citations.

Analysis of international, national and institutional collaboration in Scientific Reports

Scientific collaboration can be understood as an interaction process in which knowledge is associated with skills, competences, resources, effective communication and exchange of ideas. Understanding the benefits of such collaborations, it is very relevant from scientists point of view. Hence, scientists published many papers devoted to factors (geographical, technological, institutional, social, organizational), which can effect on the collaboration between the selected universities, countries and researchers [23, 24]. Therefore, it is worth highlighted that international, national and institutional collaboration can effect on the greater number of citations per publication. Hence, I also determined the values of these indicators. In particular, the data presented in **Fig. 5** reveals the percentage of documents in Scientific Reports which have international and national co-authors. According to **Fig. 5A**, it can be seen that the average percentage of international collaboration is equal 35.0%, while the average

percentage of domestic collaboration is equal 38.9%. Therefore, as revealed by an analysis of collaboration over the span of years, the greatest average percentage of international collaboration (>40%) was observed in years 2011-2012, while the lowest average percentage of international collaboration (31.1%) was observed in year 2022. On the other hand, if we take account the percentage of domestic collaboration (**Fig. 5B**), it can be seen that the greatest value of this indicator (40.6%) was observed in year 2021, while the lowest value of this indicator (28.5%) was observed in year 2012.
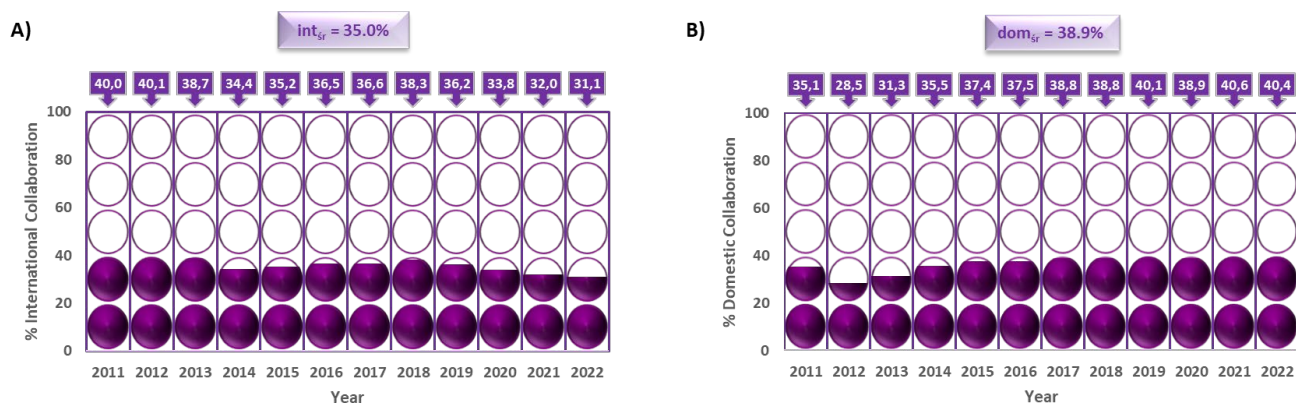

Fig. 5 The percentage of **(A)** international and **(B)** domestic collaboration for documents which were published in Scientific Reports in years 2011-2022.

Next, in order to estimate in which universities scientists should collaborate more frequently, I provide a more detailed picture about collaboration of the selected universities in which scientists published their documents in Scientific Reports with other world universities. In particular, I calculated values of CNCI for 10 Polish universities of technology in which scientists published at least 3 documents in Scientific Reports and 2 other universities, such as: University of Gdańsk, Medical University of Gdańsk. However, in this place, it is worth to mention that I also excluded universities of technology which collaborate with less than 3 other universities, i.e. Cracow University of Technology, Technical University of Częstochowa, Opole University of Technology, Kazimierz Pulaski University of Technology & Humanities in Radom. According to **Fig. 6**, it can be seen that collaboration of Gdańsk University of Technology with University of Gdańsk, Beijing University of Technology and Polish Academy of Sciences (Institute of Fluid Machinery) gives values of CNCI greater than 1.0. It means that the average number of citations per publication is greater than the average world value. Hence, it can be claimed that collaboration with these universities is very favorable for scientists from Gdańsk University of Technology. However, it is worth to mention that in the case of collaboration of Gdańsk University of Technology with other 6 universities, values of CNCI are smaller than 1.0, which means that the average number of citations per publication is smaller than the average world value and hence, this collaboration is less favorable. Based on **Fig. 6**, it can be also seen that the greatest number of documents, scientists from Gdańsk University of Technology published with scientists from Fahrenheit Universities (59 documents) and Reykjavik University (12 documents). A significantly number of collaborated papers with Fahrenheit Universities can be explained by geographical factor, which means that these 3 universities are located in one city (Gdańsk). The similar results can be observed in the case of other universities of technology. For example, scientists from Bialystok University of Technology, Lublin University of Technology, Wrocław University of Science & Technology also collaborated very often with scientists from other universities or medical universities in their cities. My results are consistent with previous study [23] in which researchers depict that distance factor is one of the main driving factors of scientific

collaboration. In the case of other universities of technology, it can be seen that scientists from some universities published at least 3 documents in Scientific Reports with many other universities, while in the case of other universities (Lublin University of Technology, Białystok University of Technology), it can be seen that scientists collaborate with only very small number of universities. For example, scientists from Lublin University of Technology published at least 3 documents in Scientific Reports only with scientists from Medical University of Lublin, University of Life Sciences in Lublin and Maria Sklodowska-Curie University. As seen in **Fig. 6**, the most favorable is collaboration of Łódź University of Technology with Fahrenheit Universities (CNCI=6.32). A very significant is also collaboration of Silesian University of Technology and Sejong University (CNCI=4.96) as well as Medical University of Gdańsk and Maria Skłodowska-Curie National Research Institute of Oncology (CNCI=4.88). Additionally, it is worth noting that collaboration with a significant number of universities provides CNCI greater than 1.0 indicating the benefits of these collaborations. Surprisingly, in all cases, collaboration of Poznań University of Technology with other universities gives CNCI smaller than 1.0. It means that documents which were written by these universities obtained a smaller number of citations per publication than the average world value. Next, it is also worth to add that scientists from University of Gdańsk and Medical University of Gdańsk published the greatest number of documents in Scientific Reports in years 2011-2022 with scientists from Fahrenheit Universities (101 and 74 documents, respectively). In the case of other selected universities, it can be seen that a significantly smaller number of collaborated papers was published in Scientific Reports. Although, collaboration of some universities of technology (Warsaw University of Technology, AGH University of Science & Technology, Poznań University of Technology, Silesian University of Technology, Wrocław University of Science & Technology) with Polish Academy of Sciences is very strong in terms of the large number of documents (13-18) which were published in Scientific Reports, it can be seen that scientists from Polish Academy of Sciences published the greatest number of documents with scientists from University of Gdańsk (25).
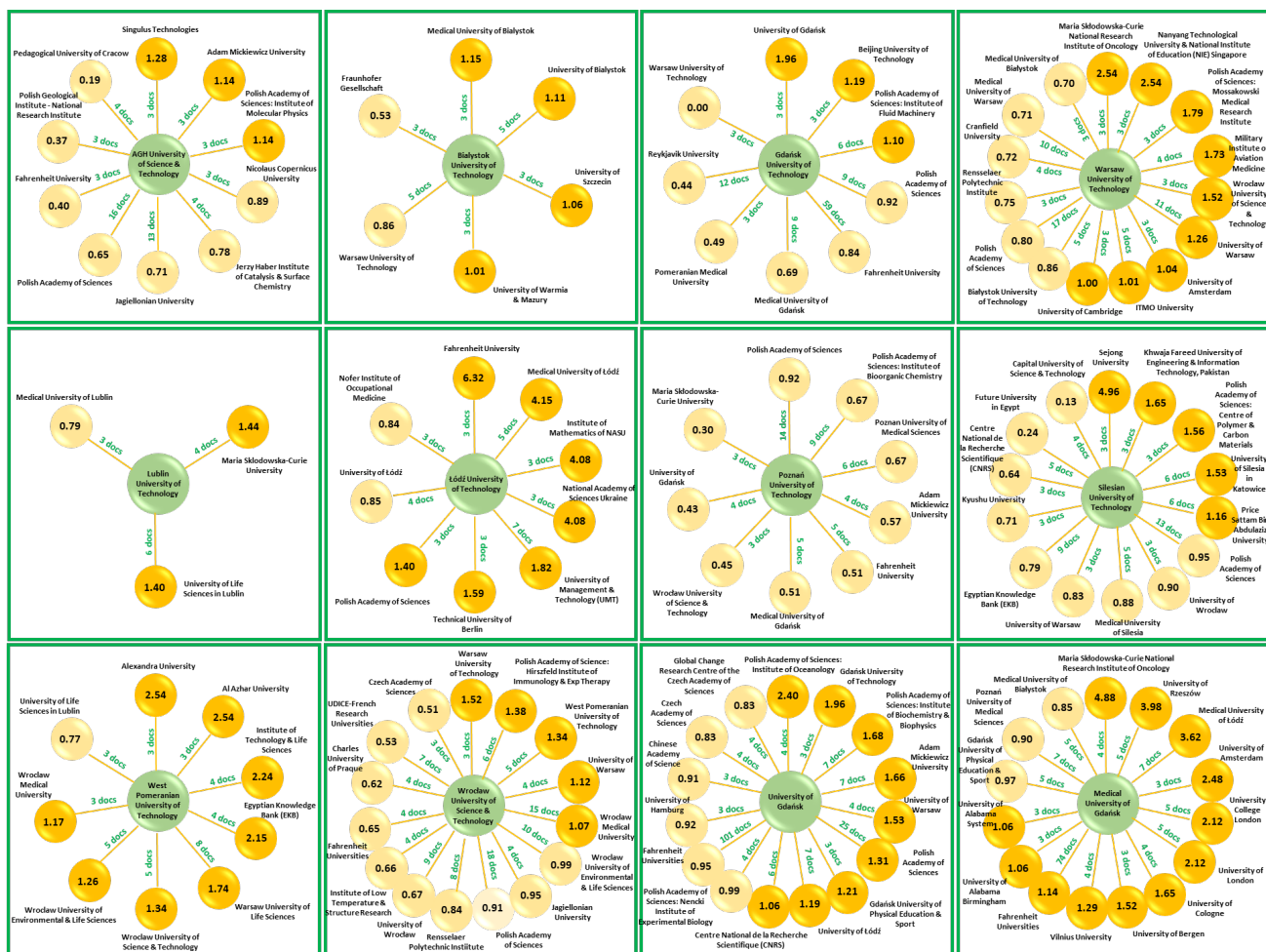
Fig. 6 Collaboration of 10 Polish universitites of technology and 2 other universities (University of Gdańsk and Medical University of Gdańsk) with other world universities in terms of CNCI. Assumption: the minimum number of published documents in Scientific Reports in years 2011-2022 is equal 3.

Analysis of number of authors who published their documents in Scientific Reports

In order to obtain an overview of number of authors who published their documents in Scientific Reports, the dependencies of number of citations per document and number of documents as a function of number of authors were depicted in **Fig. 7** and **Tab. 3**. As revealed by **Fig. 7 inset**, the greatest number of documents were written by 4-6 authors. Interestingly, 1 751 documents (1.02% of all documents) were written in Scientific Reports by single authors, while 38 documents were written by more than 100 authors, including 13 documents with more than 200 authors. Based on my findings, it can be claimed that scientists who published their articles in Scientific Reports prefer rather write papers with other scientists.
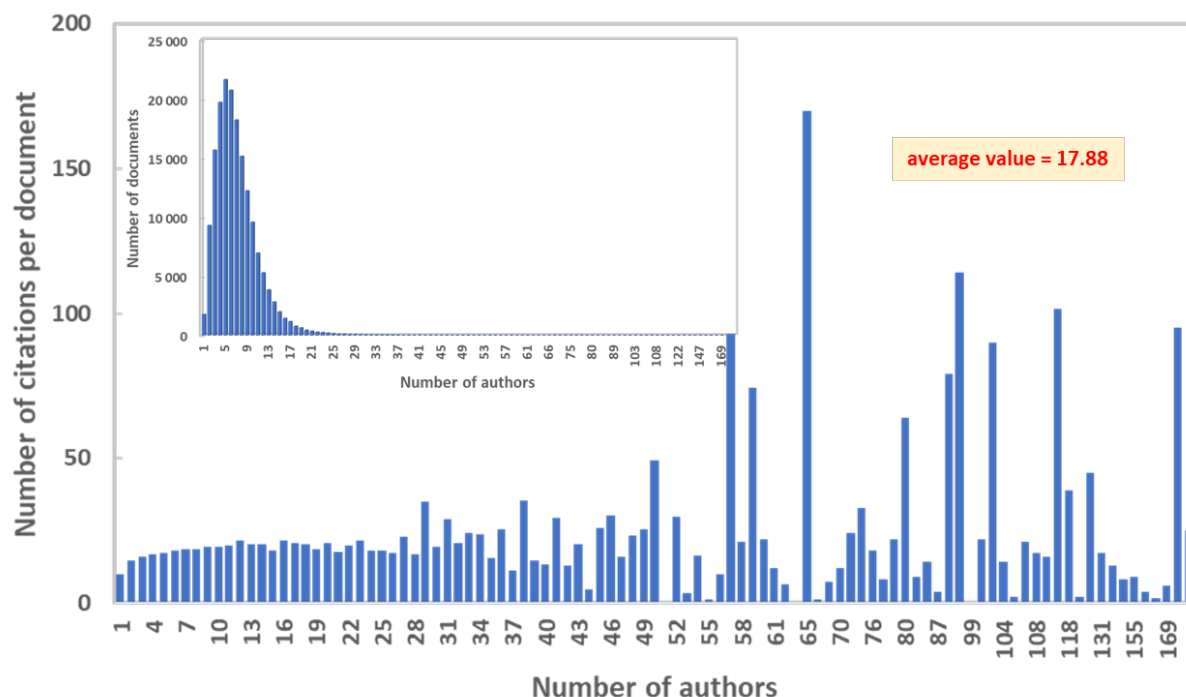
Fig. 7 Number of citations per document as a function of number of authors. **Inset** shows the number of documents as a function of number of authors.

As would be expected, the analysis of number of citations per publication reflects that documents which were written by single authors received a smaller number of citations per publication than documents which were written by more than 1 author. My results are consistent with previous study in which researchers performed that publications with large numbers of authors tend to be more cited [25, 26]. However, it is worth to mention that some exceptions also can be found, i.e. in the case of documents which were written by 51, 63, 99 authors. Interestingly, the greatest number of citations per publication (170) obtained documents which were written by 65 authors.

Tab. 3 Number of authors as a function of number of publications, citations and citations per publication.

Number of authors	TP	TC	TC/TP
1	1 751	17 611	10,1
<2-10)	132 503	2 302 210	17,4
<10-20)	34 343	687 798	20,0
<20-30)	1 928	38 484	20,0
<30-40)	324	7 141	22,0
<40-50)	83	1 736	20,9
<50-100)	60	1 594	26,6

>=100	38	1 066	28,1

Analysis of research areas and scientific disciplines in Scientific Reports

Although, Scientific Reports is assigned to multidisciplinary sciences, a detailed bibliometric analysis reflects that these documents are related with many scientific concepts and hence, these documents are assigned to various research areas, such as: Natural Sciences (Nat), Engineering & Technology (Eng), Medical & Health Sciences (Med), Agricultural & Veterinary Sciences (Agr), Social Sciences (Soc) as well as Humanities & the Arts (Hum).
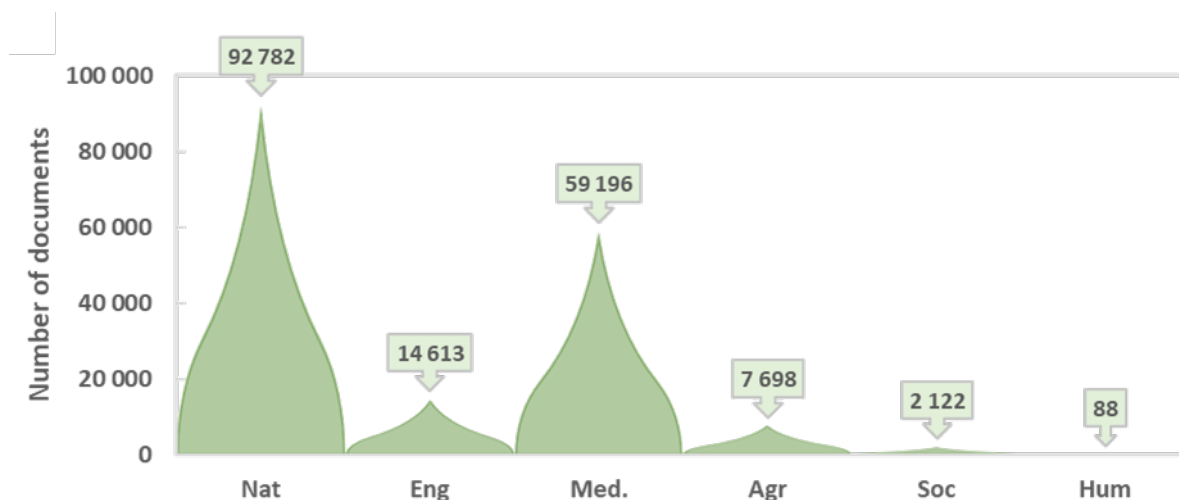

Fig. 8 Number of documents which were published in Scientific Reports in years 2011-2022 as a function of research areas.

In order to obtain a detailed picture about the research areas related with Scientific Reports, I calculated the number of documents which were published in this journal in years 2011-2022 as a function of research areas. According to **Fig. 8**, it can be seen that the greatest number of documents were assigned to Natural Sciences (92 782), followed by Medical & Health Sciences (59 196) as well as Engineering & Technology (14 613). In the case of Social Sciences as well as Humanities & the Arts, it can be seen that a significantly smaller number of documents were associated with these sciences (<8000). Therefore, **Fig. 9** depicts that if we take account the selected research areas, it can be seen that in Natural Sciences as well as Engineering & Technology, the average number of citations per publication is slightly greater than the total average number of citations per publication in Scientific Reports (18). In particular, the average number of citations per publication in these research areas is equal 19 and 25, respectively. In the case of other scientific research areas, it can be seen that the average number of citations per publication is smaller than the total average number of citations per publication in Scientific Reports, except for Agricultural & Veterinary Sciences. In the case of this research area, the average number of citations per publication is equal the total average number of citations per publication in Scientific Reports and hence, this research area obtained the third position in terms of the greatest number of citations per publication in this journal. In the case of other research areas, the average number of citations per publication is in the range of 9-14.
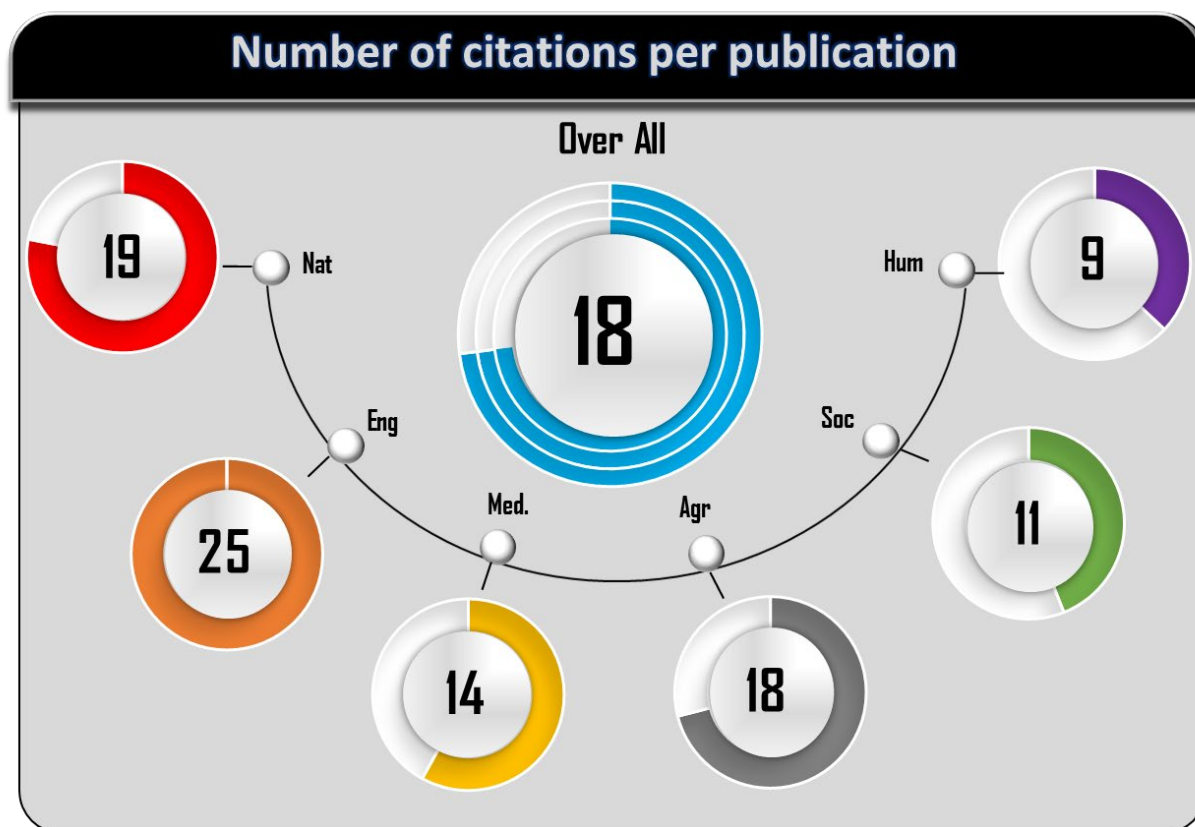
Fig. 9 Average number of citations per publication for documents which were published in Scientific Reports in years 2011-2022 as a function of research areas.

It is well known that Category Normalized Citation Impact is the average number of citations per publication normalized by the selected research area, type of document and year. In order to obtain an overview about the average values of this indicator in the selected research areas, I depicted these values in **Fig. 10**. In particular, it has been turned out that for all research areas, CNCI is greater than the average world value (CNCI=1.0). As revealed by my analysis, the greatest value of CNCI was observed in Humanities & the Arts (8.6). However, in this place, it is worth reminder that in this research area, the number of published documents is a significantly smaller than in the case of other research areas. Therefore, it is worth to add that in the case of other research areas, values of CNCI are in the range of 1.2-1.7.

Fig. 10 The average values of CNCI for documents which were published in Scientific Reports in years 2011-2022 as a function of research areas.

Next, let us look into the percentage of documents cited at least one in Scientific Reports in years 2011-2022 indicating the similarities and differences between particular research areas, as depicted in **Fig. 11**. In particular, it has been turned out that about 88-89% documents which were associated with Natural Sciences as well as Engineering & Technology were cited at least one. On the other hand, in the case of Medical & Health Sciences as well as Agricultural & Veterinary Sciences, 87% and 90% documents obtained at least one citation, respectively. In the case of Social Sciences as well as Humanities & the Arts, a slightly smaller percentages of documents (78% and 85%) received at least one citation, respectively.
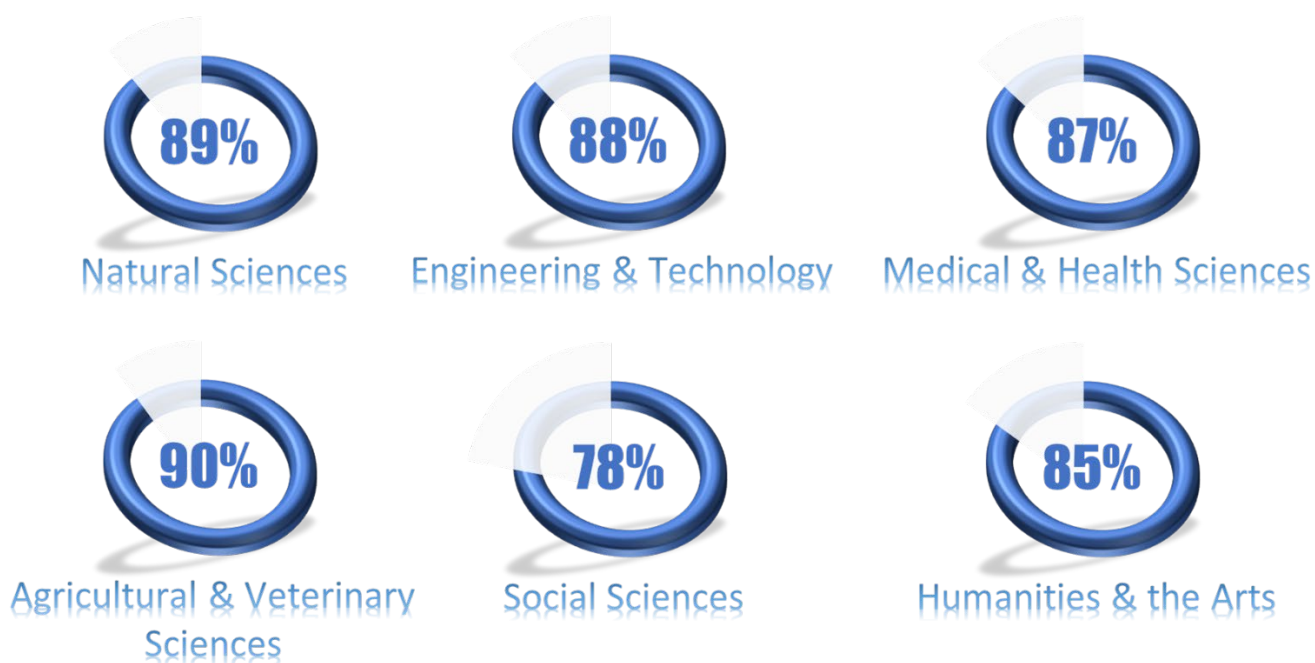
Fig. 11 The percentage of documents cited at least one as a function of research areas in Scientific Reports in years 2011-2022.

As seen in **Fig. 12** and **Fig. 13**, analysis of documents in Top 10% and Top 1% the best documents also shows the similarities and differences between the selected research areas. In particular, it has been turned out that the lowest percentage of documents in Top 10% the best documents in Scientific Reports was observed in the case of Natural Sciences (13%), while the greatest percentage of documents in Top 10% the best documents was observed in the case of Humanities & the Arts (73%).
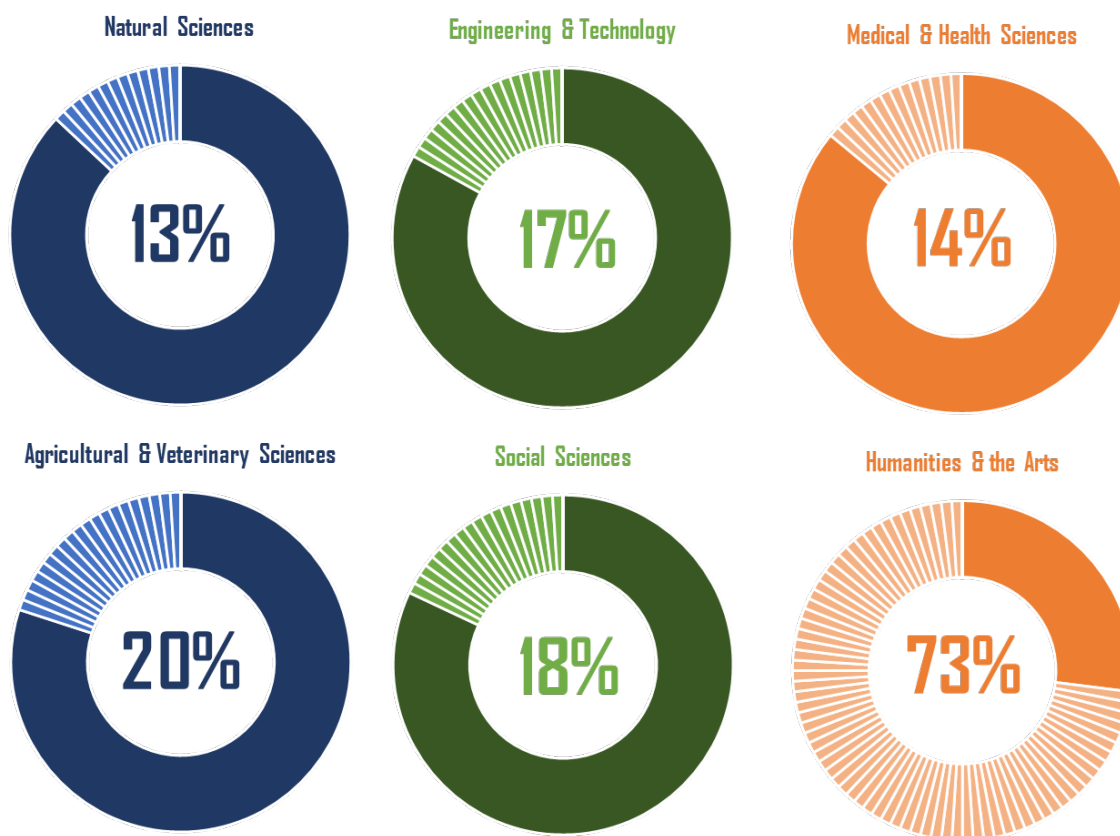
Fig. 12 The percentage of documents in Top 10% the best documents as a function of research areas in Scientific Reports in years 2011-2022.

Furthermore, it is worth noting that if we take account only 3 research areas with the greatest number of published documents in Scientific Reports (Natural Sciences, Medical & Health Sciences, Engineering & Technology), it can be seen that about 1-2% of these documents can be found in Top 1% the best documents. On the other hand, in the case of Agricultural & Veterinary Sciences as well as Social Sciences, also about 1-2% of all published documents can be found in Top 1% the best documents, while in the case of Humanities & the Arts, 17% of documents are in Top 1% the best documents. However, it is worth to add that in these research areas, scientists published a significantly smaller number of documents in Scientific Reports in years 2011-2022.
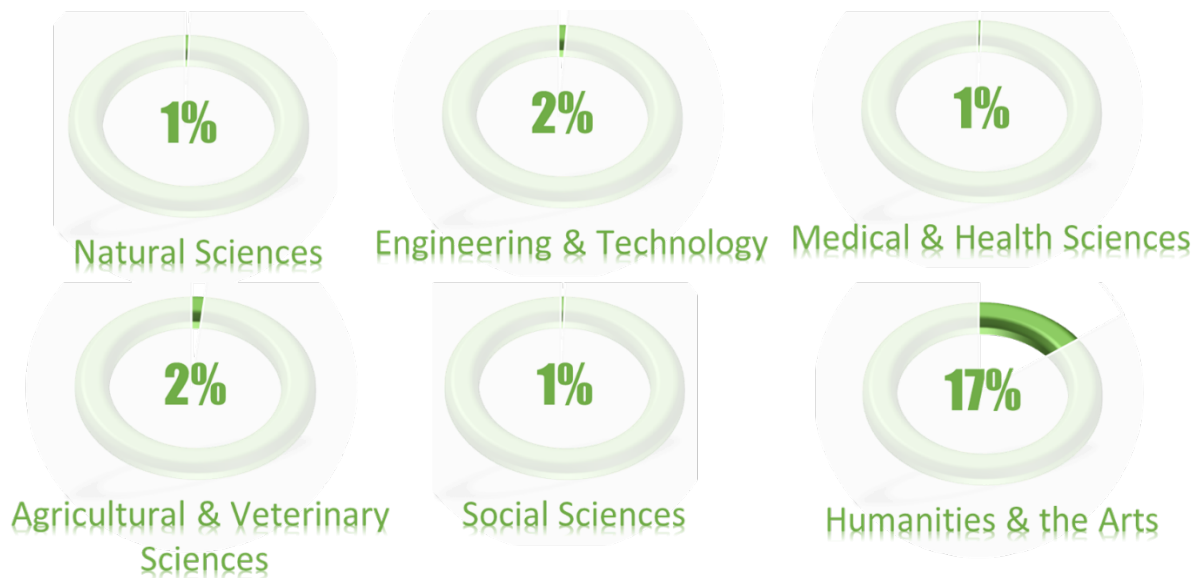
Fig. 13 The percentage of documents in Top 1% the best documents as a function of research areas in Scientific Reports in years 2011-2022.

In this place, it is worth mention that Scientific Reports was assigned to Q4 quartile in year 2011, while in years 2012-2020, this journal was assigned to Q1 quartile. Currently, Scientific Reports is assigned to Q2 quartile. Hence, in order to determine the percentage of documents in Q1 journals, I performed the percentages of documents in Q1 journals as a function of various research areas in **Fig. 14**. According to **Fig. 14**, it can be seen that the greatest number of documents in Q1 journals is related with Natural Sciences (87%), followed by Engineering & Technology (84%), Agricultural & Veterinary Sciences (81%).
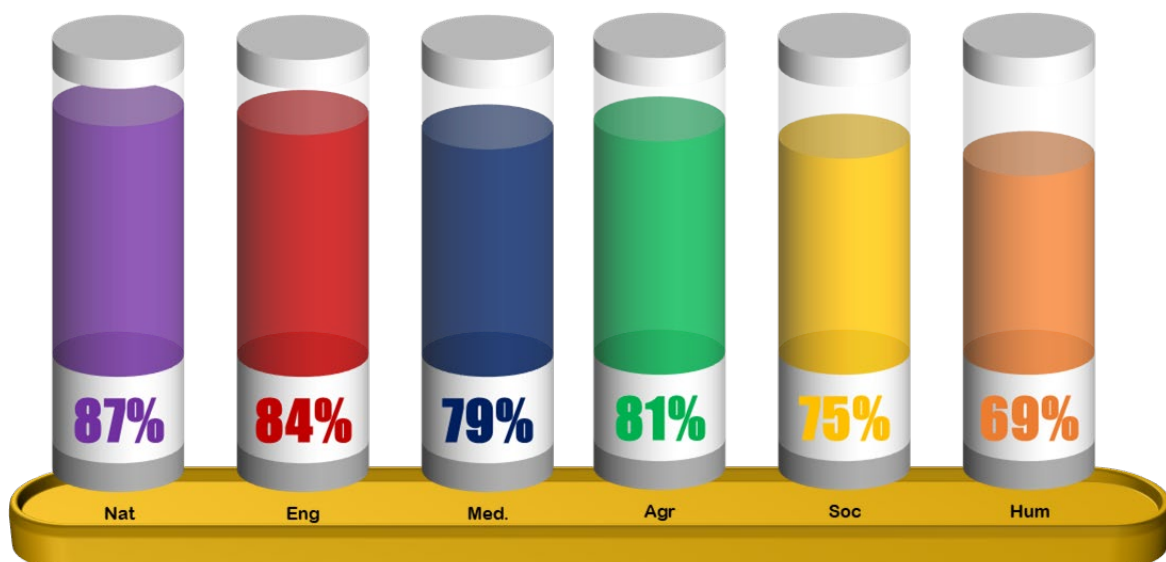
Fig. 14 The percentage of documents in Q1 journals as a function of research areas in Scientific Reports in years 2011-2022.

To present an insights into the selected scientific disciplines, I also calculated the number of documents which were published in Scientific Reports in years 2011-2022 as a function of discipline, as seen in **Fig. 15**. Based on **Fig. 15**, it can be seen that the greatest number of documents were related with Biological Sciences (47 338), followed by Clinical Medicine (35 412) and Basic Medicine (19 534). Moreover, it is worth to mention that

scientists also published a very large number of documents related with Physical Sciences, Other Natural Sciences (>10 000). Additionally, **Fig. 15** presents that scientists published more than 5000 documents which were associated with Earth & related Environmental Sciences, Materials Engineering and Chemical Sciences. Although, in the case of other scientific disciplines, a slightly smaller number of documents were published in Scientific Reports, it is worth highlighted that in most disciplines, scientists published more than 100 documents in Scientific Reports in years 2011-2022.
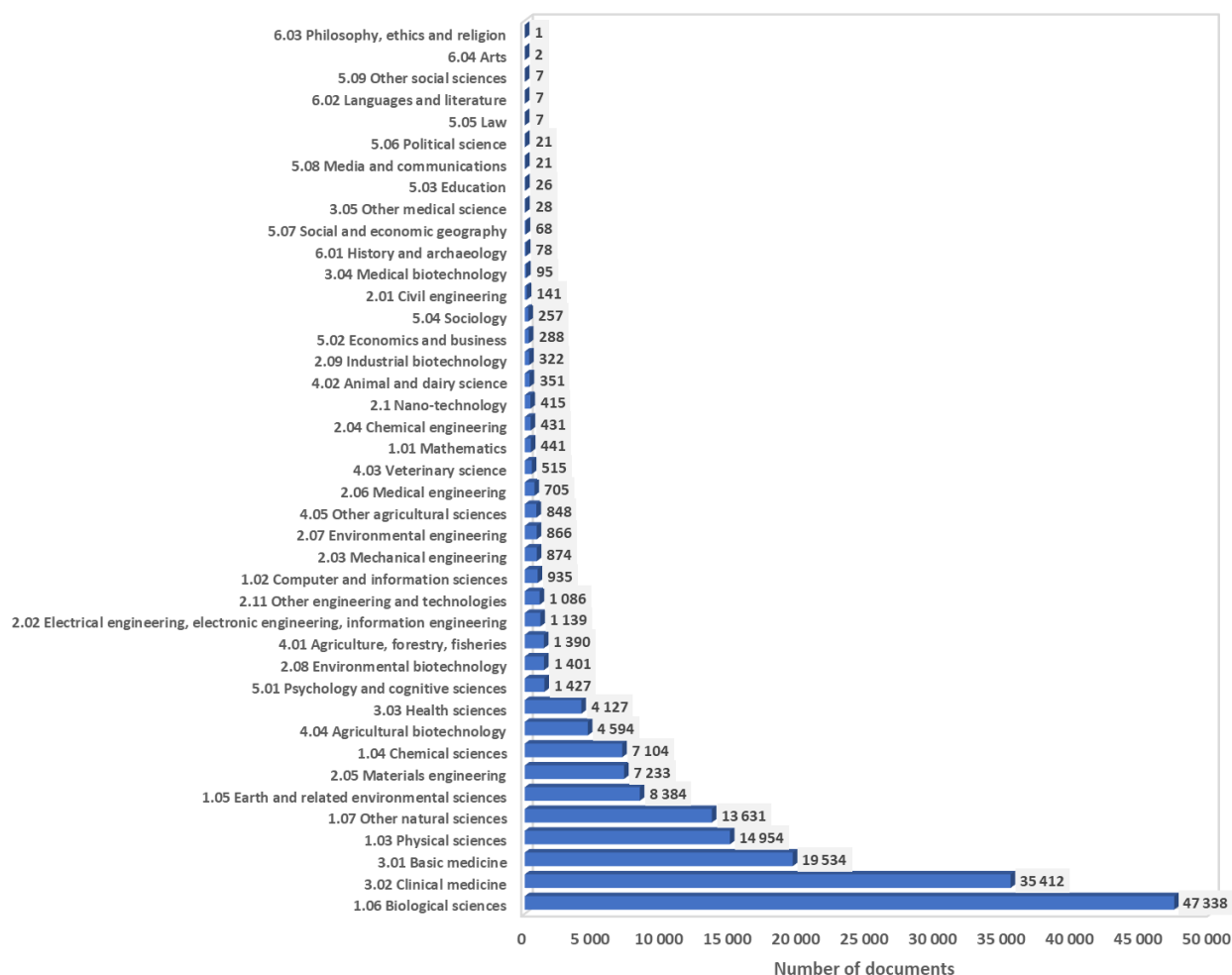
Fig. 15 Number of documents which were published in Scientific Reports in years 2011-2022 as a function of discipline.

In order to obtain an overview about the mentioned scientific disciplines, I also calculated the values of other bibliometric indicators, such as: the number of citations, the number of citations per publication, the percentage of documents cited at least one, CNCI, the percentage of documents in Top 10%/Top 1% the best documents, as can be seen in **Tab. 4**. According to **Tab. 4**, it can be seen that documents which were published in some disciplines obtained more than 30 citations per publication, i.e. Materials engineering (32.3), Industrial biotechnology (32.2). Therefore, it is worth to add that more than 80% documents were cited at least one in disciplines with the greatest number of published documents (>4000) in Scientific Reports in years 2011-2022. **Tab. 4** also reflects that in the case of most disciplines, CNCI is greater than the average world value (1.0), except for: Other natural sciences, Environmental engineering, Civil engineering, Philosophy, ethics and religious.

Tab. 4 Values of various indicators for scientific disciplines in which scientists published their documents in Scientific Reports in years 2011-2022.

Name of discipline	TP	TC	TC/TP	% Docs Cited	CNCI	% Docs in Top 1%	% Docs in Top 10%
1.06 Biological sciences	47 338	850 884	18,0	91,6	1,1	0,5	11,3
3.02 Clinical medicine	35 412	483 812	13,7	85,6	1,2	0,6	14,5
3.01 Basic medicine	19 534	317 764	16,3	89,6	1,2	0,7	11,7
1.03 Physical sciences	14 954	315 460	21,1	91,0	1,2	0,6	13,3
1.07 Other natural sciences	13 631	225 223	16,5	81,2	0,9	0,2	10,1
1.05 Earth and related environmental sciences	8 384	175 711	21,0	88,1	1,4	1,6	14,5
2.05 Materials engineering	7 233	233 524	**32,3**	92,4	1,5	1,2	16,3
1.04 Chemical sciences	7 104	199 418	28,1	92,5	1,3	1,0	15,4
4.04 Agricultural biotechnology	4 594	88 897	19,4	91,8	1,5	1,6	17,6
3.03 Health sciences	4 127	49 449	12,0	81,8	1,4	1,3	16,0
5.01 Psychology and cognitive sciences	1 427	13 448	9,4	78,8	1,1	0,8	9,9
2.08 Environmental biotechnology	1 401	30 461	21,7	92,5	1,3	1,4	14,6
4.01 Agriculture, forestry, fisheries	1 390	24 425	17,6	88,9	2,0	3,2	26,9
2.02 Electrical engineering, electronic engineering, information engineering	1 139	12 603	11,1	71,6	1,1	0,6	13,4
2.11 Other engineering and technologies	1 086	16 259	15,0	85,5	1,5	1,9	16,2
1.02 Computer and information sciences	935	12 585	13,5	67,2	1,4	2,0	15,3
2.03 Mechanical engineering	874	9 379	10,7	75,1	1,6	3,0	19,7
2.07 Environmental engineering	866	11 588	13,4	77,7	0,9	0,1	8,6
4.05 Other agricultural sciences	848	12 906	15,2	87,2	1,4	2,7	14,4
2.06 Medical engineering	705	16 012	22,7	89,7	1,6	1,3	20,7
4.03 Veterinary science	515	5 457	10,6	83,9	2,1	4,3	29,1
1.01 Mathematics	441	7 933	18,0	81,4	2,6	3,2	29,0
2.04 Chemical engineering	431	7 560	17,5	85,2	1,1	1,4	11,1
2.1 Nano-technology	415	11 683	28,2	93,3	1,1	0,5	9,2
4.02 Animal and dairy science	351	3 787	10,8	82,6	2,0	4,3	26,8
2.09 Industrial biotechnology	322	10 369	**32,2**	94,7	1,6	3,1	23,0
5.02 Economics and business	288	4 504	15,6	72,9	1,3	1,4	13,2

	TP	TC	TC/TP	% Docs Cited	CNCI	% Docs in Top 10%	% Docs in Top 1%
5.04 Sociology	257	3 752	14,6	84,4	2,8	2,7	41,3
2.01 Civil engineering	141	721	5,1	51,1	0,7	0,7	7,8
3.04 Medical biotechnology	95	1 665	17,5	90,5	1,4	0,0	21,1
6.01 History and archaeology	78	745	9,6	85,9	9,2	20,5	75,6
5.07 Social and economic geography	68	711	10,5	64,7	1,5	2,9	20,6
3.05 Other medical science	28	258	9,2	85,7	2,1	7,1	17,9
5.03 Education	26	153	5,9	65,4	2,8	7,7	26,9
5.08 Media and communications	21	223	10,6	90,5	1,8	0,0	19,1
5.06 Political science	21	110	5,2	66,7	2,0	0,0	23,8
5.05 Law	7	151	21,6	85,7	4,9	14,3	42,9
6.02 Languages and literature	7	53	7,6	85,7	5,9	14,3	57,1
5.09 Other social sciences	7	37	5,3	57,1	2,0	0,0	28,6
6.04 Arts	2	10	5,0	100,0	5,7	0,0	100,0
6.03 Philosophy, ethics and religion	1	0	0,0	0,0	0,0	0,0	0,0

Abbreviations: TP – the number of publications, **TC** – the number of citations, **TC/TP** – the number of citations per publication, **% Docs Cited** – the percentage of documents cited at least one, **CNCI** – Category Normalized Citation Impact, **% Docs in Top 10%/Top 1 %-** the percentage of documents which were published in Top 10%/Top 1% the best documents in Scientific Reports in years 2011-2022.

Additionally, it is worth noting that although, in Arts, 100% documents can be found in Top 10% the best documents, in this discipline, scientists published only 2 documents in Scientific Reports. Interestingly, if we take account only disciplines in which scientists published at least 1000 documents in Scientific Reports, it can be seen that about 9.9%-26.9% and 0.2-3.2% of all documents can be found in Top 10% and Top 1% the best documents, respectively.

Analysis of top countries in which scientists published their documents in Scientific Reports

From publisher point of view, it is interesting to know in which countries scientists published the greatest number of documents in Scientific Reports in years 2011-2022.

A)

Country	Number of documents
IRAN	2 565
RUSSIA	2 585
POLAND	3 058
BRAZIL	4 031
SWITZERLAND	4 268
SWEDEN	4 310
NETHERLANDS	4 449
TAIWAN	4 914
INDIA	5 920
CANADA	6 767
SPAIN	7 158
AUSTRALIA	7 164
ITALY	8 297
FRANCE	8 826
SOUTH KOREA	10 693
GERMANY	15 046
UNITED KINGDOM	15 472
JAPAN	16 666
CHINA	37 866
USA	40 962

B)

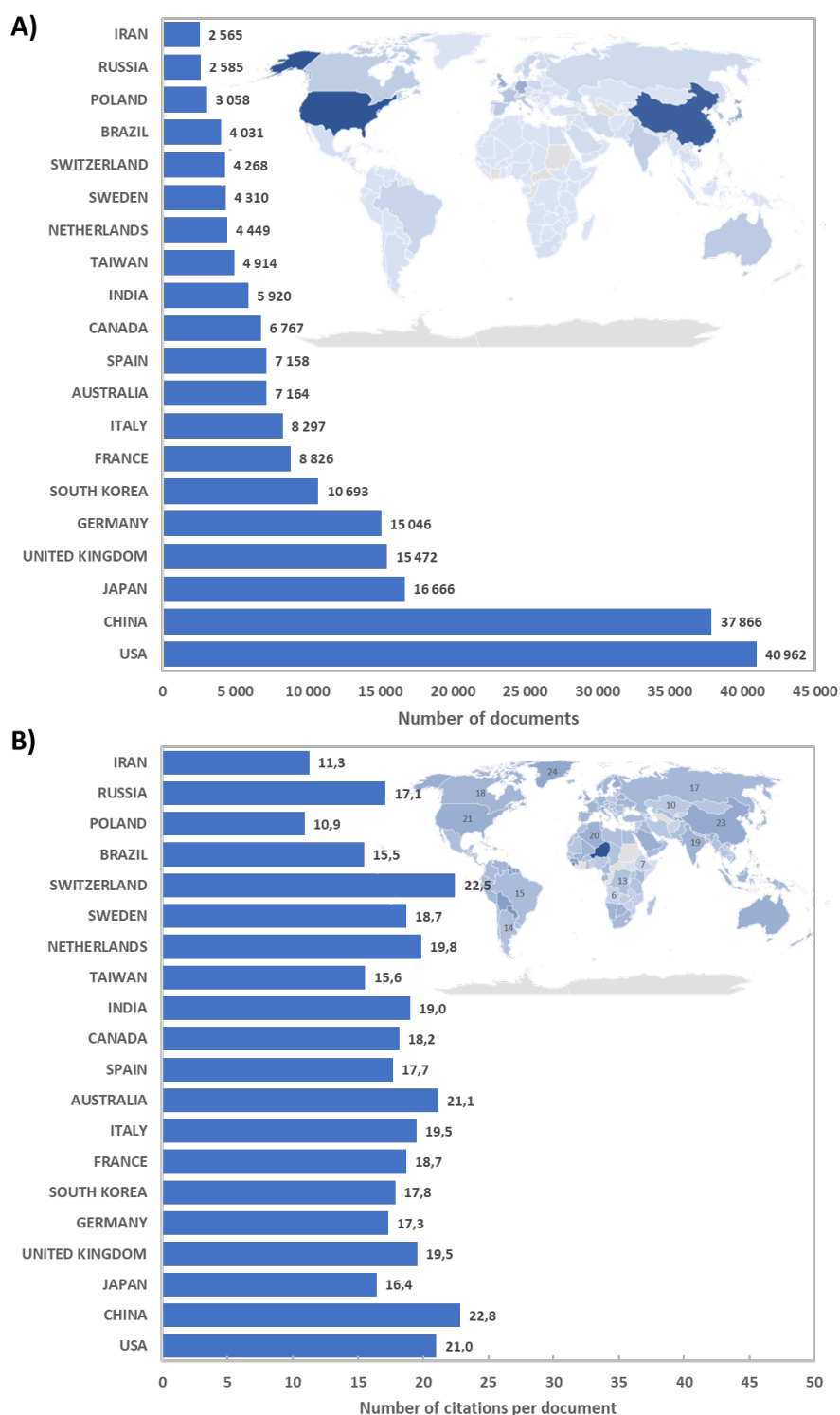| Country	Number of citations per document
IRAN	11,3
RUSSIA	17,1
POLAND	10,9
BRAZIL	15,5
SWITZERLAND	22,5
SWEDEN	18,7
NETHERLANDS	19,8
TAIWAN	15,6
INDIA	19,0
CANADA	18,2
SPAIN	17,7
AUSTRALIA	21,1
ITALY	19,5
FRANCE	18,7
SOUTH KOREA	17,8
GERMANY	17,3
UNITED KINGDOM	19,5
JAPAN	16,4
CHINA	22,8
USA	21,0

Fig. 16 (A) Number of documents and **(B)** the corresponding number of citations per document for papers which were published in Scientific Reports in years 2011-2022.

Hence, in order to obtain an insights into the most frequently published countries in Scientific Reports in years 2011-2022, I calculated the number of documents which were published in this journal by particular countries

(**Fig. 16A** and **Tab. 5**). The average number of citations per publication for top 20 countries in which scientists published the greatest number of documents in Scientific Reports in years 2011-2022 can be found in **Fig. 16B** and **Tab. 5**. Therefore, in order to obtain a more detailed picture about countries published their documents in Scientific Reports, I also performed the values of other bibliometric indicators, such as: the percentage of documents cited at least one, CNCI, the percentage of documents in which author is affiliated as the first/corresponding author, the percentage of documents which have international, national and industrial co-authors, the number of highly cited documents, the percentage of documents which were published in Top 10% and Top 1% the best documents in Scientific Reports in years 2011-2022 (**Tab. 5**). Based on **Fig. 16A** and **Tab. 5**, it can be seen that the greatest number of documents in Scientific Reports were published by scientists from USA (40 962) and China (37 866). A significantly number of documents (>10 000) were also published by other countries, such as: Japan (16 666), United Kingdom (15 472), Germany (15 046), South Korea (10 693). However, in this place, it is worth to add that China has the greatest number of people and hence, if we take account the number of publications per million inhabitants, it has been turned out that the first positions belongs to Switzerland, Sweden, Australia and Netherlands [19]. Additionally, it is worth noting that documents which were published by top 20 countries obtained a very high number of citations per publication (10.9-22.8). Interestingly, if we take account the number of citations per publication per million people, it can be seen that the first position received Switzerland. **Tab. 5** also presents that about 80.1-92.5% of all documents which were published by top 20 countries obtained at least one citation. Therefore, it is worth to add that the average values of CNCI for documents which were published in Scientific Reports in years 2011-2022 by top 20 countries are in the range of 0.99-1.43. Furthermore, it can be seen that South Korea, China, Taiwan, Japan, Iran and India have the greatest percentage of documents which have first/corresponding author affiliated with the selected countries (>80%). The average percentages of documents which have international co-authors in Scientific Reports for top 20 countries are in the range of 30.2-80.8%. Surprisingly, it is worth highlighted that Switzerland obtained the greatest value of this indicator (80.8%). As revealed by my analysis (**Tab. 5**), the percentages of documents which have national co-authors are significantly smaller in comparison to the percentages of documents which have international co-authors. In particular, the average percentages of documents which have national co-authors in Scientific Reports for top 20 countries are in the range of 10.6-53.8%, while the greatest values of this indicator was observed for Taiwan. Furthermore, is worth to mention that some documents which were published in Scientific Reports have industrial co-authors. However, in this place, it is worth to add that the percentages of documents which have industrial co-authors are rather smaller, especially: in the range of 0.7-6.8%. As seen in **Tab. 5**, the greatest number of highly cited papers (301) were written by scientists from USA. Next, it is worth to mention that the percentages of documents in Top 10% and Top 1% the best documents for top 20 countries are in the range of 9.2-16.5% and 0.3-1.4%, respectively. Interestingly, top 20 countries which published the greatest number of documents in Scientific Reports are high income countries, except for India and Iran which are lower middle income as well as Russia, China and Brazil which are upper middle income [19].
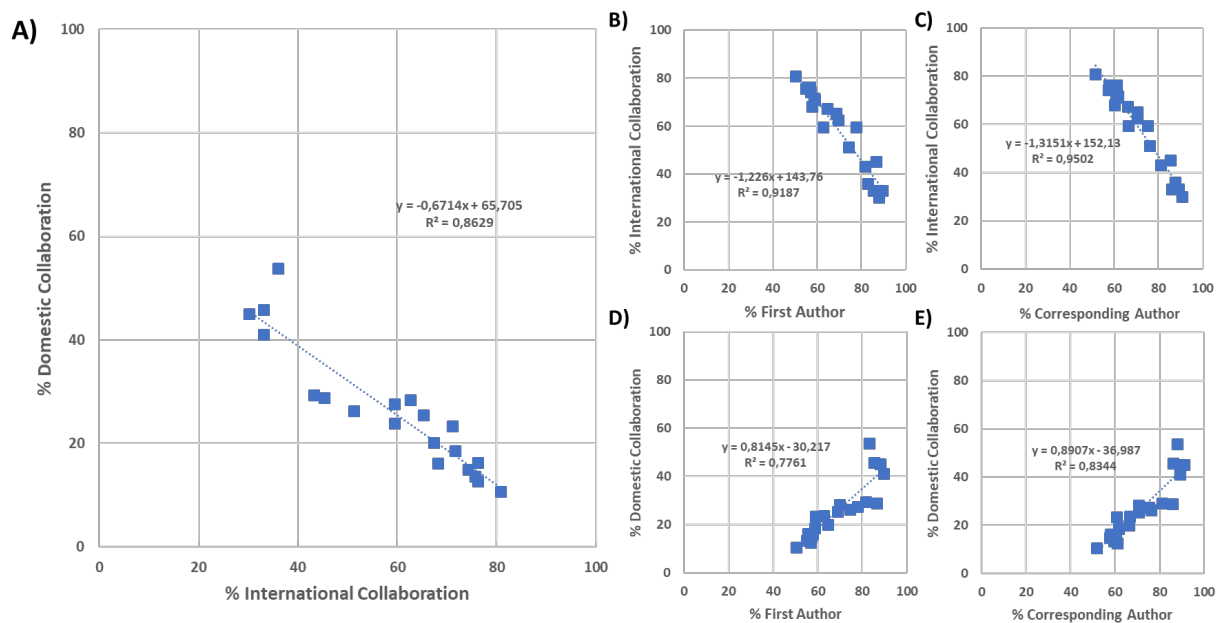
Fig. 17 The percentage of domestic collaboration as a function of **(A)** the percentage of international collaboration. The percentage of international collaboration as a function of **(B)** the percentage of documents which have first or **(C)** corresponding author affiliated in the selected country. The percentage of domestic collaboration as a function of **(D)** the percentage of documents which have first or **(E)** corresponding author affiliated in the selected country.

To estimate the effect of international and national collaboration on the percentage of documents which have first or corresponding author affiliated in the selected country, the relationships between the particular indicators were shown in **Fig. 17**. In this place, it is worth to add that these dependencies were calculated for top 20 countries in which scientists published the greatest number of documents in Scientific Reports. In particular, it has been turned out that there exists the strong correlation between the percentage of international collaboration and the percentage of domestic collaboration (R^2=0.8629), as revealed by **Fig. 17A**. It means that if the percentage of documents which have international co-authors decreases, the percentage of documents which have national co-authors increases. In the case of relationships between the percentage of international collaboration and the percentage of documents which have first (**Fig. 17B**) or corresponding author affiliated in the selected country (**Fig. 17C**), it can be seen that if the percentage of documents which have international co-authors decreases, the percentage of documents which have first or corresponding author affiliated in the selected country increases. It means that the growth of major role in article's analysis and writing were observed in this case. Therefore, it is worth to add that these correlations are strong (R^2>0.9). On the other hand, an opposite effect can be found in the case of documents which have national co-authors, as revealed by **Fig. 17D** and **Fig. 17E**. In particular, it was found that if the percentage of documents which have national co-authors increases, the percentage of documents which have first and corresponding author affiliated in the selected country also increases. However, it is worth mention that these relationships are slightly smaller (R^2=0,7761 and R^2=0,8344, respectively) in comparison to the percentage of international collaboration.

Type of indicator	TP	TC	TC/TP	% Docs Cited	CNCI	% First Auth	% Corr Auth	% Intern Coll	% Dom Coll	% Ind Coll	Highly Cited Papers	% Docs in Top 10%	% Docs in Top 1%	% Docs in Q1 Journ
TP	1,00	0,99	0,47	0,36	-0,05	0,18	0,20	-0,28	0,23	0,10	0,98	-0,01	-0,04	0,45
TC	0,99	1,00	0,52	0,38	0,00	0,16	0,18	-0,26	0,20	0,07	0,99	0,04	0,00	0,47
TC/TP	0,47	0,52	1,00	0,87	0,55	-0,40	-0,39	0,31	-0,26	0,43	0,51	0,53	0,33	0,82
% Docs Cited	0,36	0,38	0,87	1,00	0,31	-0,49	-0,47	0,40	-0,24	0,36	0,36	0,33	0,05	0,96
CNCI	-0,05	0,00	0,55	0,31	1,00	-0,55	-0,60	0,63	-0,70	0,23	0,08	0,97	0,84	0,10
% First Auth	0,18	0,16	-0,40	-0,49	-0,55	1,00	0,99	-0,96	0,88	-0,46	0,10	-0,49	-0,30	-0,34
% Corr Auth	0,20	0,18	-0,39	-0,47	-0,60	0,99	1,00	-0,97	0,91	-0,45	0,12	-0,54	-0,35	-0,30
% Intern Coll	-0,28	-0,26	0,31	0,40	0,63	-0,96	-0,97	1,00	-0,93	0,36	-0,20	0,58	0,38	0,23
% Dom Coll	0,23	0,20	-0,26	-0,24	-0,70	0,88	0,91	-0,93	1,00	-0,32	0,12	-0,66	-0,50	-0,07
% Ind Coll	0,10	0,07	0,43	0,36	0,23	-0,46	-0,45	0,36	-0,32	1,00	0,09	0,08	0,18	0,35
Highly Cited Papers	0,98	0,99	0,51	0,36	0,08	0,10	0,12	-0,20	0,12	0,09	1,00	0,11	0,09	0,43
% Docs in Top 10%	-0,01	0,04	0,53	0,33	0,97	-0,49	-0,54	0,58	-0,66	0,08	0,11	1,00	0,80	0,12
% Docs in Top 1%	-0,04	0,00	0,33	0,05	0,84	-0,30	-0,35	0,38	-0,50	0,18	0,09	0,80	1,00	-0,11
% Docs in Q1 Journ	0,45	0,47	0,82	0,96	0,10	-0,34	-0,30	0,23	-0,07	0,35	0,43	0,12	-0,11	1,00

Fig. 18 The values of Pearson coefficient (PC) for the selected bibliometric indicators. Abbreviations were explained in **Tab. 5**.

From scientists point of view, it is interesting to know how are the relationships between the particular indicators. Hence, in order to determine the correlations between the selected indicators, the values of Pearson coefficient (PC) were calculated, as depicted in **Fig. 18**. In this place, it is worth to mention that strong positive correlations were shown as dark green color, while strong negative correlations were shown as red color. Interestingly, slightly smaller positive relationships were marked as light green color, while slightly smaller negative relationships were marked as orange and light orange colors. It is also worth to add that yellow color represents very weak correlation or lack of correlation between the particular indicators. According to **Fig. 18**, it can be seen that the strong relationships were observed in the case of the percentage of international/national collaboration and the percentage of documents which have first or corresponding author affiliated in the selected country ($|PC|>0.85$). However, the trends of these correlations were explained in **Fig. 17** and hence, I focus on the relationships between the other indicators. In particular, it has been turned out that there exists also very strong positive significant correlation between the number of documents which were published in Scientific Reports and the number of

citations as well as highly cited papers. However, these observations are very obvious. It means that if the scientists published the greatest number of documents in Scientific Reports, it can be seen that they obtained the greatest number of citations, including highly cited papers. If we take account the values of Pearson coefficient, it can be seen that these values are equal 0.99 and 0.98, respectively. On the other hand, a slightly smaller correlations were observed in the case of documents cited at least one. In particular, it has been turned out that if the percentage of documents cited is greater, the percentage of documents in Q1 journals is greater (PC=0.96) and the average number of citations per publication is greater (PC=0.87). Moreover, **Fig. 18** also performs that there exists strong enough positive correlations between the CNCI and the percentage of documents in Top 10% and Top 1% the best documents (PC=0.97 and PC=0.84, respectively). Therefore, **Fig. 18** reflects that the percentage of documents which have international co-authors increase when the percentage of documents in Top 10% the best documents and CNCI increase (PC=0.58 and PC= 0.63). Although, in the case of other bibliometric indicators, the correlations are rather weak and non-significant, it is worth to add that if the percentage of international collaboration is greater, the number of citations per publication also is greater. However, this relationship is rather small (PC=0.31). On the other hand, **Fig. 18** also shows that the number of highly cited papers in Scientific Reports increases when the percentage of national collaboration increases. However, in this case, the correlation is also very weak and non-significant (PC=0.12).

Tab. 5 Values of various indicators for top 20 countries in which scientists published the greatest number of documents in Scientific Reports in years 2011-2022.

ID	Country	TP	TC	TC/TP	% Docs Cited	CNCI	% First Auth	% Corr Auth	% Intern Coll	% Dom Coll	% Ind Coll	Highly Cited Papers	% Docs in Top 10%	% Docs in Top 1%	% Docs in Q1 Journals
1	USA	40 962	860 638	21,0	91,9	1,3	62,8	66,6	59,5	23,8	3,9	301	14,5	1,1	86,1
2	CHINA	37 866	864 806	22,8	92,5	1,2	89,5	89,2	33,1	41,1	1,4	252	13,1	0,8	90,8
3	JAPAN	16 666	273 593	16,4	88,7	1,0	85,4	86,0	33,1	45,8	6,3	83	9,5	0,6	81,8
4	UNITED KINGDOM	15 472	302 423	19,5	91,3	1,3	55,1	59,3	75,6	13,6	4,5	112	14,8	1,0	85,7
5	GERMANY	15 046	260 492	17,3	90,5	1,2	64,5	66,1	67,4	20,1	4,4	75	12,6	0,9	84,1
6	SOUTH KOREA	10 693	190 845	17,8	88,2	1,1	88,1	90,9	30,2	45,1	4,0	41	11,3	0,6	82,1
7	FRANCE	8 826	165 126	18,7	91,5	1,2	59,0	60,8	71,0	23,4	4,1	53	13,8	0,8	85,7
8	ITALY	8 297	161 596	19,5	91,5	1,3	69,7	70,7	62,6	28,4	2,5	58	15,9	1,0	83,5
9	AUSTRALIA	7 164	151 452	21,1	92,2	1,3	58,6	61,7	71,7	18,6	2,1	46	16,5	1,2	86,0
10	SPAIN	7 158	126 439	17,7	90,6	1,2	68,8	70,7	65,3	25,5	2,6	40	13,7	0,9	83,8
11	CANADA	6 767	122 866	18,2	90,6	1,2	57,7	60,3	68,1	16,2	2,4	41	13,8	1,1	83,2
12	INDIA	5 920	112 498	19,0	89,8	1,3	81,7	81,2	43,2	29,3	1,3	49	15,4	1,1	80,8
13	TAIWAN	4 914	76 445	15,6	89,4	1,0	83,1	87,8	35,9	53,8	0,9	20	9,2	0,5	83,4
14	NETHERLANDS	4 449	88 310	19,8	90,9	1,4	57,0	57,5	74,3	15,0	5,9	47	14,9	1,4	83,1
15	SWEDEN	4 310	80 519	18,7	91,4	1,3	56,8	61,1	76,3	12,7	5,3	30	13,9	1,0	84,3
16	SWITZERLAND	4 268	95 822	22,5	90,9	1,4	50,4	51,6	80,8	10,6	6,8	34	15,6	1,2	83,8
17	BRAZIL	4 031	62 305	15,5	88,6	1,2	77,7	75,2	59,5	27,5	1,1	28	13,7	1,0	80,5
18	POLAND	3 058	33 307	10,9	83,1	1,0	74,4	76,2	51,3	26,3	1,2	13	9,7	0,5	71,9
19	RUSSIA	2 585	44 231	17,1	91,2	1,2	55,6	57,8	76,3	16,2	1,7	9	12,9	0,3	82,6
20	IRAN	2 565	28 882	11,3	80,1	1,3	86,6	85,6	45,3	28,8	0,7	23	14,8	1,3	60,0

Abbreviations: TP – the number of publications, **TC** – the number of citations, **TC/TP** – the number of citations per publication, **% Docs Cited** – the percentage of documents cited at least one, **CNCI** – Category Normalized Citation Impact, **% First Auth** – the percentage of documents in which author is affiliated as the first author, **% Corr Auth** – the percentage of documents in which author is affiliated as the corresponding author, **% Intern Coll** – the percentage of documents which have international co-authors, **% Dom Coll** – the percentage of documents which have national co-authors, **% Ind Coll** – the percentage of documents which have industrial co-authors, **Highly Cited Papers** – the number of documents which obtained the greatest number of citations, **% Docs in Top 10%/Top 1 %-** the percentage of documents which were published in Top 10%/Top 1% the best documents, **% Docs in Q1 Journals** – the percentage of documents in Q1 journals. Data are related with documents which were published in Scientific Reports in years 2011-2022.

Analysis of top universities in which scientists published the greatest number of documents in Scientific Reports

Institutions from all over the world have published their documents in Scientific Reports. In general, analysis of top universities in which scientists published the greatest number of documents in Scientific Reports in years 2011-2022 (**Tab. 6**) shows that scientists from Chinese Academy of Sciences published the greatest number of documents (6 132) in this journal. The second position in terms of the greatest number of published documents in this journal belongs to UDICE-French Research Universities (5 372), while the third position belongs to Centre National de la Recherche Scientifique -CNRS (5 196). These universities come from China and France. Interestingly, scientists from other top 20 universities also published a very large number of documents (>1500) in Scientific Reports in years 2011-2022. **Tab. 6** presents that the average number of citations per publication for top 20 universities is in the range of 15.0-29.6. However, in this place, it is worth to mention that Chinese Academy of Sciences (29.6) and United States Department of Energy -DOE (28.2) obtained the greatest number of citations per publication. If we take account the self-citations for documents which were published by top 20 universities, it can be seen that self-citations represent about 10-19% of all citations in this journal. A detailed values of other bibliometric indicators for top 20 universities in terms of the greatest number of documents can be found in **Tab. 6**.

Tab. 6 Values of various indicators for top 20 universities in which scientists published the greatest number of documents in Scientific Reports in years 2011-2022.

ID	Name	TP	TC	TC/TP	% self-citations	% Docs Cited	CNCI	% First Auth	% Corr Auth	% Intern Coll	% Dom Coll	% Ind Coll	Highly Cited Papers	% Docs in Top 10%	% Docs in Top 1%	H-Index	% Docs in Q1 Journals	Country
1	Chinese Academy of Sciences	6 132	181 570	29,6	19	95,9	1,3	61,9	66,5	38,0	54,3	1,2	59	15,7	1,2	141	95,1	CHINA
2	UDICE-French Research Universities	5 372	100 369	18,7	16	92,1	1,2	52,3	54,9	68,6	27,1	3,2	29	12,9	0,7	97	86,7	FRANCE
3	Centre National de la Recherche Scientifique-CNRS	5 196	100 658	19,4	17	92,1	1,2	52,0	54,0	68,8	25,3	2,9	32	13,1	0,7	102	87,0	FRANCE
4	University of California System	4 381	100 792	23,0	12	91,9	1,4	44,5	47,5	59,9	29,8	3,6	49	16,0	1,4	114	86,6	USA
5	University of London	3 179	60 689	19,1	13	90,3	1,3	45,6	50,5	74,7	18,2	4,9	21	15,1	0,9	87	84,4	ENGLAND
6	Helmholtz Association	2 658	50 253	18,9	14	92,4	1,2	40,0	44,1	70,1	26,6	4,0	20	11,9	0,9	78	87,5	GERMANY
7	Harvard University	2 629	61 008	23,2	9	91,6	1,5	41,7	45,0	67,9	28,3	4,8	25	17,0	1,4	97	85,6	USA
8	Institut National de la Sante et de la Recherche Medicale (Inserm)	2 400	39 791	16,6	13	91,8	1,1	52,2	56,0	55,9	41,5	3,6	7	11,4	0,5	70	85,8	FRANCE
9	University of Tokyo	2 376	42 630	17,9	13	90,4	1,0	51,4	54,9	32,1	58,7	5,9	10	10,1	0,6	78	84,7	JAPAN

#	Name	TP	TC	TC/TP		% Docs Cited	CNCI	% First Auth	% Corr Auth	% Intern Coll	% Dom Coll	% Ind Coll	Highly Cited Papers	% Docs in Top 10%	% Docs in Top 1%		% Docs in Q1 Journals	Country
10	Consejo Superior de Investigaciones Cientificas (CSIC)	2 070	43 088	20,8	15	92,8	1,3	52,0	56,5	66,7	25,9	1,8	12	14,2	0,9	75	89,7	SPAIN
11	Seoul National University (SNU)	2 036	30 565	15,0	10	87,7	1,0	61,5	68,4	25,3	59,7	4,1	3	10,4	0,5	67	79,3	SOUTH KOREA
12	United States Department of Energy (DOE)	1 995	56 237	28,2	15	93,4	1,3	43,3	45,9	53,7	36,5	3,5	31	14,4	1,3	98	90,1	USA
13	University of Texas System	1 804	38 251	21,2	10	92,5	1,3	43,7	49,3	54,9	33,8	3,2	14	15,1	1,1	74	86,6	USA
14	Max Planck Society	1 751	36 463	20,8	11	93,1	1,3	41,4	44,0	74,9	19,5	3,2	14	14,3	1,1	75	88,1	GERMANY
15	Consiglio Nazionale delle Ricerche (CNR)	1 718	40 700	23,7	15	94,6	1,4	35,9	44,3	57,3	40,8	1,8	18	16,9	1,3	81	88,6	ITALY
16	University of Chinese Academy of Sciences, CAS	1 664	40 593	24,4	12	94,8	1,2	66,1	33,1	28,4	70,4	0,8	14	13,9	0,8	79	94,8	CHINA
17	University College London	1 635	32 780	20,0	11	90,5	1,3	44,3	49,0	71,9	19,6	5,1	12	15,7	1,0	74	84,8	ENGLAND
18	Kyoto University	1 584	29 145	18,4	13	90,3	1,0	53,0	54,0	30,9	57,9	5,9	11	10,6	1,0	69	85,2	JAPAN
19	Harvard Medical School	1 577	34 828	22,1	9	92,0	1,3	40,0	43,4	66,7	30,6	4,5	10	16,9	1,3	78	85,2	USA
20	Shanghai Jiao Tong University	1 564	37 623	24,1	10	95,5	1,2	66,0	71,9	34,6	42,9	1,2	7	12,9	0,7	74	94,3	CHINA

Abbreviations: **TP** – the number of publications, **TC** – the number of citations, **TC/TP** – the number of citations per publication, **% Docs Cited** – the percentage of documents cited at least one, **CNCI** – Category Normalized Citation Impact, **% First Auth** – the percentage of documents in which author is affiliated as the first author, **% Corr Auth** – the percentage of documents in which author is affiliated as the corresponding author, **% Intern Coll** – the percentage of documents which have international co-authors, **% Dom Coll** – the percentage of documents which have national co-authors, **% Ind Coll** – the percentage of documents which have industrial co-authors, **Highly Cited Papers** – the number of documents which obtained the greatest number of citations, **% Docs in Top 10%/Top 1 %-** the percentage of documents which were published in Top 10%/Top 1% the best documents, **% Docs in Q1 Journals** – the percentage of documents in Q1 journals. Data are related with documents which were published in Scientific Reports in years 2011-2022.

Analysis of top authors who published the greatest number of documents in Scientific Reports

Next, I determined the names of top 10 authors who published the greatest number of documents in Scientific Reports in years 2011-2022, as can be seen in **Tab. 7**. Moreover, in order to obtain an overview about these scientists, I also performed the information about other bibliometric indicators, especially: the number of documents, the number of citations, the percentage of self-citations, CNCI, etc. In particular, it has been turned out that the greatest number of documents in Scientific Reports was published by Han Kyungdo (66), Pfeiffer Franz (64) and Kumam Poom (58). Interestingly, documents which were published by top 10 researchers obtained a very high number of citations per publication (in the range of 7.1-50.8). In this place, it is worth noting that 2 authors (Cui Tie Jun and Eugene Stanley H.) received more than 50 citations per publication. **Tab. 7** reflects that self-citations represent about 1.2-44.1% of all citations. Additionally, it is worth noting that the mentioned scientists obtained a significantly high percentages of documents cited at least one (>77%). Unfortunately, top authors were rather seldom the first authors in Scientific Reports (<23%). On the other hand, if we take account the percentages of documents which have corresponding author, it can be seen that the values of this indicator are greater (in the range of 4.7-94.8%). In particular, Kumam Poom and Cui Tie Jun are corresponding authors in more than 80% of all documents. Next, it is also worth mention that top authors in Scientific Reports rather seldom collaborate with foreign authors. In particular, it has been turned out that only 2 authors have the percentage of international collaboration greater than 90%. Analysis of **Tab. 7** also performs that the mentioned scientists published less than 4 highly cited documents in Scientific Reports in years 2011-2022. Additionally, it is worth highlighted that the greatest percentage of documents in Top 10% the best documents in Scientific Reports obtained Kumam Poom (43.1%), while the greatest percentage of documents in Top 1% the best documents in this journal obtained Liu yan (5.3%). Interestingly, only Tsubota Kazuo and Han Kyungdo are affiliated in single country.

Tab. 7 Values of various indicators for top 10 authors who published the greatest number of documents in Scientific Reports in years 2011-2022.

ID	Name	TP	TC	TC/ TP	% self-citations	% Docs Cited	CNCI	% First Auth	% Corr Auth	% Intern Coll	% Dom Coll	Highly Cited Papers	% Docs in Top 10%	% Docs in Top 1%	H-Index	% Docs in Q1 Journals	Country
1	Han, Kyungdo	66	471	7,1	12,1	83,3	0,8	0,0	10,6	15,2	77,3	0	7,6	0,0	12	66,7	SOUTH KOREA
2	Pfeiffer, Franz	64	1 481	23,1	26,5	90,6	1,3	0,0	4,7	26,6	43,8	1	14,1	0,0	22	93,6	GERMANY; SWITZERLAND
3	Kumam, Poom	58	1 047	18,1	11,0	96,6	2,8	0,0	94,8	94,8	0,0	3	43,1	5,2	17	28,3	TAIWAN; THAILAND; IRAQ; SPAIN; USA; VIETNAM; NIGERIA; CANADA; INDIA
4	liu, yan	57	1 899	33,3	4,4	93,0	1,7	19,3	12,3	33,3	38,6	3	17,5	5,3	21	90,6	USA; CHINA; BELGIUM; JAPAN; AUSTRALIA; HONG KONG; SWEDEN; CANADA; GERMANY; RUSSIA; TAIWAN; ENGLAND; SINGAPORE; FRANCE
4	LI, JIAN	57	1 404	24,6	2,2	98,3	1,5	14,0	14,0	26,3	47,4	0	17,5	0,0	21	89,1	CHINA; AUSTRIA; USA; HONG KONG; ENGLAND; MALAYSIA; AUSTRALIA; TAIWAN; NETHERLANDS; SINGAPORE; MACAU; SCOTLAND; GERMANY; FRANCE; CANADA; SOUTH AFRICA; ISRAEL;

ID	Name	TP	TC	TC/TP	% Docs Cited	CNCI	% First Auth	% Corr Auth	% Intern Coll	% Dom Coll	% Ind Coll	Highly Cited Papers	% Docs in Top 10%	% Docs in Top 1%	H-Index	% Docs in Q1 Journals	Country
																	JAPAN; SWITZERLAND; INDIA; THAILAND; CZECH REPUBLIC
6	Tsubota, Kazuo	53	869	16,4	16,7	86,8	1,3	0,0	20,8	15,1	54,7	0	17,0	0,0	18	90,0	JAPAN
7	Eugene Stanley, H.	50	2 520	50,4	5,0	92,0	1,9	0,0	10,0	92,0	2,0	1	30,0	0,0	24	98,0	USA; JAPAN; CHINA; CANADA; ISRAEL; SPAIN; GERMANY
7	Han, Kyung-Do	50	393	7,9	15,8	80,0	0,8	0,0	6,0	14,0	70,0	0	2,0	0,0	12	65,9	SOUTH KOREA; ENGLAND
9	Beste, Christian	44	528	12,0	44,1	77,3	0,6	2,3	27,3	36,4	25,0	0	2,3	0,0	15	94,3	CHINA; GERMANY; CZECH REPUBLIC; SWITZERLAND
9	Cui, Tie Jun	44	2 234	50,8	15,5	97,7	2,1	0,0	84,1	9,1	59,1	0	34,1	0,0	28	100,0	CHINA; USA; GERMANY
9	wang, dong	44	864	19,6	1,2	93,2	0,9	22,7	18,2	13,6	61,4	1	6,8	0,0	16	95,1	CHINA; CANADA; USA; JAPAN; MACAU; SINGAPORE; POLAND; RUSSIA; SWITZERLAND; HONG KONG; SAUDI ARABIA; ENGLAND; AUSTRALIA; GERMANY; DENMARK; ISRAEL
9	Seo, Sang Won	44	483	11,0	13,3	81,8	0,8	2,3	56,8	43,2	47,7	0	6,8	0,0	12	78,6	SOUTH KOREA; JAPAN; USA; SPAIN

Abbreviations: TP – the number of publications, **TC** – the number of citations, **TC/TP** – the number of citations per publication, **% Docs Cited** – the percentage of documents cited at least one, **CNCI** – Category Normalized Citation Impact, **% First Auth** – the percentage of documents in which author is affiliated as the first author, **% Corr Auth** – the percentage of documents in which author is affiliated as the corresponding author, **% Intern Coll** – the percentage of documents which have international co-authors, **% Dom Coll** – the percentage of documents which have national co-authors, **Highly Cited Papers** – the number of documents which obtained the greatest number of citations, **% Docs in Top 10%/Top 1 %-** the percentage of documents which were published in Top 10%/Top 1% the best documents, **% Docs in Q1 Journals** – the percentage of documents in Q1 journals. Data are related with documents which were published in Scientific Reports in years 2011-2022.

Analysis of top funding agencies which funded the greatest number of documents in Scientific Reports

Tab. 8 Values of various indicators for top 10 funding agencies which funded the greatest number of documents in Scientific Reports in years 2011-2022.

ID	Funding Agency	TP	TC	TC/TP	% Docs Cited	CNCI	% Intern Coll	% Dom Coll	% Ind Coll	Highly Cited Papers	% Docs in Top 10%	% Docs in Top 1%	H-Index	% Docs in Q1 Journals	Country
1	National Natural Science Foundation of China (NSFC)	24 562	627 039	25,5	95,1	1,2	28,6	44,2	1,0	171	13,6	0,8	183	94,0	CHINA
2	United States Department of Health & Human Services	13 193	261 315	19,8	92,7	1,2	39,4	37,0	2,7	74	13,0	0,9	136	86,1	USA
3	National Institutes of Health (NIH) - USA	13 072	259 395	19,8	92,7	1,2	39,4	36,9	2,7	73	13,0	0,9	136	86,1	USA
4	Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT)	10 507	187 341	17,8	91,1	1,0	28,1	50,6	5,2	40	9,3	0,4	118	85,3	JAPAN
5	Japan Society for the Promotion of Science	9 980	177 629	17,8	91,2	1,0	27,9	50,7	5,2	37	9,4	0,4	115	85,2	JAPAN
6	European Commission	9 686	199 277	20,6	92,6	1,2	61,1	25,4	3,4	51	13,7	0,7	122	86,1	BELGIUM
7	Grants-in-Aid for Scientific Research (KAKENHI)	9 208	166 038	18,0	92,1	1,0	27,1	51,5	5,2	32	9,2	0,4	113	85,3	JAPAN

		TP	TC	TC/TP	% Docs Cited	CNCI	% Intern Coll	% Dom Coll	% Ind Coll	Highly Cited Papers	% Docs in Top 10%	Top 1%	% Docs in Q1 Journals	
8	UK Research & Innovation (UKRI)	6 480	137 562	21,2	93,6	1,3	61,2	22,7	4,2	38	15,0	0,8	109	88,9	UNITED KINGDOM
9	National Science Foundation (NSF)	5 756	160 071	27,8	93,3	1,4	45,5	29,5	2,2	64	17,6	1,4	139	89,3	USA
10	German Research Foundation (DFG)	4 924	90 142	18,3	93,0	1,1	54,7	27,2	2,4	20	10,8	0,5	91	88,3	GERMANY

Abbreviations: TP – the number of publications, **TC** – the number of citations, **TC/TP** – the number of citations per publication, **% Docs Cited** – the percentage of documents cited at least one, **CNCI** – Category Normalized Citation Impact, **% Intern Coll** – the percentage of documents which have international co-authors, **% Dom Coll** – the percentage of documents which have national co-authors, **% Ind Coll** – the percentage of documents which have industrial co-authors, **Highly Cited Papers** – the number of documents which obtained the greatest number of citations, **% Docs in Top 10%/Top 1 %-** the percentage of documents which were published in Top 10%/Top 1% the best documents, **% Docs in Q1 Journals** – the percentage of documents in Q1 journals. Data are related with documents which were published in Scientific Reports in years 2011-2022.

In order to present an insights into the top funding agencies, I show the list of top 10 funding agencies which funded the greatest number of documents in Scientific Reports in years 2011-2022, as depicted in **Tab. 8**. In particular, it has been turned out that the greatest number of documents were funded by National Natural Science Foundation of China -NSFC (24 562), followed by United States Department of Health & Human Services (13193) and National Institutes of Health (NIH) – USA (13 072). The fourth position belongs to Ministry of Education, Culture, Sports, Science and Technology, Japan- MEXT (10 507), while the fifth position received Japan Society for the Promotion of Science (9 980). Interestingly, documents which were funded by top 10 funding agencies obtained a very high number of citations per publication (in the range of 17.8-27.8). Hence, it can be claimed that documents which were funded by top funding agencies have the strong impact among scientists. Therefore, as revealed by an analysis of citations, more than 90% of these documents were cited at least one. **Tab. 8** also reflects that documents which were funded by top 10 funding agencies have very often international co-authors. In particular, the percentages of international collaboration are in the range of 27.1-61.2%. The percentages of national and industrial collaboration in the case of these documents are significantly smaller in comparison to the percentages of international collaboration. Additionally, it is worth noting that National Natural Science Foundation of China -NSFC funded 171 highly cited documents in Scientific Reports. The greatest percentage of documents in Top 10% and Top 1% the best documents was observed for National Science Foundation -NSF (17.6% and 1.4%, respectively).

Analysis of the most frequently used keywords in Scientific Reports

To provide an insight into the most frequently used keywords in Scientific Reports, I used the VoSViewer software. Firstly, I used the following assumption that the minimum number of occurrences of keywords is equal 170 and hence, I depicted the most frequently used keywords in Scientific Reports in years 2011-2022 (**Fig. 19**). Then, I also show how often change the most frequently used keywords in this journal in the selected years. In particular, in this case, I used the assumption that the minimum number of occurrences of keywords is equal 5 (years 2011-2012) and 28 (years 2013-2022) (**Fig. 20**). Moreover, it is worth to add that I selected the co-occurrence type of analysis and full counting method. Next, it is worth to mention that I divided the keywords into 3 clusters (**Fig. 19** and **Fig. 20**). In this place, it is worth to reminder that the distance between the keywords is associated with the relationship between the selected keywords. On the other hand, the color of the keyword is the cluster to which the keyword has been assigned. Therefore, it is worth to add that the greater number of lines between the selected keywords means the stronger relationship between the keywords. Based on **Fig. 19**, it can be seen that red cluster consists of 473 items which were mainly associated with identification, growth, model, evolution, dynamics and performance. Interestingly, this cluster includes keywords with various scientific disciplines, especially: biological and medical sciences (stress, bacteria, metabolism, genes, genome), physical and chemical sciences (temperature, phase, water, absorption), nanotechnology (thin-films, nanoparticles, nanotubes), earth and related environmental sciences (climate change) The second cluster (green), which includes 243 items, were devoted to medical and biological keywords, i.e. expression, activation, protein, cells, mechanisms, gene-expression, cancer, gene, in-vitro. Interestingly, the third cluster (blue), which contains 241 items also focus on topics related with medicine, such as: disease, risk, association, impact, prevalence, brain, management, diagnosis. Additionally, based on **Fig. 19**, it can be seen that the highest occurrence was observed for the following keywords: expression (12 665), identification (6 299), growth (5 511) and activation (5 323).
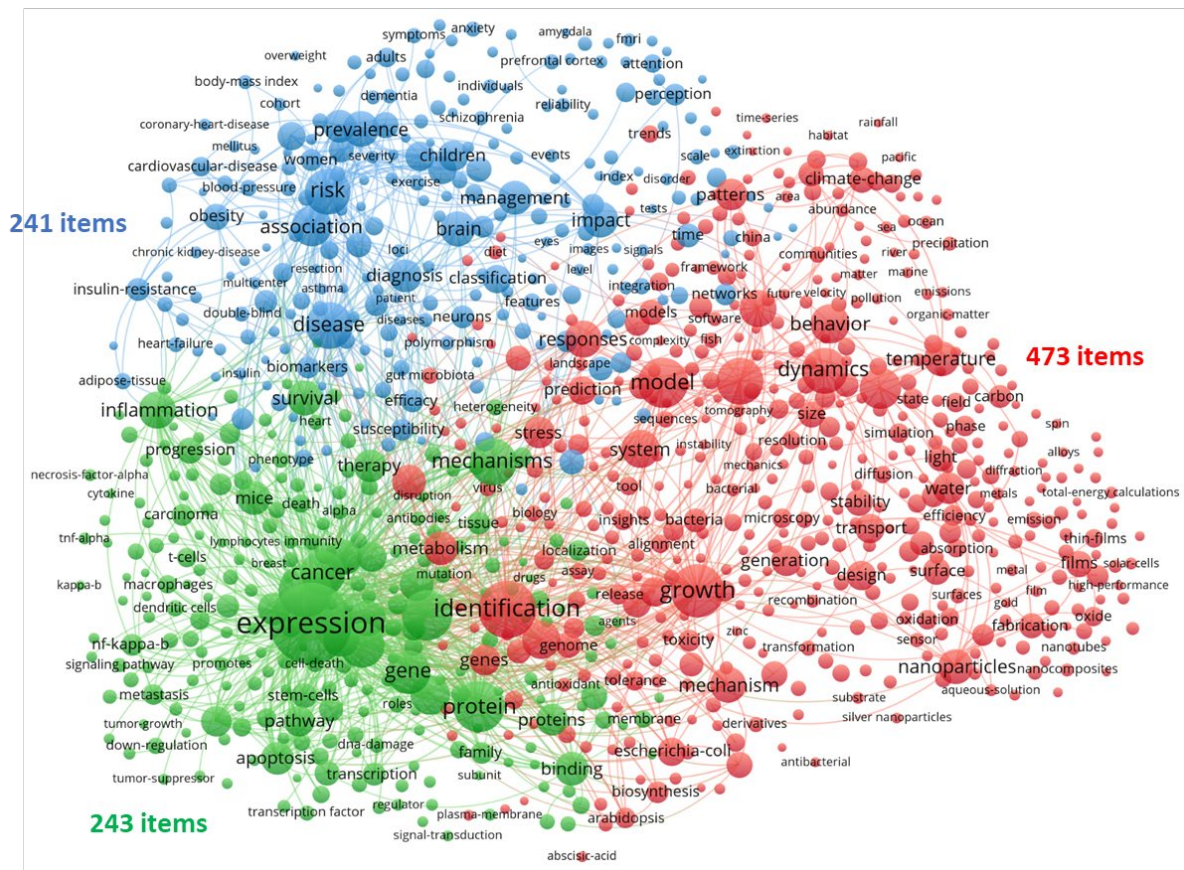
Fig. 19 The most frequently used keywords in Scientific Reports in years 2011-2022.

As seen in **Fig. 20**, the most frequently used keywords in Scientific Reports varies between particular years. Additionally, it is also worth to add that in all years, scientists focus mainly on the subjects related with medical and biological topics, especially: biochemistry & molecular biology, neurosciences, oncology, microbiology and cell biology. However, in some years, scientists also published documents related with other scientific disciplines, such as: materials science, physics applied. Therefore, analysis of keywords over the span of years reveals that the number of keywords which fulfill the selected assumption increases from 18 in year 2011 to 622 in year 2022. A detailed analysis of the most frequently used keywords in Scientific Reports was performed in **Fig. 20**.
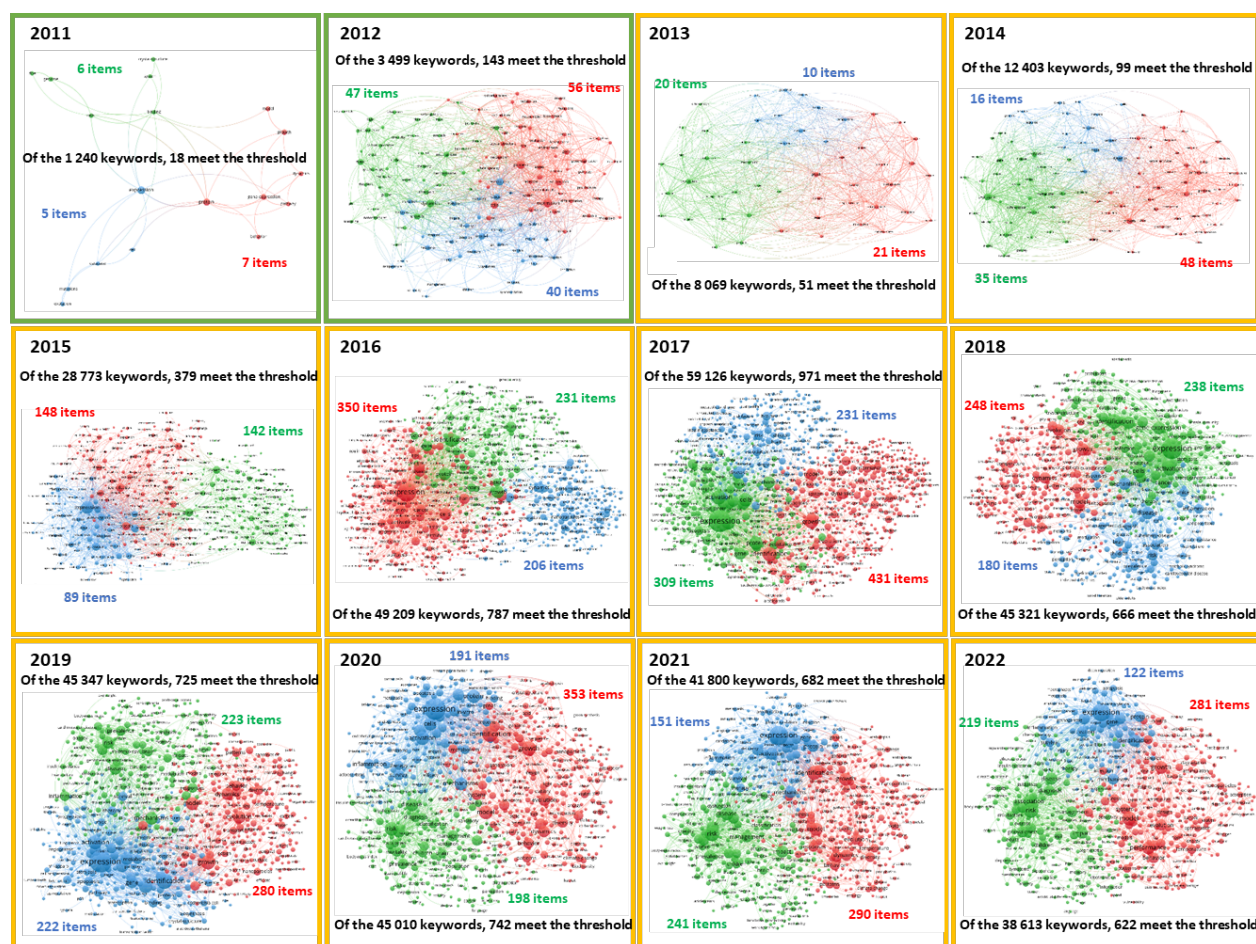
Fig. 20 The most frequently used keywords in Scientific Reports as a function of years. Assumptions: minimum number of occurrences of keywords: 5 (years 2011-2012) and 28 (years 2013-2022).

Conclusions

This paper presents a detailed bibliometric analysis of Scientific Reports in years 2011-2022 in terms of the most frequently published countries, universities and authors. In particular, this paper depicts the increasing trend in the number of publications in the period of 12 years, which means the strong impact of Scientific Reports for scientists. Based on my findings, it can be claimed that although, documents which were published in Scientific Reports are mainly related with Natural Sciences, Medical and Health Sciences as well as Engineering, this journal also published documents associated with other sciences, such as: Social Sciences and Humanities. Additionally, it is worth to add that in the case of top 20 countries in which scientists published the greatest number of documents in Scientific Reports, it was observed some strong positive or negative correlations between the selected indicators. In particular, it has been turned out that if the percentage of documents which have international co-authors decreases, the percentage of documents which have national co-authors increases. Moreover, my results show that if the percentage of documents which have first or corresponding author affiliated in the selected country increases, the percentage of documents which have international and national co-authors decreases and increases, respectively. Therefore, it is worth to mention that the weak positive correlations were observed in the case of some indicators related with citations. In particular, it has been turned out that if the percentage of documents cited is greater, the percentage of documents in Top 10% and Top 1% the best documents also is greater. On the other hand, the strong positive relationships (PC>0.8) were observed in the case of CNCI and the percentage of

documents in Top 10% and Top 1% the best documents. Interestingly, the greatest percentage of documents which have international co-authors is also related with the greatest percentage of documents in Top 10% the best documents. Furthermore, it was found that although, the correlation is rather weak (PC=~0.3) in the case of top 20 countries with the greatest number of published documents in Scientific Reports, the number of citations per publication increases when the percentage of documents which have international co-authors increases.

A more detailed conclusions were performed below:

1. Scientific Reports has Impact Factor equal 4.997 in year 2021, while Journal Normalized Citation Impact is equal 1.001.

2. Currently, Scientific Reports is assigned to Q2 quartile.

3. Scientists published 171 030 documents in Scientific Reports in years 2011-2022.

4. The greatest number of documents were articles (164 597, 96% of all documents) in Scientific Reports in years 2011-2022.

5. The average number of citations per publication for documents which were published in Scientific Reports is equal 17.88, while the average value of CNCI is equal 1.16.

6. The average percentage of documents cited at least one in Scientific Reports is equal 88.15.

7. Self-citations represent 4.1% of all citations in Scientific Reports.

8. 11 documents which were published in Scientific Reports obtained more than 750 citations, including 1 document with more than 6500 citations.

9. The average percentage of international collaboration is equal 35.0%, while the average percentage of domestic collaboration is equal 38.9%.

10. Collaboration of Gdańsk University of Technology with University of Gdańsk, Beijing University of Technology and Polish Academy of Sciences (Institute of Fluid Machinery) in Scientific Reports is favorable (CNCI>1.0).

11. Collaboration with a significant number of Polish universities of technology as well as University of Gdańsk and Gdańsk Medical University in Scientific Reports provides CNCI greater than 1.0 indicating the benefits of these collaborations.

12. The greatest number of documents in Scientific Reports were written by 4-6 authors.

13. 1 751 documents (1.02% of all documents) were written in Scientific Reports by single authors, while 38 documents were written by more than 100 authors, including 13 documents with more than 200 authors.

14. Scientists who published their articles in Scientific Reports prefer rather write papers with other scientists.

15. Documents which were published by single authors in Scientific Reports received rather a smaller number of citations per publication than documents which were written by more than 1 author.

16. The greatest number of citations per publication in Scientific Reports obtained documents which were written by 65 authors.

17. In Scientific Reports, the greatest number of published documents is related with Natural Sciences as well as Medical and Health Sciences, especially: Biological Sciences, Clinical Medicine, Basic Medicine, Physical Sciences, Other Natural Sciences.

18. The greatest number of citations per document obtained documents associated with Engineering & Technology.

19. In the case of all research areas, CNCI is greater than the average world value (1.0).

20. In the case of all research areas, more than 75% of all documents obtained at least one citation in Scientific Reports.

21. In the case of 3 research areas with the greatest number of documents which were published in Scientific Reports (Natural Sciences, Medical & Health Sciences, Engineering & Technology), about 13-17% and about 1-2% can be found in Top 10% and Top 1% the best documents, respectively.

22. USA and China published the greatest number of documents in Scientific Reports, while Switzerland, Sweden, Australia and Netherlands published the greatest number of documents per million inhabitants.

23. Chinese Academy of Sciences is top university in terms of the greatest number of published documents in Scientific Reports.

24. The greatest number of documents in Scientific Reports were published by Han Kyungdo and Pfeiffer Franz.

25. National Natural Science Foundation of China (NSFC) funded the greatest number of documents in Scientific Reports.

26. Expression, identification, growth and activation are the most frequently used keywords in Scientific Reports.

Finally, it is worth to add that results which were performed in this paper can be helpful for publisher, administrators and scientists who plan to publish their papers in Scientific Reports.

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