POLISH NATIONAL AGENCY FOR ACADEMIC EXCHANGE

ACADEMIC COOPERATION
BETWEEN POLAND AND GERMANY

opracowanie

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CONTENTS

INTRODUCTION

The aim of the study is to present a picture of academic cooperation between Poland and Germany. Academic cooperation is understood here in its broad context, both individual and institutional.

The study is exploratory and practical in nature and contains answers to the following questions:

- What is the volume of publications written in Polish-German co-authorship?
- What thematic areas dominate in this respect?
- What has been the intensity of this cooperation over the years?
- Which higher education institutions in Poland cooperate most intensively with their German counterparts?
- Which Polish universities host the most students/scientists from Germany?

The study is addressed to the broadly understood academic community and the environment of higher education and science institutions, as well as to the creators of national international policy in the field of academic cooperation.

The study used data from the following databases: SCOPUS,[1] OECD, UNESCO and POLon.

Due to the small numbers of some groups of German students and employees studying or working at Polish universities, the study limits the presentation of data to those necessary to ensure the anonymity of the people.

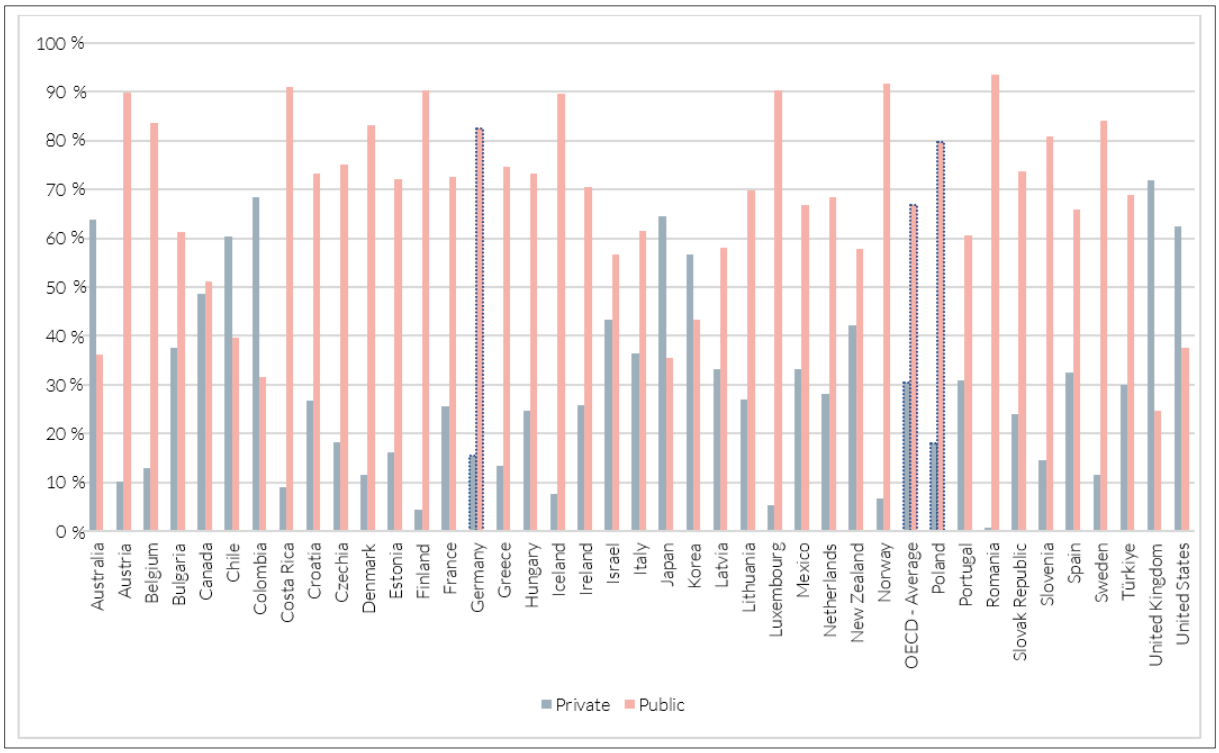
The study is another in a series of analyses available on the NAWA website.

[1] Access to the SCOPUS database and the SciVal tool under the national license provided by the Ministry of Science and Higher Education

1 POLAND AND GERMANY – BASIC DATA

Below are Graphs showing the percentage distribution of public and private expenditure on higher education, the share of people with higher education by age group and the international mobility of students, in OECD countries. All of the presented indicators refer to average levels for OECD countries, including Germany and Poland. Unfortunately, the last available data dates back to 2020, which is especially important in the case of financial data, in which events related to the COVID-19 pandemic and Russian aggression against Ukraine were of great importance.

Graph 1 Higher education expenditure (public and private) as a % of total higher education expenditure (2020)

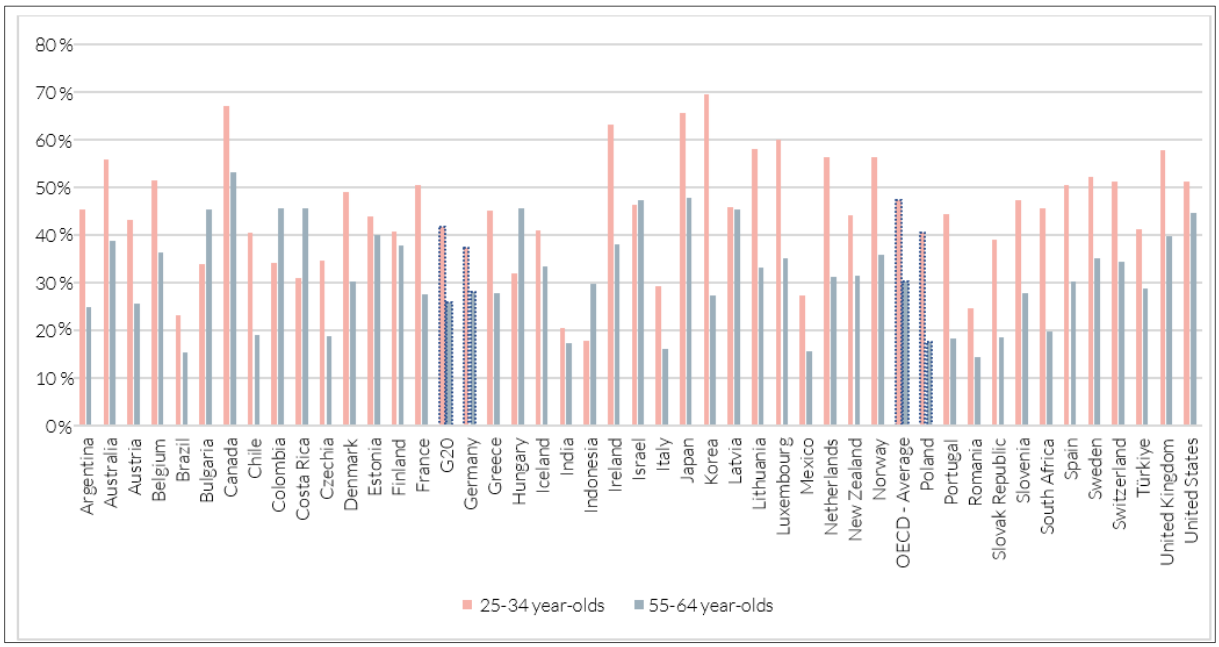


Source: OECD (2024), Spending on tertiary education (indicator). doi: 10.1787/a3523185-en (Accessed on 15 April 2024)

The above Graph presents a measure of the percentage of total expenditure on higher education. In OECD countries, tertiary education institutions are mainly financed by public funds, although there is a significant and growing level of funding from households and other private entities (NGOs, unions, associations, foundations, etc.). The low level of public expenditure on higher education generates a larger stream of private funds allocated for the purpose. In OECD countries, the average level of financing from public funds is 67% and from private funds - 30%. Against this background, the proportions of financing sources in Romania are noteworthy, where the level of public expenditure exceeds 90%. The highest percentage of private expenditure on higher education is in the UK (72%), Colombia (68%). Educational expenses, commonly associated with a heavy burden on home budgets, are in fifth place (62%), following Japan and Australia.

In the case of Poland, the percentage of public expenditure on higher education is above the OECD average and amounts to 80%, and private expenditure - below the average (18%). The values of the discussed indicators for Germany are at a similar level as in the case of Poland and amount to 83% and 16%, respectively.

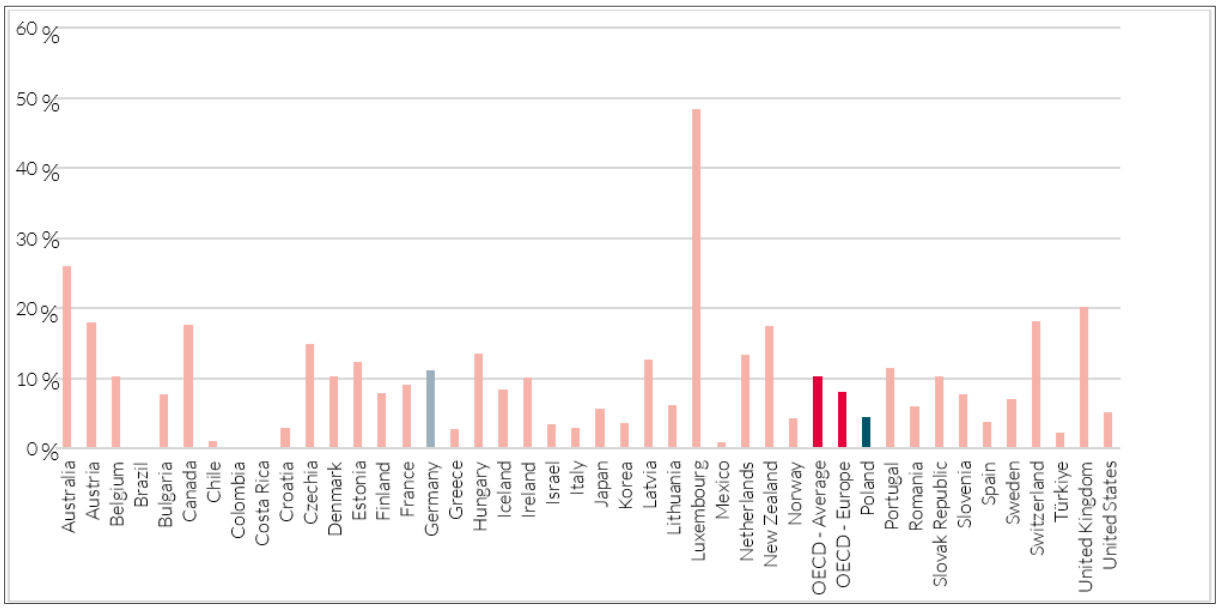
Graph 2 Percentage of people with higher education by age group (2022)



Source: OECD (2024), Population with tertiary education (indicator). doi: 10.1787/0b8f90e9-en (Accessed on 15 April 2024)

The above Graph shows indicators describing the share of people with higher education within two age groups. The education level of adults is often used as a measure of human capital and skills accessed in a given population, as a labor force.In OECD countries, the share of people with higher education in the younger age group is on average 47%, and in the older age group - 30%. In the group of G20 countries, the distance between the groups is smaller and amounts to 42% and 26%, respectively. The indicators for Poland are below the averages for both groups of countries: 41% and 18%. The situation is similar in Germany (37% and 28%), but what is noteworthy here is that the two age groups are separated by less than 10 percentage points (in Poland the distance is twice as large - 23 percentage points).

Graph 3 Student mobility indicator (2020)



Source: OECD (2024), "International student mobility" (indicator), https://doi.org/10.1787/4bcf6fc3-en (Accessed on 15 April 2024)

The mobility rate shows the number of international higher education students admitted as a percentage of all students enrolled in the host country. International students are those who have obtained their prior education in another country and are not residents of the country in which they are currently studying. The average for OECD countries is 10%, for European countries – 8%. The highest percentage of foreign students is recorded in Luxembourg (48%), Australia (26%) and Great Britain (20%). According to OECD data, foreigners constitute 4% of all students in Poland and 11% in Germany.

According to data from the POLon system, in the 2022/2023 academic year, citizens of Ukraine, Belarus and Turkey predominate among foreign students studying in Poland. Foreigners most often study management, IT and medicine. Among foreign employees who conduct research activities in particular fields and are employed as academic teachers, the largest group are citizens of Ukraine, India and Italy. Most often, they hold a doctoral degree and represent the fields of exact and natural sciences, social sciences and humanities.

In the case of German citizens, most students from this country study at medical universities in: Szczecin, Wroclaw and Białystok. Hence, the most popular fields of study among German students are: medicine, dentistry and management. German academic teachers are most often associated with the University of Wroclaw and the Jagiellonian University. Most often, they hold a doctoral degree and represent the field of natural and exact sciences.

Therefore, among German citizens who have linked their educational path and scientific career with Polish science and higher education institutions, the popularity of the field of study they choose does not coincide with the field of science represented by academic teachers employed at Polish universities.

Another important measure describing international scientific cooperation are publications that appeared in indexed sources. In OECD countries, among the publications registered in the SCOPUS database, every second one concerned the area of *Natural Science*, every third one concerned *Medical Science*, and every fourth one concerned *Engineering and Technologies*. In terms of the number of publications by authors affiliated to institutions grouped according to their countries of affiliation, the first three places are occupied by: the USA, Great Britain and Germany. Poland is in the second ten. The institutions to which the authors of indexed publications are most often affiliated are: the French Center national de la recherche scientifique (CNRS) and two American ones - Harvard University and the United States Department of Energy.

Among German institutions, the highest position is taken by the Technical University of Munich (51st position), and among the Polish institutions - the Polish Academy of Sciences (91st position).

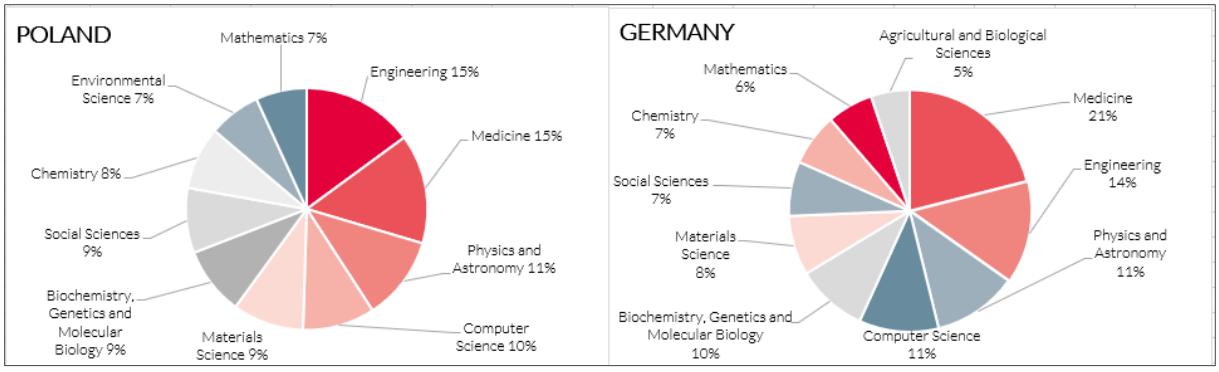
Tabele 1 Comparison of the number of publications by Polish and German scientists (2017-2023[2])

Publication year	Number of publications	
	Poland	Germany
2023	59,027	205,419
2022	61,131	212,861
2021	64,577	217,957
2020	60,484	201,342
2019	56,950	198,418
2018	53,296	194,665
2017	50,379	192,111
Total:	405,844	1,422,773

Source: SCOPUS-SciVal [accessed: 16.05.2024)

The pool of indexed publications for 2017-2023 by scientists affiliated to German institutions was 3.5 times larger than in the same period - to Polish institutions. However, the level of dynamics of change in the number of publications within both countries is interesting - in the case of Poland, the average year-to-year increase was 3%, and in Germany - it was 1%.

Graph 4 Publications of Polish and German scientists by area of knowledge (%) – comparison

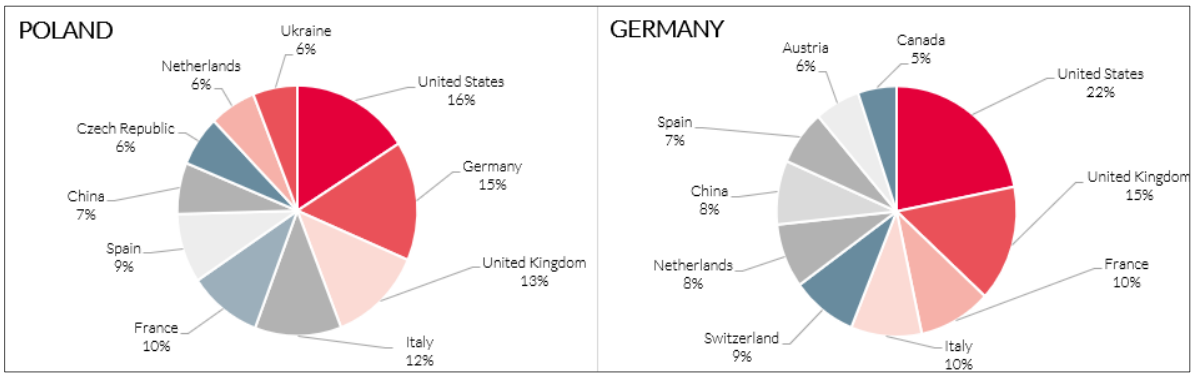


Source: SCOPUS-SciVal [accessed: 16.05.2024)

Converging areas of publications constituting the three largest thematic collections were observed. Scientists affiliated with Polish or German institutions most often published in the fields of: *Engineering; Medicine; Physics and Astronomy.* Among the 10 thematic areas of the publication, 9 are similar (in Poland, the tenth area is *Environmental Science* and in Germany - *Agricultural and Biological Sciences*).

[2] Data for 2023 is updated on an ongoing basis, so it is expected that in the second half of 2024 there will be an increase in both publications published in 2023 and their citations.

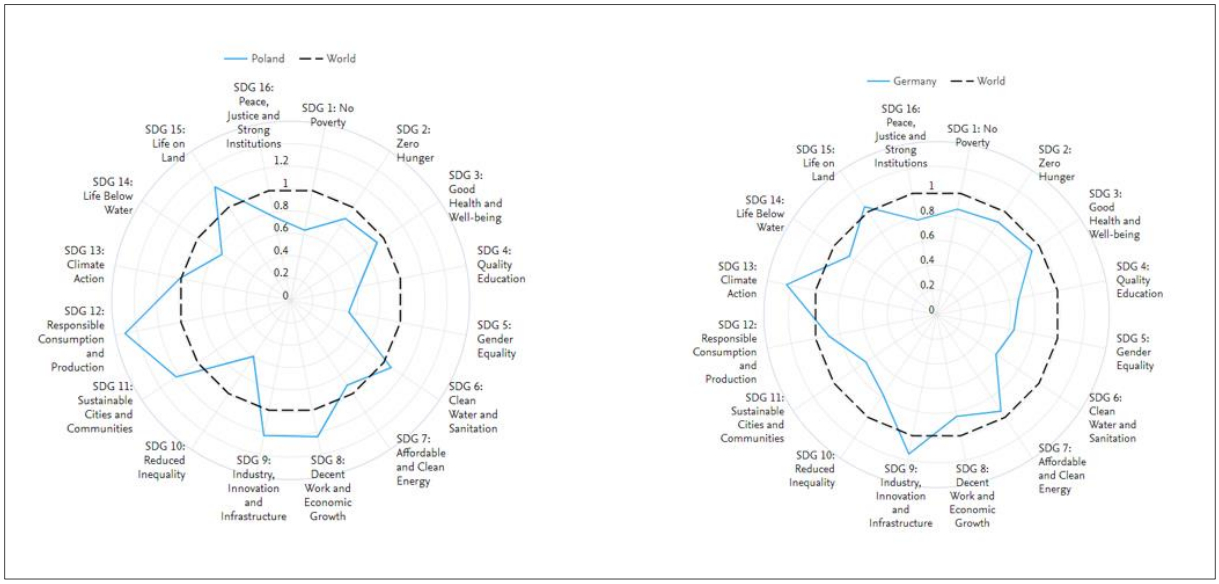
Graph 5 Countries of origin of co-authors of publications by Polish and German scientists – comparison (%)



Source: SCOPUS-SciVal [accessed: 16.05.2024)

Polish scientists most often publish in co-authorship with colleagues from the USA, Germany and Great Britain. However, German scientists most often cooperate with their counterparts from the USA, Great Britain and France (Polish co-authors are in the second ten).

Graph 6 Sustainable Development Goals (SDGs)[3]. Relative Activity Index[4] (RAI) - Poland-Germany comparison (2018-2022)



Source: SCOPUS-SciVal [accessed: 16.05.2024)

[3] SCOPUS provides indicator values for SDGs 1-16. SDG 17 is not monitored in the database.

[4] Relative Activity Index (RAI) is defined as the share of publications of an individual (here: country) in a given field in relation to the global share of publications in the same field. A value of 1.0 indicates that an individual's research activity in a given field exactly matches the global activity in that field; a value higher than 1.0 means more pressure; and a value lower than 1.0 suggests less pressure. For SDGs, RAI is calculated by looking at the total number of publications by an entity on a given SDG, divided by the total number of publications by the same entity to obtain a percentage. The same calculations are performed for each SDG for the world. The rate for an individual is calculated by dividing the percentage of the unit by the percentage for the world.

Another area that will be used to compare Polish and German contributions to the development of world science are publications identified as responding to the challenges of one of the UN Sustainable Development Goals (hereinafter: SDG). Globally, among the publications assigned to SDG goals 1-16, those dealing with health and quality of life (SDG 3) predominate. Eight times fewer publications were identified in the field of access to sustainable energy (SDG 7), although on a global scale it is the second goal in terms of the number of publications.

If we look at the share of scientists from both countries in a given field (here the field is the SDG goal) in relation to the global share of publications in the same field (RAI index), we will see that in Poland the largest share of achievements is within the goal focusing on solving problems regarding ensuring sustainable consumption and production (SDG 12). In Germany, however, scientists are focusing on the climate problem (SDG 13).

2 POLISH-GERMAN SCIENTIFIC COOPERATION (2017-2023)

The following part will analyze the publication cooperation of scientists affiliated with Polish and German scientific institutions. Only those publications were taken into account in which at least one author indicated that they belonged to the Polish and German academic community.

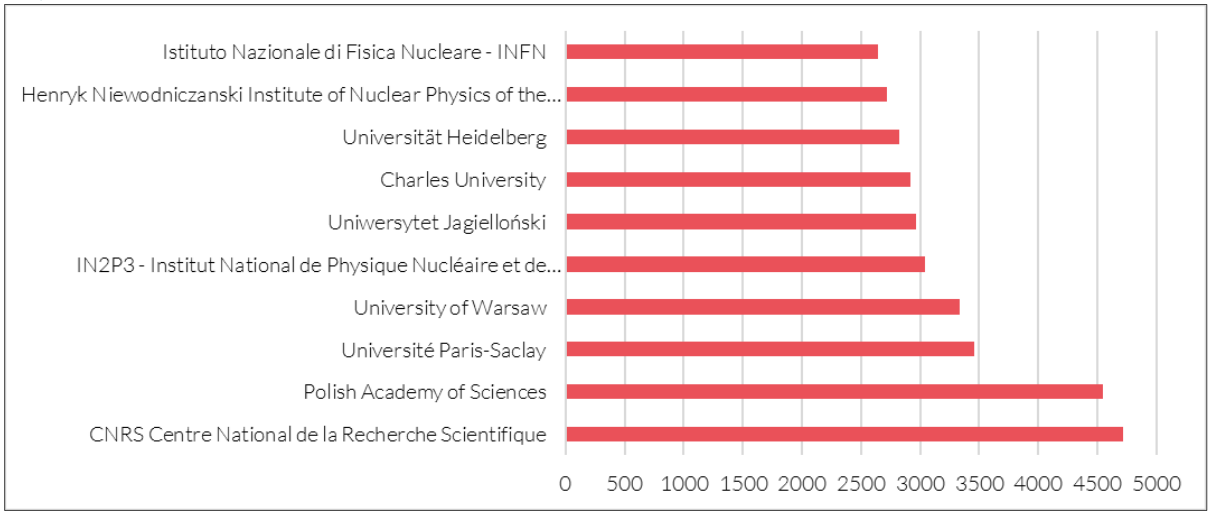
Tabele 2 Joint Polish-German publications in the SCOPUS database

Publication year	Number of publications
2023	5,060
2022	5,213
2021	4,982
2020	4,543
2019	4,070
2018	4,035
2017	3,730
Total:	31,633

Source: SCOPUS-SciVal [accessed: 16.05.2024]

Since 2017, more than 30,000 joint publications have been recorded in the SCOPUS database. During the time, the average year-to-year change in the number of publications was 5%. The most abundant year in this respect was 2020, as compared to 2019, the number of publications increased by 12%.

Graph 7 Author affiliations



Source: SCOPUS-SciVal [accessed: 16.05.2024)

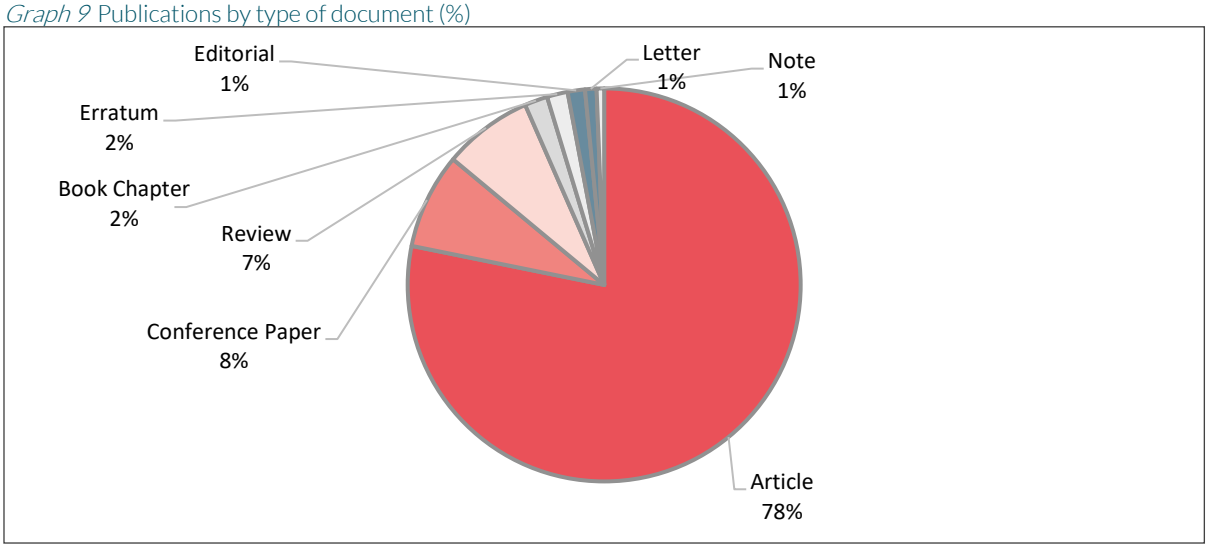
Among the ten most popular affiliations, apart from German and Polish institutions, there are also Italian, Czech and French ones.

Graph 8 Countries of origin of co-authors of publications (excluding Poland and Germany) (%)

Source: SCOPUS-SciVal [accessed: 16.05.2024)

The authors of the publications most often indicate the countries of origin (apart from Germany and Poland): Great Britain, Italy and the USA. It differs from the case of affiliation to an institution (see Graph 7).

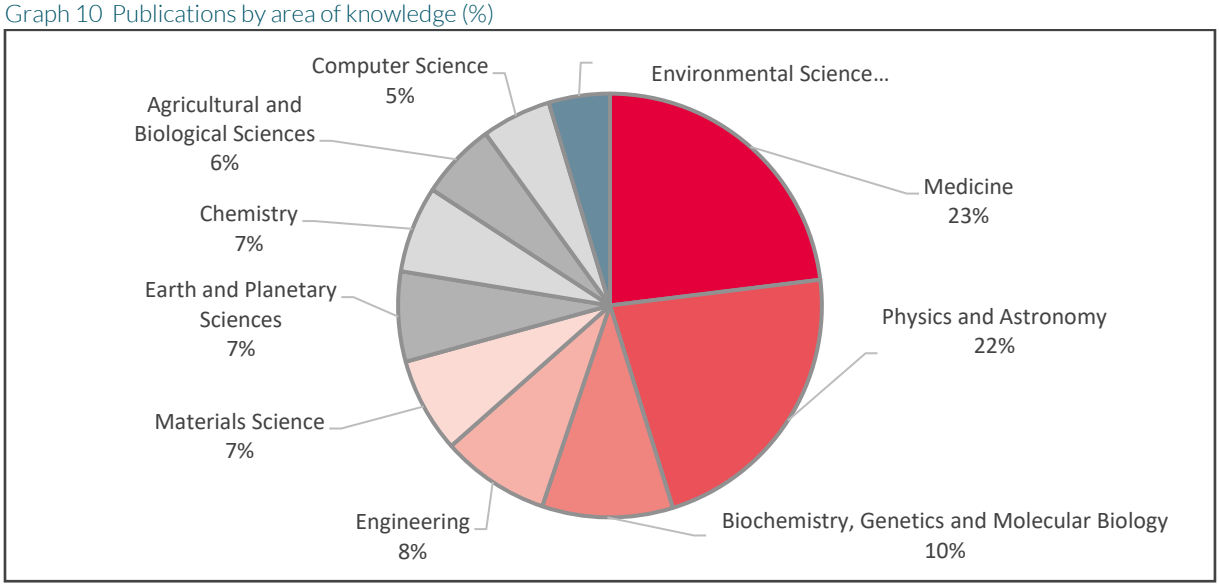
Graph 9 Publications by type of document (%)



Source: SCOPUS-SciVal [accessed: 22.05.2024)

In terms of the type of joint publications, articles in scientific journals predominate, accounting for ¾ of all Polish-German publications. The remaining ¼ are conference materials, reviews and book chapters.

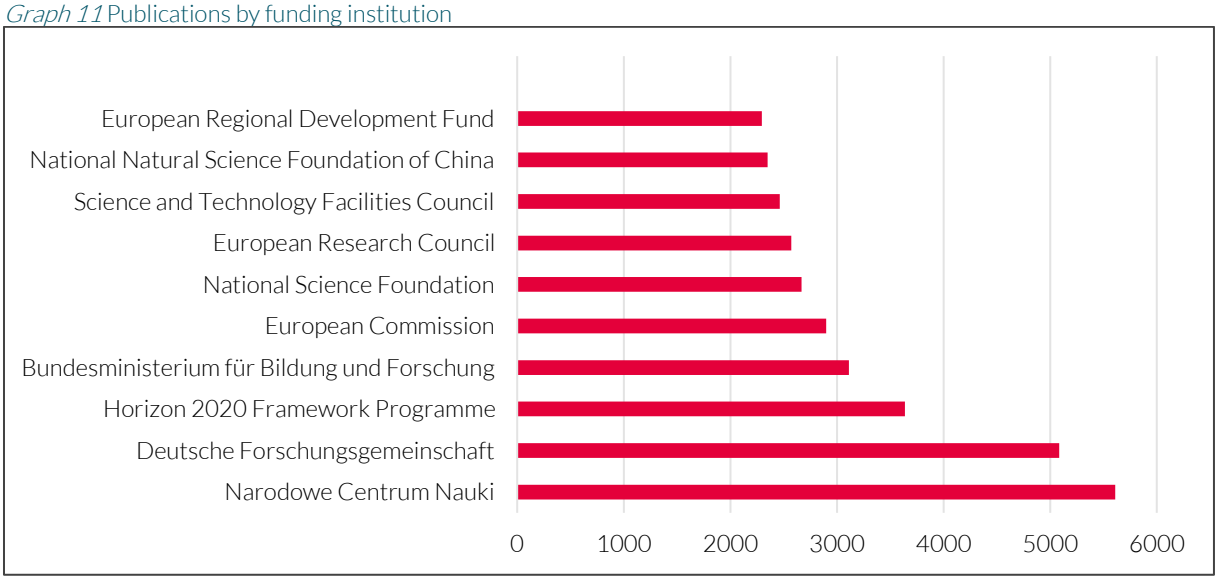
Graph 10 Publications by area of knowledge (%)



Source: SCOPUS-SciVal [accessed: 22.05.2024)

In their joint publications, scientists from Poland and Germany focus primarily on the research area of: *Medicine, Physics and Astronomy and Biochemistry, Genetics and Molecular Biology.*

Graph 11 Publications by funding institution



Source: SCOPUS-SciVal [accessed: 22.05.2024)

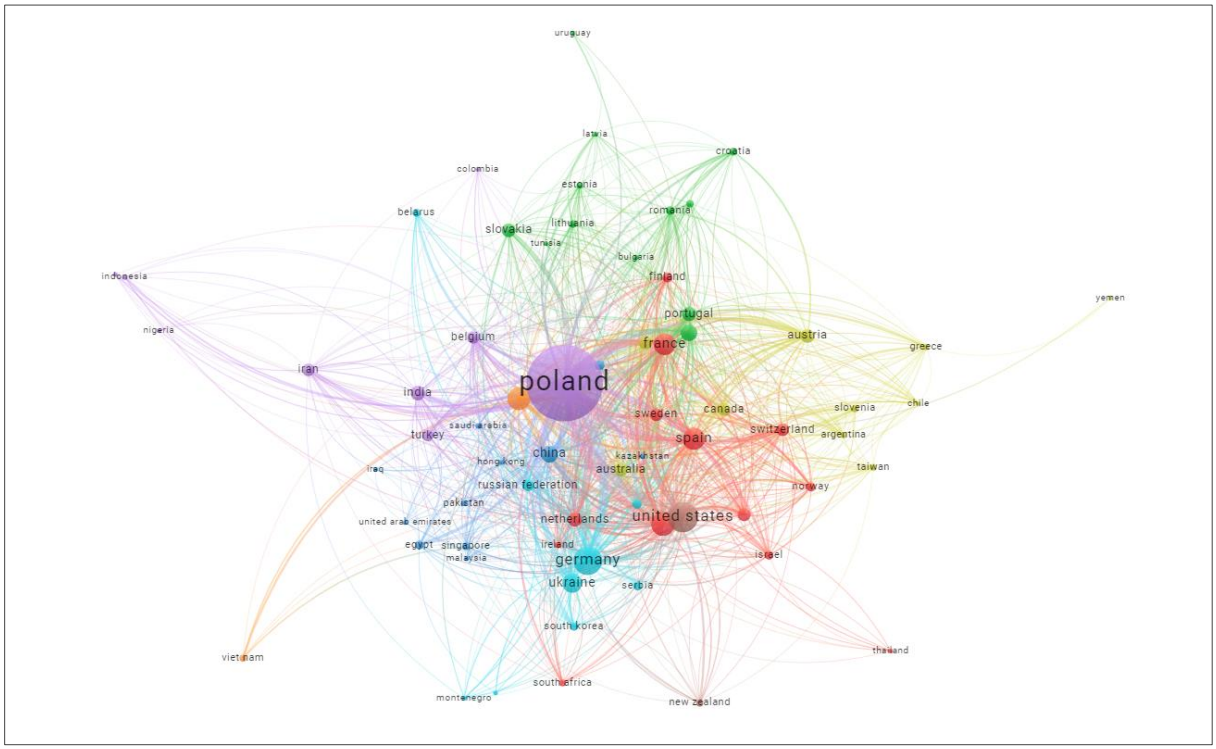
Joint Polish-German publications were most often financed from three sources: the National Science Center, Deutsche Forschungsgemeinschaft and the Horizon 2020 Framework Programe. In addition to European funding sources, the top ten also includes one Asian organization, the National Natural Science Foundation of China.

3 NAWA'S CONTRIBUTION TO POLISH-GERMAN SCIENTIFIC COOPERATION

The following part of the analysis is intended to show not only the impact of NAWA funding on the resulting publications, at least one author is affiliated to a German and Polish institution, but also to show NAWA's global contribution to the resulting scientific publications.

A bibliometric analysis based on the SCOPUS database shows that publications co-financed by NAWA were co-authored by scientists from 68 countries. The Network Map generated below shows that the publications are grouped into 8 thematic clusters, creating 1,061 links between themselves and 9,075 links between countries. It means that each of the publications co-financed from NAWA funds "generated" another 3 connections with other countries to which their co-authors are affiliated.

Map 1 Map of the network of connections between the countries of origin of the co-authors of publications co-financed by the Polish National Agency for Academic Exchange

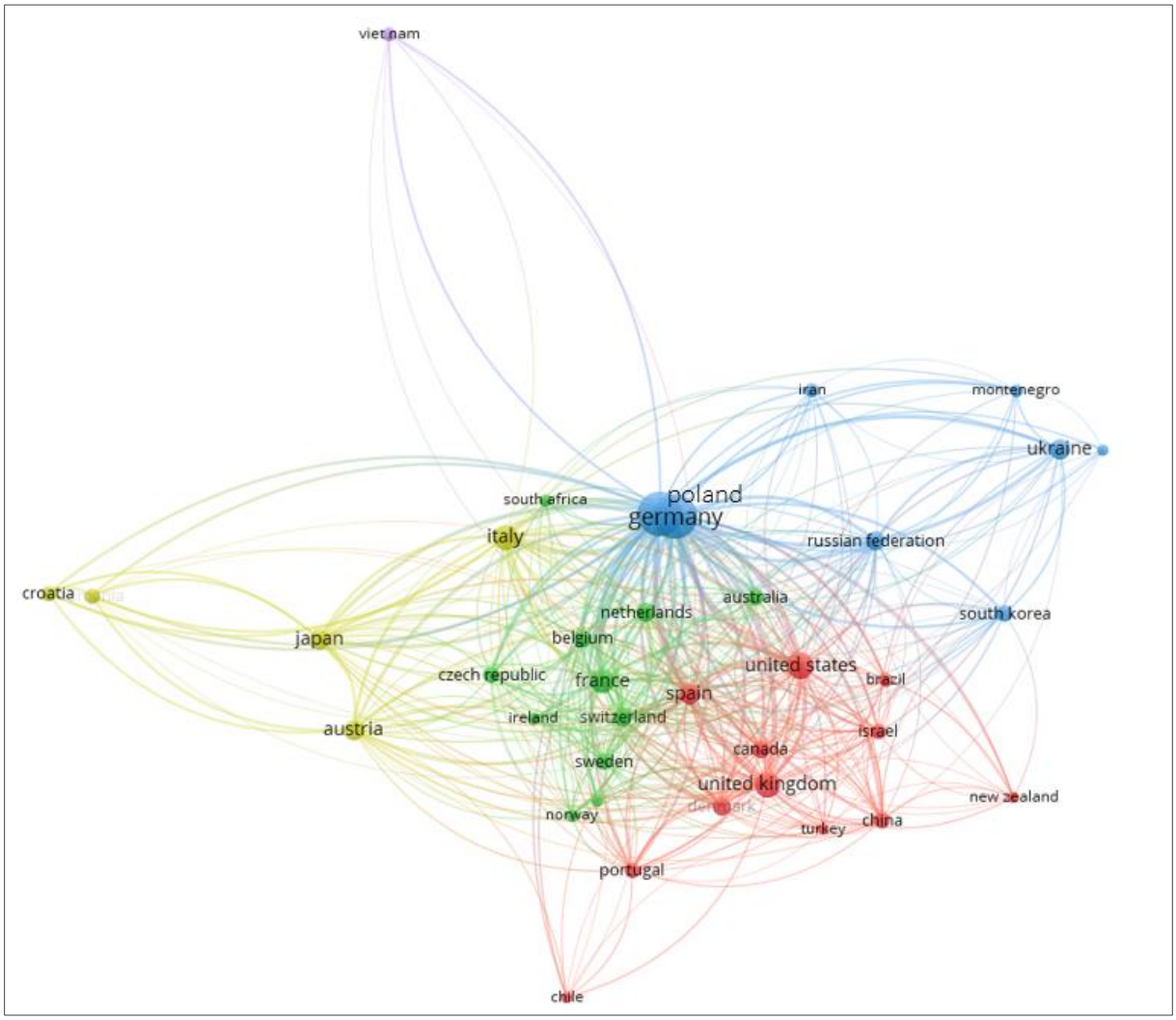


Source: own development based on SCOPUS/SciVal [accessed: 19.04.2024 r.]; visualization using the VOSviewer

Pursuant to data from the SCOPUS database, a correlation coefficient was calculated, determining the correlation for the variables "documents/number of documents" and "total link strength" and for "citations" and "total link strength" for all observations (i.e. 68 countries). A very strong relationship was noted in both pairs of variables (from 0.97 to 1.00), confirming the thesis of high importance for scientific visibility and international cooperation among the authors of publications (in this case - publications created with the financial support of NAWA).

In 2017-2023, 527 publications co-financed by NAWA were created, with at least one author indicating Polish and German affiliation. NAWA's share in the creation of Polish-German publications is 1.7%.

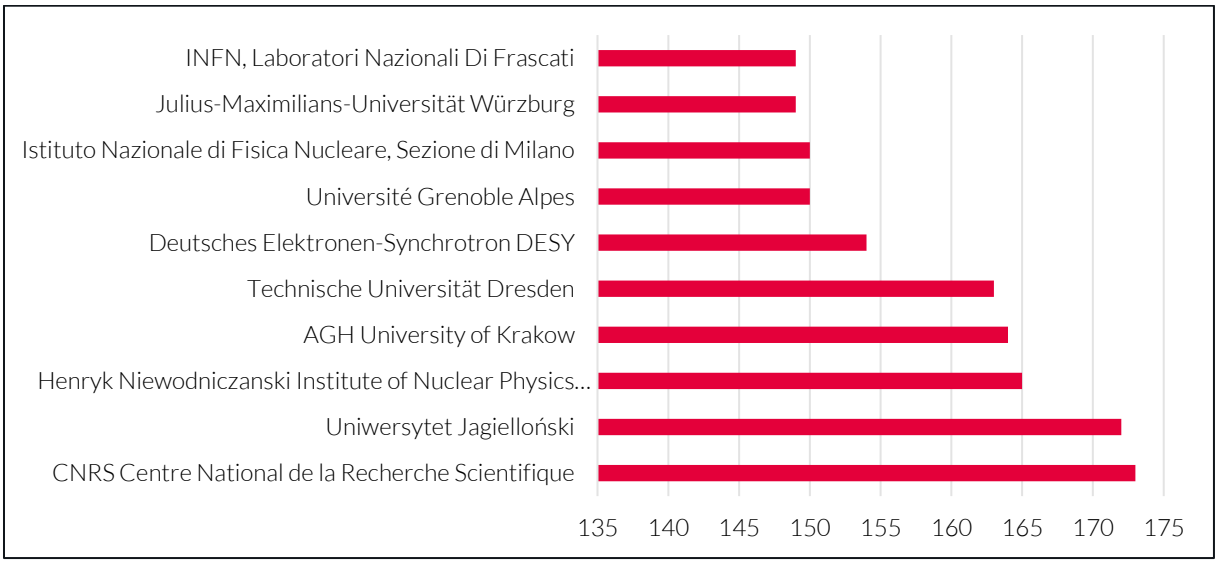
Map 2 Map of the network of connections between countries of origin of Polish-German co-authors of publications co-financed by the Polish National Agency for Academic Exchange



Source: own development based on SCOPUS/SciVal [accessed: 19.04.2024 r.]; visualization using the VOSviewer

The map above shows that cooperation between scientists from two countries resulted in cooperation with another 35, which in turn resulted in over 400 connections between the countries. The 37 countries visible on the map form five geographical groups and there are links between each country in the form of joint, international publications.

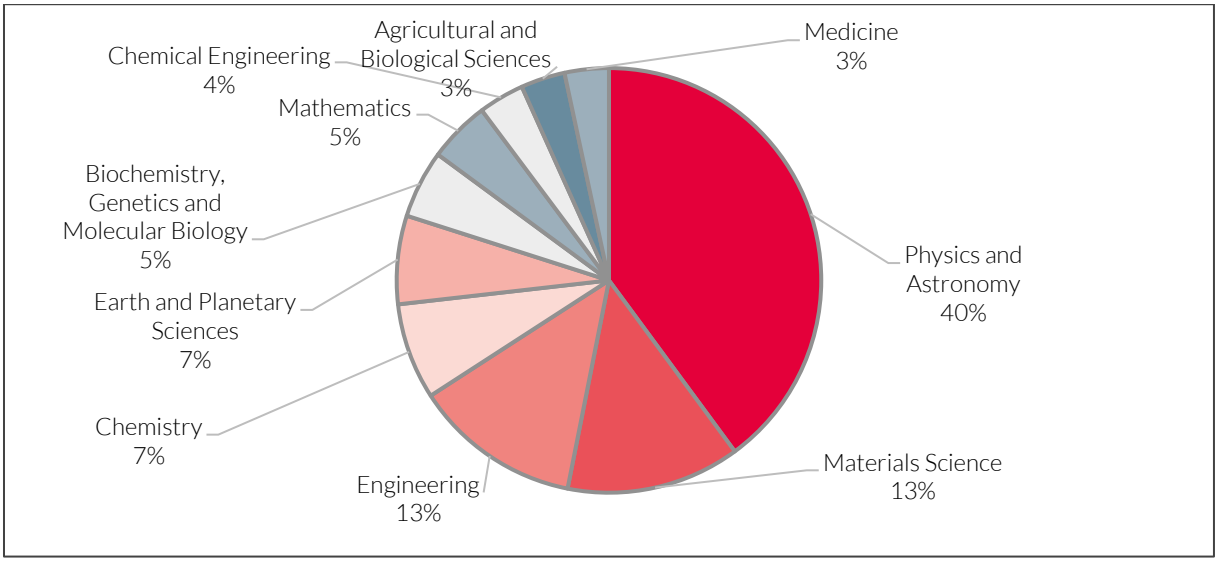
Graph 12 Affiliations of authors of publications co-funded by NAWA



Source: SCOPUS-SciVal [accessed: 16.05.2024)

In the Polish-German cooperation in which NAWA participates, European centers specializing in natural and technical sciences are the leading institutions as the institutions to which the authors are affiliated. In addition to Italy, France and Spain, co-authors of the publications identify themselves as American and Japanese scientists.

Graph 13 Publications co-funded by NAWA by thematic field



Source: SCOPUS-SciVal [accessed: 22.04.2024)

The thematic area of joint publications is consistent with the fields of study most frequently chosen by Germans in Poland and the fields represented by German scientists working in Polish institutions.

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