



POLISH NATIONAL AGENCY
FOR ACADEMIC EXCHANGE

ACADEMIC COOPERATION BETWEEN POLAND AND SWEDEN



Warsaw 2024

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INTRODUCTION

The aim of the study is to present a picture of academic cooperation between Poland and Sweden. 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-Swedish co-authorship?
- What thematic areas dominate in the respect?
- What has been the intensity of this cooperation over the years?
- Which higher education institutions in Poland cooperate most intensively with their Swedish counterparts?
- Which Polish universities host the most students/scientists from Sweden?

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

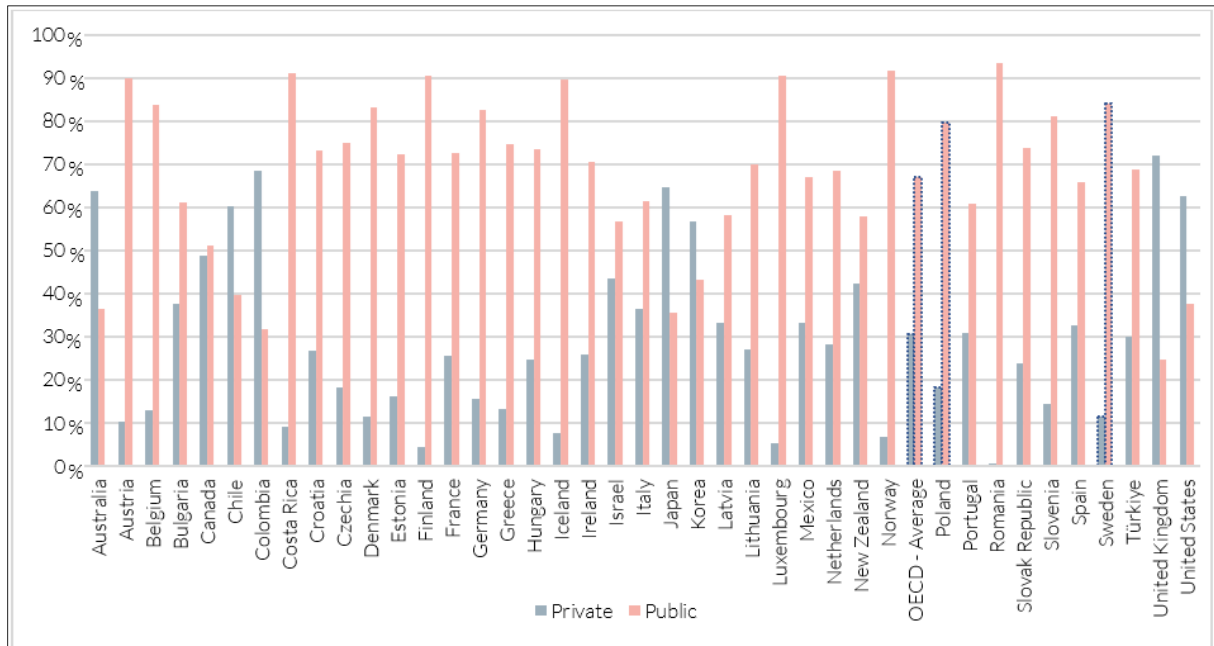
The study is another in a series of analyses available on the NAWA [website](#).

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 SWEDEN – BASIC DATA

Below are charts 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 presented indicators refer to average levels for OECD countries, including Sweden and Poland. Unfortunately, the latest available data dates back to 2020, which is particularly important in the case of financial data, in which events related to the COVID-19 pandemic and Russian aggression against Ukraine were of particular importance.

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

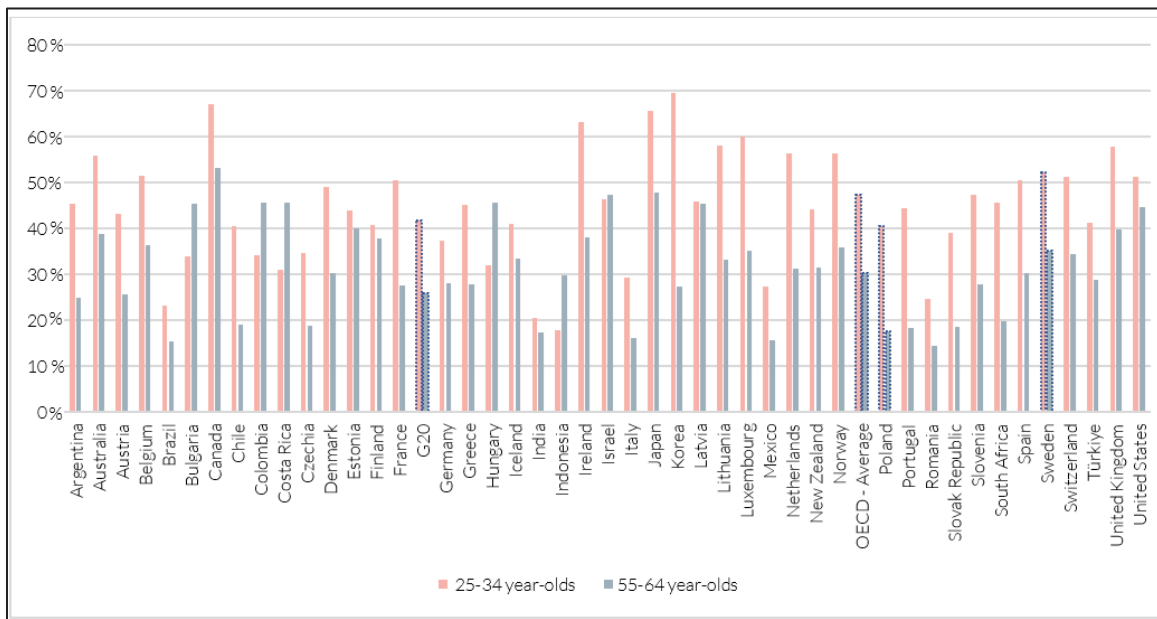


Source: OECD (2024), Spending on tertiary education (indicator). doi: 10.1787/a3523185-en (Accessed on 15 April 2024)

The chart above 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 this purpose. In OECD countries, the average level of financing from public funds is 67% and from private funds - 30%. Against the background, the proportions of financing sources in Romania are noteworthy, the level of public expenditure exceeds 90%. The highest percentage of private spending 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%), behind 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 Sweden are: 84% and 11%, respectively.

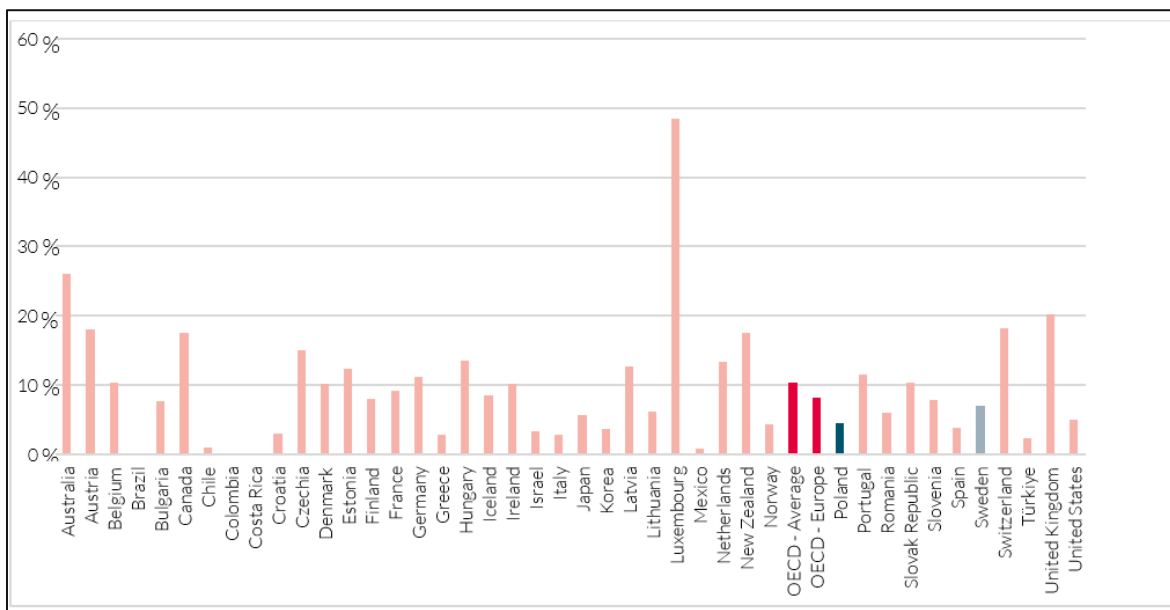
Graph 2 Percentage of people with higher education by age group (2022)



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

The chart above shows indicators describing the share of people with higher education within two age groups. The educational level of adults is often used as a measure of the human capital and skills available 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. Indicators for Poland are below the averages for both groups of countries: 41% and 18%. In the case of Sweden, more than half of people aged 25-34 have higher education and 35% in the older age group.

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 indicator 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 7% in Sweden.

According to data from the POLon system for 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 specific 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 Swedish citizens, most students from the country study at medical universities in Gdansk, Olsztyn and Szczecin. It is probably why the most popular fields of study among German students are: medicine, dentistry and psychology. Swedish academic teachers in Poland constitute a group of no more than 10 people.

To sum up, the group of Swedish citizens who have linked their educational path and scientific career with Polish science and higher education institutions does not exceed 600 people.

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 Swedish institutions, the highest is Karolinska Institutet (67th position) and among Polish institutions - Polish Academy of Sciences (91st position).

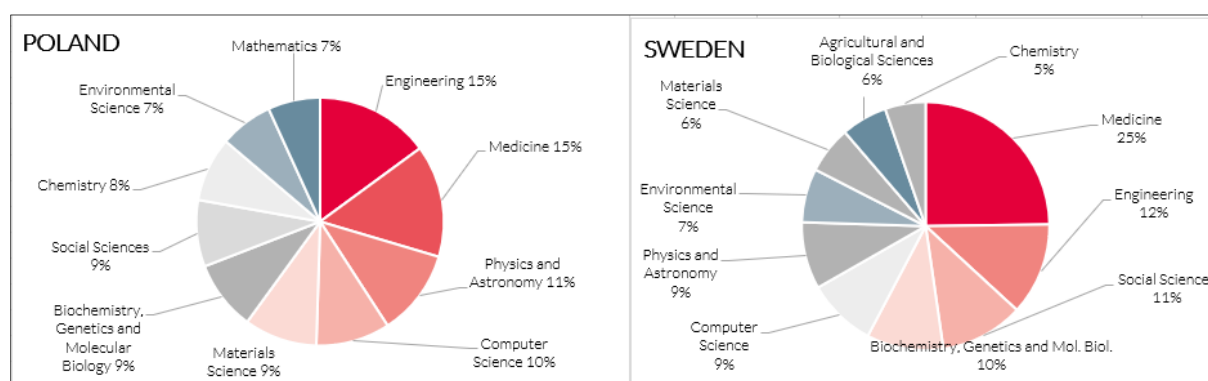
Tabela 1 Comparison of the number of publications by Polish and Swedish scientists (2017-2023²)

Publication year	Number of publications	
	Poland	Sweden
2023	5,9027	5,0055
2022	6,1131	5,0410
2021	6,4577	5,1037
2020	6,0484	4,8002
2019	5,6950	4,6593
2018	5,3296	4,5858
2017	5,0379	4,4974
Total:	405,844	336,929

Source: SCOPUS-SciVal [accessed: 16.04.2024]

The pool of indexed publications for 2017-2023 by scientists affiliated to Swedish institutions is comparable to the Polish one. 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 Sweden - it was 2%.

Chart4 Publications of Polish and Swedish scientists by area of knowledge (%) – comparison

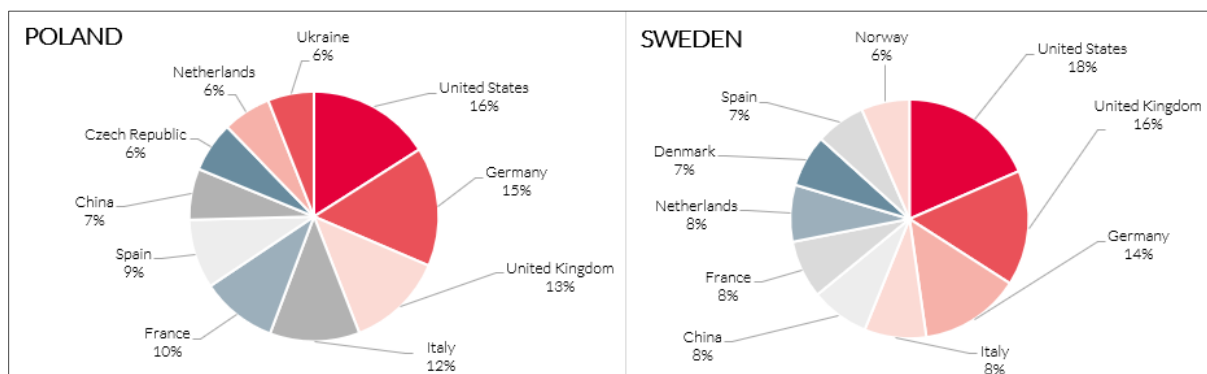


Source: SCOPUS-SciVal [accessed: 16.05.2024]

Among the main areas of interest of Polish and Swedish scientists, 9 out of 10 largest thematic collections were observed to be similar. The area covered in Polish publications is *Mathematics*, and in Swedish publications - *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.

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



Source: SCOPUS-SciVal [accessed: 16.04.2024]

Both Polish and Swedish scientists most often publish in co-authorship with colleagues from the USA, Germany and Great Britain. In the case of Swedish scientists, among the co-authors of their publications, Polish scientists are in the second ten (and vice versa).

Chart 6 Sustainable Development Goals (SDGs)³. Relative Activity Index⁴ (RAI) - Poland-Sweden comparison (2018-2022)



Source: SCOPUS-SciVal [accessed: 16.04.2024]

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 in the field of access to sustainable energy (SDG 7) were identified, 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 Sweden, however, scientists focus on the issue of gender equality (SDG 5).

2 POLISH-SWEDISH SCIENTIFIC COOPERATION (2017-2023)

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

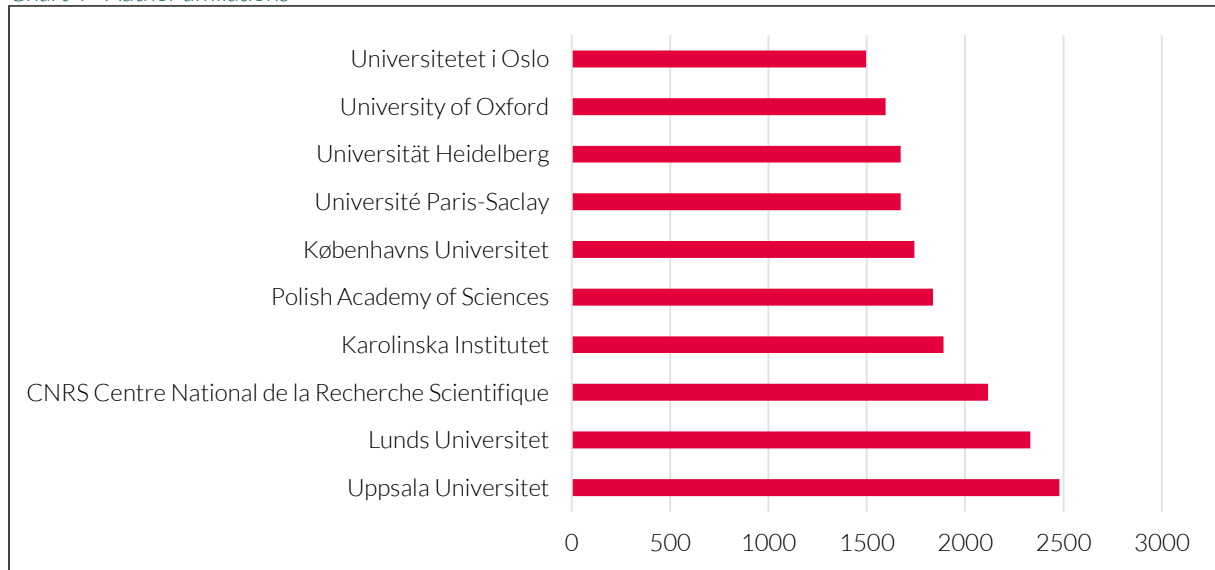
Table 2 Joint Polish-Swedish publications in the SCOPUS database

Publication year	Number of publications
2023	1,796
2022	1,673
2021	1,669
2020	1,504
2019	1,382
2018	1,329
2017	1,183
Total:	10,536

Source: SCOPUS-SciVal [accessed: 16.05.2024]

Since 2017, more than 10,000 joint publications have been recorded in the SCOPUS database. During the time, the average year-to-year change in the number of publications was 7%. The most abundant year in this respect was 2018, the number of publications increased by 12%, as compared to 2017.

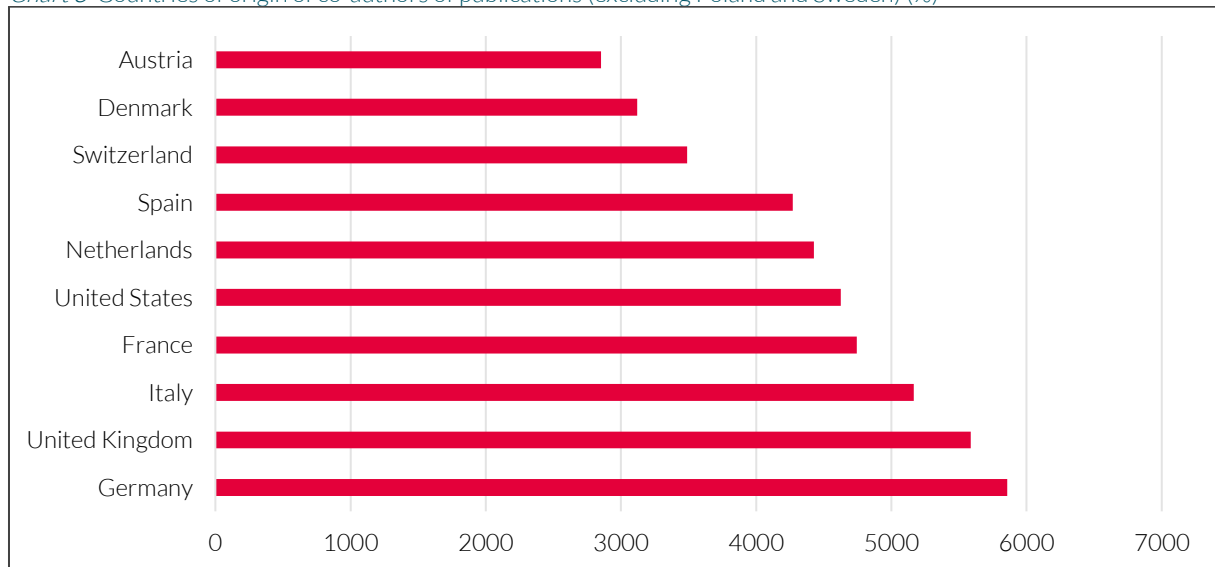
Chart 7 Author affiliations



Source: SCOPUS-SciVal [accessed: 16.04.2024]

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

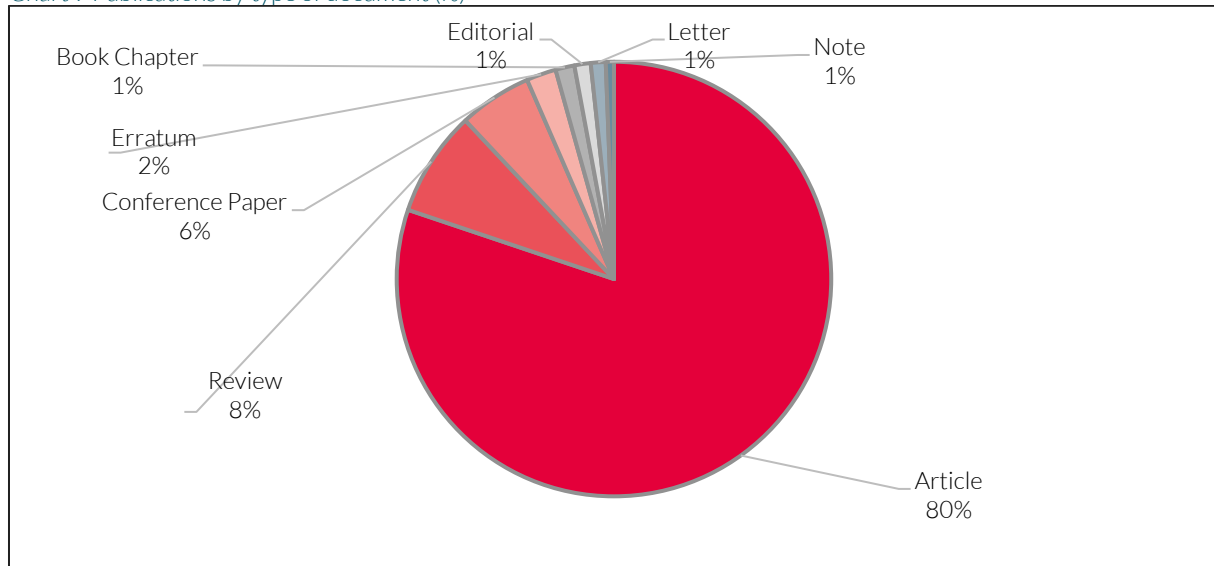
Chart 8 Countries of origin of co-authors of publications (excluding Poland and Sweden) (%)



Source: SCOPUS-SciVal [accessed: 16.04.2024]

The authors of publications most often indicate the countries of origin (apart from Sweden and Poland): Germany, Great Britain, Italy and the USA, which partially overlaps in the case of affiliation to institutions (see Chart 7).

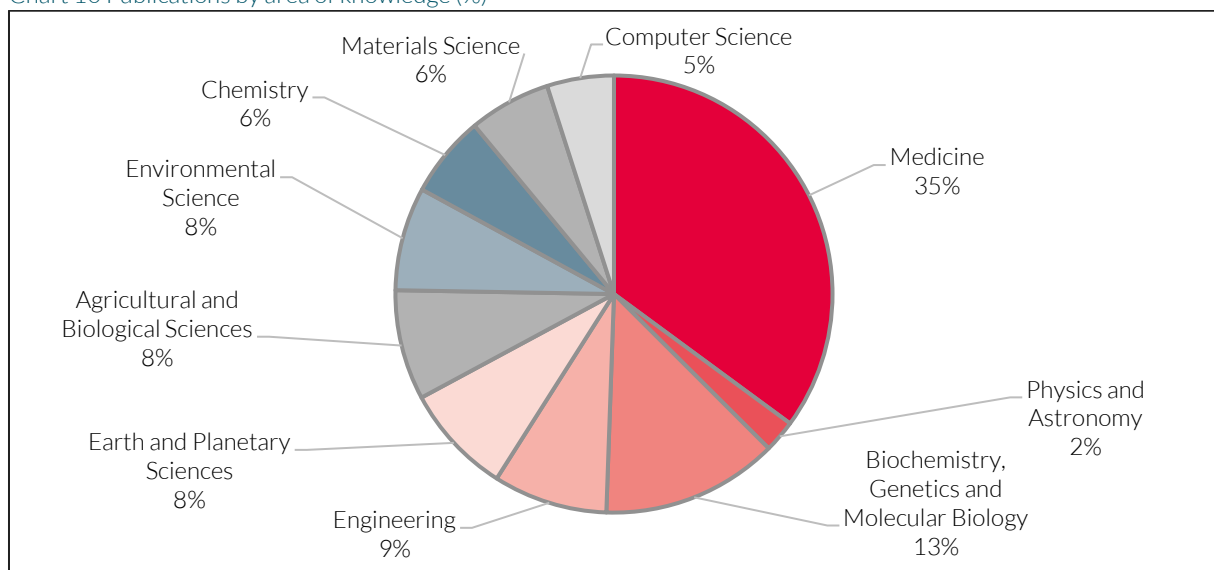
Chart 9 Publications by type of document (%)



Source: SCOPUS-SciVal [accessed: 22.04.2024]

In terms of the type of joint publications, articles in scientific journals predominate, accounting for 80% of all Polish-Swedish publications.

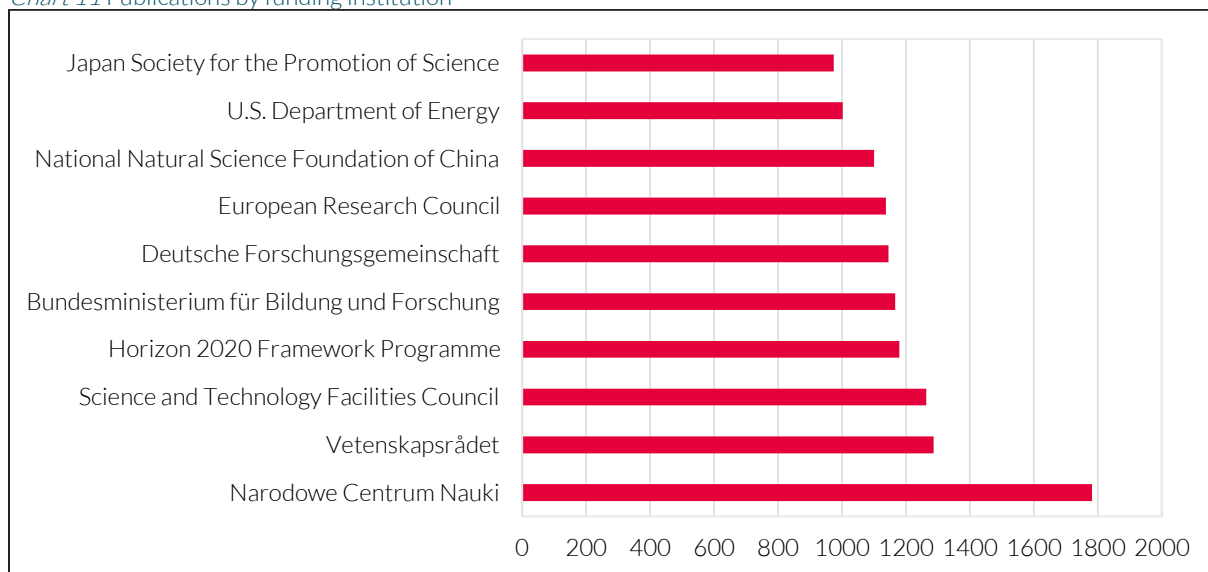
Chart 10 Publications by area of knowledge (%)



Source: SCOPUS-SciVal [accessed: 22.04.2024]

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

Chart 11 Publications by funding institution



Source: SCOPUS-SciVal (accessed: 22.04.2024)

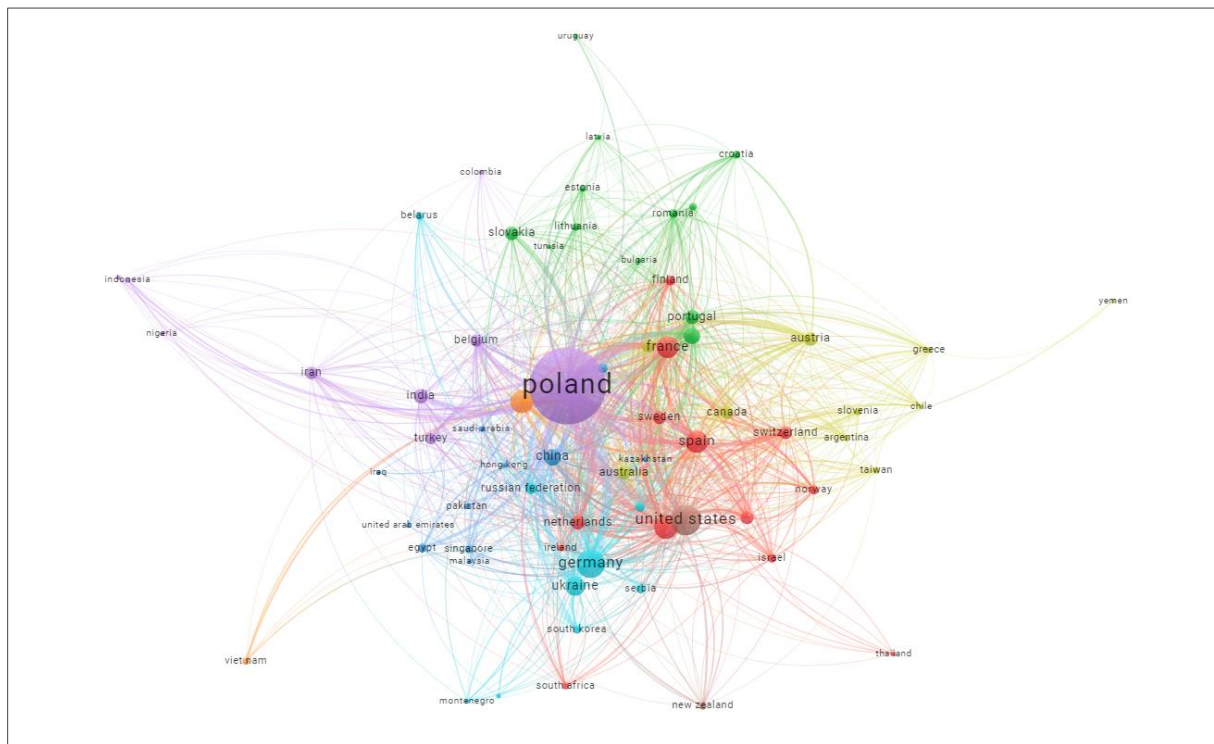
Joint Polish-Swedish publications were most often financed from three sources: the National Science Center, Vetenskapsrådet and the Science and Technology Facilities Council. In addition to European funding sources, the top ten also includes two Asian and one North American organizations.

3 NAWA'S CONTRIBUTION TO POLISH-SWEDISH SCIENTIFIC COOPERATION

The following part of the analysis is intended to show not only the impact of NAWA funding on the resulting publications, where 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.

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.

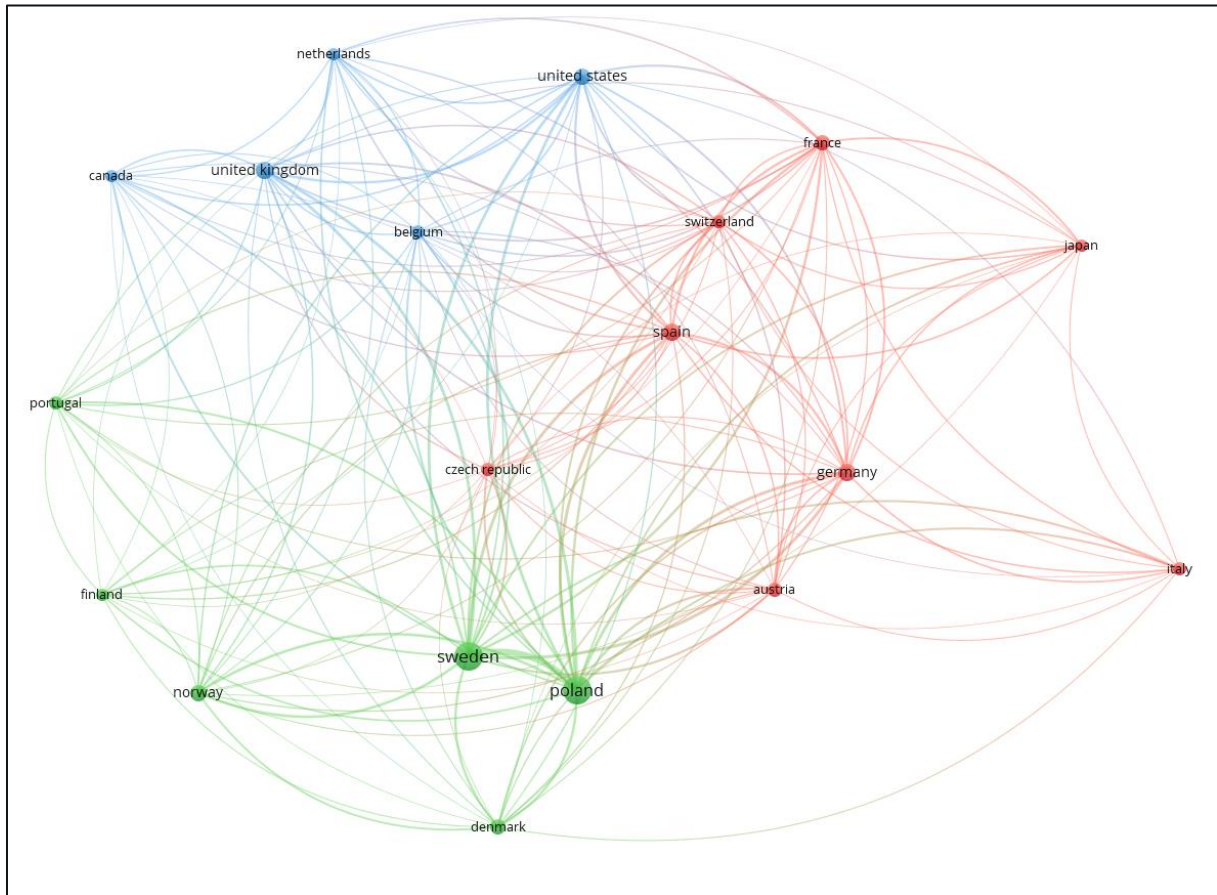
Map 1 Map of the network of connections between the countries of origin of the co-authors of publications co-financed by the Polish National Agency for Academic Exchange



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).

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

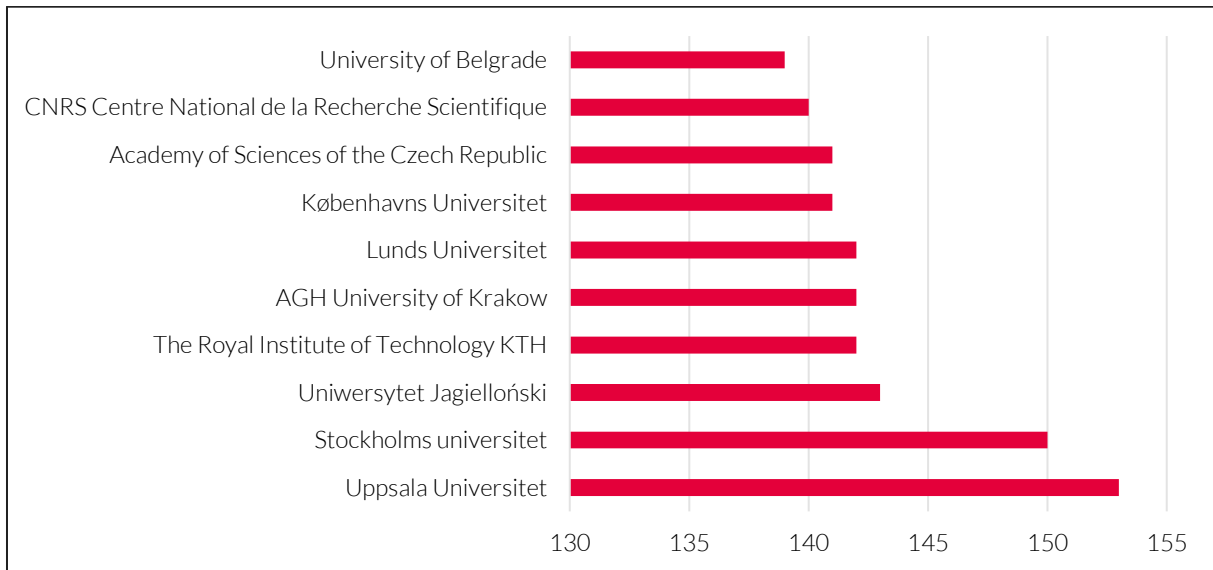


Source: own development based on SCOPUS/SciVal [accessed: 19.04.2024 r.]; visualization using the VOSviewer

In 2017-2023, 216 publications co-financed by NAWA were created, with at least one author indicated Polish and Swedish affiliation. NAWA's share in the creation of Polish-German publications is 2%.

The map above shows that cooperation between scientists from two countries resulted in cooperation with other 17, which in turn resulted in over 160 connections between the countries. The 19 countries visible on the map form three geographical groups of countries, but there are connections between each country in the form of joint international publications.

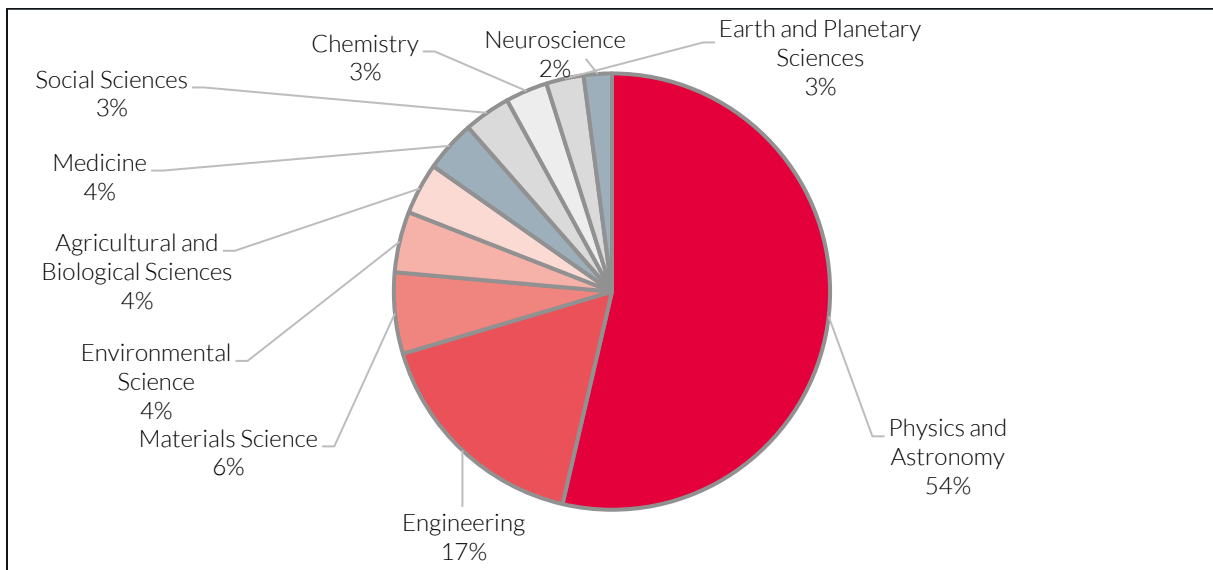
Chart 12 Affiliations of authors of publications co-funded by NAWA



Source: SCOPUS-SciVal (accessed: 16.04.2024)

In the Polish-Swedish cooperation in which NAWA participates, the leading institutions financing research are European institutions: British, Czech and Romanian.

Chart 13 Publications co-funded by NAWA by thematic field



Source: SCOPUS-SciVal (accessed: 22.04.2024)

In terms of the thematic area covered by the Polish-Swedish publications co-financed by NAWA, there are clearly visible differences from those presented in the previous Charts, presenting the achievements of both countries separately and jointly (regardless of the source of financing).

Study prepared by:

Jolanta Buczek, PhD - NAWA

Publisher:

Polish National Agency for Academic Exchange
ul. Polna 40
00-643 Warszawa
phone no. (22) 390 35 00
www.nawa.gov.pl

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