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WHAT'S IN THE NAME? POLISH-BRITISH ACADEMIC COLLABORATION

ABSTRACT: Since the beginning of the 21st century, the Polish system of science and higher education has faced several important changes. By entering the European Union Poland received access to extra research funds and fully developed its participation in the EU sponsored Erasmus mobility scheme. Two waves of reforms of Polish higher education emphasized the importance of international academic collaboration. The paper analyzes trends in academic collaboration between British and Polish researchers, covering the years 2000-2020. It is based on a detailed analysis of publications indexed by Scopus, with a concurring country affiliation of the 'United Kingdom' and 'Poland' resulting in 36,582 publications in total. Even a simple descriptive statistical analysis based on 'Subject Areas' and 'Keywords' (as identified by Scopus) provided enough data to examine whether the changes of Polish higher education policy actually resulted in strengthening Polish-British academic collaboration. It has also helped to identify a few fields of studies that brought promising growth in a number of joint publications, with 'Medicine' being the most prominent example.

Keywords: science and higher education policy, Poland, United Kingdom, university, research productivity, international research collaboration.

SETTING THE CONTEXT

In 2020, the Polish National Agency for Academic Exchange commissioned a series of reports on the current level and future perspectives of academic collaboration between

Poland and three countries: United Kingdom,[1] United States,[2] and Vietnam.[3] The initial results proved to be so interesting that the team of researchers decided to further explore the nature of Polish-UK academic collaboration, joined by two scholars from the University College London: Jim McKinley, a professor of the Faculty of Education and Society, and Agata Mikołajewska, a doctoral student. The outcomes of such actual Polish-UK research collaboration became the inspiration for this text, focusing on tracing the possible impact of higher education policy (as well as some key political changes) on joint activities of Polish and British scholars. Therefore, the paper starts with a brief overview of the development of Polish system of science and higher education after the political transformation of 1989. To sketch a broader picture, it was then necessary to explore recent trends in international research collaboration, since it is this type of university activity that gained substantial support from national governments and international bodies (such as the European Union). Finally, the key part of the paper analyzes the trends in Polish-UK research collaboration as reflected in Scopus database. These data leads to final conclusions confirming that clearly formulated and firmly implemented science and higher education policy eventually brings expected results.

THE QUEST OF POLISH SCIENCE FOR INTERNATIONAL RECOGNITION

The political transformation of 1989 in Poland had a tremendous impact on the whole system of science and higher education: it re-established institutional autonomy and secured academic freedom.[4] Dropping the Iron Curtain opened the doors for student and faculty mobility, although, at the very beginning, it did not enjoy any substantial financial support granted by the newly formed democratic government of Poland. Thanks to joining TEMPUS and then, in 1998, SOCRATES programs, Polish

[1] J. Bugaj, M. Szarucki, R. Rybkowski, *Wzmocnienie międzynarodowej współpracy akademickiej polskich instytucji szkolnictwa wyższego i budowa strategicznych relacji z zagranicznymi partnerami. Współpraca akademicka pomiędzy Polską a Wielką Brytanią*, Warszawa 2021, at https://nawa.gov.pl/images/Badania-i-analizy/UK_OPRACOWANIE.pdf, 22 January 2025.

[2] R. Rybkowski, J. Bugaj, M. Szarucki, *Wzmocnienie międzynarodowej współpracy akademickiej polskich instytucji szkolnictwa wyższego i budowa strategicznych relacji z zagranicznymi partnerami. Współpraca akademicka pomiędzy Polską a Stanami Zjednoczonymi Ameryki*, Warszawa 2021, at https://nawa.gov.pl/images/Badania-i-analizy/USA_OPRACOWANIE.pdf, 22 January 2025.

[3] M. Szarucki, J. Bugaj, R. Rybkowski, *Wzmocnienie międzynarodowej współpracy akademickiej polskich instytucji szkolnictwa wyższego i budowa strategicznych relacji z zagranicznymi partnerami. Współpraca akademicka pomiędzy Polską a Wietnamem*, Warszawa 2021, at https://nawa.gov.pl/images/Badania-i-analizy/WIETNAM_OPRACOWANIE.pdf, 22 January 2025.

[4] R. Rybkowski, "University as a Collaborator: Universities, Society, and Culture," in M. Banaś, F. Czech, M. Kołaczek (eds), *Universities and Non-Governmental Organisations: A Comparative European Study of the Potential for Civil Society Collaboration*, New York 2024, pp. 49-61.

students gained access to financial assistance that resulted in more than 13,000 students completing some part of their study in EU countries.[5]

In the 2000s Poland entered as an active member of European Higher Education Area, implementing the Bologna Process, adopting the three-plus-two approach and implementing a credit system based on ECTS. Consequently, upon its accession to the European Union on May 1, 2004, Poland found its scientific and higher education systems well-prepared in legal and organizational terms, albeit with a notable caveat: significant underfunding persisted. At the same time the Polish government and society noticed that higher education along with advanced research are driving forces for social and economic development in the world of a modern knowledge-based economy.[6]

Up until 2007, Poland's approach to internationalization within higher education and research remained narrowly focused, primarily emphasizing student and faculty mobility. However, in that year, the Organization for Economic Co-operation and Development (OECD) released the report *OECD Reviews of Tertiary Education: Poland*, which underscored the critical importance of international academic collaboration. Drawing upon the example of the Czech Republic, the authors urged the Polish government to adopt measures encouraging tertiary education institutions to take on a more proactive role in internationalization.[7] The OECD report recommended that national policy concentrate on establishing *a framework conducive to internationalization*. This framework encompassed various elements, including *appropriate quality assurance systems, the presence of international panel members in programs accreditation and in research assessments, funding arrangements which allow institutions to raise revenues from internationalization, salaries that strengthen the ability of institutions to compete for foreign researchers and national programs of doctoral scholarships for promising foreign students.*[8] Notably, the OECD's perspective on higher education internationalization in 2007 did not yet include joint publications.

Similarly compelling was the report issued by the World Bank in 2004. Here, the authors emphasized the role of higher education internationalization in ensuring the high quality of teaching. Unlike the OECD, the World Bank acknowledged the significance of disseminating research findings, noting that the current academic career path for Polish researchers heavily prioritized publications in internationally peer-reviewed journals, with patents or industrial innovations receiving comparatively less recognition, if any at all.[9]

Both reports exerted a significant influence on Polish higher education policy, as they unequivocally underscored the imperative for reform. Prompted by these assessments, the liberal government under Prime Minister Donald Tusk embarked on a new

5 M. Dąbrowa-Szefler, J. Jabłecka-Prysłopska, *OECD Thematic Review of Tertiary Education: Country Background Report for Poland*, Warsaw 2006.

6 R. Rybkowski, "University as a Collaborator...".

7 O. Fulton et al., *OECD Reviews of Tertiary Education: Poland*, Paris 2007.

8 Ibid.

9 The World Bank, *Tertiary Education in Poland*, Warsaw 2004, p. 33.

phase of higher education reforms in 2009. Recognizing the escalating demand for graduates from science and engineering disciplines, the Polish government endorsed initiatives aimed at enhancing the competitiveness of its higher education sector on a global scale. Enhancing competitiveness vis-à-vis Western European institutions held the potential to bolster Poland's research funding, given the relative lack of success among Polish scholars in securing European Union grants compared to their Western counterparts.

Minister of Science and Higher Education, Barbara Kudrycka, discerned the pivotal role of internationalization in research and academic collaboration. Consequently, regulations implemented in 2011 acknowledged the feasibility of establishing international research institutes empowered to conduct doctoral studies in Poland. Additional funding was allocated to support initiatives geared towards enhancing program accreditation and international recognition of academic offerings by Polish higher education institutions. This era under Minister Barbara Kudrycka's leadership marked the initial recognition and endorsement of international academic collaboration within Polish higher education policy.[10]

Parliamentary elections of 2015, with the right-wing Law and Justice party coming to power, brought even more unrestricted support for internationalization of higher education and research. In 2016 the then Minister of Science and Higher Education, Jarosław Gowin, presented his strategy for *research excellence, modernized higher education, partnership with business and social responsibility of science*. In this astonishingly short document, he emphasized the importance of internationalization and global promotion of Polish research centers and declared the creation of National Agency for Academic Exchange, with special funds provided to intensify international collaboration of Polish scholars.[11]

The same year, Jarosław Gowin commissioned a report prepared under the EU Horizon 2020 Policy Support Facility framework to identify problems of Polish higher education and science and suggest necessary improvements of policy. In September 2017 a group of international experts presented *Peer Review of Poland's Higher Education and Science System*, which provided an honest diagnosis of international academic collaboration of Polish scholars, by stating that *according to the EC Collaboration index for all scientific publications and co-publications between 2000 and 2011, Poland reached the third lowest score in the European Union, only marginally above Lithuania and – by a wider margin – Croatia.*[12] The experts continued their disturbing conclusions, by adding that *the EC analysis shows that Poland is the worst performing country in the EU*

[10] R. Rybkowski, "University as a Collaborator...", p. 51.

[11] "Strategia Gowina," *Ministerstwo Nauki i Szkolnictwa Wyższego*, 2016, at http://pjg.org.pl/wp-content/uploads/2016/09/Strategia-Gowina. pdf, 22 January 2025.

[12] European Commission, *Peer Review: Poland's Higher Education and Science System*, Luxembourg 2017, p. 168.

in terms of international scientific publications as a percentage of total publications in the country, and has not made progress in this measure since 2007.[13]

Advised by international experts and urged by demands expressed by Polish scholars, in 2018 the ruling majority of Law and Justice government launched a substantial reform by adopting a new act: *Ustawa z dnia 20 lipca 2018 r.: Prawo o szkolnictwie wyższym i nauce* (*Law on Higher Education and Science*).[14] This new *Law on Higher Education and Science* established previously envisioned the National Agency for Academic Exchange. However, the principal measures pertaining to internationalization were implemented through a novel approach to evaluating the quality of scientific activity. According to the *Law on Higher Education and Science*, all institutions involved in scientific activities, such as universities, research institutes and special international research institutes (already created under the framework introduced by Minister Kudrycka) had to be evaluated at least every four years. The primary criteria for assessment included, most notably, *scientific monographs printed by a publishing house issuing peer-reviewed scientific monographs* and *scientific articles published in scientific journals that publishes peer-reviewed articles or peer-reviewed materials from an international conference, listed in the international databases of the scientific journals with the broadest coverage* (Art. 265.9).

The Ministry of Science and Higher Education issued manuals to advertise the intended outcomes of the reforms and to help scholars understand the principles of the evaluation, thus helping them in setting their own career paths and publishing practices. One of the manuals opens with a clear statement referring to the internationalization of science: *For some time now, academics worldwide have been subjected to increasing pressure to publish in scientific journals that are visible in the international scientific community, i.e., included in Scopus or Web of Science lists. This is one of the effects of a long-term change occurring in the higher education and research sector*.[15]

The manual emphasized the importance of international visibility and recognition of the results of research published by Polish scholars as it was *in Poland's interest for the results of Polish research and analyses, especially those concerning the culture and history of our country, to be more visible to the international research community*.[16] At the same time the Polish Science Evaluation Committee was obliged to *greater utilization of international journal databases and bibliometric tools within institutional science evaluation*[17] that eventually led to the conclusion that Polish scholars should be more active in coauthoring publications with foreign colleagues, thus bringing greater visibility of Polish scholarship. Consequently, since 2018, higher education institutions

[13] Ibid., p. 169.

[14] *Ustawa z dnia 20 lipca 2018 r. – Prawo o szkolnictwie wyższym i nauce* (Dz.U. 2018, poz. 1668, z późn. zm.).

[15] Ministerstwo Nauki i Szkolnictwa Wyższego, *Ewaluacja jakości działalności naukowej. Przewodnik*, Warszawa 2018, p. 5, at https://www.gov.pl/attachment/c28d4c75-a14e-46c5-bf41-912ea28cda5b, 22 January 2025.

[16] Ibid., p. 119.

[17] Ibid., p. 124.

and research institutes have received firm assurances regarding the pivotal role of international academic collaboration, manifested through co-authored publications. Given the widespread adoption of English as the lingua franca of academic discourse and the geographical proximity of the United Kingdom, collaborations between Polish and UK researchers have assumed heightened significance. This underscores the imperative to scrutinize recent trends in Polish-UK research collaboration.

GLOBALIZATION OF ACADEMIC COLLABORATION

Since the beginning of the 21st century, academic partnership has become crucial in international scientific discourse resulting in a rapid growth of research collaboration, with co-authored papers cited more frequently than those by single-country authors. Emphasizing the importance of joint publications is not only the Polish approach but rather a widely accepted approach across modern higher education systems, the United Kingdom being one of the most obvious examples. In their paper Obambaa and Mwema point out that *a study commissioned by the UK's Office of Science and Innovation examined the scope and dynamics of scientific collaboration between the United Kingdom and eight Organization for Economic Cooperation and Development (OECD) member countries using the number of co-authored articles as the indicator for international research partnership. It found that international collaboration was growing faster than the total scientific outputs of each of these OECD countries individually. (...) a finding that strongly emphasizes the growing scientific impact and reputation of international research cooperation*.[18] It is especially visible from the perspective of an individuals, as *international academic staff reported that their disciplinary reputation could be established through successful, high quality publications, international conference presentations, and research funding bids...*[19]

International research collaboration and partnership, already reflected in literature, is *seen to hold increased potential for research capacity building and improving the impact of research upon policy and practice within diverse contexts*. From the perspective of United Kingdom, the major investment in international collaboration were part of greater effort to *strengthen overall capacity and critical mass*, and similar trends can be identified in the United States and many European countries. Barrett, Crossley and Dachi reason that research collaboration should also be used as an effective tool for supporting international development because transfer of research paradigms to low-income countries has become a part of the *global political economy for educational and development research*.[20]

[18] M.O. Obamba, J.K. Mwema, "Symmetry and Asymmetry: New Contours, Paradigms, and Politics in African Academic Partnerships," *Higher Education Policy*, vol. 22, no. 3 (2009), p. 352.

[19] S. Robson, "Internationalization: A Transformative Agenda for Higher Education?," *Teachers and Teaching: Theory and Practice*, vol. 17, no. 6 (2011), p. 624.

[20] A.M. Barrett, M. Crossley, H.A. Dachi, "International Collaboration and Research Capacity Building: Learning from the EdQual Experience," *Comparative Education*, vol. 47, no. 1 (2011), pp. 26-28.

Marek Kwiek from the Center for Public Policy Studies explains that international research collaboration (IRC) *(both intra-European and beyond) has become a metric of excellence and quality within the European Research Area. In general, major European excellence initiatives of the last decade that offer additional and highly concentrated funding have also promoted IRC as their key goal*. The key reason for such an approach is that IRC has become crucial in modern systems of higher education and science, leading to the increase of co-authored publications and active academic collaboration despite geographical distance.[21] Consequently, proved IRC has become a commonly accepted condition for a successful career path in Europe, since *IRC is currently prioritized and funded as critically important in the struggle for resources and academic reputation*.[22]

Kwiek warns, however, that IRC has its costs as well as benefits because emerging research consortia require greater effort and means to manage them. The coordination of international teams tends to generate more cost. *Furthermore, while research collaboration with highly productive scientists generally increases individual productivity, collaboration with low-productivity scientists is reported to have the opposite effect*.[23] Thus, on the one hand the well-established British system of higher education and science might use its academic collaboration as a means for supporting international development, but on the other hand, it could be less supportive in the case of collaboration with countries like Poland.

Recent studies exploring patterns of international collaboration show that not all scientific disciplines are equal. Sakata and his colleagues used the example of *service science, management and engineering* to trace reasons for intensive academic collaboration. The authors explains that the very nature of these disciplines calls for an interdisciplinary approach and reaching for the collaborating scientists not only in other fields of study but also from other countries. Only in this way can one build a complete picture of the forces driving the progress in the field.[24] The academic disciplines themselves play a significant role in intensifying internationalization of research. Many scholars *view their discipline as a 'home' or shared space and (...) disciplinary differences affect the potential and level of international collaboration. Researchers in the natural sciences and technology fields are reported to have more involvement in international collaboration than those in the humanities*.[25]

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[21] M. Kwiek, "What Large-Scale Publication and Citation Data Tell Us about International Research Collaboration in Europe: Changing National Patterns in Global Contexts," *Studies in Higher Education*, vol. 46, no. 12 (2021), pp. 2629-2630.

[22] Ibid., p. 31.

[23] M. Kwiek, "Internationalists and Locals: International Research Collaboration in a Resource-Poor System," *Scientometrics*, vol. 124 (2020), p. 59.

[24] I. Sakata et al., "Bibliometric Analysis of Service Innovation Research: Identifying Knowledge Domain and Global Network of Knowledge," *Technological Forecasting and Social Change*, vol. 80, no. 6 (2013), p. 1086.

[25] A.A. Woldegiyorgis, D. Proctor, H. de Wit, "Internationalization of Research: Key Considerations and Concerns," *Journal of Studies in International Education*, vol. 22, no. 2 (2018), p. 166.

Kyvik and Reymert analyzed the research and publication activity of Norwegian research universities (i.e., the system with abundance of resources) and they came to not so surprising conclusions: scholars representing 'medicine/health' and 'natural science' were almost twice as active in international research collaboration as the scholars representing 'humanities', with 'social science' performing just a little better. The also proved *that older academic staff are less inclined than their younger colleagues to collaborate in international research networks, and that they tend to work more alone.*[26]

Growing international research collaboration caught the attention of policymakers that took *a strategic approach to enhance research productivity at faculty and institution levels* that eventually led to *aggressively recruiting scholars from other universities, including foreign universities.*[27] Such approach has been adopted not only by policymakers in different countries, but we can see that they are increasingly stimulating research collaboration at the international level. *For example, the European Commission aims to create a European Research Area (ERA) by stimulating research collaboration between different member states.*[28] National policies have started to favor international research collaboration and, as Woldegiyorgis, Proctor, and de Wit summarize, the rationale for national policies promoting internationalization of research are as follows:

> *(a) by facilitating for larger sets of actors to smoothly coordinate activities, and by creating the space for the critical mass of complementary expertise in areas of national need, it is possible to improve research excellence and innovation performance; (b) by building up a strong and welcoming research and development (R&D) system and innovation network, a country can become globally more competitive to attract best minds in desired disciplines; (c) by responding to global issues and positioning itself in the wider global community, a country can share common ideas and values with the rest of the world, not only helping its own visibility but also contributing for the betterment of the human life in general*.[29]

Thus, the review of literature concerning international research collaboration proves that the change in Polish science and higher education policy was following emerging trends in the global system and increasing pressure on co-authoring publications is by no means a surprise. At the same time British universities and research institutions did not feel any special pressure to focus their attention on collaborating with Polish scholars since the facts are simple: it is Poland that could profit from international collaboration with the UK.

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[26] S. Kyvik, I. Reymert, "Research Collaboration in Groups and Networks: Differences across Academic Fields," *Scientometrics*, vol. 113 (2017), p. 965.

[27] J.C. Shin, W.K. Cummings, "Multilevel Analysis of Academic Publishing across Disciplines: Research Preference, Collaboration, and Time on Research," *Scientometrics*, vol. 85, no. 2 (2010), p. 582.

[28] R. Ponds, "The Limits to Internationalization of Scientific Research Collaboration," *The Journal of Technology Transfer*, vol. 34, no. 1 (2009), p. 77.

[29] A.A. Woldegiyorgis, D. Proctor, H. de Wit, "Internationalization of Research...", p. 164.

TRACING POLISH-UK ACADEMIC COLLABORATION

The examination of Polish-UK academic collaboration was based on exploring the Scopus database (owned by Elsevier). Scopus advertises itself as *a source-neutral abstract and citation database curated by independent subject matter experts who are recognized leaders in their fields. Scopus puts powerful discovery and analytics tools in the hands of researchers, librarians, research managers and funders to promote ideas, people and institutions.*[30] The main reason for choosing Scopus is that this database *efficiently covers publications in the field of social sciences and humanities, which is not the case of the Web of Science by Clarivate (formerly Thompson Reuters) that focuses more on hard sciences and technology*.[31] It is worth noticing that Marek Kwiek in his research on Polish academic productivity also employed the Scopus database because it *affords the best overview of the structure of world science, including most of the journals in the Thomson Reuters Web of Science.*[32]

Knowing the context for the Polish science and higher education policy that brought incentives for institutional and individual international research collaboration, the timeframe for the research was set for the years 2000-2020. The team searched for the number of publications co-authored by scholars from Poland and the UK, thus, the actual query string for searching Scopus was: 'AFFILCOUNTRY (Poland and 'United Kingdom') and PUBYEAR AFT 1999 and PUBYEAR BEF 2021'. Since Scopus is monitoring publication output on daily basis[33] it is necessary to point out that the database exploration was completed December 22, 2022. The annual output of Polish-UK co-authored publications is presented in Table 1. To better understand the scope of Polish-UK research collaboration, the table also includes other countries that demonstrate the highest level of academic cooperation with Polish scientists.

Table 1. Number of publications co-authored by Polish scholars, by year and country. The United Kingdom is highlighted.

Country	United States	Germany	United Kingdom	France	Italy	Spain	Russian Federation	Netherlands
2000	1216	1019	**558**	676	373	185	436	222
2001	1250	1087	**518**	690	390	199	457	249
2002	1306	1101	**564**	783	409	205	504	231
2003	1673	1507	**690**	941	506	313	601	327
2004	1856	1598	**805**	1073	610	410	602	365

[30] "About," *Scopus*, at https://blog.scopus.com/about, 22 January 2025.

[31] M. Szarucki et al., "A Comprehensive Review of Research Approaches in the Energy Sector: A Management Sciences Perspective," *Energies*, vol .15, no. 22 (2022): 8495.

[32] M. Kwiek, "What Large-Scale Publication...", p. 2634.

[33] "About," *Scopus*.

2005	1985	1745	**902**	1095	693	407	683	385
2006	1937	1804	**1001**	1150	755	510	617	412
2007	1931	1883	**1102**	1184	838	568	675	439
2008	1943	1847	**1210**	1212	856	580	648	451
2009	2081	2047	**1277**	1451	950	756	678	588
2010	2208	2121	**1498**	1477	1118	880	670	672
2011	2409	2310	**1744**	1620	1281	1038	788	784
2012	2797	2646	**1975**	1845	1557	1311	1016	978
2013	2933	2814	**2165**	1911	1624	1385	1020	959
2014	3 084	2 988	**2 341**	2 055	1 846	1 514	1 161	1 082
2015	3 330	3 257	**2 451**	2 251	2 022	1 700	1 243	1 253
2016	3 617	3 465	**2 863**	2 353	2 349	1 922	1 428	1 414
2017	3 830	3 679	**3 033**	2 608	2 623	2 044	1 434	1 470
2018	4 021	3 937	**3 114**	2 575	2 742	2 137	1 521	1 560
2019	4 098	3 949	**3 194**	2 542	2 745	2 227	1 581	1 596
2020	4 644	4 431	**3 662**	2 816	3 438	2 569	1 713	1 786
Total	**54 149**	**51 235**	**36 667**	**34 308**	**29 725**	**22 860**	**19 476**	**17 223**

Source: Scopus; own research.

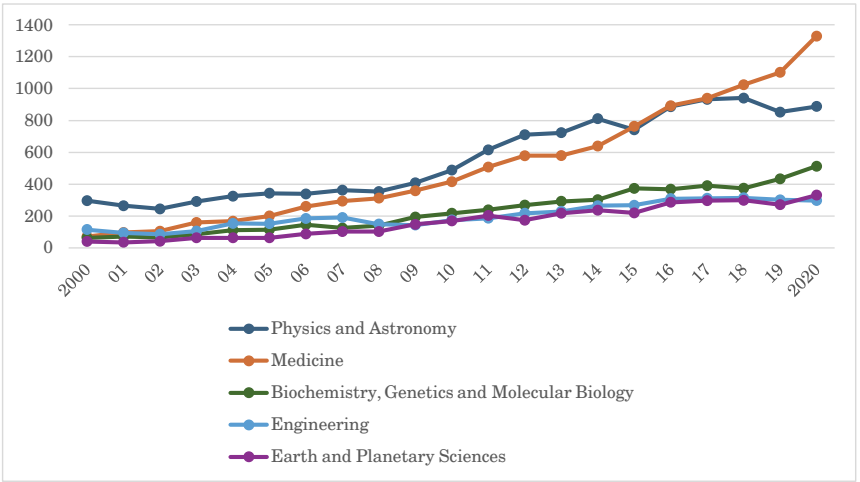
The growth of the number of Polish-UK co-authored publications has been steady and remarkable, reaching 656.27% within twenty-one years. It also easy to notice that implementation of Barbara Kudrycka's policy resulted in growing activity, as one can observe quick growth after 2010. Another huge increase seems to be the result of the implementation of Jarosław Gowin's reforms and his new approach to research quality evaluation, promoting ostensibly IRC. Within just one year (2019-2020) we can see an increase of 468 publications, that is 14.65%. It is also quite visible that joining the European Union on May 1, 2004, had no similar effect on IRC activity of Polish scholars, which is especially visible in the case of other countries (it is worth to notice that number of joint publications with Spain even slightly decreased in the years 2004-2005).

For a more detailed examination of the nature of Polish-UK IRC the team focused on annual data and employed a tailored query string: for example, for the year 2010, the query string was: 'AFFILCOUNTRY (Poland and 'United Kingdom') and PUBYEAR is 2010'. Then, the search was based on: (a) Academic disciplines: only those with a minimum of 500 publications across the 2000-2020 timeframe were included; (b) Keywords: terms with a frequency of at least 500 occurrences during the specified period were considered; and (c) Institutional affiliations: all affiliations from the UK

were considered, including the smallest one, which was the University of Strathclyde with 18 occurrences.

Scopus database indexes publications by taking various factors into consideration. One of the most obvious, and widely accepted in academia, is based on subject areas that publications pertain to. The decision of ascribing a publication to subject area is made by Scopus itself, thus securing that common rules and procedures are employed in case of any publication. It is necessary to understand that a publication might be cross listed, representing two or even more subject areas. The most popular subject areas of Polish-UK IRC are presented in Graph 1. During the years 2000-2020 there were 11,809 publications in Physics and Astronomy and 10,787 publications in Medicine, making these two subject areas undoubtedly the most popular. The third—Biochemistry, Genetics and Molecular Biology—is represented by only 4,877 publications.

Graph 1. Most popular subject areas of Polish-UK IRC publications.

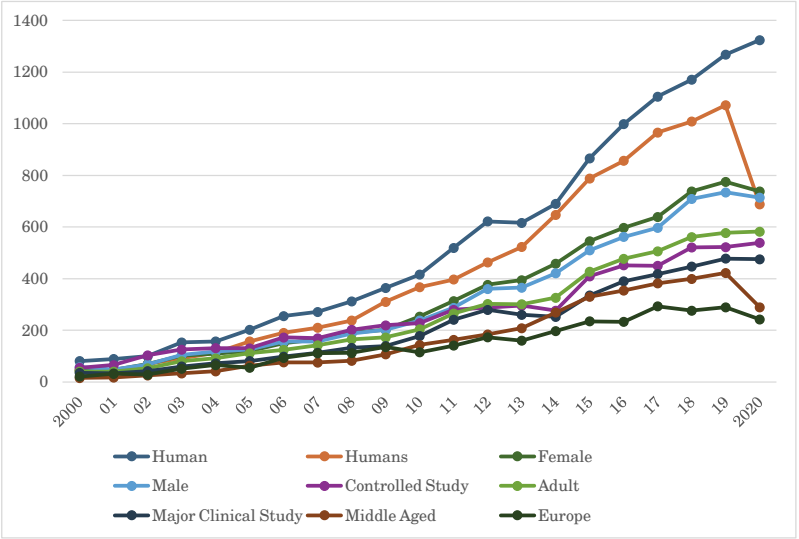


Source: Scopus database; own research.

Graph 1 illustrates two interesting characteristics. As in the case of a total number of Polish-UK publications, there is a visible increase in the years after 2010. However, the previously most popular Physics and Astronomy was overtaken by Medicine in 2015. Actually, the number of publications in Physics and Astronomy slightly dropped down from 940 in 2018 to 852 in 2019 and 888 in 2020. At the same time Medicine enjoyed substantial growth by more than 30%, that is from 1024 in 2018 to 1329 in 2020. On the other end of the list there are the three least popular subject areas: Nursing with just 514 publications in total, Energy – with 555 publications and Arts and Humanities with mere 610 publications. It is worth noticing, however, that in the case of Nursing numbers grew from 24 in 2014 to 83 in 2020; in the case of Energy – from 20 to 72. Arts and Humanities enjoyed only a miniscule increase from 52 to 72 publications.

An overview of the most commonly used keywords provides an even broader picture of Polish-UK research collaboration. As in the case of subject areas, keywords are defined and set by Scopus itself, to secure the compatibility within indexed publications. Graph 2 presents the most commons keywords of Polish-UK publications. There should be no surprise that almost all of ten most popular ones are related to Medicine as a subject area (especially, after excluding such keywords as 'Article' or 'Priority Journal'). The first keyword that is not so closely related to Medicine is... 'Europe', being 13th most popular (also included in Graph 2 for comparison).

Graph 2. A selection of the most popular keywords of Polish-UK publications.

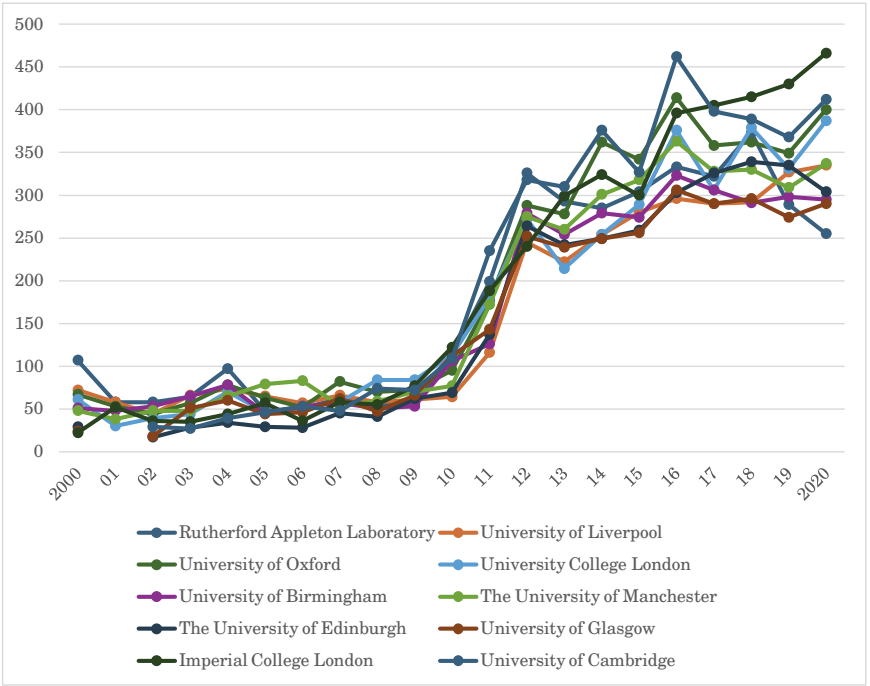


Source: Scopus database; own research.

Similarly to the increase in Polish-UK IRC activity reflected in the most popular subject areas, there is a visible increase in publication output after the implementation of Barbara Kudrycka's policy in 2011. And there is one surprising decrease after Jarosław Gowin's reform: the keyword 'Humans' dropped down form 1072 in 2019 to 688 in 2020. However, the most probable explanation of such decrease is some change in application of keywords by Scopus. Among the not so popular keywords are 'Poland' and 'United Kingdom'. It is surprising that between 2013 and 2020 the number of occurrences did not change almost at all. It was (respectively) 104 and 103 in the case of 'Poland' and 60 and 63 in the case of 'United Kingdom'.

Graph 3 illustrates the intensity of British institutions in Polish-UK academic collaboration. The most surprising is the fact that all ten most active UK institutions show a substantial increase in Polish-UK publication output after 2010. Within three years Rutherford Appleton Laboratory faced the increase from 112 to 326 publications and the University of Liverpool from 64 to 245.

Graph 3. British research institutions most active in Polish-UK collaboration.



Source: Scopus database; own research.

CONCLUSIONS

The analysis of Polish-UK international research collaboration serves as a testament to Poland's embrace of a globalized approach to disseminating research findings, evident in the consistent rise in the number of joint publications with foreign authors. Intriguingly, Poland's accession to full membership in the European Union did not yield an immediate and direct impact on publication output. One might expect that shifts in science and higher education policies would influence international research collaboration (IRC), as reflected in Polish-UK research output, and data from the Scopus database corroborates this assumption. Notably, the activities of British institutions offer compelling evidence that the adoption of new Polish regulations and policies indeed shapes the choices, activity, and productivity of Polish scholars.

The growth of Polish-UK IRC supports the claims of Roderik Ponds (researching the Dutch system of science and higher education himself)—the growth of publication output is visible across all subject fields, although some 'leaders' might be easily traced.[34]

[34] R. Ponds, "The Limits to Internationalization...", p. 83.

The globalized science and research results communication is further intensified by expanding international research networks and/or consortia. As one of the papers puts it clearly: *Today a French mathematician collaborates with a Brazilian one or an Australian one very easily while teams of physicists working at a large particle accelerator, funded by numerous countries, will often be composed of scientists of dozens of different nationalities.*[35] The team of researchers from Microsoft Research noticed in their paper the general trend of growth of the number of scientists co-authoring one paper.[36] This means that the majority of the Polish-UK co-authored papers are actually submitted by multinational teams, quite often being the examples of Polish-US publications at the same time.

Since 2015, 'Medicine' has emerged as the focal point of Polish-UK academic collaboration, supplanting the previously dominant 'Physics and Astronomy' field. Keyword analysis provides additional evidence of the steady expansion of 'Medicine'. It is noteworthy that two keywords directly referencing Polish-UK collaboration rank only of moderate importance. The absence of 'Poland' and 'United Kingdom' among the most prevalent keywords underscores the relatively weak academic collaboration within the domains of 'Social Sciences' and 'Arts and Humanities', suggesting areas ripe for improvement. It is, however, necessary to understand that the publication activity of Polish scholars is more influenced by internal policies and regulations than by national higher education and science policy.[37] Therefore, it is advised to take institutional, organizational culture into consideration in future studies of Polish academic collaboration with foreign researchers. It would be also important to continue investigating collaboration of Polish scholars with their colleagues from some given countries. Superb existing publications focus on international collaboration and collaborative research output in general without taking differences in organizing and managing collaboration with particular partnering countries.[38]

Lastly, the case of Polish-UK international research collaboration serves as compelling evidence that well-defined and effectively implemented science and higher education policies yield tangible results with minimal delay. Within two to three years of Barbara Kudrycka's and subsequently Jarosław Gowin's reforms, a discernible uptick in the joint publication productivity of Polish scientists is evident.

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35 S. Mosbah-Natanson, Y. Gingras, "The Globalization of Social Sciences? Evidence from a Quantitative Analysis of 30 Years of Production, Collaboration and Citations in the Social Sciences (1980-2009)," *Current Sociology*, vol. 62, no. 5 (2014), p. 627.

36 Y. Dong et al., "A Century of Science: Globalization of Scientific Collaborations, Citations, and Innovations," in S. Matwin, S. Yu, F. Farooq (eds), *KDD '17: Proceedings of the 23rd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, New York 2017, p. 1439.

37 D. Antonowicz, *Między siłą globalnych procesów a lokalną tradycją. Polskie szkolnictwo wyższe w dobie przemian*, Toruń 2015.

38 See: M. Kwiek, W. Roszka, "Gender Disparities in International Research Collaboration: A Study of 25,000 University Professors," *Journal of Economic Surveys*, vol. 35, no. 5 (2021), pp. 1344-1380; P. Korytkowski, E. Kulczycki, "Examining How Country-Level Science Policy Shapes Publication Patterns: The Case of Poland," *Scientometrics*, vol. 119 (2019), pp. 1519-1543.

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