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PUSH

POLISH-UK SCIENTIFIC HORIZONS

ANALYSIS

OF THE CURRENT AND FUTURE UK-POLISH
RESEARCH AND INNOVATION RELATIONSHIP

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FOREWORD

Polonium Foundation is an independent non-governmental organisation (NGO), registered in Poland and dedicated to uniting, networking, and researching the Polish scientific diaspora around the globe. Our mission is to transform "brain drain" into "brain circulation," promoting international cooperation between native science and research professionals working in leading research and innovation (R&I) institutions internationally. The focus of the Polonium Foundation is to promote the exchange of knowledge, to nurture interdisciplinary collaborations across academia, industry, as well as, entrepreneurship, science diplomacy and policy making, and other spaces related and dependent on subject-matter-expertise.

Polonium Foundation actively supports scientific diasporas by facilitating connections and providing a platform for scientists to exchange ideas, collaborate, and access global opportunities. We organise events, workshops, training, and conferences to promote knowledge-sharing and professional development, empower ing scientists to excel and contribute to the global scientific community. We also conduct research that captures the state of the scientific diaspora, including this study.

The Foundation's roots go back to the United Kingdom, where the first activities started and where our community has been the strongest for years. Regardless of Polonium's global expansion, we remain active in the UK science research and policy scene. Our primary motive for conducting this study was to translate our knowledge and network into tangible recommendations to enhance the research and innovation relationship between Poland and the UK. The unique position of Polonium Foundation as an organically built "bottom-up" initiative enabled us to reach the broad R&I community in Poland and the UK and convinced the community to participate in this study.

The Polonium Foundation employs a dynamic and multifaceted approach, receiving crucial funding from diverse sources, including grants from the European Union, Polish institutions, and philanthropists who share our vision. Additionally, the foundation collaborates with commercial entities, such as life science and tech companies, to expand its reach globally and create innovative programs for the scientific community. The Polonium Foundation's core strength lies in the dedication of over 50 volunteers worldwide, who, despite holding various professional roles, contribute their expertise and commitment to the foundation's initiatives. These passionate individuals, spanning from Southern California to Southeast Asia, play a crucial role in driving the programs and bringing Polonium's initiatives to fruition.

Dr Ala Santos
President and CEO
Polonium Foundation

EXECUTIVE SUMMARY

International research and innovation collaborations are key in transforming the global landscape of technologies, economy, and accessibility. This report aims at assessing the state of past, present, and future research and innovation relationships between Poland and the United Kingdom. The statistical data, its analysis, and the institutional opinion summaries were achieved through desk-based research, survey participation, and interviewing key Polish and British stakeholders. Here we also discuss the key drivers of collaborations, the existing and potential challenges, and the prospects of future potential. Finally, we provide recommendations on how to boost and support UK-Polish research & innovation (R&I) collaboration on several levels: government, institutional, and individual.

Our initial desk-based research confirmed the UK's strong position in research and innovation culture. The fostering of cooperation and scientific exchange, the promotion of high-quality research, a strong mentorship/sponsorship mentality, and modern infrastructure are key elements drawing in some of the top scientists from across the world. The UK excels in the areas, such as healthcare, life sciences, and in the recently prioritised areas, such as artificial intelligence (AI), quantum technology, engineering biology, future telecommunications, and semiconductors. On the other hand, Poland has seen ongoing improvement in research funding and infrastructure, together with emerging as a major player in the field of AI and biotechnology. The bilateral UK-PL collaboration is mainly research-driven, illustrated by the growing number of joint publications, prevalent in the area of IT and life sciences. This collaboration is fostered through joint research projects, conferences and networking events, and academic research exchanges.

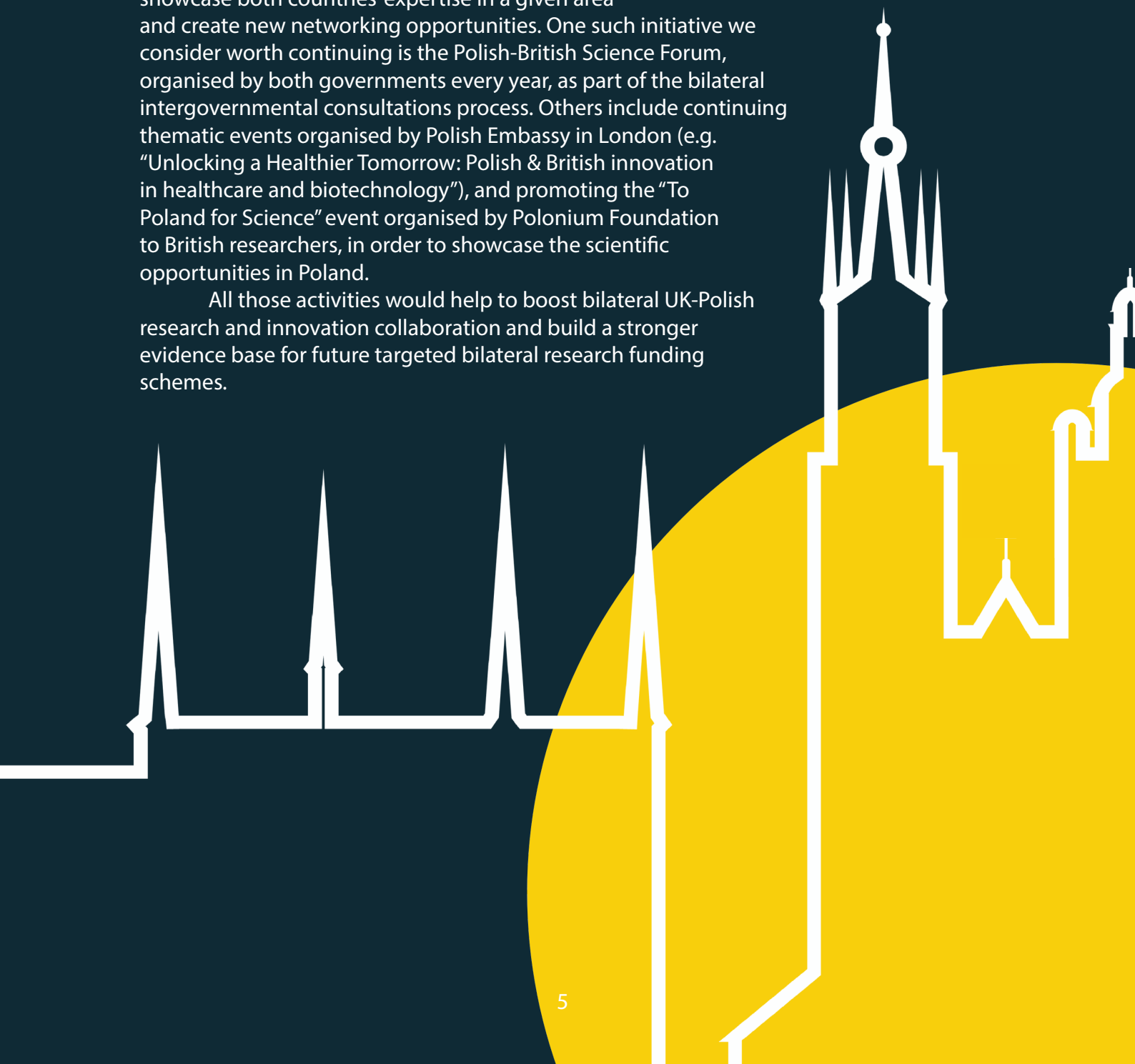
Our study survey showed that there is a high appetite from researchers from both countries to collaborate. While the majority of respondents from the UK were of Polish origin, nearly all British respondents indicated that they see Poland as an attractive R&I country. In terms of funding, for both the UK and Poland, the EU Research and Innovation programmes were the main source of bilateral collaboration funding. The key drivers for collaborations included field-specific expertise, followed by established links with research groups. For PL-based respondents, another key driver was access to high-quality infrastructure, while for the UK-based respondents, it was the access to funding. The main obstacles included lack of awareness of available funding, no established connections, and not being aware of how to look for a partner.

The interviews with stakeholders highlighted the importance of international collaboration. One of the key messages was that the drivers for stakeholders are bottom-up activities. With more evidence of successful bilateral research collaborations in place, there are higher chances for the governments to consider and discuss potential future bilateral funding.

Several actions can be undertaken to boost Polish-UK R&I collaborations. First of all, now that the UK's association to Horizon Europe has been confirmed, joint funding, especially as part of the Horizon Programme, which used to be the major funding source, should be promoted. Similarly, other sources of international research funding offered by UK and Polish institutions should be communicated more clearly and frequently. Information campaigns, and funding opportunity presentations at conferences, universities and research institutions by key UK and Polish stakeholders can mitigate the lack of awareness regarding the funding.

Additionally, continuous development of Poland's scientific potential and a clearer articulation of Polish research and development priorities and strength internationally would help to attract new partners from the UK. In order to foster new connections, it would be useful to organise various sector-specific events both in the UK and Poland to showcase both countries' expertise in a given area and create new networking opportunities. One such initiative we consider worth continuing is the Polish-British Science Forum, organised by both governments every year, as part of the bilateral intergovernmental consultations process. Others include continuing thematic events organised by Polish Embassy in London (e.g. "Unlocking a Healthier Tomorrow: Polish & British innovation in healthcare and biotechnology"), and promoting the "To Poland for Science" event organised by Polonium Foundation to British researchers, in order to showcase the scientific opportunities in Poland.

All those activities would help to boost bilateral UK-Polish research and innovation collaboration and build a stronger evidence base for future targeted bilateral research funding schemes.



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1. INTRODUCTION

INITIAL FINDINGS

A strong tradition of shaping global research culture has long attracted leading scientists to the United Kingdom. The fostering of cooperation and scientific exchange, the promotion of high-quality research, strong mentorship, and modern infrastructure are key elements drawing in some of the top scientists from across the world. One of the stand-out characteristics of UK research is its strong role in interdisciplinary and international collaboration. Together with a high level of specialisation, strategic investment in innovation and technology, and a transferable and application-focused approach, the UK research culture continues to attract international researchers.

Following the exit of the UK from the European Union (commonly known as "Brexit"), for several years an uncertainty regarding accessibility to some crucial European Union funding was felt by UK-based researchers[1]. Over this time the UK has implemented several transitional measures to remain attractive to foreign scientists and to continue to cultivate its ambition of becoming a "science superpower" by 2030. Finally, on 7th September 2023[2], the UK government and the European Commission announced UK's association to the Horizon Europe and Copernicus Programmes to once again enable UK-based scientists to benefit fully from participation in the world's largest research collaborative programmes[3].

To this end, UK policy is prioritising major investments in five critical technology sectors: artificial intelligence (AI), quantum technology, engineering biology, future telecommunications, and semiconductors, with a planned public research and development (R&D) investment of £20bn in 2024/2025. Given the fact that the UK has left the EU, the UK is now prioritising the maintenance and establishment of research and innovation (R&I) collaborations within the new legal context[4], and promoting the UK as a global technology hub for Initial Public Offerings (IPOs) to attract international technology companies to be listed on UK public markets[5]. The UK R&I market is constantly searching for possibilities to expand not only in Asia and South America, but also in Central and Eastern Europe (CEE)[2]. One of the most attractive and dynamically developing CEE countries is Poland. Poland is already well-represented in the UK scientific community via the Polish scientific diaspora. According to the Polonium Foundation's 2018 Diaspora study[6], Polish academics abroad are mostly concentrated in the:

>52% UNITED KINGDOM **12.8% USA** **12.4% GERMANY**

Collaborations between UK and Poland-based industry and academia, on the other hand, have a relatively shorter history. Poland's rapid development over recent decades has opened exciting new avenues for UK partnerships and joint R&I goals.

[1] Horizon Europe Guarantee scheme extension to support UK R&D, 2023, 6th March, Gov.uk https://www.gov.uk/government/news/horizon-europe-guarantee-scheme-extension-to-support-uk-rd accessed on 13th April 2023
[2] Science & Technology Framework, Gov.UK https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1140217/uk-science-technology-framework.pdf accessed on 30th May 2023
[3] Gov.uk Press release 7th September 2023 https://www.gov.uk/government/news/uk-joins-horizon-europe-under-a-new-bespoke-deal accessed 8th October 2023
[4] Independent review of the UK's research, development and innovation organisational landscape. Final report and recommendations, March 2023 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1141484/rdi-landscape-review.pdf accessed on 13th March 2023
[5] The UK's International Technology Strategy, March 2023 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1144576/uk-international-technology-strategy-web-version.pdf accessed on 30th May 2023
[6] Czerniawska, et al. 2018 Report Beyond recognition: Polish scientific diaspora as a source of social capitalism. Polonium Foundation https://poloniumfoundation.org/research/diaspora-report accessed 13th March 2023

While the United Kingdom has a long and successful record in R&I, Poland has been steadily strengthening its position in many research areas and is increasingly seen as an equal partner by Western institutions and industry players. Poland's most important asset is undoubtedly its well-educated and hard-working people. Poland is currently considered to be a mine of tech talent according to some venture capitalist firms[7]. Importantly, Poland is not only seen as a source of skilled and affordable workers but also as an emerging start-up ecosystem with innovative ideas. Since it acceded to the European Union in 2004, Polish R&I policy has been undergoing a major overhaul. Over time, Poland's performance has improved – the strong increase in the years 2018-2020 is mainly due to a rapid increase in broadband penetration rates and opportunity-driven entrepreneurship[8]. According to Poland's National Centre for Research and Development, Poland is now home to over 10,000 innovative businesses[7]. In the future, Poland is set to continue its investment in digitisation, new technologies, sustainability initiatives, and start-ups.

The cooperation between the UK and Poland is attractive not only in terms of one-way mentoring for Polish innovation and businesses but also for UK scientists and entrepreneurs in terms of investments, new collaboration opportunities, business expansion, and knowledge exchange. The Polish market is developing dynamically, and the Polish government is willing to invest in international cooperation and innovation opportunities. Poland is one of the best investment locations in the CEE region due to its human capital, entrepreneurship, and high work ethic, boosted by the country's central location, economic stability, and steadily increasing GDP[9]. Bolstering the research and innovation relationship between Poland and the United Kingdom is thus attractive for representatives of both countries.

Since the early 1990's, the Polish academic profession has undergone dramatic changes. Primarily driven by new highly competitive research funding and the introduction of updated career requirements, these changes have focused heavily on internationalisation, i.e., increasing international collaborations, hiring international (not Polish-born) researchers and Principal Investigators (PIs) at leading Polish research institutions, and publishing in international peer-reviewed journals[10]. International collaboration in research is highly associated with research productivity[11], underscoring the crucial role of such collaborations and their profitability to all international partners involved.

In this report, we analyse the current state and future perspectives of the UK-Polish research and innovation relationship. We focus on how Poland and the UK develop cooperation in areas such as science and entrepreneurship with a spotlight on the biotechnology and information technology (IT) industry, since these are sectors with recent dynamic growth. The UK has identified IT (Artificial Intelligence, Quantum Technologies) and biotech (Engineering Biology) as key technological sectors for public investment, international partnerships, and drivers of the UK economy[4]. At the same time, Poland is on its way to becoming the leading colocation data centre hub and key European Tech centre, with Tech & IT accounting for 8% of Polish GDP, and key IT giants (Microsoft, Google, Meta, Intel, Samsung, and Amazon) investing in Polish IT and establishing centres[12].

[7] Jackson J., 2023, 3rd February, euronews.com https://www.euronews.com/next/2023/02/03/polands-reverse-brain-drain-meet-the-poles-returning-home-to-work-in-its-booming-tech-sect accessed 9th March 2023
[8] The National Centre for Research and Development https://www.gov.pl/web/ncbr-en/polish-research--innovation-policy accessed 8th March 2023
[9] https://archive.bpcc.org.pl/contact-magazine/issues/13/categories/55/articles/397 accessed 9th March 2023
[10] Kwiek M. 2015 Studies in Higher Education doi: 10.1080/03075079.2015.1060706 accessed 8th March 2023
[11] Kwiek M. 2014 Zeitschrift fur Padagogik doi:10.25656/01:14677 accessed 8th March 2023
[12] Skiba K., Inside Poland's Quietly Booming Tech Sector, 3rd August 2023 https://worldcrunch.com/business-finance/poland-tech-growth-innovation accessed 23rd October 2023

On the other hand, we focused on biotech as it is one of the quickest-expanding R&I sectors in Poland. While up to 2010 this field was not prioritised, since then it has become one of the fastest-growing sectors in Poland. In 2019 Polish biotech R&D reported a 6.5% increase in internal expenditure and spent of 976.8m PLN with nearly 8000 people involved in the research[13].

In this report, we present an analysis of scientific collaboration between private and public research institutions, and governmental initiatives promoting joint research, and industrial relations, with an emphasis on UK- and Poland-based start-ups and entrepreneurial endeavours. Our evidence-based observations and recommendations are focused on a structured survey targeting individual researchers in both countries and key take-aways from interviews with key players of the Polish and UK R&D scene.

Assessing the UK-Polish academic relationship

The impact and success of international academic partnerships can be assessed at the individual, institutional, and (inter)national levels[14]. While the individual level refers primarily to student exchanges, studies abroad, or post-graduate career mobility and the benefits to the individuals involved, the links that are created in the process reverberate through the institutional, national, and global levels in the long-term. Thus, the impact of studies or work abroad (e.g. postdocs, sabbaticals, dual professorship appointments, etc) for bilateral research & development is not to be underestimated. Institutional-level impact refers to joint research projects, co-authored publications, joint grant applications, and sharing resources (e.g. research equipment, funding, academic staff) and know-how. Ultimately, the aim of academic internationalisation should be the national and global impact. While institutional efforts will reflect on the nations involved, long-lasting (inter)national impact necessitates the involvement of partners in government, non-governmental organisations (NGOs), and industry.

Before assessing the success of the UK-Polish academic relationship at the three levels outlined above, it is useful to highlight the current state of British and Polish academia. The Polish higher education system is characterised by a high fragmentation of Polish tertiary education institutions – in the academic year 2022-2023, there were 359 functioning higher education institutions in Poland[15], with 22 universities featured in the QS World University Rankings 2023, including two in the top 300[16]. In 2021, Poland ranked 16th out of the EU's 27 member states (EU-27) in terms of gross domestic expenditure on R&D (GERD) as a percentage of GDP[17]. It would be interesting to see how Poland performed in recent years, with the Eurostat update on R&D expenditure due in March 2024. The 2021 data showed a significant increase in spending compared to a decade before (0.69 percentage point increase relative to 2011), which was the third largest increase among the EU-27. Over 50% of Poland's R&D expenditure is funded by the business enterprise sector, which places it 14th out of the EU-27 in terms of business contributions.

[13] Polish Investment & Trade Agency. The biotechnology sector in Poland 2021 https://expo.gov.pl/wp-content/uploads/2021/11/The-Biotechnology-Nanotechnology-and-Pharmaceutical-Sector.pdf Accessed 13th April 2023
[14] Hamdullahpur F. 2019 Succ Global Coll in Higher Ed Inst doi:10.1007/978-3-030-25525-1_3 accessed 8th March 2023
[15] GUS, 2023, 15th June https://stat.gov.pl/obszary-tematyczne/edukacja/edukacja/szkolnictwo-wyzsze-w-roku-akademickim-20222023-wyniki-wstepne,8,9.html accessed 8th October 2023
[16] World University Rankings 2023 https://www.topuniversities.com/university-rankings/world-university-rankings/2023 accessed 10th March 2023
[17] Eurostat. R&D expenditure - Statistics explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=R%26D_expenditure#R.26D_expenditure_by_source_of_funds Accessed 31st May, 2023

Notably, 39% of Poland's R&D expenditure is funded by the government, which places Poland 4th out of the EU-27 in terms of government contribution[17]. These figures are reflective of the positively evolving situation of the R&D sector in Poland, with the support of government policy. Nevertheless, the number of EU grants, like the European Research Council (ERC) awards, awarded to applicants from Poland remains low. As of January 2024, only 37 Starting grants (0.76% of all funded projects), 7 Consolidator grants (0.23%) and 8 Advanced grants (0.27%) were signed in Poland in the fields of Life Sciences and Physical Sciences & Engineering, and 6 Proof-of-concept grants (0.33%)[18].

In the United Kingdom, there were 285 higher education providers reported in 2021-2022[19], of which 157 institutions conduct research activity[20]. Out of all UK universities, 89 were listed in the QS World University Rankings 2023, with four in the global top 10[15]. Universities in the UK consistently rank among the top universities in the world, making the UK a highly desirable destination for academic and research staff. Additionally, the UK has historically been the top recipient of ERC grants: as of January 2024, the UK has received 640 Starting grants (13.19% of all funded projects), 318 Consolidator grants (13%) and 528 Advanced grants (17.71%) in Life Sciences and Physical Sciences & Engineering, and 236 Proof-of-concept grants (13.15%), (this takes into account no grants signed due to Brexit between 2020-2023). With researchers representing over 60 nationalities, Polish researchers in the UK account for only 1% of total ERC grant recipients (19 grants in 2007-2022). Nevertheless, while 7 Advanced grants have been awarded to Polish researchers in the UK, Poland has received only 9 Advanced grants until now[18].

Despite the Polish government's focus on strengthening cooperation between science and business, R&D expenditure is not yet significant enough to be reflected in innovation metrics such as public-private sector co-publications. To promote the formation of research universities, Poland has introduced an updated evaluation of research quality in higher education ("Ewaluacja Jakości Działalności Naukowej"[21]), which is similar to the Research Excellence Framework[22] system in the UK. This evaluation of higher education in the period between 2017 and 2021 was carried out in January 2022, and, in conjunction with the 2019 Excellence Initiative - Research University programme (IDUB, pl. Inicjatywa Doskonałości - Uczelnia Badawcza)[23], was developed to support the best Polish universities to perform research at a similar level to research-focused European universities and to increase their international impact.

At the institutional level, the Polish-UK research and innovation relationship has a long and successful tradition. Poland collaborated with the UK on 1044 projects within the H2020 programme and 341 projects under the Horizon Europe programme (as of 4th May 2023)[24]. The main areas of H2020 collaborations were: research infrastructures; smart, green and integrated transport; food security, sustainable agriculture and forestry; marine and maritime and inland water research; and information and communication technologies.

[18] EC Dashboard https://dashboard.tech.ec.europa.eu/qs_digit_dashboard_mt/public/sense/app/c140622a-87e0-412e-8b29-9b5ddd857e13/sheet/61a0bd1d-cd6d-4ac8-8b55-80d8661e44c0/state/analysis accessed 9th January 2024
[19] Universities UK, 2023, 22nd February https://www.universitiesuk.ac.uk/latest/insights-and-analysis/higher-education-numbers accessed 10th March 2023
[20] REF 2021 https://www.ref.ac.uk/ accessed 13th April 2023
[21] Ewaluacja, Ministerstwo Edukacji i Nauki https://www.gov.pl/web/edukacja-i-nauka/ewaluacja#:~:text=Ewaluacja%20to%20ocena%20jako%C5%9Bci%20dzia%C5%82alno%C5%9Bci,%2C%20B%2B%2C%20B%20albo%20C accessed 30th May 2023
[22] Research Excellence Framework 2021 https://www.ref.ac.uk accessed 10th March 2023
[23] The Excellence Initiative - Research University programme https://www.gov.pl/web/science/the-excellence-initiative---research-university-programme accessed 13th April 2023
[24] Krajowy Punkt Kontaktowy, Analizy i Statystyki 4th May 2023 https://www.kpk.gov.pl/analizy-i-statystyki accessed 31st May 2023

In the period between 2005 and 2014, Poland ranked 19th among the UK's top 20 collaborative partner countries (12th among EU member states), with 13,690 papers co-authored by Poland- and UK-based authors[25]. The number of Polish-British co-publications has increased substantially since 2004, with a nearly five-fold increase over the last two decades (Figure 1). While the majority of Polish-British co-publications also contain at least one other international collaborator, exclusively Polish-UK co-authorships constitute 15% of internationally collaborative publications over the last 10 years (2013-2023). Of these 62% were open access (Figure 1.1).

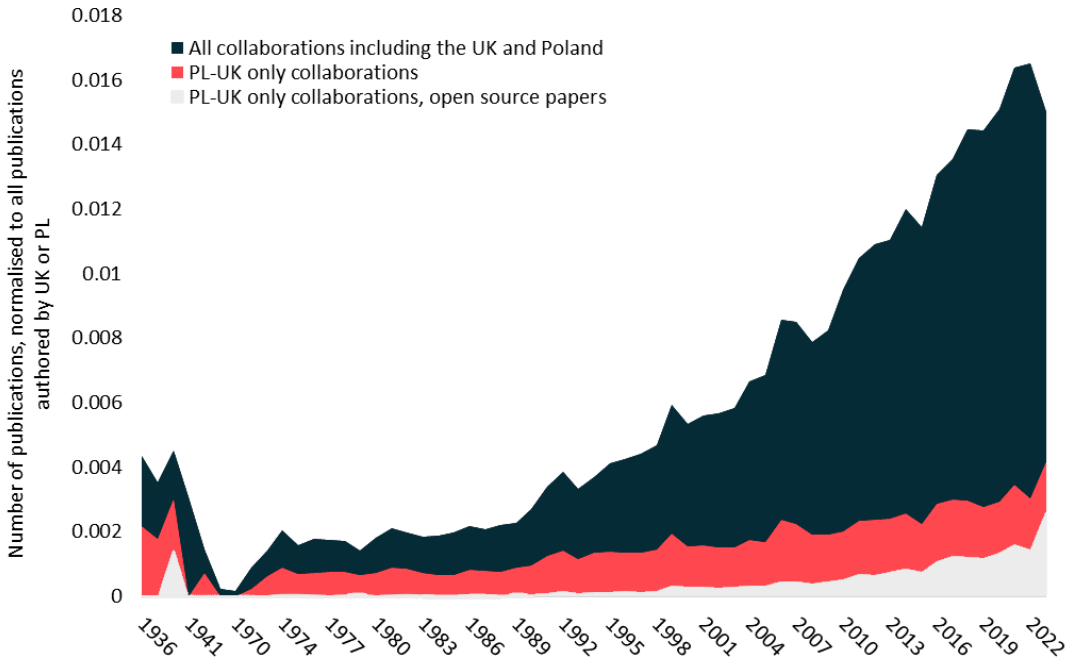


Figure 1.1. Evolution of PL-UK collaborative publications over the years. (Source: Web of Science, internal analysis)

The majority of Polish-British co-publications are related to research in STEM fields, with 37% of all publications in the domain of Science Technology, 20% in Life Sciences & Biomedicine, 20% in Physical Sciences, and 15% in Technology (Figure 1.2). This breakdown is broadly analogous to that across all publications originating from either Poland or the UK, with an overrepresentation of Physical Science and Technology publications among Polish-UK collaborations.

[25] The Royal Society report May 2016 https://royalsociety.org/-/media/policy/projects/eu-uk-funding/phase-2/EU-role-in-international-research-collaboration-and-researcher-mobility.pdf accessed 8th March 2023

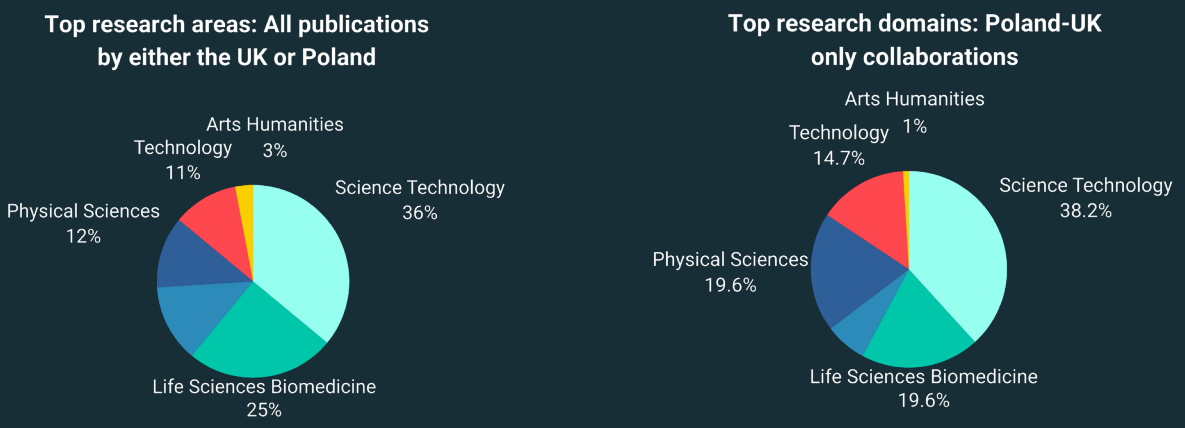


Figure 1.2. Top research fields of the PL-UK collaborative publications between 2013-2023. (Source: Web of Science, internal analysis)

Government policy is essential to the success of international partnerships at the (inter)national level. Following Brexit, the UK has been trying to maintain its relationships with Europe, for example through a guarantee scheme to cover the cost of participation of successful UK applicants[26]. After years of negotiations, the UK and EU have come to an agreement for the UK to become an associated country to Horizon Europe and Copernicus Programmes[3].

Polish researchers in the UK

The UK remains an attractive destination for Polish researchers. Polish group leaders can be found at some of the top British universities. At the time of writing this report, Oxford and Cambridge Universities employ at least 18 Polish principal investigators (PIs) in STEM fields, many of whom are recognized as worldwide experts in their fields. For example, Professor Magda Żernicka-Goetz, who is a Professor of Mammalian Development and Stem Cell Biology at Cambridge University, was awarded the 2022 Edwin G. Conklin Medal by the Society for Developmental Biology, in recognition of her extraordinary contributions to the field of developmental biology and her excellent mentorship of next-generation scientists[27]. Another example of a Polish UK-based researcher making a profound impact on her field is Professor Marta Kwiatkowska[28], Professor of Computing Systems and Fellow of Trinity College, University of Oxford, and Associate Head of MPLS. Professor Kwiatkowska's research has been supported by prestigious grant funding, including ERC Advanced Grants, EPSRC, EU, DARPA, and Microsoft Research Cambridge, to name a few.

Polish STEM researchers based in the UK are actively involved in applying for national and international funding. Between 2007 and 2023, 19 ERC grants were awarded and signed by Polish scientists in the UK: 12 in the Physical Sciences and Engineering and 7 in Life science[18]. Additionally, 80% of Polish ERC awardees remained in the UK at professorship positions following the end of their ERC grants, with 20% relocating to Switzerland, Germany, or the USA (internal data).

[26] UK participation in Horizon Europe, York University https://www.york.ac.uk/staff/research/external-funding/european/uk-participation-in-eu-funded-research-programmes/ accessed 13th April 2023
[27] Żernicka-Goetz Lab https://zernickagoetzlab.com/news accessed 15th March 2023
[28] Marta Kwiatkowska https://www.cs.ox.ac.uk/people/marta.kwiatkowska/ accessed 15th March 2023

The Polonium Foundation's research into the Polish scientific diaspora revealed a strong link between Polish academics abroad and Poland due to family ties (74% of respondents) but also at the professional level through collaborative projects with groups at Polish institutions (53% of respondents)[6]. Strengthening this professional tie is a key policy-making opportunity for maintaining and fostering bilateral collaboration.

Poland as the scientific choice for UK academics

Although Poland is a less popular destination for UK researchers, UK universities are expanding into the Polish market through cooperation and mutual certification. In 2020, the very first UK university - Coventry, opened its campus in Poland, and in 2022 also launched the Coventry University Research Institute Europe (CURIE) in Wrocław. The University focuses on tackling key global challenges, such as low-carbon vehicle technology or cyber security[29]. The key benefits of studying at a British university in Poland are the flexible studying models, fees that are affordable for Polish students, as well as access to European funds. Imperial College London has also recently initiated a science communication collaboration with Polish-based institutions, including four Polish Universities: Adam Mickiewicz University, the Jagiellonian University, the Medical University of Gdańsk, and the Warsaw University of Technology[30]. The long-standing cooperation is set to develop further through the organisation of joint workshops and engagement with local communities.

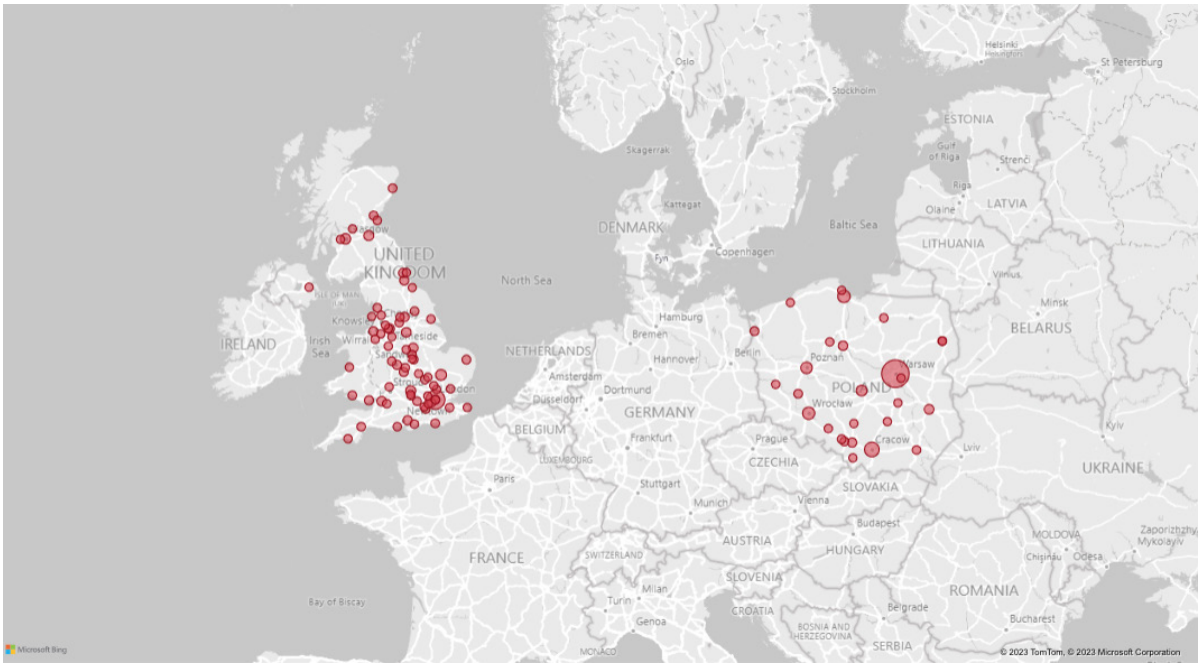


Figure 1.3. Geographical distribution of Polish and British institutional affiliations of the collaborative scientific papers. (Source: Web of Science, internal analysis)

Figure 1.3 shows the geographical distribution of Polish and UK institutions involved in mutual co-publications. Interestingly, the affiliations of UK-based authors of joint Polish-UK papers are distributed fairly equally around the country. On the other hand, the network of Poland-based partners is rather sparse, with a clear hub in Warsaw (Figure 1.3).

[29] Coventry University, 18th October 2022 https://www.coventry.ac.uk/research/about-us/research-news/2022/curie/ accessed 30th May 2023
[30] Imperial College news 2021, 24th May https://www.imperial.ac.uk/news/222013/new-imperial-partnership-explore-science-communication/ accessed 8th March 2023

Polish research institutions have low numbers of international scientists. A 2019 ERA-LEARN report showed that among the 69 institutes of the Polish Academy of Sciences, only 8% of the staff are international. However, there are exceptions to the rule, as in the case of the highly recognised Institute of Mathematics of the Polish Academy of Sciences which has approximately 40% of international staff[31]. Several factors impede the internationalisation of Polish research institutions: competition with other European institutions in wealthier countries and with institutes of high prestige, combined with relatively low salaries and limited funding at Polish institutions. More recently, Polish institutions have initiated schemes to increase the level of internationalisation of Polish higher education. The expanding funding programme offered since 2011 at the National Science Center (NCN) has been open to international scientists (non-Polish speakers and non-Polish nationals). Moreover, the Foundation for Polish Science (FNP) has a range of programmes for researchers irrespective of their country of origin, for example International Research Agendas, First Team, Proof of Concept. Another example is the establishment of the Polish National Agency for Academic Exchange (NAWA) in 2017, which offers programmes of academic exchange for students and scientists. Since 2020, NAWA has been actively promoting the internationalisation of Polish science through the Ulam program. By 2023, the program has successfully granted funding to 250 post-PhD level scientists from 52 countries[32].

UK - Global Science and Tech Leader

UK is an established leader in science and technology and has been even called a "Science and Technology Superpower"[33]. The leading position of the UK is based mainly on extensive and long-term experience in cutting-edge research and industry-science collaborations, the ability to attract highly skilled researchers, collaborations, and effectiveness. Although recent political and social events, such as Brexit and COVID, created a backdrop in terms of investments and contributed to market uncertainty, the UK was successful in responding to market new challenges and showed the flexibility needed[34]. The UK has the skills, competencies, experience in leadership, and top-level experts to sustain its highest status as a Science and Tech leader despite Brexit. The position of the UK as a science and tech leader is supported by multiple governmental and non-governmental organisations.

Recently, the UK government took action to sustain its country's leading position in science and technology. At the beginning of 2023 a new government department dedicated to science and technology, namely Department for Science, Innovation and Technology[35] was established. Its goals are to address the opportunities and challenges brought by rapid technological change and to continue to prioritise technology and science.

[31] ERA Learn Country Report Poland https://www.era-learn.eu/documents/era-learn-country-report-poland.pdf accessed 13th April 2023
[32] NAWA https://nawa.gov.pl/en/students/foreign-students/exchange-programme-for-students-and-scientists-as-part-of-bilateral-cooperation-offer-for-incoming-students-and-scientists accessed 13th April 2023
[33] Council for Science and Technology, 22nd July 2021 https://www.gov.uk/government/publications/the-uk-as-a-science-and-technology-superpower/the-uk-as-a-science-and-technology-superpower-accessible-html-version-of-letter accessed 31st May 2023
[34] Tech Nation, 12th January 2023 https://technation.io/news/2022-uk-tech-ecosystem-report/ accessed 31st May 2023
[35] Nature News, 7th February 2023 https://www.nature.com/articles/d41586-023-00370-0 accessed 31st May 2023

Another significant stakeholder in the UK international collaboration is Science and Innovation Network (SIN)[36]. SIN has approximately 100 officers in 40 countries and its main goal is to promote the UK as a scientific partner and foster strategic collaborations. These collaborations encourage new ideas, inform policy, and help to drive further innovation, which in turn supports and promotes growth and prosperity in the UK[37].

In terms of science, the UK accounts for 13% of the top 1% of most highly cited research across all fields[38]. The UK is home to several world-famous discoveries, such as graphene and the first successful AI program. To this end, it is also the Google's largest AI research division – DeepMind, which published the world's largest protein structure database, AlphaFold[39]. Also, the UK has an impressive track record in terms of the Nobel Prizes with 19 Nobel Prizes over the past decade and 125 Nobel Prizes over a century[40]. With just over 3% of the world's spending on research and development, the UK produces over 6% of the world's research articles and 16% of the world's most highly cited papers. UK's research is known for detailed longitudinal data (e.g. UK biobank), international cooperation on research infrastructure (e.g. CERN), and coordination of cutting-edge facilities (e.g. Square Kilometre Array)[41]. Collaboration is a key to UK research success, and UK openly promotes open science, building networks around the world, being strategic and using its influence for global good[42].

The UK is also a world-class leader in the tech area with its tech market worth over one trillion dollars[2]. The technology sector in the UK has been described as a national asset that gives the country an economic and strategic edge. The technologies that have been defined as most critical for the UK in terms of science and technology are: Artificial Intelligence, Engineering biology, Future telecommunications, Semiconductors, and Quantum technologies[2]. All these areas have been identified as goals for long-term planning and the UK government plans to be involved in shaping long-term strategies based on them. Moreover, the UK still learns from other successful economies, including the US and Japan, and plans to increase investment in science and technology from business and industry from 55% to 75%[2]. Finally, the UK has a long tradition of being a leader in automotive, engines, aerospace, and pharma (GSK and AstraZeneca being pharma leaders).

Poland - the emerging biotech and IT leader

Polish society is highly pro-entrepreneurial, with 78% of adult Poles believing that self-employment is a good career path and 77% believing that people who have successfully set up new companies deserve recognition. Among the 21 European countries surveyed, these correspond to the 2nd and 6th highest scores, respectively[43].

There has been increasing participation of Poland in public partnerships in research and innovation (P2Ps) in Horizon 2020 - a total number of 75 public participations up till June 2021 - average EU15 participation and above the EU13 average.

[36] Gov.uk https://www.gov.uk/world/organisations/uk-science-and-innovation-network accessed 31st May 2023
[37] UK Science and Innovation Network Report 2015 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/417600/bis-15-210-science-Innovation-network-report.pdf accessed 31st May 2023
[38] University of Sussex News, 20th March 2023 https://www.sussex.ac.uk/broadcast/read/60369 accessed 31st May 2023
[39] AlphaFold website https://alphafold.ebi.ac.uk accessed 23rd October 2023
[40] Nobel laureates and research affiliations https://www.nobelprize.org/prizes/facts/lists/affiliations.php accessed 9th January 2024
[41] Gov.uk, 11th March 2014 https://www.gov.uk/government/speeches/great-britain-the-best-place-in-the-world-to-do-science accessed 31st May 2023
[42] Wellcome, October 2020 https://wellcome.org/sites/default/files/uk-role-global-research-report.pdf accessed 31st May 2023
[43] PARP Survey Report 2020 https://en.parp.gov.pl/storage/publications/pdf/GEM-Poland-2020_EN_21.01.21.pdf accessed 8th March 2023

Additionally, Poland coordinated three P2P networks[44]. Nevertheless, Poland significantly supported fewer projects (137) than other countries with similar capacity in researchers (Netherlands - 402, Belgium - 165) or GERD per researcher (Spain - 397)[43]. Some limitations identified for Poland's participation in P2Ps include limited incentives for international collaboration or more challenging P2P calls. The key Poland's P2Ps areas of investment include Biotech (e.g. nanotechnologies & advanced materials manufacturing, resource efficiency & raw materials, food security, and future and emerging technologies). In the H2020 Programme, the United Kingdom has been one of the top 5 collaborative countries for Polish researchers, after Germany, Italy, Spain, and France[24]. Poland-based PIs are still underrepresented in international grant calls. For example, in the recent ERC synergy 2023 call, out of the 37 winning projects, none were hosted in Poland, and the few Polish PIs were based in the Netherlands or Germany[45].

Although biotechnology is still an emerging sector in Poland, the country managed to establish a leading position in some areas, such as bioinformatics, neuroscience, RNA technologies, genomics, and epigenetics. In 2022, the Central Statistical Office reported 187 biotech companies operating in Poland, with 70 companies in the field of nanotechnology[46]. In recent years Polish pharmaceutical companies appeared in the generic and biosimilar space, leading the way to the early drug development in Poland. Several Polish pharmaceutical and MedTech companies are worth mentioning, among them Polpharma in a wide spectrum of scientific domains, Selvita for drug development, and Ardigen for bioinformatics and data science, both established on international markets. In the last 10 years, Polpharma has gained international recognition as one of the leaders in the development of biologics and biosimilars, with two products receiving FDA and EMA certification, and introducing to the market the first European biosimilar to treat multiple sclerosis[47]. Regarding RNA technologies, Poland is a leader with ExplorRNA, a company with strong scientific leadership, supported recently by Bill and Mellinda Gates Foundation[48] and RNA research centres located in Warsaw and Poznań[49]. Although there is rapid growth in Polish biotech, it is still a young scene with several logistical problems, such as a lack of high-quality laboratory space[50].

Several major advancements have been reached in the last few years. There are over 80 science and technology parks in Poland with a focus on strategic Polish sectors including biotechnology, with a handful dedicated to life science/biotechnology parks: 6 biomedical and biotechnology clusters and 8 dedicated technology parks for pharmaceuticals and life science research[43]. These include the Małopolskie Centre of Biotechnology in Kraków built by the Jagiellonian University which received €24 million in EU-financed structural funds. Another significant development is the PORT science campus in Wrocław with over 2,000 m^2 of laboratory space which received over €200 million in EU and public funding. PORT is one of the very few institutions offering laboratory space for commercial use, which is required for effective technology transfer and commercialisation of academic-born innovations.

Poland has become an attractive partner in terms of research and innovation in IT. Tech market contributes to 8% of Polish gross domestic product (GDP)[51] and Poland has a reputation of the top choice for IT outsourcing[52].

[44] Country fiche Poland, Europa.eu https://ec.europa.eu/research-and-innovation/sites/default/files/bmr-2022/ec_rtd_bmr-2022-poland-country-fiche.pdf accessed 14th April 2023
[45] ERC News, 26th October 2023 https://erc.europa.eu/news-events/news/erc-2023-synergy-grants-results accessed 30th October 2023
[46] Stat.gov.pl Biotechnologia i nanotechnologie w Polsce w 2022 roku, 9th Novermber 2023 https://stat.gov.pl/obszary-tematyczne/nauka-i-technika-spoleczenstwo-informacyjne/nauka-i-technika/biotechnologia-i-nanotechnologia-w-polsce-w-2022-roku,10,11.html accessed 20th December 2023
[47] Polpharma Biologics, 26th September 2023 https://polpharmabiologics.com/en/knowledge/latest-news/article/polpharma-biologics-announces-approval-of-europes-first-and-only-biosimilar-for-multiple-sclerosis-tyruko-r-natalizumab accessed 28th October 2023
[48] ExploRNA https://explorna.com accessed 9th March 2023
[49] IBMiB http://ibmib.amu.edu.pl/en/rna-research-center-in-poznan/ accessed 1st March 2023
[50] Impact 2018 https://impactcee.com/wp-content/uploads/2018/09/Impact_Report_Biotech-1.pdf accessed 8th March 2023
[51] PFR Group https://www.paih.gov.pl/sectors/ict accessed 1st March 2023
[52] PentaBlog 2021, 24th August https://www.pentalog.com/blog/it-outsourcing/outsourcing-it-to-poland/ accessed 1st March 2023

Its main assets are highly qualified and ambitious professionals and competitive labour costs. The steady growth in the economy and a stable political situation make it an attractive country to invest in for foreign corporations. That is why Poland managed to attract both IT giants (such as Amazon, IBM, Google, or Cisco Systems), as well as smaller software houses, not only to Warsaw but also to other major Polish cities, such as Wrocław, Kraków, Gdańsk and Poznań. The scientific strengths in IT contributed to the development of Poland AI strategy by the Council of Ministers in 2020 with clear guidance and policy initiatives to develop a holistic AI ecosystem, e.g. introduction of AI education as early as preschool, establishment of Virtual Research Institute for AI, and promotion of a culture of collaborations[53]. The Polish start-up scene has significantly developed during the last five years with start-ups multiplying and growing. Poland has invested in technological innovation and is supporting entrepreneurship, also on the microlevel, making it an interesting partner in research and innovation. Poland ranked in 2022 at number 33 globally and as number 5 in Eastern Europe according to StartUp Blink[54]. The vast majority of Polish start-ups are in the IT domain. Additionally, Polish IT experts create foundations to support international technical education, such as Quantum AI Foundation focused on education, research, development, and collaboration in the field of Artificial Intelligence and Quantum Computing[55]. Poland excels especially in AI with Neoteric, nexocode, Tooploox, Software Mind and Digica being the key players[56].

Polish-UK businesses

UK companies are keen to invest in Poland, both in biotech as well as in IT. AstraZeneca (main base in Cambridge, UK) has been present on the Polish market for more than 30 years, also with its Global Clinical Trials Centre. AstraZeneca has been recently granted a R&D center status by the Polish Ministry of Development[57]. Other big pharma from the UK, such as GSK, also have their operational hubs in Poland with a large number of their representatives.

Polish companies from the IT and biotech sector, often choose London and surroundings as their first step in global expansion to the non-EU markets. Selvita, a leading Polish biotech CRO, opened their offices in Cambridge to facilitate UK market operations. A Polish vet prosthetics start-up Wimba has raised over €810k to enter, among others, the UK market[58]. Eleven Labs, a UK-based start-up with Polish Founders based in London, is focusing on speech and AI, enabling among others, converting speech into different languages. Now, their beta version has been released in English and Polish[59]. There are several examples of Polish companies successfully graduating from various UK accelerators: Yosh.ai, Reality Games (Oxygen Accelerator at Google Campus London, 2014), just to name a few[60].

[53] Poland AI Strategy Report, 1st September 2021, https://ai-watch.ec.europa.eu/countries/poland/poland-ai-strategy-report_en accessed 19th November 2023
[54] StartupBlink 2022 https://www.startupblink.com/startup-ecosystem/poland accessed 1st March 2023
[55] Quantum AI Foundation https://www.qaif.org/ accessed 30th May 2023
[56] Clutch Reviews 2023 https://clutch.co/pl/developers/artificial-intelligence accessed 8th March 2023
[57] AstraZeneca https://careers.astrazeneca.com/poland accessed 9th March 2023
[58] Ain Capital 2022, 17th October https://ain.capital/2022/10/17/wimba-raises-over-830k/ accessed 9th March 2023
[59] TFN 2023, 25th January https://techfundingnews.com/as-generative-ai-booms-this-british-startup-secures-2m-to-imitate-human-voices/ accessed 9th March 2023
[60] Boron M., LinkedIn Post 2019, 9th April https://www.linkedin.com/pulse/i-am-polish-startup-so-would-consider-acceleration-uk-marcin-boron/ accessed 9th March 2023

In the area of Biotech, a Polish biotech company, Genegoggle Sp. z o.o., which leverages multi-dimensional genomic and epigenetic elements to discover novel therapeutics and intelligent systems to improve human health, has recently finished acceleration in the very prestigious Illumina Cambridge, UK accelerator[61].

Logo	Name	Start-up/Company	Area	Product	Founder/CEO
yosh.AI	Yosh.ai	Start-up	Tech	AI voice and tech assistant	Kasia Dorsey
REALITY BIG DATA GAMES	Reality Games	Start-up	Tech	Interactive games for smartphones	Zbigniew John Woznowski
WIMBA	Wimba	Start-up	MedTech	Prosthetic for animals	Grzegorz Kosch
Genegoggle See it through	Genegoggle Sp. z o.	Start-up	BioTech	Multi-omics strategies to create an analytical platform for precision medicine and chronic diseases	Jakub Mieczkowski

Table 1.1. Examples of Polish start-ups and companies that expanded onto the UK market

Equally UK start-ups and research and innovation companies are searching to expand into the Polish market. Among them are Revolut, Monzo bank, Weezy[62] (now acquired by Getir), TransferWise (Wise), Onfido, Qatalog, Gousto[63] or Ovo Energy[41]. Some UK start-ups received investment from Polish sources, such as Spottitt through acceleration with PSG Poland and Microsoft Poland, while Polish fund RKKVC invested into Move.ai, which is developing motion capture technology[64], and in the FIDO.tech[65], a British (Northumbrian) company developing technology to detect leakage in the water systems.

Logo	Name	Startup/Company	Area	Product	Founder/CEO
spottitt	Spottitt	Start-up	Tech	AI geospatial data provider	Lucy Kennedy
MOVE	Move.ai	Start-up	Tech	Virtual production/motion capture technology	Tino Millar
FIDO	FIDO.tech	Start-up	Tech	AI leakage detection system	Victoria Edwards

Table 1.2. UK start-ups and companies in Poland

[61] Illumina 2021, 15th September https://www.illumina.com/company/news-center/press-releases/2021/2f0d693d-c0bf-4fb8-bb05-f6bce7f9dc7b.html accessed 9th March 2023
[62] Startup Magazine https://startupsmagazine.co.uk/article-top-15-uk-startups-list accessed 9th March 2023
[63] Failory 2022, 9th June https://www.failory.com/startups/united-kingdom accessed 9th March 2023
[64] Ain Capital 2022, 28th November https://ain.capital/2022/11/28/rkkvc-invests-in-move-ai/ accessed 9th March 2023
[65] Ain Capital 2022, 6th October https://ain.capital/2022/10/06/rkkvc-joins-a-7-2m-round-for-fido-tech/ accessed 9th March 2023

Mechanisms supporting bilateral and international R&I collaboration in the UK and Poland

There are several institutions that support bilateral Polish-UK cooperation and start-ups from the UK in Poland and the other way round - Polish start-ups and research and innovation in the UK. They are both governmental, like the UK Science and Innovation Network[66], with goals to stimulate strategic science collaborations with Poland to benefit the UK and deliver wider policy goals, and to harness Polish international technology partnerships and investment to grow UK innovation capability. In 2018, in partnership with the Polish Ministry of Science and Higher Education, British Council Poland, British Embassy Warsaw and SIN Poland celebrated the UK-PL Year of Entrepreneurship, Science and Innovation (YESI). The year included a rich programme of events to boost and showcase opportunities for cooperation, including the first Polish-British Science Forum, held in Warsaw on 13-14 September 2018[67]. YESI was also one of the joint initiatives agreed by the UK and Polish governments via the process of UK-Polish bilateral intergovernmental consultations (IGCs), held regularly since 2016. The IGC process showcases the strength of bilateral relations, also in the areas of science, innovation, and tech.

The British Council is the United Kingdom's international organisation for cultural relations and educational opportunities. The British Council funded and coordinated several projects supporting Polish-UK scientific collaboration, such as The British-Polish Young Scientists Programme, YSP between 2003-2010[68]. British Council is supporting researchers in showcasing their work internationally, for example through science communication contests (e.g. FameLab organised in partnership with Copernicus Science Centre between 2011 and 2021) and engaging the public directly with scientific subjects that affect our society[69].

The UK government has a clear goal of promoting and supporting international collaborations in research and innovations. This is done both on the national and local levels. Current funding schemes include, for example, international travel awards for researchers, EPSRC grants for work with overseas scientists, MRC applied global health partnership grant, and grants co-funded with international governments (such as India-UK partnership, UK-Japan research programme, China-UK, Luxembourg-UK, Norway-UK, Brazil-UK, US-UK)[70]. MRC and BBSRC also offer £16m fund for Human Functional Genomics Initiative clusters, where the lead participant must be based in eligible UK-institution, but international researchers can apply as co-investigators[71]. Additionally, following the Brexit referendum UK governments and several institutions initiated schemes to support European collaborations. For example, Scottish government launched Saltire Research Awards (£3m) in June 2021 to support Scottish connections with EU partners[72], while the UK's Department for Business, Energy & Industrial Strategy, in partnership with the British Academy, SIN, UKRI, and KTN, opened a programme for a Horizon Europe Pump Priming Collaboration[73].

[66] UK Science & Innovation Network https://www.gov.uk/world/organisations/uk-science-and-innovation-network accessed 9th March 2023
[67] Gov.uk 2018, 17th September https://www.gov.uk/government/news/poland-uk-science-forum-takes-place-in-warsaw accessed 9th March 2023
[68] Biotechnologia https://biotechnologia.pl/biotechnologia/ruszyl-nabor-do-young-scientists-programme-ysp,3806 accessed 14th April 2023
[69] British Council https://www.britishcouncil.pl/en/programmes/science accessed 15th April 2023
[70] UKRI https://www.ukri.org/opportunity/?keywords=international&filter_council%5B0%5D=816&filter_council%5B1%5D=820&filter_council%5B2%5D=822&filter_council%5B3%5D=824&filter_council%5B4%5D=826&filter_council%5B5%5D=828&filter_council%5B6%5D=830&filter_funding_type%5B0%5D=16&filter_status%5B0%5D=open&filter_status%5B1%5D=upcoming&filter_order=publication_date&filter_submitted=true accessed 1st June 2023
[71] UKRI https://www.ukri.org/opportunity/human-functional-genomics-initiative-clusters/ accessed 1st June 2023
[72] Gov.scot https://www.gov.scot/policies/science-and-research/international-research-collaboration/ accessed 1st June 2023
[73] The British Academy https://www.thebritishacademy.ac.uk/funding/Horizon-Europe-Pump-Priming-Collaboration-between-UK-and-EU-Partners/ accessed

Universities UK, a collective voice of 140 universities across the UK, also promotes international collaborations between UK universities and other countries. Some schemes include UK-Ukraine R&I twinning grants, support in participation in Horizon Europe, global internships, and mobility schemes[74]. International Max Planck Partnership (IMPP) brings together physicists from five Scottish universities and five German Max Planck Institutes, to provide a collaborative environment to investigate quantum limits and develop new technologies[75]. For the start-ups of non-UK-based founders there are also some government support programmes, such as the Global Tech Connect[76]. Some local initiatives that support international collaborations in the UK develop on the local level. These include for example incubators, such as Set Squared which is a shared business incubator in partnership with 5 UK universities, or bilateral collaborations on research topics.

The Polish Ministry of Science and Higher Education is promoting internalisation of Polish higher education institutions[77], Polish-UK bilateral cooperation, and supporting Polish studies at British universities[79]. It is also developing teaching skills for Polish academics in cooperation with UK universities[77] and is involved in several initiatives, such as the Polish-British Science Forum[80]. The National Center for Research and Development (NCBR) is an executive agency of the Polish Ministry of Development Funds and Regional Policy, with close cooperation with the Ministry of Education and Science. Its goal is to bring together the world of science and business through co-financing of R&D projects[81]. Although NCBR does not have any active agreements with British institutions, it promotes international collaborative R&I projects through grant programmes, such as InnoGlobo launched on 1st July 2021[82] and as a national operator for Eureka[83]. Polish Investment & Trade Agency (PAIH) co-organizes initiatives such as the British Polish Tech Forum[84] to support tech partnerships. PAIH has a representative office in London, which helps in finding business partners and establishing co-operations. PAIH also cooperates with the EY, Cambridge Innovation Center, and Foundation Venture Café Warsaw to provide programs for international start-ups in Poland[85]. They provide advisory on different levels, including taxes and law.

Polish institutions are also promoting the PL-UK collaboration through agreements with British scientific organisations. For example, the Polish Academy of Sciences, the largest scientific network in Poland, signed a Memorandum of Understanding with the Royal Society of Edinburgh in 2022 to promote, facilitate, and encourage collaboration between research groups in Poland and Scotland[86]. Poland's EU-AMTH (a Euro Asia Medical & Technology Hub) signed a Memorandum of Understanding with Cambridge Medical Academy to realise common projects in the healthcare sector[87].

[74] Universities UK https://www.universitiesuk.ac.uk/universities-uk-international/explore-uuki/international-research-collaboration accessed 1st June 2023
[75] University of Glasgow https://www.gla.ac.uk/research/beacons/nanoquantum/researchfeatures/internationalmaxplanckpartnership/ accessed 1st June 2023
[76] Global Tech Connect https://www.globaltechconnect.org/ accessed 1st June 2023
[77] Study.gov.uk https://study.gov.pl/news/minister-science-signed-higher-education-internationalisation-program accessed 15th April 2023
[78] Study.gov.pl https://study.gov.pl/news/university-warsaw-will-support-polish-studies-university-cambridge accessed 15th April 2023
[79] Ucl.ac.uk https://www.ucl.ac.uk/ioe/innovation-and-enterprise/enriching-teaching-universities-across-poland accessed 15th April 2023
[80] Gov.pl https://www.gov.pl/web/edukacja-i-nauka/iv-polsko-brytyjskie-forum-naukowe-we-wroclawiu accessed 15th April 2023
[81] NCBR, gov.pl https://www.gov.pl/web/ncbr-en/ accessed 15th April 2023
[82] NCBR, gov.pl https://www.gov.pl/web/qatar/innoglobo--the-new-ncbr-funding-programme-concentrated-on-global-rd-ideas accessed 16th April 2023
[83] Eureka https://www.eurekanetwork.org/countries/poland/ accessed 31st May 2023
[84] GoTechPoland https://www.gotechpoland.co.uk/ accessed 16th April 2023
[85] EY 2021, 30th March https://www.ey.com/en_pl/innovation/softlanding-poland-welcomes-foreign-startups accessed 9th March 2023
[86] Rse.gov.uk https://rse.org.uk/academy/polish-academy-of-sciences/ accessed 14th April 2023
[87] Ukemed.com https://www.ukemed.com/whats-new/news/strategic-collaboration-between-uk-and-poland/ accessed 14th April 2023

On the other hand, Polish organisations based in the UK are also active in establishing connections with institutions in Poland. For example, the Association of Polish Technicians in the UK signed a cooperation agreement with Silesian University of Technology to support doctoral students benefiting from British science and technology and to understand the transition onto British market[88]. PLUGin Foundation, established in London, is an organisation supporting Polish start-ups abroad. It dates to 2014 when a one-off event for the Polish tech community in London took place. Other flagship projects are: Pitch To London competition and the Ambassadors of Polish Innovation[89].

Polish-UK relations in terms of collaboration on science and technology evolved over the years. While at the beginning, the UK was seen more as a mentor and adviser to the Polish emerging markets, now Poland is seen as a partner in some strategic areas. The strengths of the UK include established leadership positions, successful collaborations, and experience in cutting-edge research, commercialisation, and science-business collaborations. On the other hand, Poland distinguishes itself by presenting not only a highly skilled and economically robust workforce but also a dynamic startup ecosystem. It stands as a frontrunner in the field of IT and is increasingly recognised as an emerging market in cutting-edge biotech sectors, including bioinformatics and advanced therapies. These domains serve to enrich and foster collaborations between Poland and the UK.

Limitations of current market analysis

Most of the information on the UK-Polish Research and Innovation cooperation is based on case reports, conference protocols, or single articles in the press. We did not identify a summary report based on the statistical analysis and surveys encompassing larger unbiased cohorts. That is why our knowledge on the topic is fragmented and may not illustrate well the actual interests and challenges in the Polish-UK R&D cooperation. Also, although the scientific accomplishments and achievements in terms of gaining funding for start-ups are often presented, we rarely find information about challenges for British entrepreneurs to develop their initiatives in Poland and for Polish entrepreneurs in the UK. Moreover, most of the information is from before 2020. From this time, also because of the COVID-19 pandemic and Brexit, some of the priorities and business models changed significantly and the R&D landscape greatly evolved.

In the next step, we address this gap in the UK-PL market knowledge through a structured report based on a survey and interviews with scientists and entrepreneurs performed in 2023. We hope that with a more detailed and targeted stakeholder analysis of the common areas of interest, we will be able to promote and strengthen Polish-UK collaboration in research and innovation.

[88] Polishscience.pl https://polishscience.pl/en/collaboration-between-the-silesian-university-of-technology-and-the-association-of-polish-technicians-in-the-uk/ accessed 14th April 2023
[89] Polishtechday.com https://polishtechday.com/ accessed 16th April 2023

2. IN-DEPTH RESEARCH

METHODOLOGY

SURVEY

Together with the Science Innovation Network in Poland and the British Embassy Warsaw, the Polonium Foundation created an online survey containing 16 key questions regarding past, present, and future research and innovation (R&I) collaborations between researchers, academics, and professionals based in Poland and the United Kingdom. Participants were asked questions regarding their key demographics (country of residence, nationality, research experience, sector, position) and R&I collaborations (field, sector, type, reasons, funding, outcomes, potential, barriers). The online survey was shared using Typeform platform among STEM departments of Russell Group universities in the UK and 21 Polish research universities (pl. "uczelnie badawcze", including University of Warsaw (pl. Uniwersytet Warszawski), Gdańsk University of Technology (pl. Politechnika Gdańska), and Wrocław University of Technology (pl. Politechnika Wrocławska). We also contacted 29 UK research institutes (e.g., funded by the Medical Research Council (MRC) or the Wellcome Trust) and 10 Polish research centres (e.g., International Institute of Molecular and Cell Biology (pl. Międzynarodowy Instytut Biologii Molekularnej i Komórkowej and Łukasiewicz Research Network (pl. Sieć Badawcza Łukasiewicz)), asking them to share our survey with their employees and broader network. In order to reach respondents from start-ups and industry we shared our survey on the professional social media platform LinkedIn, and through partner organisations, such as the Association of Polish Engineers in Great Britain, PolishTechDay, StartUp Hub Poland and StartSmart Central and Eastern Europe (CEE). We also contacted other institutions to share our survey with their contacts, including accelerators and innovation organisations, as well as Polish and British funding agencies. Additionally, we sent individual emails with surveys to over 150 principal investigators in the UK and 40 start-up founders/CEOs.

In total, we collected answers from 154 respondents between 1st June and 31st July 2023 using the online platform Typeform.com. We consequently analysed the data based on the country of residence of respondents, with country of residence defined as the country in which most of the respondent's research activity is conducted.

154

RESPONDENTS

INTERVIEWS

We conducted online interviews (30 - 60 minutes) with seven British stakeholders - 1) Department for Science, Innovation and Technology (DSIT), 2) UK Research and Innovation (UKRI), 3) Innovate UK, 4) British Academy, 5) Universities UK, 6) Alan Turing Institute, and 7) Royal Society, and eight Polish stakeholders - 1) National Science Centre (pl. Narodowe Centrum Nauki; NCN), 2) Polish National Agency for Academic Exchange (pl. Narodowa Agencja Wymiany Akademickiej; NAWA), 3) Polish Academy of Sciences (pl. Polska Akademia Nauk; PAN), 4) Polish Young Academy of the Polish Academy of Sciences (pl. Akademia Młodych Uczonych; AMU PAN), 5) Ministry of Education and Science (pl. Ministerstwo Edukacji i Nauki), 6) National Centre for Research and Development (pl. Narodowe Centrum Badań i Rozwoju; NCBR), 7) IDEAS NCBR (Intelligent Algorithms for Digital Economy of the National Centre for Research and Development), and 8) Foundation for Polish Science (pl. Fundacja na rzecz Nauki Polskiej; FNP) . All interviews were conducted in June and July 2023. The key issues that were addressed during these interviews were: support for international science (initiatives, programmes, funds, workshops), priorities for international collaborations (countries, sectors and themes, type of collaborations), the importance of Poland-UK R&I collaborations (Do they exist? How are they supported? How can they be effective? Mechanisms to support such collaborations), key strengths and weaknesses of Poland-UK R&I collaborations (How to address weaknesses? How to enhance/support existing collaborations?), and future potential for R&I collaborations. We were seeking their insights on the PL-UK collaboration and gathering valuable recommendations for its enhancement.

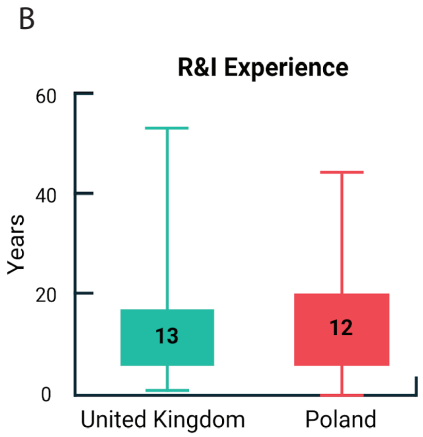
7 BRITISH STAKEHOLDERS

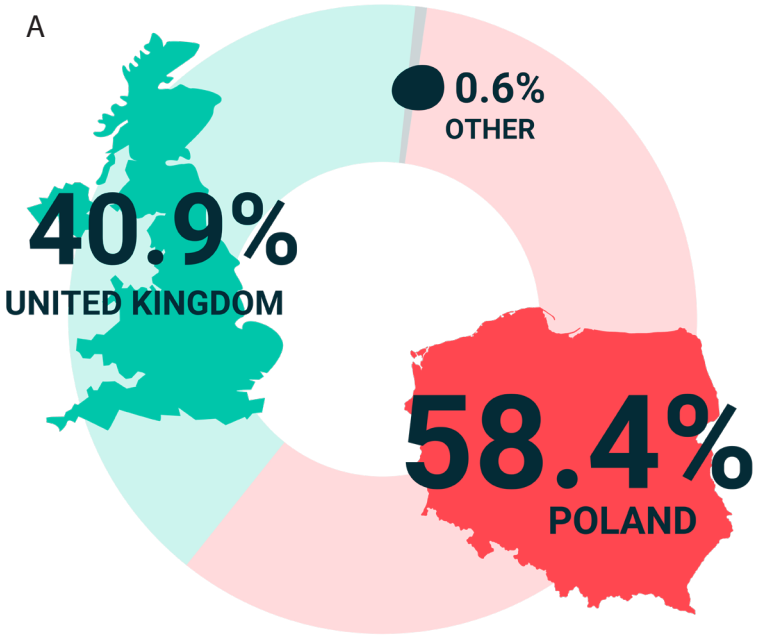
POLISH STAKEHOLDERS 8

3. IN-DEPTH RESEARCH
RESULTS

Demographics of Survey Respondents

In total, 154 people responded to the survey. A slight majority of respondents (58%) was currently based in Poland (PL), compared to 41% based in the United Kingdom (UK) (Figure 3.1A). Most of the respondents were Polish nationals - both among those based in Poland (88.9%) and among those based in the UK (47.6%). A substantial proportion of UK-based respondents had dual Polish-British nationality (23.8%), compared to only 4.4% of PL-based respondents with dual nationality. Only 6.7% of the respondents based in Poland were international, 3.3% of those being British, while international respondents represented 28.4% of the UK-based respondents, of which 25.4% were British.





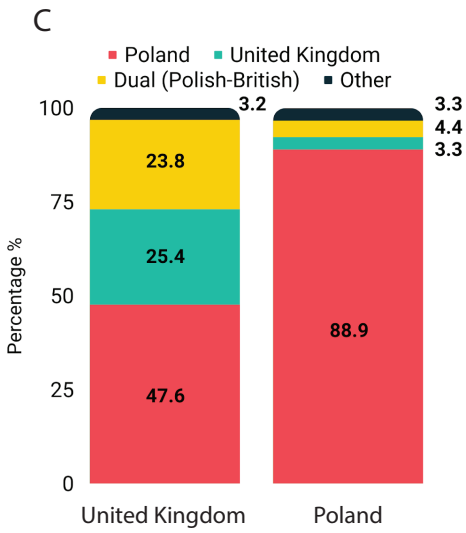


Figure 3.1. Key demographic information about survey respondents. (A) Main country of residence, defined as the country in which the respondent's research or work activity is based for most of the year. (B) Years of research and innovation experience in the main country of residence. (C) Nationality (Polish only, British only, dual Polish-British, other) of Polish- and British-based respondents as identified by respondents.

Other nationalities included Irish and Australian for UK-based respondents, and German, Australian, and Indian for respondents based in Poland.

Survey respondents were highly educated, with 95% of both PL- and UK-based respondents having at least a Master's degree and more than 74% holding a PhD title (Figure 3.2A). The respondents' high academic qualifications effectively translated to years of R&I experience (median of 12 and 13 years for PL- and UK-based respondents, respectively; Figure 3.1B). In terms of the research fields represented by our survey population (Figure 3.2B), most of the UK-based respondents worked in the medical and health sciences (nearly 50%), followed by similar percentages (around 30%) of engineering & technology, and natural sciences. Meanwhile, most of the PL-based respondents represented the engineering & technology field (more than 35%), followed by natural sciences, and medical and health sciences, respectively (Figure 3.2B). A small but non-negligible percentage of respondents represented the social sciences and humanities, particularly among UK-based respondents (almost 14% in total).

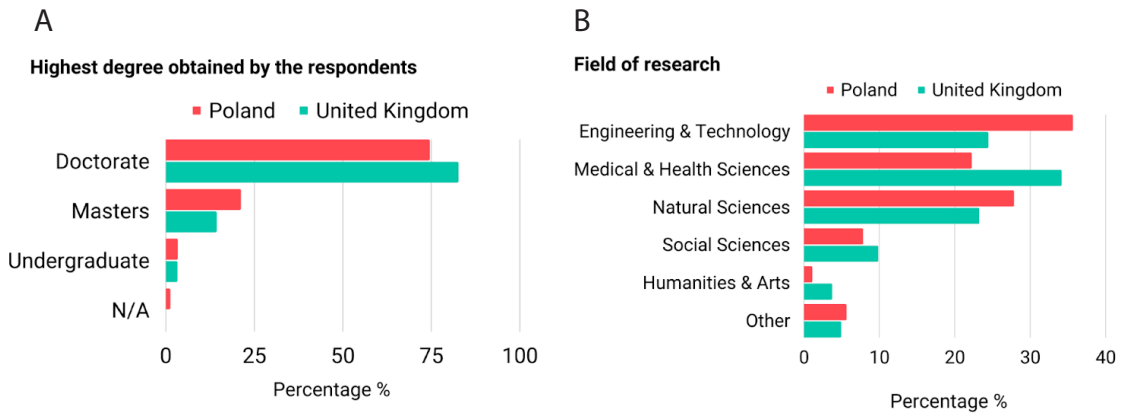


Figure 3.2. Key information about Poland- and UK-based survey respondents. (A) Highest degree obtained. B) Current research field (multiple choice).

A large majority of respondents was from the academic sector: 78% of PL-based and 70% of UK-based respondents in total, with more than half of PL-based respondents representing the basic sciences. Industry sector respondents - both Poland- and UK-based - worked mainly in start-ups, followed closely by established industry (Figure 3.3A). 3.4% of PL-based respondents selected "other" for their professional sector, which they identified as the foundation of research & science development, arts, construction project management, and private research facility. At the same time, 6.5% of UK-based respondents as "other" sector identified research management, humanities, technology transfer, microelectronics support for academia & research, and private applied research organisation.

Most of both UK- and PL-based respondents held management-level positions (Figure 3.3B). Specifically, among academic sector respondents, most were Professors/Lecturers (47.6% of Poland-based and 52.9% of UK-based respondents), followed by Research Fellows/Associates/Post-docs (10.7% PL-based, 11.5% UK-based), Principal Scientists (14.7% of PL-based respondents) and Group leaders (7.1-9.8% of all respondents). Similarly, industry-sector respondents were mainly CEOs/Founders (17.9% of PL-based and 26.9% of UK-based respondents) and Project managers (14.3% of PL-based and 7.7% of UK-based respondents).

In the industry and start-up sector also included academics: Lecturers/Professors (14.3% of PL-based and 15.4% of UK-based respondents) In the industry and start-up sector also included academics: Lecturers/Professors (14.3% of PL-based and 15.4% of UK-based respondents) and Research Fellows/Associates/Postdocs (up to 12%) (Figure 3.3C). Other academic positions included pro-dean, division head, research facilitator, PhD student, and clinical research associate, while the industry sector included CSO, chief engineer, director of business development, investor, expert, software developer, project assistant, and freelancer.

In summary, most of our survey respondents held management-level positions and most had been in their current country of residence for over a decade, indicating that a large proportion of respondents had been in their country of residence since their university studies. It is insightful to juxtapose this finding with the information gleaned from our interviews with key stakeholders.

Among our Polish interviewees, several stakeholders mentioned programmes that aim to support the international networking of early career researchers. While this is to be expected for an organisation like AMU PAN, i.e., Polish Young Academy of the Polish Academy of Sciences, we found that this was also the case, for instance, for IDEAS NCBR, AI research institute, which supports PhD schools where the student spends half of his/her PhD in Poland and 50% abroad. IDEAS NCBR also offers shorter fellowships, mainly for PhD students and other early career researchers, allowing the researcher to go abroad for 1 to 6 months. While these programmes are not specifically geared towards the UK, their prioritisation demonstrates the value of early career mobility in establishing research networks.

Among UK stakeholders, Universities UK also emphasised their initiatives aimed at expanding UK universities' international activity and creating opportunities to expand links with universities abroad, although without a specific focus on any single target country. The British Academy provides several funding schemes, also for collaboration with Poland. However, sometimes they struggle to find applicants from Poland: their Programme in 2020 did not start because of the scarce interest from Polish researchers. British Academy, Innovate UK and UKRI highlighted the importance of the EU Programs, especially Horizon in fostering collaborations with EU countries. Both UK stakeholders and survey participants emphasised the importance of improving communication about available funding opportunities.

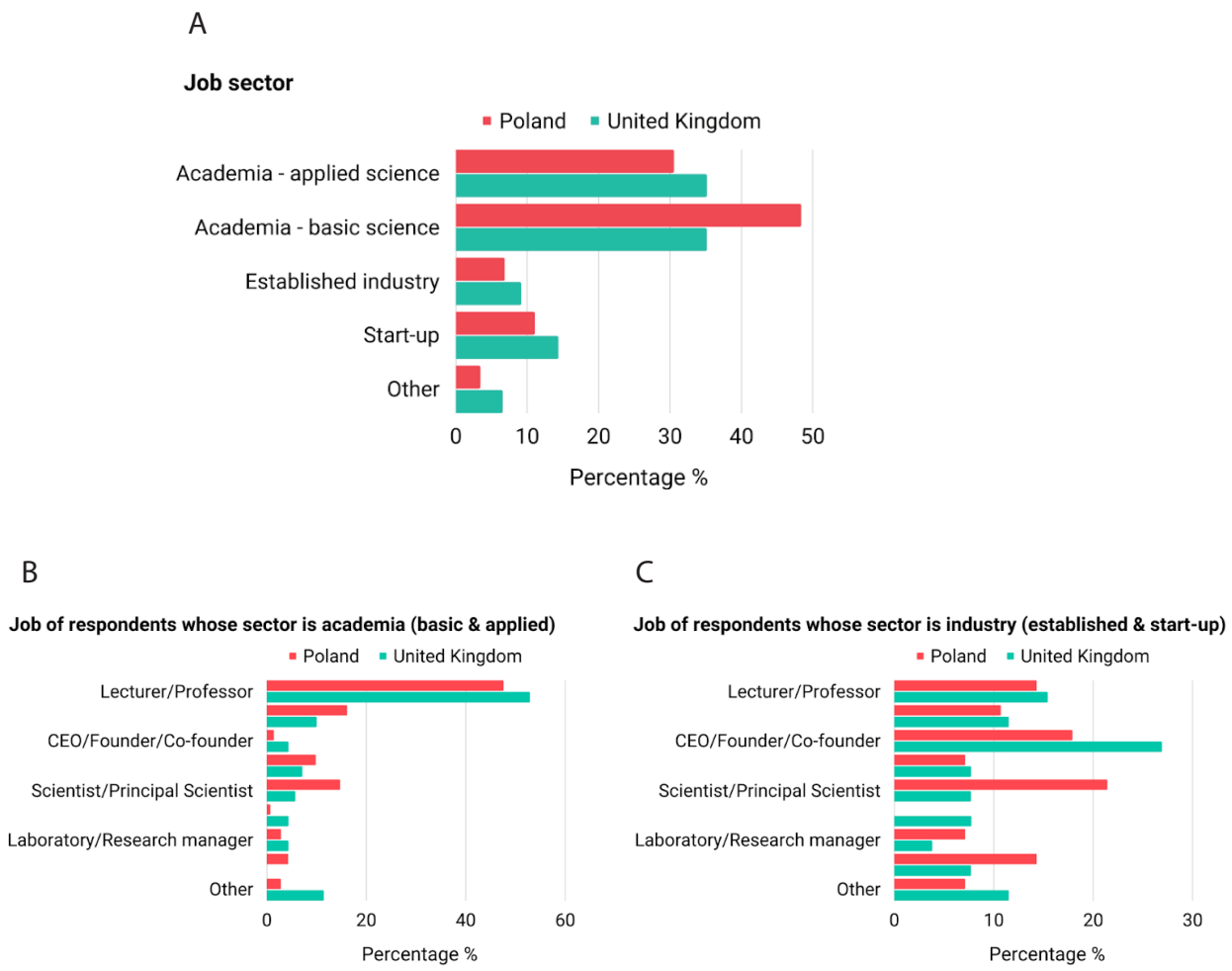


Figure 3.3. Key information about Poland- and UK-based survey respondents in relation to their job sector and position. (A) Job sector (multiple choice). B) Job position (academia: basic & applied) C) Job position (industry: startup and established industry).

Past UK-PL Research and Innovation collaborations

To ascertain the evolution of Polish-British collaborations from past to present, we asked survey participants about their past participation in projects that involved both Poland-based and UK-based partners. The survey responses showed that our cohort was balanced in terms of those who had previously engaged in collaborative work (about 50%) and those who had not (about 50%), both for Poland- and UK-based respondents (Figure 3.4A). Interestingly, when looking at answers from UK-based respondents based on their nationality, over 60% of British or dual nationals had past R&I collaboration with a PL-based partner. Meanwhile, R&I collaboration was only at 37% among Polish nationals in the UK (Figure 3.4B). An overwhelming majority of past collaborations were academic (79% for PL-based and 83% for UK-based respondents), with only 7 to 12% of past collaborations happening in the industry and 5 to 10% in start-ups (Figure 3.4C). Other sectors included urban labs and public health institutes.

The main field of collaboration for respondents from both countries was the medical and health sciences (31-36.4%), followed by natural sciences (27.3%-28.6%), and engineering and technology (25.5%-26.2%) (Figure 3.4D). Survey respondents indicated that the most common type of Polish-British initiatives in the past were joint research projects (20%-29%), joint meetings and events (17%-22%), and academic exchanges or researcher mobility programmes (17%) (Figure 3.4E). Other identified initiatives included support in the use of design tools, promotion of collaborative work development, technology transfer, organisation membership and conference, and manufacturing.

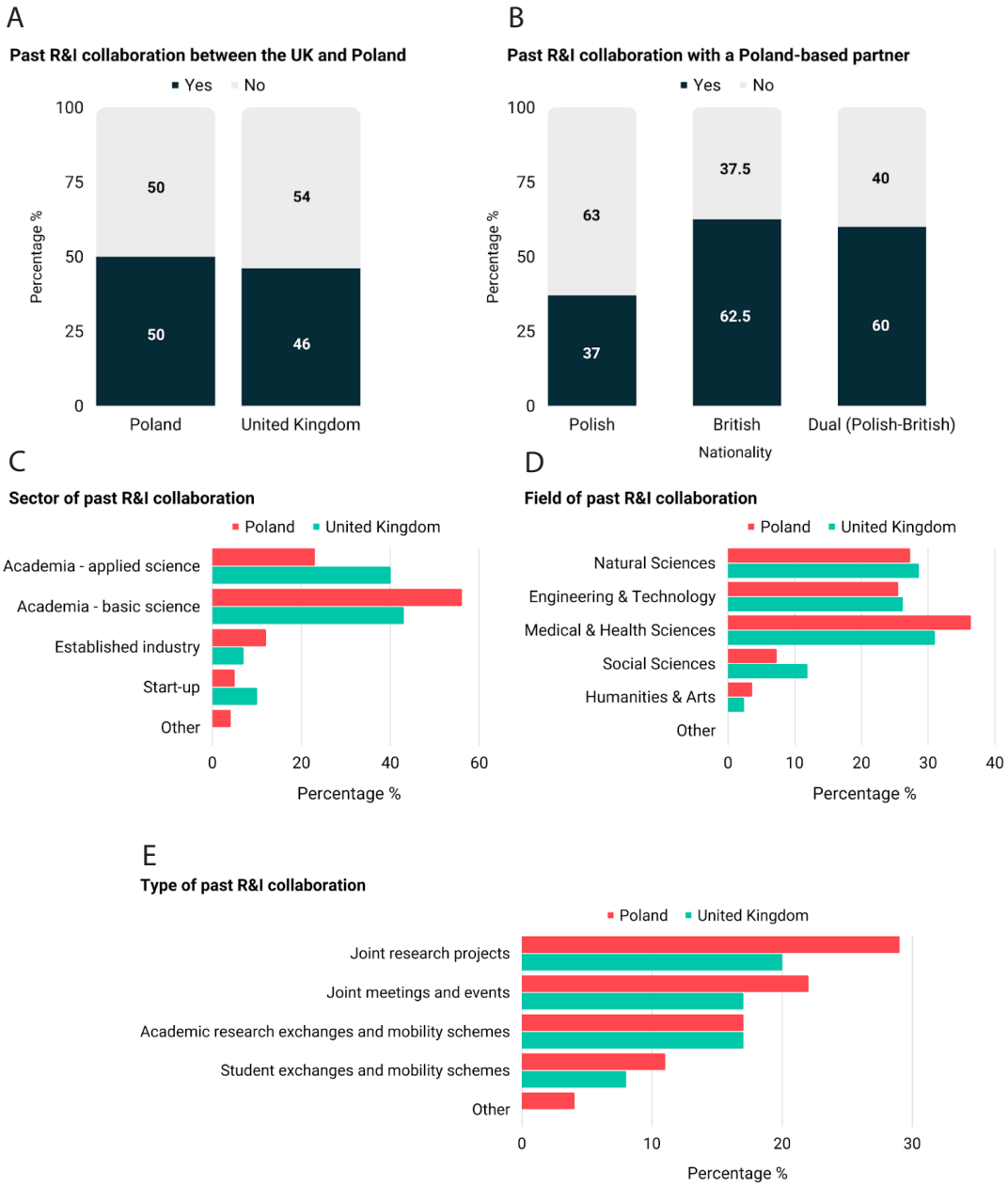


Figure 3.4. Basic information about past Polish-British collaborative projects of survey respondents. (A) Percentage of Polish- and British-based respondents having engaged in at least one Polish-British collaborative project in the past. (B) Difference in past experience in collaborative projects in UK-based respondents based on their nationality. C) Main sector of past collaborative projects. (D) Main field of research and innovation of past collaborative projects. (E) Type of past research and innovation collaboration.

Our survey respondents indicated that EU programs were the main source of funding for past Polish-British collaborative projects (26.2% and 23.7%% for Poland- and UK-based respondents, respectively; Figure 3.5A). For UK-based respondents, this was followed closely by Polish funding agencies (18.6%), and the UK government (18.6%). Meanwhile, for PL-based respondents, the most common sources of funding besides EU funding were Polish funding agencies (15.4%) and "other sources" (15.4%), which included private funding, mixed existing funding, Polish university funding,private non-UK/non-EU funding or no funding at all. Other commonly reported sources of funding for PL-based respondents were the Polish government (12.3%) and UK funding agencies (12.3%). Private investment funds were in the minority of funding sources for projects in both countries (between 4.6% to 8.5%). Interestingly, for UK-based respondents, the key drive for EU funding for past projects was from British nationals (30%) followed by UK funding agencies (20%), while Polish nationals had been mainly funded by Polish funding agencies (28.6%) followed by EU funding (23.8%). In contrast, dual nationals were mainly funded by the UK government (22.2%) followed by EU funding (16.7%) and UK private investment funds (16.7%) (Figure 5B).

To establish what motivated survey participants to take part in joint Polish-British projects, we asked for the main reasons for initiating or joining past collaborations. Both PL- and UK-based respondents cited the partners' high expertise in the relevant research field as the top reason for past collaboration (Figure 3.5C). This was particularly pronounced in the case of UK-based partners (40% of respondents as compared to 32.2% of PL-based respondents). This motivating factor was followed closely by the presence of well-established research links with the partner involved in the joint project. Once again, this percentage was markedly higher in the case of UK-based (28%) as compared to PL-based (22.2%) respondents. When looking closer at the UK-based respondents, the key groups highlighting high expertise in the relevant research fields of PL-based partners were British nationals (47.4%) and dual nationals (38.5%). Polish nationals based in the UK selected well-established research links as a key reason for past R&I collaboration (36.8%).

A significant proportion of Poland-based respondents (14.4%) cited access to high-quality research infrastructure as the reason for establishing R&I collaborations with UK partners; this was in stark contrast to only 4% of UK-based respondents citing this reason for collaboration with PL-based partners. Access to funding was a comparably frequent reason for collaboration for both PL- and UK-based respondents (around 10% to 12%), while an R&I-friendly environment (10%) and science-industry-commercialisation initiatives (6.7%) were cited more often by PL-based respondents. Among other reasons for collaboration, UK-based survey participants listed: encountering collaborative partners at a scientific meeting, familiarity with partner group leaders from time spent in Poland, and facilitation of Poland-related research through collaboration with a local researcher. Meanwhile, Poland-based respondents listed previous successful cooperation and direct business cooperation with British companies as further reasons for past collaborations.

Given that respondents indicated academic collaborations as the main sector of joint Polish-British projects, it was unsurprising that the main outcomes of these projects were research publications, preliminary data for future grants, and conference publications (Figure 3.5D). Together, these three factors made up 74% (Poland-based respondents) and 82% (UK-based respondents) of survey responses. New technologies, services, and patents were more often cited by PL-based partners than UK-based ones (19% versus 8% of respondents in total for the three cooperation outcomes). Other collaboration outcomes mentioned by the UK side were a co-written book, benefits to Polish institutes, and contributions to a new or amended EU-level regulation. Finally, other outcomes mentioned by Poland-based respondents included technology evaluation, contacts, experience, and networking.

As a final assessment of past collaborations, survey participants who had answered that they had never participated in a Polish-British collaboration were asked to specify what had stopped them from such collaborations in the past (Figure 3.5E). The key obstacle for all respondents in initiating R&I collaboration with PL or UK partners in the past was the lack of established connections (33.8% of PL-based respondents and 36.2% for UK-based respondents), followed by not being aware of any specific bilateral collaboration funding (26.3% and 27.5%, respectively) and not knowing how to look for partners (20% and 17.4%, respectively).

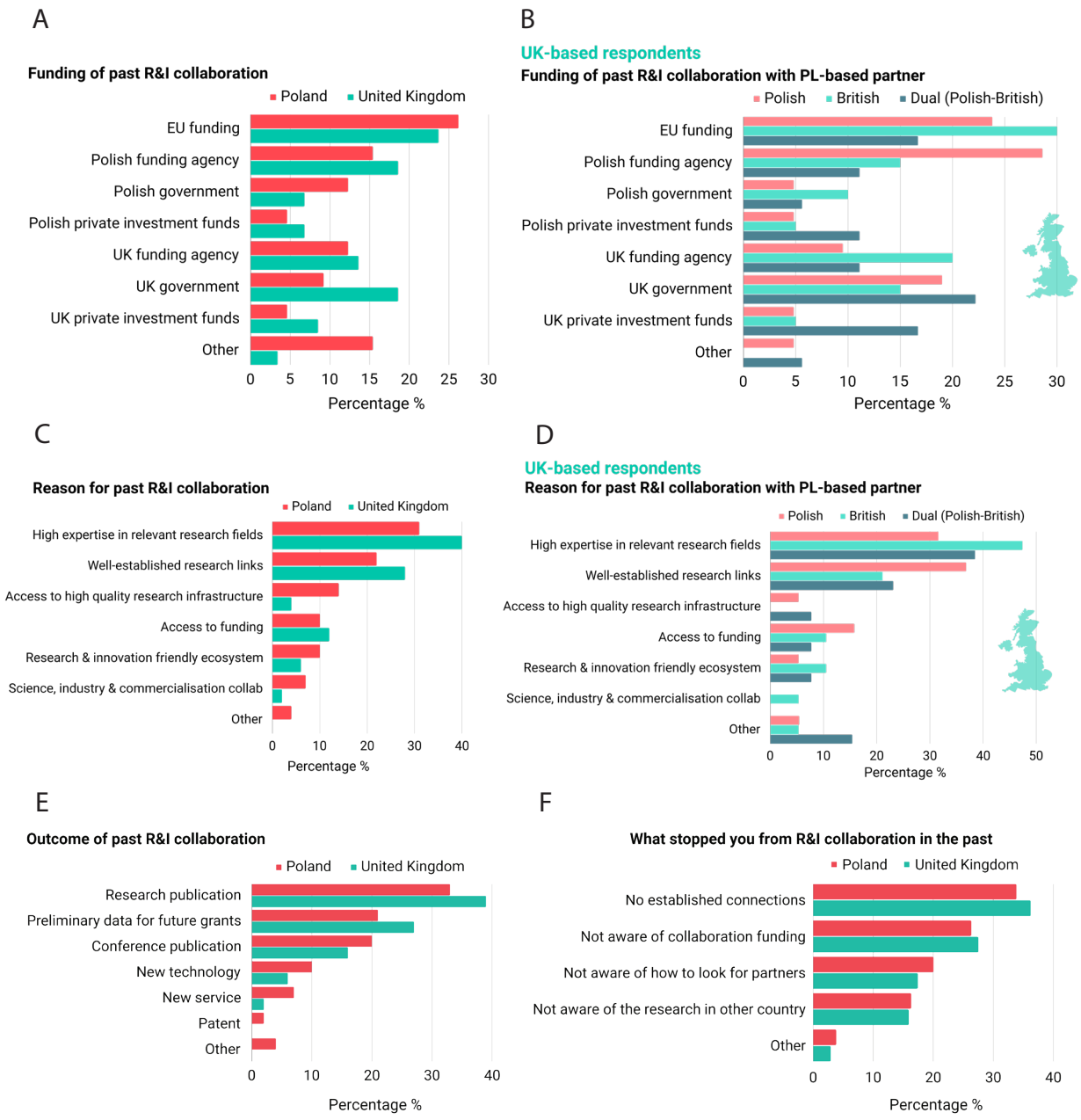


Figure 3.5. Details of past Polish-British collaborative projects of survey respondents. (A) Main funding sources. (B) Main funding sources of UK-based respondents based on their nationality. (C) Reasons for R&I collaborations. (D) Reasons for R&I collaborations of UK-based respondents based on their nationality. (E) Outcomes of collaborative projects. (F) Reasons for lack of collaboration in the past.

Current UK-PL Research and Innovation collaborations

In the next stage of our report, we investigated the status of current or ongoing R&I collaborations between partners based in Poland and the United Kingdom. Only about 25% of respondents from both countries indicated that they were currently collaborating on a joint project (Figure 3.6A). Most of the ongoing R&I collaborations were in the academic sector, with most respondents engaging in basic science - 52% for Poland-based and 39% for UK-based respondents - or applied science - roughly 30% for both Polish- and UK-based respondents (Figure 3.6B). Additionally, 17% of R&I collaborations of UK-based respondents were industry-based and 13% were start-up collaborations. For Poland-based respondents, 13% and 10% of collaborations were in these sectors, respectively. The same three fields were reported as most common in terms of R&I collaborations for both countries, albeit in different orders (Figure 3.6C). Poland-based respondents mainly engaged in natural science-related collaborations (37%), medical and health sciences (22.2%) and engineering and technology (25.9%) and UK-based respondents reported most collaborations in the field of medical and health sciences (45.8%), followed by natural sciences (25%) and engineering and technology (20.8%). Rather surprisingly, no current collaborations were reported in the humanities and arts, and the percentages of collaborations in the social sciences were very low: only around 11.1% for PL-based respondents and 8.3% for UK-based.

The main type of ongoing R&I collaborations were joint research projects for both sides (44% for PL-based and 47% for UK-based; Figure 3.6D). Other initiatives included joint meetings and events (26% for PL-based and 20% for UK-based) and research exchanges and mobility schemes (18% for PL-based and 20% for UK-based). Student exchanges were selected in 10% of cases for PL-based and 7% of cases for UK-based, with other options indicating collaborations as clients or joint tender for an EU institution (for UK-based) and having an academic principal investigator based in the UK with a team in Poland (for PL-based).

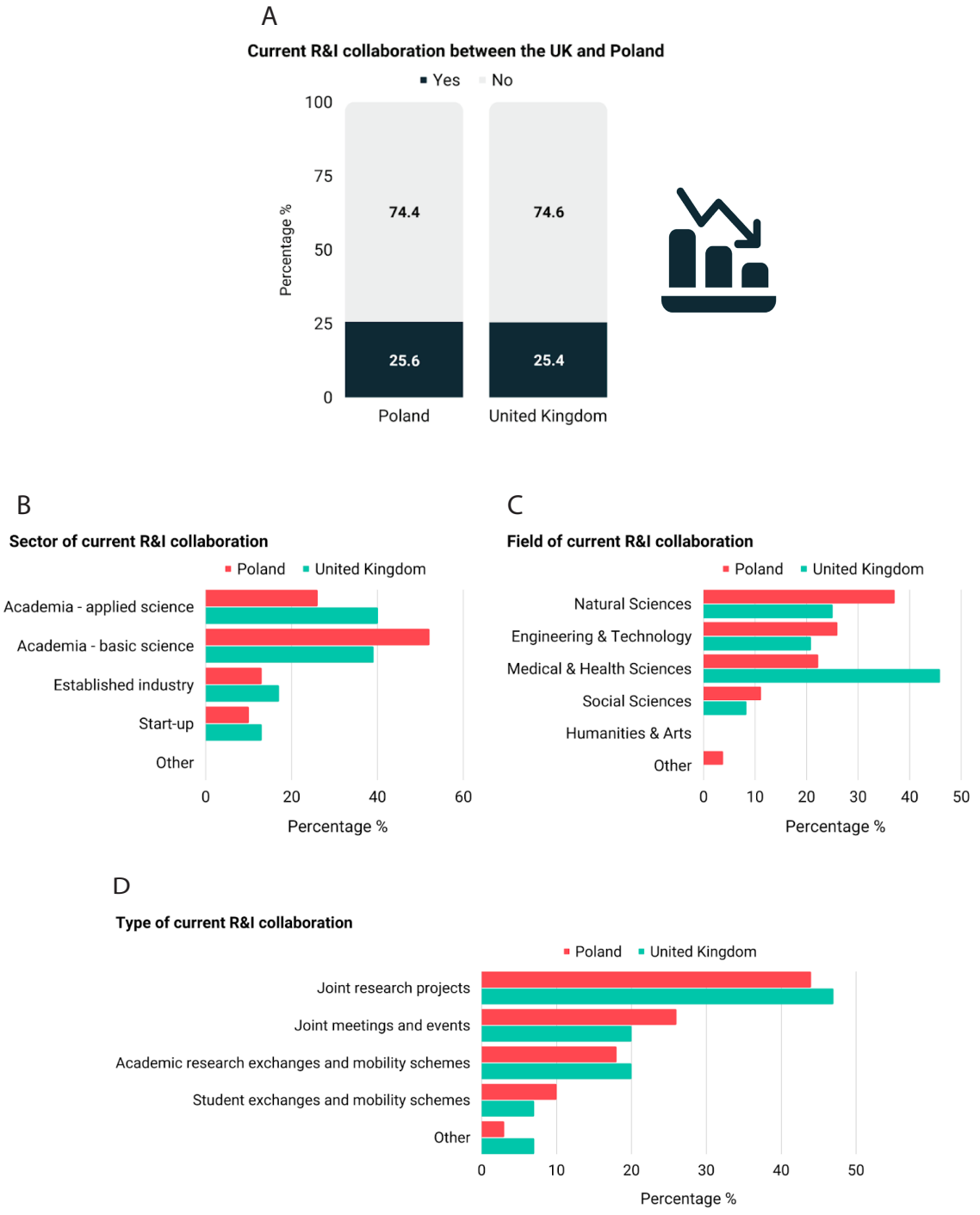


Figure 3.6. Basic information about current Polish-British collaborative projects of survey respondents. (A) Percentage of Polish- and British-based respondents having a current Polish-British collaborative project. (B) Main sector of current collaborative projects. (C) Main field of research and innovation of current collaborative projects. (D) Type of current research and innovation collaboration.

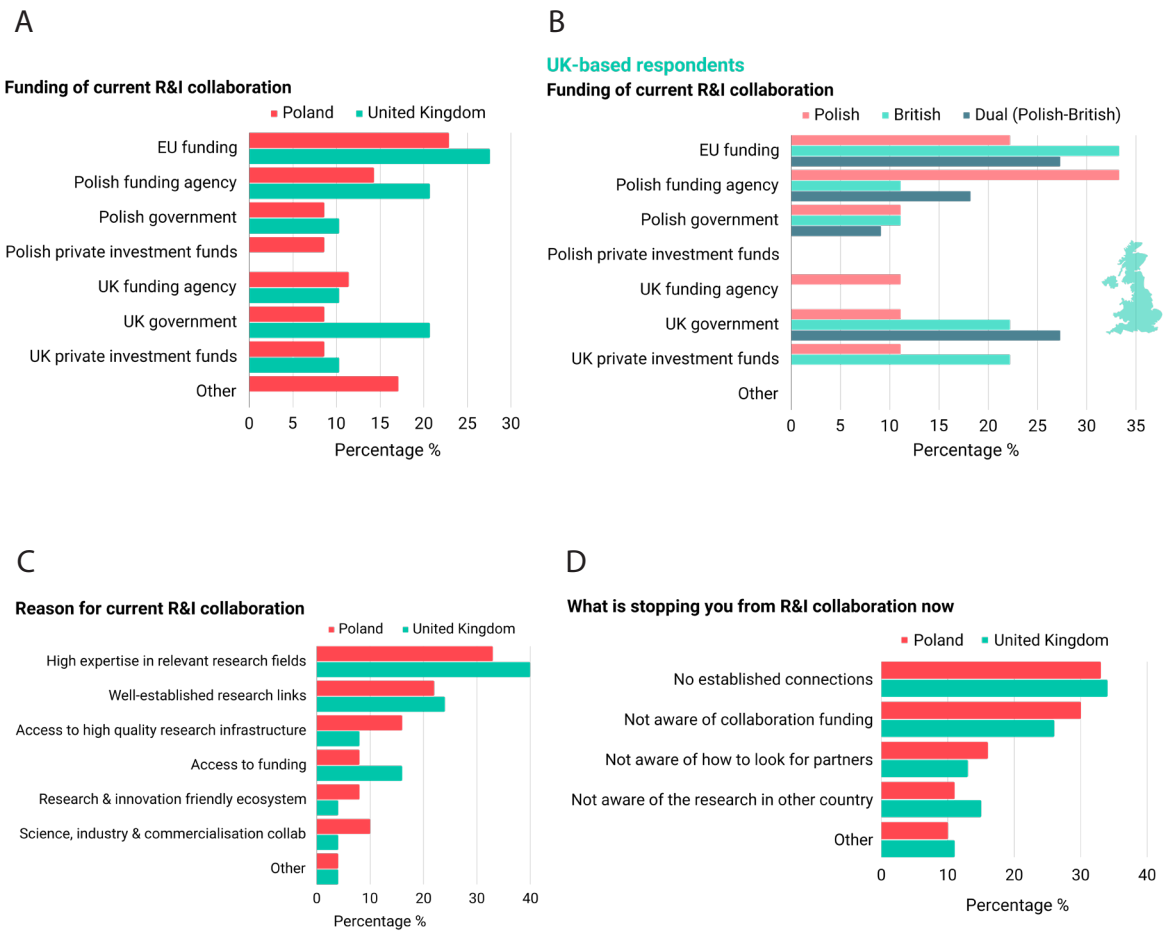


Figure 3.7. Details of current Polish-British collaborative projects of survey respondents. (A) Main funding sources. (B) Main funding sources of UK-based respondents based on their nationality. (C) Reasons for R&I collaborations. D) Reasons for lack of current collaboration.

The current R&I collaborations between partners based in Poland and in the United Kingdom are mainly funded through EU funding schemes (27.6% for UK-based, 22.9% for PL-based respondents; Figure 3.7A). The second most common source of funding for UK-based respondents was jointly indicated as Polish funding agencies and the UK government (20.7% in both cases). When looking closer at the UK-based respondents, the EU funding as the key drive for current R&I projects was selected by British nationals (33.3%), while Polish nationals were mainly funded by the Polish funding agency (33.3%). Dual nationals selected both EU funding and UK government funding as top funding sources of current collaborations (both 27.3%) (Figure 3.7B).

For PL-based respondents, the option "other" was the second most common answer (17.1%), followed closely by Polish funding agencies (14.3%). Among "other" funding sources, PL-based respondents listed private funds, university funds, self-funding, mixed existing funding, or no funding at all.

Interestingly, both PL- and UK-based respondents indicated some level of UK private investment funds in their activities (8.6% for PL-based and 10.3% for UK-based), while Polish private investment funds were only indicated by PL-based respondents (8.6%).

The main reason for current R&I collaborations was high expertise in relevant research fields for respondents from both countries (33% for PL-based and 40% for UK-based; Figure 3.7C). The second most common answer was having well-established research links (22% and 24%, respectively). As a third option, PL-based respondents selected access to high-quality research infrastructure (16%), while UK-based respondents highlighted access to funding (16%). This requirement for access to funding respondents has increased when compared to responses about past collaborations (12%) and could be caused by more complicated and limited access to EU funding by UK-based respondents following Brexit. These changes have been consistently identified by respondents when asked about barriers to establishing such R&I collaboration between Poland and the United Kingdom. For the respondents indicating that they did not have any ongoing research & innovation project between Poland and the United Kingdom (Figure 3.7D), the most common reason was a lack of awareness of collaborative funding opportunities (over 30% of both Poland- and UK-based respondents), followed by a lack of established connections with groups or institutions in the partner country (26-30% of respondents) and not knowing how to look for a collaborative partner (16% of Poland-based respondents) or not being aware of research in the other country (15% of UK-based respondents). Several "other" reasons were indicated, for example, not having enough time for UK-PL collaboration, cultural differences, and not having the right opportunity to do so (for UK-based respondents), university restrictions, difficulty in obtaining a visa for short research stays, lack of success from previous collaborations, or lack of equality between partners (for Poland-based respondents).

Future UK-PL Research and Innovation collaborations

In the final section of the survey, we asked respondents about their views on the future of Polish-British R&I collaborations. The UK was considered an attractive collaboration partner by 78% of Poland-based respondents, while Poland was considered an attractive partner by a relatively smaller but still sizable percentage (68%) of UK-based respondents (Figure 3.8A).

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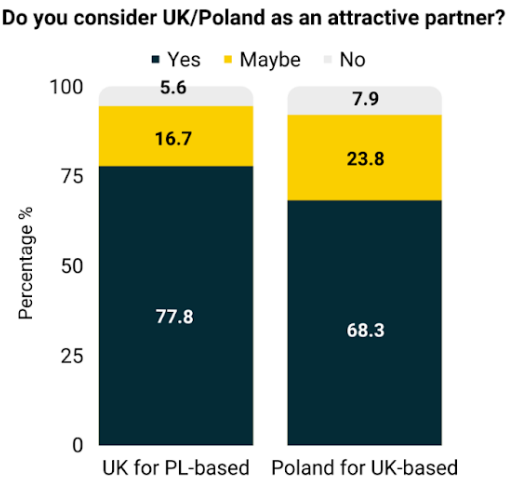

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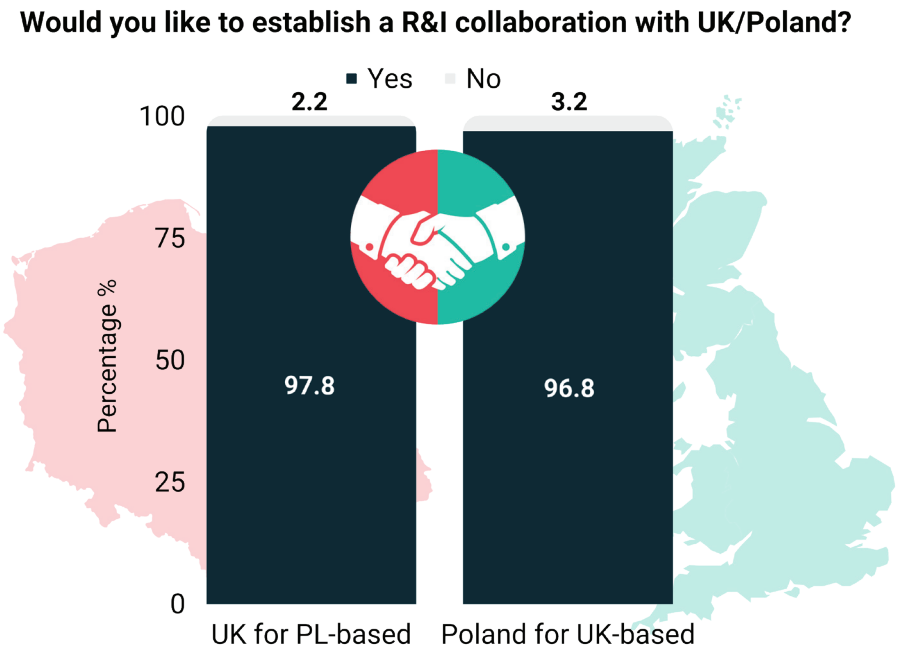


Figure 3.8. The attractiveness for future R&I collaborations between researchers in Poland and the United Kingdom (A) Attractive partner. (B) Poland as an attractive partner for UK-based respondents based on their nationality. (C) Establishing new collaborations.

The percentage of respondents answering that they did not consider the other country as an attractive partner was almost equal for Poland- and UK-based respondents, at around 6 to 8%. Surprisingly, when looking closer at the UK-based respondents 93.75% of British nationals consider Poland as an attractive country, while only 53.33% of Polish nationals have the same opinion. Nevertheless, most respondents would like to establish an R&I collaboration with partners from the other country (Figure 3.8B): 97.8% of Poland-based respondents and 96.8% of UK-based respondents indicated that they would like to establish an R&I collaboration.

When asked about the reasons for which they considered the other country to be an attractive partner, respondents emphasised the quality of local science and research, the expertise of local researchers, and the availability of funding or infrastructure (Table 3.1). Several of the UK-based respondents listed Poland as their home country, indicating that they had personal links to the country, which motivated them to seek Polish collaborators. Other reasons for establishing R&I collaborations with Poland were access to EU funding or extending EU networks.

For Poland-based respondents, the key motivations in establishing future R&I collaboration with UK partners were the scientific potential, access to a valuable market, prestige, and the high level of experience of UK partners, with UK universities being pioneers in many fields. On the other hand, the respondents from Poland for whom the UK was not an attractive partner listed Brexit and the fact that the UK is outside of the EU market as the main reason, while respondents from the UK for whom Poland was not an attractive partner also listed Brexit-related challenges (e.g., increased bureaucracy) and previous bad experience with Polish companies/academia or low level of research in specific research fields.

United Kingdom for Poland-based respondents	Poland for UK-based respondents
Prestigious research centres and educational resources	High academic standards
Prestigious funding	Access to EU funding
Great researchers	Great scientists
Research culture	Good culture of work
High quality science and novel research	Great energy of young people
High mobility of researchers	High number of Polish researchers in the UK
High tech environment	Robust biotech in Poland
More investors for technology	Active startup scene
Top position in the world of science	High expertise
Mutual interests and good relationship between Poland and the UK	Aligned priorities and values
Great infrastructure and advanced medical technology	Lower cost of research infrastructure
Great market size	Vibrant manufacturing sector
Strength in certain research fields, e.g. naval architecture, shipbuilding, offshore engineering, marine engineering	Strength in certain research fields, e.g. microelectronics or agri-biotech
Geographically close and English language	Geographical location

Table 3.1. Key reasons for the United Kingdom or Poland being an attractive research & innovation partner

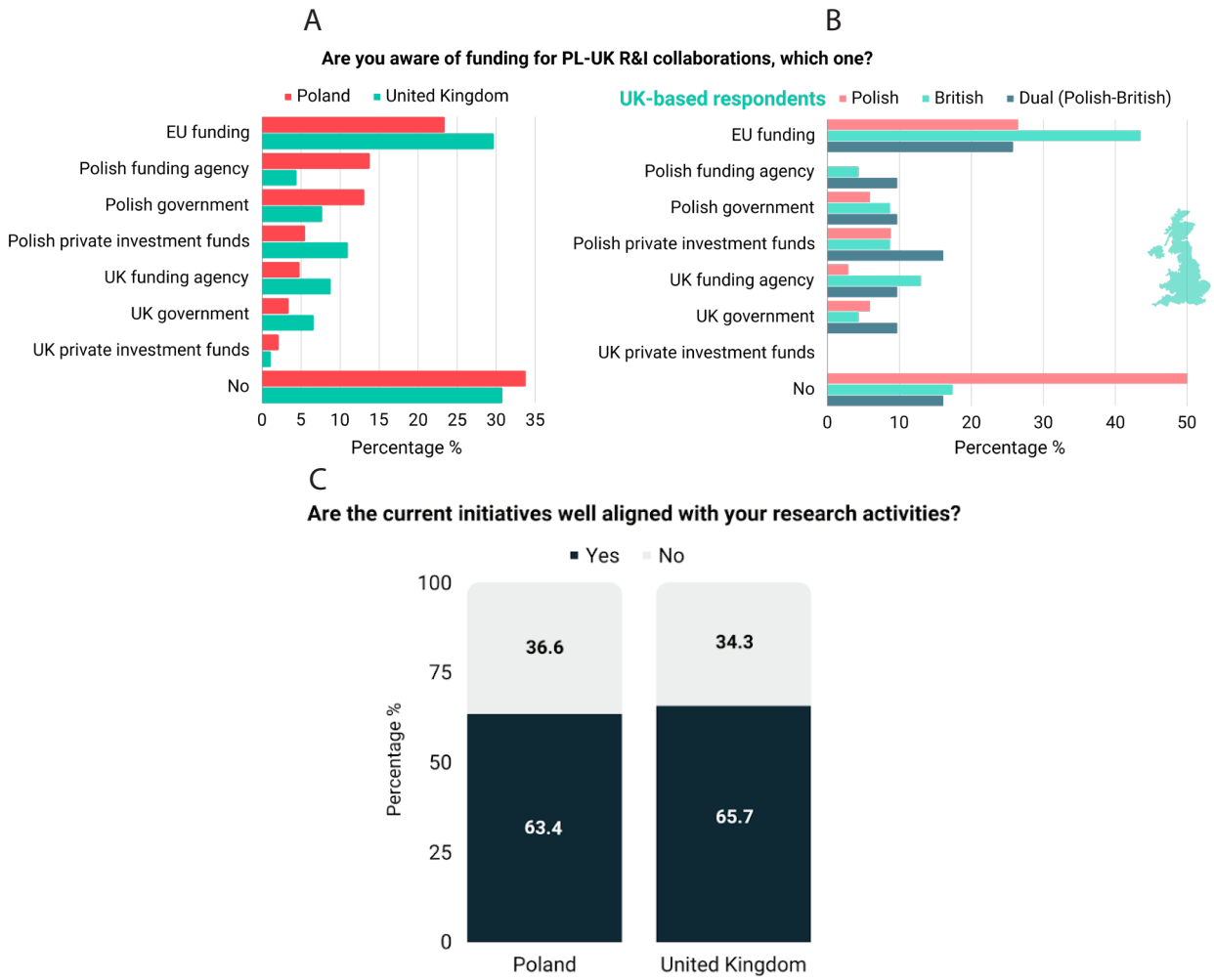


Figure 3.9. Establishing future R&I collaborations between researchers in Poland and the United Kingdom (A) Funding awareness. (B) Funding awareness of UK-based respondents based on their nationality. (C) Alignment of existing initiatives.

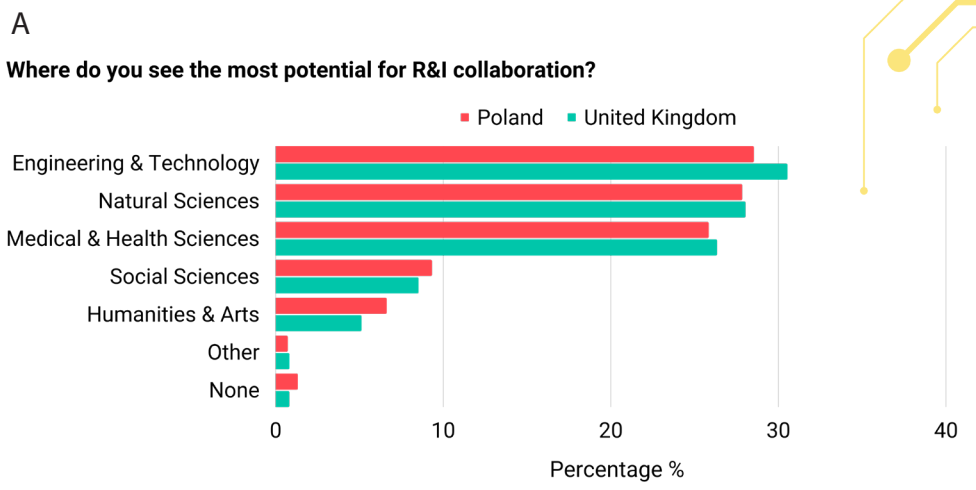
To additionally explore specific obstacles for future UK-PL collaborations, we asked respondents about their awareness of the availability and scope of relevant funding opportunities. A substantial percentage of respondents (around 30%) answered that they were not aware of funding to support R&I collaboration between Poland and the UK (Figure 3.9A). Those who were aware of funding knew primarily about EU funding opportunities (23.4% of Poland-based and 29.7% of UK-based respondents). For UK-based respondents, most British nationals were aware of EU funding (43.5%), while half of the Polish nationals indicated they were not aware of any funding at all (Figure 3.9B). Comparatively much smaller percentages of respondents knew about the existence of UK-PL-specific funding opportunities offered by Polish or UK governments or funding agencies. These results were directly reflected in the fact that nearly one-third of the respondents from both countries stated that the current initiatives are not well aligned with their research activities (Figure 3.9C). The main reasons for this lack of alignment, as indicated by UK-based respondents, were: limited availability of funding in the UK, a lack of research mobility for senior scientists, a lack of funding based on highly specialised fields, and a lack of large grants for UK-PL projects.

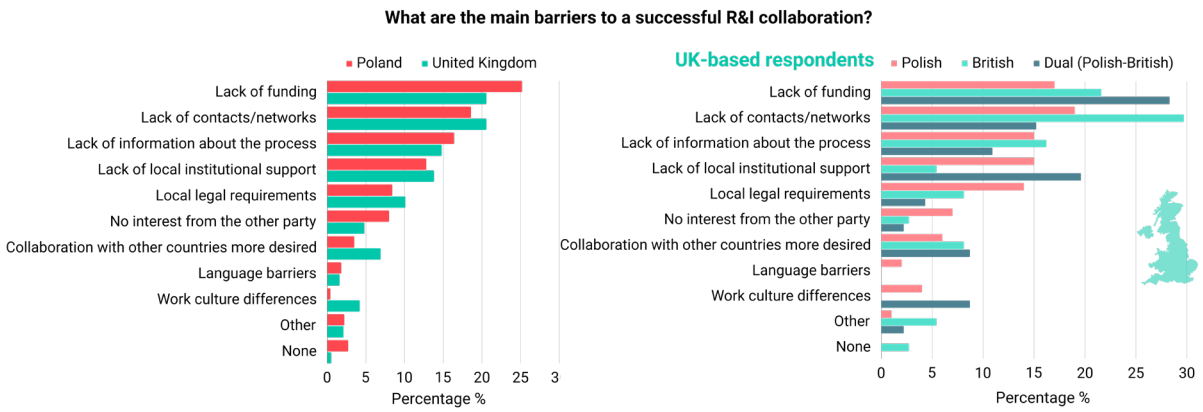
For the Polish side, the reasons why the current initiatives are not aligned with research activities were mostly related to bureaucratic and funding considerations, with To further elucidate respondents' views on future perspectives of UK-PL R&I collaboration, we asked them to identify the fields in which they saw the greatest potential for joint projects (Figure 3.10A).

Respondents based in both Poland and the United Kingdom indicated engineering and technology as the field with the highest potential for R&I collaboration (around 30% of respondents). This was closely followed by the natural sciences (around 28%) and medical and health sciences (around 26%). A few suggestions included consultancy, knowledge exchange, and public engagement from UK-based respondents and relocating UK businesses with exports to the EU from PL-based respondents.

We asked respondents to identify the key barriers that in their view might impede future UK-PL R&I collaborations (Figure 3.10B). The most selected answer for Poland-based respondents was a lack of funding (more than 25% of respondents), while for UK-based respondents, lack of funding and lack of contacts or networks were both top reasons at around 20% of responses. Other common answers for PL-based respondents were: a lack of contacts/networks, a lack of information about the process of establishing such a collaboration, and a lack of local institutional support. The pattern of responses was quite similar for UK-based respondents. UK-based respondents who selected "other" as their response listed additional reasons such as: a lack of interest from Polish researchers and academic institutions in hiring foreign staff or recruiting Polish researchers working abroad, difficulties in bringing researchers together, limited, and constrained funding, the quality of research in Poland, and a lack of capacity or time for such collaborations. Poland-based respondents highlighted the fact of the UK being outside of the EU as a key barrier, as well as poor coordination of international projects and difficulties in building research budgets due to the high costs of partners from the UK. Moreover, when studying the UK-based respondents, British and Polish nationals highlighted the lack of contacts/network as a key barrier (29.7% and 19%, respectively), while dual nationals the lack of funding (28.3%) followed by lack of institutional support (19.6%) (Figure 3.10C).

The final question that we asked survey participants pertained to factors that in their opinion could help in initiating future R&I collaborations between Poland and the United Kingdom (Figure 3.10D). The most frequent solution selected by respondents from both countries was targeted funding (around 16%), followed by in-person networking events (around 12%). The pattern of responses of Poland- and UK-based respondents diverged slightly for the remaining choice of solutions. High up as a solution for Poland-based respondents was access to an online platform for identifying collaborations, such as Polonium Network (10.4% of respondents). Meanwhile, the next most popular responses from UK-based respondents were increasing awareness of existing funding mechanisms and availability of funds for international consortia (both 9.6%). "Other" factors listed by respondents included the return of the UK to the EU for PL-based respondents, an institutional drive towards improvement of the quality of new collaborations, and a higher level of funding without barriers for UK-based respondents. When looking at UK-based respondents according to their nationality, all nationals list targeted funding as key help in initiating R&I collaboration with PL-based partners. However, the second highlighted support in such initiative for British and dual nationals was the availability of funds for international consortia, while for Polish nationals in-person networking events. (Figure 3.10E).





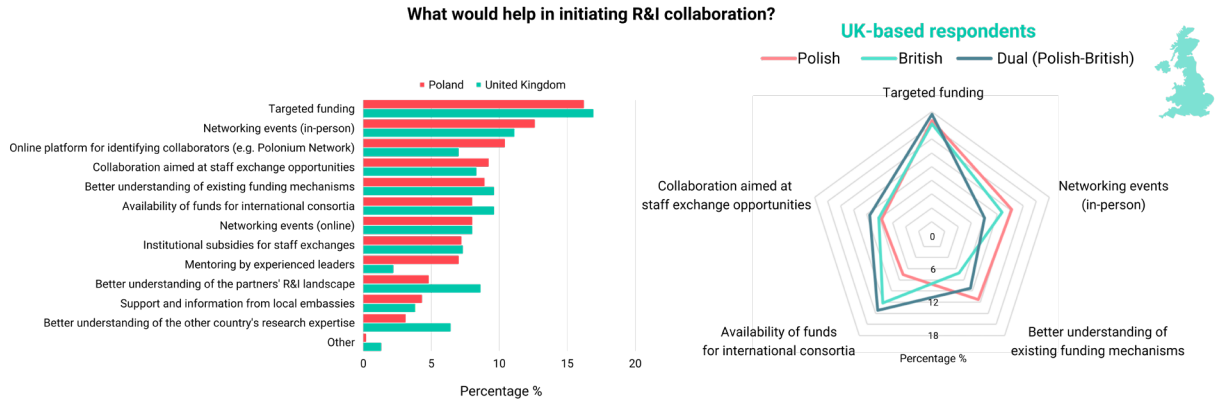


Figure 3.10. Potential and barriers for future R&I collaborations between researchers in Poland and the United Kingdom (A) Potential for R&I collaborations. (B) Barriers against successful collaborations. C) Barriers against successful collaborations for UK-based respondents based on their nationality. (D) Help needed to initiate R&I collaboration. (E) Top 5 ways of helping to initiate R&I collaboration for UK-based respondents based on their nationality.

Stakeholders perspective on R&I collaborations

Over the years, Polish and British stakeholders have been supporting international research and collaboration through varied activities and programmes. The Polish Ministry of Education and Science (MEiN) highlighted its prioritisation of EU countries for collaborative programmes, together with countries neighbouring Poland and the US. The UK is undoubtedly identified as a country with great potential, with multiple partnerships between Polish and UK-based institutions already in place. Establishing collaborations between EU countries is supported through EU funding, similarly to the majority of UK-PL collaborations as reported by our survey. Currently, open initiatives include the Eureka collaborative research and development grant[90] and ERA-NET (e.g. ERA-NET ICRAD[91], QuantERA[92]), and since the UK is now officially once again part of Horizon Europe, it is of most importance to once again encourage the collaborations between the countries, and apply for joint funding.

The British Department for Science, Innovation and Technology (DSIT) highlighted the importance of international collaborations, and the DSIT's role in providing the right conditions for stakeholders on both sides to engage with each other, similarly to the UK Research and Innovation (UKRI). DSIT wants to maintain the UK's role as an attractive destination for international talent and to maintain the high quality of research infrastructure. They have also identified that for some sectors, partnerships are essential due to operating costs. For example, in fields related to space or nuclear fusion, expensive infrastructure is required, making these key international collaborative fields. The UKRI confirmed that the UK benefits hugely from international collaborations across the board. However, they indicated that collaboration with Poland, while important and increasingly more popular, has not traditionally been a priority, as Poland has high expertise in specific fields, but not across a broad spectrum of research fields or sectors.

Polish and British governmental organisations highlighted that the key to identifying priorities in terms of countries for future collaboration is the needs and priorities of their researchers and businesses. If, at a given time, researchers/businesses from their country have multiple ongoing collaborations in a specific field with another country, this is seen as an opportunity for the government to initiate discussions. Specifically, the UKRI has a bottom-up approach, with a lot of freedom in dispersing funds for research, driven by the research community and the specific collaborations that researchers want to establish. Some of the key funds, e.g., from MRC, have an open co-investigator policy, which means that they can fund co-investigator positions from anywhere in the world for a given project.

[90] Eureka https://www.eurekanetwork.org accessed 13th September 2023
[91] Gov.pl ICRAD https://www.gov.pl/web/ncbr/iii-konkurs-programu-era-net-icrad-international-coordination-of-research-on-infectious-animal-diseases accessed 13th September 2023
[92] QuantEra Call 2023 https://quantera.eu/call-2023-announcement/ accessed 13th September 2023

4. FINAL CONCLUSIONS

In this report, we set out to investigate the current state and future perspectives of the UK-Polish research and innovation relationship. To this end, we created an online survey that included questions regarding past, present, and future R&I collaborations between researchers, academics, and professionals based in Poland and the United Kingdom. We were able to collect over 150 responses from respondents based in Poland and the UK. Additionally, we conducted online interviews with key stakeholders, six of them British and eight of them Polish.

The survey and interview responses we collected constitute a valuable resource, based on first-hand experience (of survey respondents) and direct access to policy-making (of key stakeholders), for a complete assessment of the opportunities and challenges in establishing, maintaining, and fostering R&I collaborations between Poland and the UK.

Key findings

Our report shows that both Polish and British representatives of the research and innovation community have a very high interest in strengthening bilateral collaboration. About half of Poland-based and half of UK-based respondents had already participated in a joint project at the time of their survey participation, and an overwhelming majority (around 98%) of respondents was interested in establishing such a collaboration in the future. Our initial desk research showed that the majority of collaborative projects that resulted in joined publications are from science & technology, and life sciences & biomedicine. Interestingly, the majority of our survey respondents had and have ongoing collaborative projects in engineering & technology, natural sciences, and health & medical sciences.

The enduring rationale behind establishing PL-UK collaborations has remained unchanged over the years, with high expertise in the relevant research field of the partner and well-established research links reported as the most common reasons among our survey respondents. Additionally, for the UK side, a driving factor for collaboration with Poland is often access to funding, grants, and international consortia. Moreover, UK-based collaborators highlight that what they value in the Polish collaborators a high level of expertise. Interestingly, while nearly 94% of British nationals consider Poland an attractive country for R&I collaboration, only 53.33% of Polish nationals have the same opinion. This reason behind scepticism of UK-based Polish nationals concerning Poland's attractiveness should be investigated further, whether it is based on prior experience or personal opinion. For Poland-based respondents access to high-quality research infrastructure is important when considering R&I collaboration with a UK-based partner.

The most significant obstacles in establishing collaboration have evolved over time. In the past, collaborations were mostly hindered by a lack of awareness of research in the other country, knowledge on how to look for partners (UK-based survey respondents), and a lack of established connections or awareness of collaboration funding (Poland-based respondents). Interestingly, the key obstacles to establishing collaborations now are the same for Poland- and UK-based respondents.

They include lack of awareness regarding funding and no established connections. Additionally, what makes the UK not an attractive partner for Poland-based respondents is Brexit and barriers related to the bureaucracy as well as uncertain status in the EU Programs, especially Horizon Europe. From the Poland-based researchers, there are a lot of bureaucratic obstacles related to work in the UK, like visas, with limited access to vital information on how to establish international collaboration. Nevertheless, since the survey took place, on 1st January 2024 the UK rejoined the Horizon programme[3], which should yet again make the UK easier to access for EU nationals, including Poland, and promote inter-European collaborations and partnerships. The same pertains to the Copernicus programme, which the UK will join from the 1st of January 2024[93]. The UK has decided not to rejoin the Euratom Research & Training Programme, which covers nuclear research and innovation. Instead, the UK government has announced the allocation of up to £650 million for UK alternatives as part of the UK Fusion Strategy[94]. For UK-based researchers, the key obstacle in establishing the R&I collaboration with Poland-based partners is the limited understanding of the structure of the Polish research and innovation ecosystem.

Study conclusions

We received survey responses from a group of 154 respondents, representing academic research, technology translation, start-ups, and industry. Half of the survey participants had a research and innovation collaboration between Poland and the United Kingdom in the past, with 20% of the participants having an ongoing collaboration. Additionally, we performed interviews with 7 UK and 8 PL-based stakeholders, seeking their insights on the PL-UK collaboration and gathering valuable recommendations for its enhancement.

Both the UK and PL sides expressed openness to collaborations, largely motivated by an appreciation of the partner's expertise in the relevant research fields and the existence of well-established research links. Additionally, access to funding plays an important role for the UK side, whereas access to high-quality research infrastructure is important for the Polish side.

The main reason for a lack of ongoing collaborations was a lack of awareness of collaborative funding opportunities. The second obstacle to collaboration was the lack of established connections with groups or institutions in the partner country and not knowing how to look for a collaborative partner (for Poland-based respondents) or not being aware of research in the other country (for UK-based respondents).

Our findings highlight the fact that bottom-up initiatives are currently driving business and science collaborations, with room to grow in terms of top-down collaboration initiation. While the UK is considered by the Polish side as a country with an excellent scientific environment and a large Polish diaspora, Poland is seen as an expert in selected disciplines, but not in a broad spectrum of fields.

[93] Gov.uk Guidance UK involvement in the EU Space Programme - GOV.UK (www.gov.uk) accessed 18th September 2023
[94] Gov.uk News story 07/09/2023 Government announces up to £650 million for UK alternatives to Euratom R&T - GOV.UK (www.gov.uk) accessed 18th September 2023

Recommendations

Funding

- Increase promotion of the UK's association to Horizon Europe and available EU funding opportunities, by both governments, Embassies, and UK and Polish research and innovation stakeholders.
- Support UK-Polish joint projects under Horizon Europe in the areas of mutual interest and to the benefit of both countries, by Polish and UK National Contact Points, UK KTN (Knowledge Transfer Network), and Polish Industry Contact Points.
- Increase the visibility of the other existing bilateral and multilateral funding opportunities and calls for bids offered by UK and Polish research and innovation funding agencies, by the agencies themselves, both Embassies, Polonium Foundation, and other R&I stakeholders. In the long term, consider setting up a bilateral research funding scheme by the respective UK and Polish research and innovation funding agencies, in the areas of mutual interest and to the benefit of both countries.

Connecting researchers

- Promoting the formation of new connections between researchers through scientist databases, such as Polonium Network; by organising and providing funding for bilateral scientific events, conferences, study visits, and international exchanges.
- Taking advantage of the scientific diaspora, e.g. Polish scientists based in the UK, to create links between Polish and British institutions, and promote collaborative projects.
- Increase awareness of Poland's research strengths and capabilities internationally. Polish institutions and funding bodies could provide up-to-date information on their key research domains, publications, and patents/technologies, on their website and through newsletters. The information should be available in English. One of the ideas could be to continue the project "From Poland with Science" – showcasing examples of Polish research excellence in the UK, and similar projects with shared goals.
- Identifying collaboration trends across different research disciplines to support bottom-up approach in cultivating bilateral collaborations, e.g. through statistical data obtained by National Research Agencies.
- To promote bilateral research collaborations through top-down initiatives such as joint Polish-British conferences and scientific events, bilateral researcher mobility, and the funding of short- to long-term research fellowships. One such initiative worth continuing is the Polish-British Science Forum organised by UK and Polish Ministries and Embassies, as part of the UK-Polish intergovernmental consultation process.

Research infrastructure

- UK to continue to support Poland in increasing its scientific potential by sharing expertise and experience via the established UK-Polish Research Culture Dialogue led by the two Ministries and Embassies. Provide training and support to project and technology transfer offices at Polish research institutions to promote technology transfer and patents. Support skills and knowledge exchange between key core scientific staff to increase the potential of Polish research infrastructure and research ecosystem, and to enhance access to skilled staff at British research infrastructure.
- Promote Polish Centres of Excellence, such as NOMATEN Center for Nuclear Research[95], Dioscuri Centers of Excellence[96], and the newly opened Centre of Excellence in Artificial Intelligence (CE AI)[97], to make them an attractive R&I partner for UK-based researchers.
- Establish shared access to top scientific literature and support in open-access publications.

Business entrepreneurship

- Providing venture scientist training programme in Poland to promote creation of spin-outs and start-ups, e.g. ConceptionX in the UK[98].
- Establishing clear guidance on intellectual property (IP) protection during collaboration on innovative project to protect researchers from all organisations involved.

[95] Horizon 2020 Fact Sheet https://cordis.europa.eu/project/id/857470 accessed 8th October 2023
[96] Max Planck Dioscuri Programme https://www.mpg.de/dioscuri accessed 8th October 2023
[97] Centre of Excellence in Artificial Intelligence https://ceai.agh.edu.pl/ accessed 9th January 2024
[98] ConceptionX https://www.conceptionx.org/ accessed 9th January 2024

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