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Higher education and research: multiple negative effects and no new opportunities after Brexit

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ABSTRACT

Brexit has weakened collaboration between UK higher education institutions and their EU counterparts, with negative implications for UK resources and capacity, without leading to new global strategies and opportunities. In 2020 the UK government withdrew from the Erasmus student mobility scheme and introduced the Turing scheme. While Erasmus had supported both outward UK student mobility and inward movement from Europe, Turing supports only outward mobility. In 2021–2022 the cessation of UK tuition fee arrangements for EU citizens entering UK degrees led to a sharp drop in numbers. Collaborative European research programmes have been crucial in building the infrastructure and network centrality of UK science and in attracting EU citizen researchers, but at the time of writing future UK participation as a non-member country was unresolved. The long uncertainty about this, coupled with the cessation of free people movement, have triggered the exit of some UK-based researchers and declines in UK researchers' competitiveness in European grants, EU doctoral students and established researchers entering UK, and EU country citizens as a proportion of UK academic staff. In addition, the loss of access to European structural funds has slowed the modernisation of UK higher education institutions and reduced their social contributions.

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Introduction

Higher education and the associated research together constitute a major social sector in the UK. In 2020–2021 there were 2,751, 865 enrolled students within the country, of whom 78.0 per cent were citizens or other permanent residents. Higher education students constituted 3.2 per cent of the total national population. Participation has expanded to the point where more than half of all young people leaving school can expect to enrol in higher education in their lifetimes, the majority doing so immediately. In total 57 per cent of all enrolled students, and almost exactly 50 per cent of all doctoral students, were women, though gender patterns varied by field of study. Of 367,570 first

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degrees awarded in 2020-2021, 31.2 per cent went to students classified ethnically as Black, Asian or Mixed (HESA, 2023).

Of the 22 per cent of enrolled students who were not national residents in 2020-2021, 152,905 came from EU countries and another 452,225 from non-EU countries, over half of the latter originating in China or India. Until 2019, when it was passed by Australia, the UK attracted the world's second largest number of incoming international students after the United States (US) (UNESCO, 2023). The UK then proved more successful than the other major international education provider nations in sustaining international student numbers during in the pandemic in 2020 and 2021, with continuing growth (HESA, 2023; UCAS, 2021).

There were 214 classified higher education provider institutions in 2020-2021, and in addition 5.6 per cent of all enrolled higher education students were pursuing accredited higher education in Further Education institutions. However, the social and economic role of higher education, especially the larger universities, extends well beyond the student enrolment and the 229,595 academic and 191,440 non-academic full time equivalent staff (HESA, 2023). Each successive cohort of graduates enters the workforce and the professions, the institutions and their students and staff drive employment and commercial turnover in cities and regional economies, and higher education is the vehicle for extensive international relations and knowledge transfers. Frontier Economics (2021), commissioned by Universities UK (UUK), estimates that in 2018-2019, universities across the UK generated £95 billion in gross economic output and contributed £52 billion to GDP. The total gross benefit of the 2018-2019 cohort of international students to the UK economy alone was estimated at £28.8 billion (UUK, 2022). OECD R&D (research and development) data show the UK spent £9.1 billion on research in higher education institutions in 2019 (OECD, 2023).

UK research plays a larger part in worldwide scientific networks than the size of the country would suggest. The UK is the world's sixth largest spender on research in higher education but its research has the third largest scientific impact after the US and China. Using Scopus data, in 2020 there were 105,565 new published papers authored by researchers in the UK, based on a paper count in which authorship of shared papers is attributed on a fractional basis (NSB, 2022). Most of these researchers were in universities. This was 3.59 per cent of total Scopus-recognised science, a category which includes social sciences and some humanities. Scopus data show that for publications produced in 2019-2021, 3.9 per cent of all authors were from UK but 10.4 per cent of all citations were to publications authored from UK. In 2021, 9.3 per cent of publications produced in UK were ranked in the top 5 per cent of their field on the basis of citations (UUK, 2023). According to the Web of Science (WoS) data for scientific output in the 2017-2020 period, the UK housed seven of the world's top 100 universities in the volume of top 5 per cent papers that were produced, including three of the top ten institutions (Leiden University, 2022).

The UK also has a remarkable role in cross-border research collaboration. Again drawing on Scopus, in 2020, 64.4 per cent of all science papers involving UK authors included authors from at least one other country. UK researchers collaborated especially intensively in the EU countries and the Anglophone world (NSB, 2022). UK science has not been as well networked as US science, which seems to have significant links into every other national science system, but in terms of global networking it has been second to the US.

Despite chronic under-funding and a relatively high level of student tuition charges, higher education and the associated science sector are UK success stories. However, all of the above data on UK higher education and research freeze-frame a moving target. This might lead to complacency about stable power, but none of it – the student intake, especially from international sources, the volume of high citation research and the pattern of research partnerships, or the total economic contribution of the sector – is fixed in stone. All of these outcomes derive from a complex policy context and ever-changing patterns of internal capacity, opportunity and incentive, in which the UK's links with higher education and science in Europe have been formative and until 2016 were increasingly central. The trajectory of UK higher education and research was and is highly vulnerable to Brexit, with negative effects that were widely predicted in 2016 and are now becoming apparent.

Because of a relatively high level of active integration into Europe, especially in research, with 17 per cent of academic staff being non-UK EU citizens (HESA, 2023), and with students like many other young people strongly favouring EU membership, the sector has been closely identified with the Remain camp. This may have compounded its post-Brexit policy problems. Protecting higher education and science from the effects of Brexit has not been a high priority for a government determined to get Brexit done without acknowledging the downsides or reconciling its critics. Nor has the government done much to build global opportunities beyond Europe for UK higher education institutions and researchers. UK higher education has long been well connected internationally but as yet there is little evidence of positive growth into post-EU portfolios of activity, let alone a new strategy.

The main domains in which Brexit has played out specifically in higher education since 2016 are the (1) the enrolment of EU citizen students in UK degree courses; (2) patterns of student mobility in both directions through the EU's flagship Erasmus+ and parallel UK-based schemes; and (3) research funding and collaboration, primarily through the EU's large-scale Horizon programme, which historically has been associated not only with funding and projects but with the entry into UK of significant numbers of EU-citizen researchers. EU citizen movement into UK university employment was much facilitated by the free movement of labour within the EU. Each of these domains is now discussed.

During the period of EU membership UK higher education and further education institutions also drew significant resource support from the European Regional Development Fund and the European Social Fund, including new capital facilities in disadvantaged regions of the country (O'Carroll et al., 2022), as is discussed briefly below. The impact of Brexit in regional and local development is also addressed separately in this special issue.

Enrolment of EU students in UK higher education institutions

At first glance the referendum and its aftermath appear to have had only a modest impact on the number of EU citizen students entering degree programmes in UK. In 2016–2017 there were 138,040 non-UK EU citizen students, 5.92 per cent of the total. In 2020–2021 there were 152,905 EU citizen students, a slight fall to 5.56 per cent of the total. Commenting (first-year) EU students had fallen in 2019–2020 but rose slightly in 2020–2021, despite the deepening cultural divide between continental Europe and UK as Brexit became normalised.

However, the 2020–2021 academic year was the last year in which EU students enjoyed home fee status and access to student finance through the UK tuition loans system. From 2021–2022 onwards new EU students paid full international student fees and were required to pay up front in the year of study unless they had scholarship support. The slight rise in 2020–2021 is readily explained as the accumulation of last-chance demand for subsidised places. EU student applications submitted to UCAS for the 2021–2022 academic year fell by 40 per cent on the previous year (UCAS, 2021; UUK, 2022). When the enrolment data for 2021–2022 and subsequent years are available, the decline predicted in 2016 will be apparent.

The effects are most dramatic in those institutions that have historically enrolled large numbers of EU citizen students, including most of the universities in London, three in Scotland, and Coventry and Warwick in the West Midlands of England. High demand institutions can replace EU students with domestic students, but the viability of some specialist programmes, for example a Masters in European Law, is inevitably undermined.

Student mobility: reciprocal Erasmus+ replaced by unilateral Turing

Until the Brexit referendum changed the landscape, the UK combined two heterogeneous approaches to cross-border student mobility in higher education, both on a large-scale, that were essentially incompatible. The first was commercial international education, exclusively focused on the inward movement of students into the UK, that had become (as it still is) a major source of funding for higher education, including research activity (Adams, 2022). In the most recent year for which data are available, 2020–2021, fees from the 452, 225 non-EU international students enrolled in programmes within the UK generated £7.44 billion in revenue, 16.88 per cent of all institutional income (HESA, 2023). The second approach was participation in the EU's student mobility scheme Erasmus+, which is funded by the EU and based on the principle of reciprocity between inward and outward student movement.

Prior to Brexit, European students were exceptional in one sense, in that they were treated very differently to other international students. They were not exceptional in another sense, in that their access to higher education was almost as good as that of UK students. As well as those that paid UK fees for UK degrees (though they were not eligible for maintenance grants/loans), others entered the UK on a shorter-term basis via Erasmus+.

Altbach and Knight (2007) use the term 'European internationalisation' (p. 293) to refer to a type of internationalisation that fosters cooperation and integration between countries within the EU and the immediate European neighbourhood. Erasmus+ is the EU's programme for education, training, youth and sport. One of its main aims is to promote a sense of European identity and citizenship among participants (Papatsiba, 2006; Van Mol, 2018). It began with an exchange programme for 3,244 higher education students in 1987–1988, moving between eleven member states, including the UK. Erasmus + now has an overall budget of €26.2 billion for seven years (2021–2027), an increase of 56 per cent from the €14.7 billion provided in the previous phase (European Commission, 2022).

The European Commission estimates that more than 648,000 learners and staff benefited from a mobility activity in 2021 alone, 83 per cent of whom were students or

trainees, while 17 per cent were staff. Overall, since 1987, 12.5 million people have been supported through Erasmus (European Union, 2022). The programme now includes 33 countries throughout the European region and its neighbourhood and encompasses a plethora of activities including student and trainee mobility, staff mobility, vocational education and training, projects for youth, sport actions and learning mobility activities for school pupils and staff (Hubble et al., 2021). Between 1987 and the UK's withdrawal, 200,000 UK-based individuals studied and worked in Europe (Adams, 2022).

The final programme involving the UK ran from 2014–2020. The UK Erasmus+ National Agency (2020) estimates that 6,993 projects were funded, and €1 billion was awarded in total in the UK. The UK Erasmus+ National Agency was a partnership between the British Council and Ecorys UK. The Department of Education was ultimately responsible for overseeing the operation of the programme. Institutions were funded in three Key Action (KA) areas: KA1 (Mobility of Individuals), which absorbed the largest part of the funds, €104 million in the 2017 'call' (Hubble et al., 2021), KA2 (Cooperation among organisations and institutions) and KA3 (Support to policy development and cooperation). Those institutions with a strong internationalisation agenda benefited most. Under KA1, 169 UK institutions received grants to support mobility in higher education, ranging up to €2.6 million at the University of Edinburgh, the top UK sending institution in 2019.

In 2018–2019, 18,305 UK-based outbound students studied or undertook a traineeship in another country, making the UK the sixth largest sending country overall. In return, 30,501 inbound students and trainees attended UK institutions (European Commission, 2019). Erasmus students were a significant part of the student community in many UK institutions. These students paid their home institution tuition fees as part of agreed reciprocal arrangements under Erasmus+. These fees were either non-existent or significantly lower than those paid by their UK counterparts. Their education in the UK was subsidised by the UK taxpayer, just as the Erasmus participation of UK students abroad was subsidised in the countries concerned. However, there was a financial imbalance because of British students' relatively low take-up of Erasmus places in non-English-speaking countries.

Inbound mobility under Erasmus+ was important not just because of reciprocity and building trust between equal partners but also because it contributed to the UK economy through student spending on goods and services. Incoming students under Erasmus+ contributed an estimated £440 million to the UK economy in 2018 (Hubble et al., 2021). In the case of student trainees, it also created a 'vital support to the private and public sectors by bringing distinctive perspectives and skills' while supporting collaboration across countries. Incoming students also championed language learning, raised home student's knowledge of the benefits associated with mobility, and had 'lasting impacts on the networks of institutions and collaborations, including a catalytic effect on attracting other students' to pursue further studies in the UK (British Academy, 2020, p. 9). Crucially too, Erasmus played a key role in Northern Ireland as a mediator of geopolitical tensions that existed in previous decades, by promoting cultural exchange and the role of universities as international intersections. Erasmus also provided an important pathway for language degrees, the educational promotion of languages and an international dimension in many non-language degrees at UK universities; for example in business studies, law, management, and political science. Language learning is closely linked to the development of intercultural competence. Foreign languages struggle to

maintain a role in UK education. Every instance of multi-lingual exposure helps and Erasmus legitimated plural languages and cultures.

After the Brexit decision the initial position of the UK government was that it would seek continued participation in Erasmus + by specifically funding its role in the scheme. However, in December 2020 it made the surprise announcement that the UK would withdraw from Erasmus and introduce its own Turing Scheme for student mobility (Paul, 2021). Continued participation in Erasmus was said to be too costly and limited by the scheme's regional bias. In contrast Turing would constitute a truly global programme. The aspiration of Erasmus to foster European identity and quasi-citizenship is hard to reconcile with the 'Global Britain' discourse and has little political support in a post-Brexit UK. The UK's International Education Strategy (HM Government, 2019) repeatedly articulates that opportunity lies beyond Europe, and that 'leaving the EU presents the UK with the opportunity to extend its role on the global stage' (p. 10). In announcing the decision, then Prime Minister Boris Johnson also stated that Erasmus + benefitted the EU more than the UK in economic terms. He stated that 'the UK is a massive net contributor to the continent's higher education economy because over the last decades we had so many EU nationals, which has been a wonderful thing, but our arrangements mean the UK exchequer more or less loses out on the deal' (Gallardo, 2020).

The four objectives of the Turing Scheme include advancing 'Global Britain', with over 150 countries involved; 'levelling up' within the UK; developing key skills to improve employability; and the better value for UK taxpayers (UK Government, 2022). The Turing Scheme is not based on the principle of reciprocity and makes no provision for overseas students to study in the UK. It is entirely focused on the outward movement of UK students. It deviates from one of the core principles of student exchange diplomacy, whereby states seek to accomplish foreign policy objectives by engaging with foreign publics and on the basis that international learning experience should be mutually beneficial. Exchange diplomacy can be defined as 'an actor's attempt to manage the international environment by sending its citizens overseas and reciprocally accepting citizens from overseas for a period of study and/or acculturation' (Cull, 2008, p. 33). Turing also contradicts notions of soft power via education, whereby states achieve influence by welcoming and educating students from abroad.

The 2022–2023 budget for the Turing Scheme is £110 million, less than the total value of all Erasmus + projects funded in the UK, valued at €144.69 million in 2019. After a first inaugural year under the auspices of the British Council, in December 2021 administration and promotion of the Turing programme was surprisingly outsourced to Capita plc ('Capita'), a private consulting and digital services business also known to be one of the largest business process outsourcing and professional services company in the UK, despite the British Council's demonstrable experience building and managing international educational exchanges. The 23-month awarded contract is worth £6.27 million (Capita, 2021), to administer funding of £110 million (Adams, 2021). This temporality contrasts with the seven-year EU funding frameworks for research and education, and risks diverting more resources towards administration and management of short cyclical schemes. Capita appointed the Association of Commonwealth Universities (ACU) as principal partner to lead on the assessment of applications and to support with monitoring and evaluation. This suggests that British priorities and strategic interests are being re-

worked on traditional lines. In the context of deepening tensions between China and the UK, and the absence of energetic promotion of educational links into other world regions such as Latin America, non-Anglophone Africa and Central Asia, the default for 'Global Britain' is a post-imperial revival.

Questions therefore arise about the extent to which the Turing Scheme can and will foster diverse experiences. Although Erasmus + has a regional bias framed as 'European internationalisation' (Altbach & Knight, 2007, p. 293) it encompasses a remarkably diverse setting in linguistic and cultural terms and it has expanded its reach beyond Europe, especially in Latin America and the Asia-Pacific regions, notably through the Erasmus Mundus Action and capacity-building projects in higher education, vocational education, training, youth and sport. The EU alone has 24 official languages, and many member states are home to several other officially recognised national and regional languages. There is also a wide variety of structural models of higher education systems (Kyvik, 2004) and academic traditions (Picard, 2012). Inter-regional partnerships between far-flung English-speaking Commonwealth nations espousing similar academic traditions and steeped in a long-standing colonial legacy are unlikely to foster a comparable range of experiences. As argued by Brennan et al. (2007) when it comes to internationalisation of UK higher education, some specific UK characteristics are worth taking into consideration, particularly the role of the English language. On the one hand, it can facilitate UK academics' capacity to internationalise and enhance the popularity of the UK as a study destination, but another dimension of language is the role it can play in narrowing the definition of 'international' as restricted to just a small number of English-speaking former colonies, as illustrated by some 'international' conferences and academic journals that 'limit themselves to the UK, Australia, Canada, and New Zealand with an occasional American squeezed in' (p. 171).

More positively, the UK government has singled out increased access to disadvantaged student groups through Turing as the key differentiator and measure of improvement. This is where the Scheme takes in levelling up. In August 2021, it was stated that 48 per cent of participants would be from disadvantaged backgrounds, whereas when the UK was part of Erasmus+, the most privileged students were 1.7 times more likely to benefit from studying abroad than students as a whole. However, while Turing enables 40,000 UK-based students to study and work abroad anywhere in the world in 2021-2022, only 39 universities received grants for these placements (Department for Education, 2021), less than one fifth of all provider institutions. This is likely to exclude many institutions with relatively high numbers of students from disadvantaged backgrounds. Reports of issues delivering Turing bursaries to students while on their mobility placement are emerging, an issue compounded by the high percentage of UK students from disadvantaged backgrounds. With universities having to apply for Turing mobility funds annually and only receiving their allocation in the summer holidays, it is difficult for students and universities to plan with certainty as typically overseas placements are arranged over a year ahead (Staton & Foster, 2023). The funding cycle appears to be out of touch with the needs of disadvantaged students (who need to pay upfront visa costs and organise travel arrangements without knowing whether their university has been successful) and the planning requirements of international mobility. Further, the narrowing of linguistic and cultural diversity inherent in Turing-style mobility has socio-economic implications within the UK. The British Council's 2018 Language Trends

report highlights a widening gap in access to foreign languages at school according to students' socio-economic background (Tinsley & Doležal, 2018). Compared to their predecessors in Erasmus+, Turing's student participants from disadvantaged backgrounds may have less stimulus to develop intercultural competences.

The horizon impasse: research funding and networks in limbo

While UK university scholarship and research have ancient roots and the country's advanced scientific capacity has accumulated since the nineteenth century, its present global standing and impact especially rests on effective positioning and networking within Europe. Figure 1 indicates the centrality achieved by UK research within European networks (European Commission, 2017).

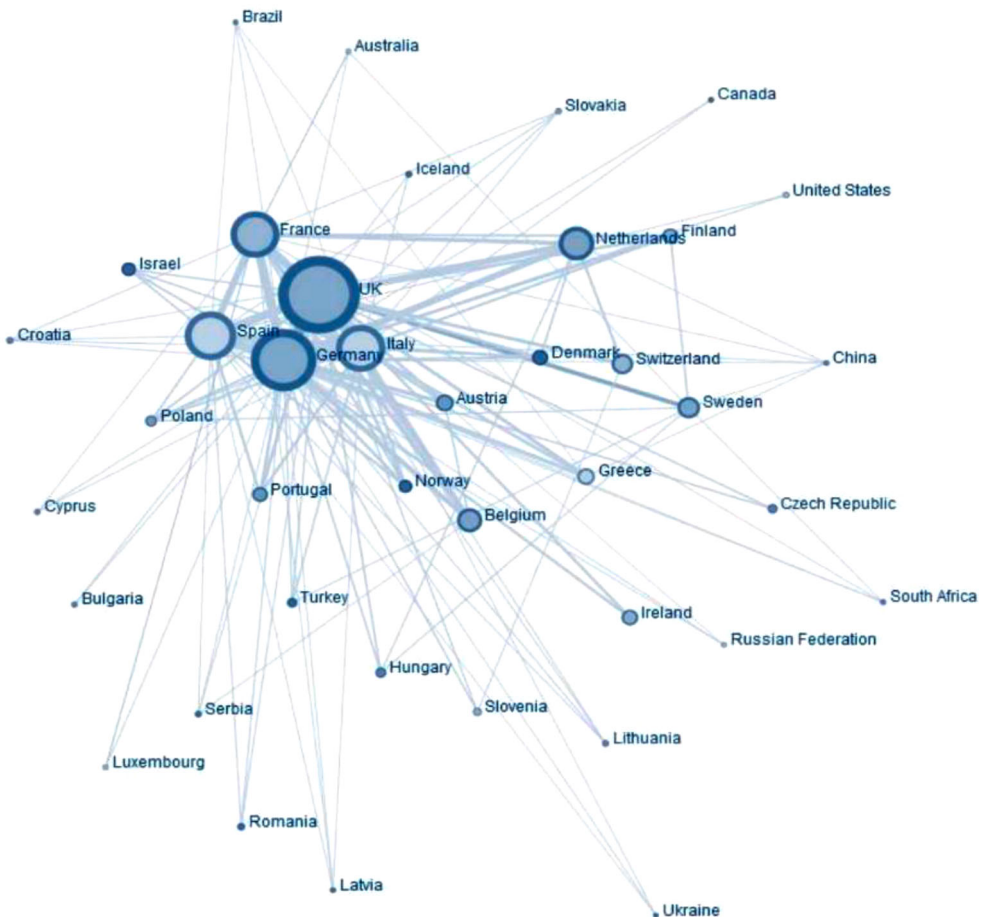


Figure 1. Collaborative Horizon 2020 networks between countries based on project participation.

Source: European Commission (2017) – JRC Technology Innovation Monitoring. Cut-off date: 1 January 2017.

Note: EU funded research and innovation networks are not confined to EU countries: researchers from 149 countries participated in Horizon 2020 in 2014–2017, providing nearly 1.5 million one-to-one opportunities to collaborate among 23,664 participants in over 7,500 projects (Balland et al., 2019). This is knowledge production on an extensive scale, surpassing research collaboration instigated by single countries, bilateral or small multi-country schemes.

Brexit places at risk this centrality with its productive synergy between regional activity and local/national capacity-building. How great is that risk depends on whether the UK can secure at least attenuated participation in European Framework programmes via Horizon Europe, the main research programme. At the time of writing that issue was unresolved.

The first EU Framework Programme (FP) for Research and Innovation in 1984 had a budget of €3.75 billion. By 2020 when Horizon 2020 finished it had €80 billion. Many regional projects require cross-country partnerships, and this has reinforced the networking fostered by electronic communications in global science (Marginson, 2022; Wagner et al., 2015). Over the 36 years the UK continuously bolstered its position as central hub and influential network member within the research and innovation collaborations incentivised by successive EU FPs.

Two significant European Union (EU) funding schemes for research and innovation that foster flows of research talent are the European Research Council (ERC) and Marie Skłodowska-Curie Actions (MSCA). The ERC grants are awarded to outstanding researchers with a track record of research excellence in any field of research, while the MSCA awards are open to talented researchers of any field, including both early-career and experienced researchers. Both schemes provide long-term funding for excellent research projects, ranging from basic research to marketable innovation. Prior to Brexit the UK excelled in winning these prestigious grants. Data from FP7 (2007–2013) show that it was the top performing country, receiving €1.665 billion in ERC grants and €1.086 billion in MSCAs. Next most successful was Germany with €1.087 billion and €0.564 billion respectively (EEAS, 2021). As well as being a vital second source of funding alongside UK research council funding, European funding has been especially important in those specific disciplines where research is more strongly supported in relative terms in Europe than in the UK, fields such as Archaeology, Classics and Computing (Technopolis, 2017). Between the commencement of ERC grants in 2007 until its exit from the EU in 2020 the UK retained the position of leading recipient nation in relation to ERC grants (European Research Council, 2023).

An interim evaluation of Horizon 2020 concludes that, among all eligible organisations from across the public and private sectors the ‘British universities ... typically act as the main knowledge brokers’ (European Commission, 2017, p. 372). As Jackson-Bowers et al state (2006, p. 2), ‘knowledge brokers build relationships and networks, and are well informed and up to date on what is happening in their domain ... [and are] trustworthy subject experts with a high level of credibility.’ This role implies the accumulation of expanding capabilities for connections, collaborations and joint ventures, and facility in the exchange of ideas and resources that develop in the flow of people and funding. De Domenico and Arenas (2016) assert that key explanatory factors in a country’s success in EU research funding are its attractiveness, meaning its ability to attract researchers from abroad; and its stickiness, meaning its ability to prevent brain drain. In the 2007–2014 FP Switzerland and UK exhibited the greatest attractiveness, and Israel and the UK the highest stickiness. Prior to Brexit, the UK was a major net importer of mobile EU doctoral students, researchers and academics, who were drawn by a ‘a combination of inter alia linguistics, the reputation of its universities and international outlook’, as well as an ‘open labour market’ (Garben, 2020, pp. 335–336).

Given how much UK university research has benefited from EU membership, from both the business and the science points of view and given the broader benefits of the research

collaborations to the UK economy and society, it is surprising that the anti-Brexit message in relation to research did not break out of the sector's echo chambers. Perhaps this suggests shortcomings in the communication systems of the universities and of science, but Corbett (2018) argues that higher education and research are second-order policy domains that are unlikely to 'be a make-or-break issue for either the UK government or the EU.' Interestingly, it was Leave, rather than Remain, that included research and higher education as a policy issue. The Leave campaign claimed that EU-focused collaborations were holding back the UK and promised a more open international environment and truly global opportunities for research post-Brexit (BBC, 2017). Little has been heard of this since 2016. Meanwhile the costs of Brexit for research have become increasingly apparent.

Just as success breeds success, the reverse is true: absence and failure also magnify themselves. Yet while it takes decades to build the roles of knowledge broker and talent magnet in research, these are lost more quickly if the advantages of collaborating with the knowledge broker diminish or vanish. Uncertainty has already diminished the UK position.

The UK was the second largest recipient of Horizon 2020 funding with EU contributions amounting to €6.9 billion (Cut-off date August 2020) (House of Commons Library, 2020, p. 27). Around 14 per cent of funds allocated from Horizon 2020 have gone to the UK, with three British universities in the top ten recipients to date. This has been a relatively strong performance given the high levels of uncertainty and antagonism during the protracted EU/UK negotiations but nevertheless, it indicates a decline in the UK position. Between 2017 and 2020, the UK dropped from joint first place with Germany to fifth place, behind Germany, France, Spain and Italy (THE, 2021). If the UK had kept pace with Germany it would have participated in 2,742 more projects between 2017–2020. From a high of €1.484 billion in grant income in 2015 UK institutions won €0.919 billion in 2020, a drop of 38pc. Brexit cost UK research £1.46 billion in Horizon 2020 grant income (Scientists for Europe, 2021).

The decline of UK participation in and coordination of collaborative projects between 2016–2020 can be attributed to the risk represented by partnerships with British universities. Marie Skłodowska-Curie grants that involve individual researcher mobility have also been affected. The end of free movement for EU citizens has curtailed their residency rights in the UK, has imposed visa related costs and additional bureaucratic processes, and has implications for the prospect of long-term residence after the MCRA fellowship.

What then are the future prospects? The EU-UK Trade and Cooperation Agreement, commonly known as the 'Brexit deal', includes provision for UK association to Horizon Europe, the current research FP which enjoys a budget of €95.5 billion for the years 2021–2027. The 2021 Comprehensive Spending Review allocating £1.3 billion in 2021–2022 for UK's association to Horizon Europe, rising to £2.1 billion in 2024–2025.

However, at the time of writing the UK was currently locked out of Horizon Europe, due to the ongoing EU-UK dispute over the implementation of the Northern Ireland Protocol (House of Lords European Affairs Committee, 2022; Politico, 2022; Science/Business, 2021). Further, if the UK's Protocol dispute with the EU was settled, there is no certainty that the two parties would agree on terms for UK participation in Horizon or even whether the UK government would see a return to Horizon as a matter of priority. The unresolved UK participation in Horizon during five years of negotiations has accumulated as a 'toxic

uncertainty', as the Chief Executive of Universities UK recently put it (Science/Business, 2022a). It is causing increasingly severe disruption to carefully curated research collaborations and long-term strategic partnerships, and of course inhibits new partnerships and projects. All the time, the position of UK research within Europe is eroding.

The UK government has introduced a financial net that provides a funding guarantee to all successful UK projects in Horizon Europe, with projects receiving funding through UK Research Councils. This funding guarantee has been extended several times since 2021 and it is currently in place for all Horizon Europe competitions with a final deadline date on or before 31 March 2023. Eligible, successful applicants to Horizon Europe receive the full value of their funding at their UK host institution for the lifetime of the grant. Such government guarantees were previously applied during the Brexit negotiations, when the UK underwrote awards under Horizon 2020. These temporary stabilising measures could be replaced by the activation of the so-called 'Plan B' **for non-association to Horizon Europe as outlined in the document 'Supporting UK R&D and collaborative research beyond European programmes'** (BEIS, 2022). This proposes new UK research schemes with a domestic and international scope that *would keep the UK at the forefront of cutting-edge research*:

In the event we are unable to associate, we will use the funding allocated to Horizon Europe at the 2021 Spending Review to build on our existing R&D programmes with flagship new domestic and international research and innovation investments to support top talent, drive end-to-end innovation and foster international collaboration with EU and global partners. These programmes will enable the UK to meet its global Science Superpower and Innovation Nation ambitions more quickly (BEIS, 2022, p. 7)

Yet as Jones (2022) remarks, the 'details of implementation remain sketchy, and delivery may prove challenging to the existing agencies and bodies that will be charged with executing these schemes.' Professor John Krebs, co-author of a Lords report on the government's global ambitions for science and technology (Sample, 2022) warns of the danger of 'no clear strategy as to how the 'superpower' ambition might be realised'. To be a global science superpower in a single country, without the European funding structure, would require a truly extraordinary level of investment at a time of financial austerity.

Before Brexit, UK universities and their researchers effectively managed the European funding and collaboration structure, with UK institutions centrally positioned within European networks and able to draw freely on this large and dynamic talent pool. Any other structure is less cost effective. The weakening of the funding base is directly visible but that is not the whole story. As Highman (2017) notes, beneath 'the tip of the iceberg', the visible inflow of research grants, lies the 'added value of collaboration, reputation, networking, joint use of research facilities and the leverage effect of EU funding'. Network centrality continually improves 'the knowledge, capabilities, organisational structures and strategies of the organisations involved' (Breschi et al., 2009, p. 833). You have to be in it to win it.

Eu funding for UK universities through innovation and regional development

Prior to the completion of Brexit,, in addition to the Framework Programmes for research, UK universities drew support from various EU funding programmes that foster economic

and social development, such as the European Regional Development Fund (ERDF) and the European Social Fund (ESF). These programmes funded UK policies for innovation, SME competitiveness, low carbon, broadband, urban development, social inclusion, skills and employment. EU funding was critical for investment projects and services for local authorities, development/enterprise bodies, and the voluntary sector. In higher education these funds supported long-term investment and provided opportunities to participate in projects that contribute to the economic and social development of regions and populations. The evaluation of Research Impact and Knowledge Exchange activities has played a significant role in driving UK universities towards greater engagement and active contribution beyond just generating new research knowledge.

Long-term investments in infrastructure supported by ERDF helped universities to enhance their role as regional hubs of knowledge and innovation. This expectation was reiterated by the 2023 Nurse Review of the research, development and innovation landscape:

Universities and other RPOs should support their local community and economy by enhancing their role as an information nexus and by helping local industries link to research capabilities wherever they are in the UK (Department for Science, Innovation, and Technology, 2023, p. 15).

After joining the European Community in 1975, the UK received significant funding from Structural Funds, with a total allocation of £66 billion, and over £100 billion when combined with co-financing from public and private sectors for regional economic and social development (Bachtler & Begg, 2017). During the 2014–2020 Multiannual Financial Framework, the UK received €11 billion in structural funds, with €5.8 billion from the ERDF and €5.1 billion from the ESF (House of Commons Library, 2020). ERDF research and innovation funding was relatively more important than Framework Programme funding in Northern Ireland and Wales. These two nations both received a greater proportion of ERDF research and innovation funding than Horizon 2020 funding (Technopolis, 2017).

Overall universities played a crucial role within UK in implementing these funds, with 20.6 per cent of the £2.696 billion ERDF funds assigned to England reserved for university-led projects. In Wales, universities were in charge of 30 per cent of the projects that received funding (UUK, 2022). The UK government has pledged to match EU funding with the UK Shared Prosperity Fund (UKSPF) launched in April 2022, but this scheme has been criticised for not being as extensive or effective in supporting the differing regional needs as was the ERDF (Institute for Government, 2018). Additionally, the department in charge of UKSPF lacks experience in managing research and innovation. For Universities, the transition to UKSPF funding is marking the abrupt end of about a hundred projects and leaves considerable uncertainty not only for universities but also for their partners. These projects have been undertaken in collaboration with SMEs and large companies which in turn have also benefited from their involvement in multiple EU Framework Programmes, leading to improved access to other European markets.

As noted, the matched funding component of these EU programmes provided financial leverage, with European Investment Bank (EIB) loans covering up to 50 per cent of the total cost. This created a 'crowding-in' effect that encouraged further private investment in R&D outside the programme. Studies estimate this effect at 0.74,

meaning that for every €1 spent on R&D by the European Commission, a further €0.74 was invested by other organisations in the EU economy (Technopolis, 2017, p. 6).

Before Brexit the European Investment Bank (EIB) also played a significant role in financing UK universities. The EIB provided loans for research and innovation-related activities totalling €5.9bn from 2007 to 2016. After Brexit new EIB lending to the UK university sector ceased, and some universities repaid their loans because of concerns over the flexibility of covenants after Brexit (McCann et al., 2019). UK universities had also been relying on EIB loans to finance their campus development. Russell Group universities and universities with a relatively large number of staff and postgraduate taught students were also more likely to borrow: prestigious universities had better access to debt markets and they borrowed to expand their campuses to meet accommodation needs.

Concluding remarks

In higher education and research, the largest change resulting from Brexit is not the resource flows, important as they are, but the implications for the demography of the UK sector and hence for its internal diversity, external connectedness and evolving cultural identity. With people movement into UK higher education dramatically reduced, the country no longer functions as a magnet for talent in the same manner as when it was explicitly positioned within Europe and inward mobility was fostered by European schemes and subsidies.

Undergraduate and taught Masters students from EU countries are now required to pay full cost international student fees, ranging beyond £40,000 for a single year at a prestige university. The proportion of students from EU countries is falling sharply. Unlike prospective international students from affluent families in much of the world, many students from Western Europe have access to high quality universities (fostered by three decades of cooperative regional development within the European Higher Education Area and the largest R&D budget in the world) that are free to enter, or charge only nominal tuition fees. For them the UK is now unaffordable. This demographic effect has been compounded by the end of subsidised shorter-term inward student mobility under Erasmus + . The UK's 'replacement', the Turing Scheme, funds only the outward journeys of UK resident students. A small minority of UK students each year will have an enriched cultural-educational experience but the potential for internationalisation at home of all students has been weakened drastically.

Corresponding to this, the reduced role of the UK in collaborative European research has generated reductions in the inward flows of doctoral students, postdoctoral researchers and scholars, and mature researchers. This effect will be magnified if the UK is wholly unable to participate in Horizon Europe in future. Even if participation is salvaged, UK science will be unable to play the same leadership role in European research from outside the EU, and will have less financial capacity to draw talent. The EU will insist that UK science takes out a sum of research grants that is no larger than the funding that the country puts upfront into Horizon: the UK will no longer be able to leverage its scientific merit to gain net research resources as under previous FPs. Further, the end of free people movement into the UK from EU countries (not to mention perceptions of UK hostility and insularity, whether justified or not) further reduces potential applications from EU member countries for UK-based academic posts.

In 2017–2018 just after Brexit, non-UK EU students constituted 40.1 per cent of all post-graduate researchers at each of Cambridge and Imperial, where there were very large concentrations of STEM researchers (HESA, 2023). Prior to Brexit, many such European doctoral students could be expected to build long-term careers in the UK. A fall in their number now looks inevitable. Increasingly, UK science will depend in future on high quality entrants from China but if UK/China tensions continue that inflow of talent is also in jeopardy.

In 2020–2021, 38,320 full-time equivalent academic staff had EU country nationality, 17.1 per cent of all academic staff. The proportion was higher in some research-intensive universities, and in the natural, mathematical and medical sciences (HESA, 2023). However, the proportion of staff who are EU citizens staff will decline in future. It is already happening in some institutions. While up to 2020–2021 there was little change in the overall proportion of academic staff who were EU citizens, in 2020–2021, 23.3 per cent of academic staff from Imperial were non-UK EU citizens compared to 32.0 per cent in 2016–2017. At UCL the drop was from 27.2 to 21.4 per cent, at Cambridge from 26.1 per cent to 19.5 per cent, and at Oxford from 25.1 to only 16.5 per cent (HESA, 2023). This trend is driven not only by a reduction in hiring from Europe but by the exit of European citizens within UK universities. In 2022 it was reported that one in eight of the UK-based recipients of the 2021 round of European Research Council (ERC) grants had left the UK to move their grant to an eligible EU organisation Science/Business (2022b). Almost 50 per cent of all UK-based ERC grantees are nationals of a country other than UK, a higher proportion than anywhere except Switzerland (Siftova, 2022). If there are continued obstacles to effective participation in European research programmes in future, many more research leaders will leave the UK research system.

The falling away of European faces and voices has effects also for the four fifths of UK-based academic staff who are not EU country citizens. Research on Brexit and higher education conducted by the ESRC/RE Centre for Global Higher Education in 2017 and 2018 found that comparatively few non-EU citizens themselves identified as ‘European’ – British exceptionalism runs deep, despite the geography – yet the overwhelming majority of the 127 staff members interviewed had a strong sense of engagement with Europe. Brexit had a potent emotional dimension, largely negative. Many interviewees referred to a profound sense of loss (Marginson et al., 2020). Links with European higher education and research continue but the compelling drivers, the flow of Erasmus + students, the single EU talent pool and the unambiguous role in Horizon Europe, are attenuated or absent. In the long run the severance wounds in higher education will heal and be forgotten. But at this time it is unclear what if anything will replace the many-sided EU links in terms of resources, activities, people, cultural immersion and the larger sense of belonging within the global space.

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