**Scientists for EU Campaign – Written evidence (EUM0058)**

*Lead authors are Dr Mike Galsworthy (Programme Director), Dr Rob Davidson (CTO) and Dr Claire Skentelbery (research team).*

Scientists for EU launched as a social media campaign on May 8th 2015. It has since acquired a voluntary research team (http://scientistsforeu.uk/about/who-we-are) and an advisory board featuring leading UK scientists and political cross-party representation (http://scientistsforeu.uk/about/advisory-board). We also thank anonymous contributors to our survey concerning this submission – and Dr Jonathan Adams for providing us with Thomson Reuters Web of Science data, analysed by Evidence Ltd.

**Summary**

*In this submission, we argue and evidence the following ten statements:*

1. The EU is the world’s biggest hub of scientific activity – and the UK’s central position in that hub is a major contributor to the UK’s recent rise to first place globally in scientific productivity.

2. To clarify benefits of EU membership to UK science, we must compare extrapolation of the continuing relationship with realistic assessments of the best alternative models on offer for UK science outside EU membership.

3. The promise of extra money for UK science derived from pulling out of the EU, then investing the UK’s net contribution to the EU budget into national research and innovation (R&I), is doubtful. Leaving the EU has wider negative economic consequences which, when all is summed, remove rather than provide money for science.

4. A significant amount of the UK’s net contribution to the EU budget goes to build R&I capacity in under-competitive member states. This produces more excellent individuals and top science/innovation capacity in the multinational collaborations that UK institutes so often lead. Thus, they strengthen the global hub that positions UK science so dominantly in the world.

5. UK national public investment into science is complemented by an additional >10% of funds (and rising) from the EU. Much of those EU funds are irreplaceable by national money as they pertain to the benefits of multinational frameworks that the UK could not establish alone.

6. Leaving the EU would incur a guaranteed loss of UK democratic representation in the decision-making processes of the European Parliament. This would end our scientific community’s influence via UK MEPs on key EU policies relevant to UK science interests. However, UK science advice to the Commission would be retained via newly-established mechanisms.
7. Attempting to ‘buy back’ into the science programme following a departure would likely result in a partial access model that continues collaboration but protects the interests of the remaining countries. Unlike other non-EU countries which can easily be absorbed by the EU science programme at a charge, the UK is now the largest actor within the programme. Leaving the EU sets up a poor dynamic to re-enter the EU science programme as the leading player.

8. The example of Switzerland, with its recent demotion in Horizon 2020, shows that partial access to the EU programme is a model which the EU can use with external partners. That precedent also established the key role of Freedom of Movement (FoM) from the EU as a pre-requisite for European countries to gain access to core parts of the EU science programme.

9. The consequence of reduction in Horizon 2020 participation, even with full national funding replacement, will be damaging for the UK as a scientific leader. Universities would lose coordination roles and talent to countries where full Horizon 2020 access is possible.

10. Remaining in the EU secures a robust future for UK science. The EU programme is growing, improving and highly responsive to UK demands. All the dynamics are moving in the right direction for EU membership to establish UK science an ever-more prominent position in the global R&I ecosystem.

Scientists for EU

Scientists for EU was initiated on May 8th, the day of the Conservative election victory, when it became clear that there would be a referendum on the UK’s membership of the EU.

Scientists for EU began as a social media campaign by Dr Mike Galsworthy & Dr Rob Davidson. The campaign quickly amassed thousands of followers on Facebook and Twitter. On October 9th, Scientists for EU launched the official campaign, with an advisory board comprising representatives from the Conservatives, Labour and Liberal Democrats alongside leading science figures such as Lord Martin Rees, Sir Tom Blundell and Dame Anne Glover.

The mission of Scientists for EU is to play a vocal role in the referendum debate, highlighting the importance of EU membership to UK science. It also presents the opportunity to educate on why science is critical for the UK’s future economy, global standing and citizens’ quality of life.

Scientists for EU has no intention to instruct the British public which way to vote in the referendum. Rather, we wish to raise the profile of science and the achievements of the EU in science in the referendum debate, encouraging voters to become informed on the matters and factor that knowledge into their decision making. As such, the campaign wholeheartedly welcomes all voices concerning science into the debate.

1 http://scientistsforeu.uk/about/who-we-are/
2 http://scientistsforeu.uk/about/advisory-board/
Ultimately, with primary loyalty to the UK and the UK science community, it is important that the relationship between UK science and the EU is understood. Should the public vote to stay, we must have good understandings of what limitations the EU brings to bear upon science and how best to remedy those, whilst taking advantage of benefits. Should the UK public vote to leave, we must be in possession of an understanding of the consequences, taking advantage of opportunities and mitigating damage. Either way, fuller information and considered debate is in the interests of all.

Section 1: Context of UK science and EU membership referendum

1.1 The position of EU and UK science in the world

“...Europe’s productivity continues to increase while the US’s growth has slowed somewhat in recent years. In 2011, Europe produced 33.4% of the world’s research outputs, while the US accounted for 23.4%.”

Comparative Benchmarking of European and US Research Collaboration and Researcher Mobility - 2013
A report prepared in collaboration between Science Europe and Elsevier’s SciVal Analytics
(page 6)
“Europe” was defined as the 27 European Union (EU) member states and 14 associated countries contributing to the framework programme budget under FP7.

“...the UK has overtaken the US to rank 1st by field-weighted citation impact... It is likely that recent increases in UK research productivity have, at least to some extent, been driven by the increase in UK international research collaboration, which is also associated with greater citation impact...”

International Comparative Performance of the UK Research Base – 2013
A report by Elsevier for the UK’s Department of Business, Innovation and Skills (BIS)
(page 2)

1.1.1 Collectively, the countries of the EU produce approximately 20% more scientific academic output that the US, by the last data-points available. This would be a fairly moot bragging point, were it not for how the EU science programme has managed to network the European countries into a collaborative engine which serves as a hub of science in the wider world. This, in turn, has benefited UK science prowess demonstrably.

1.1.2 The EU is now a community of scientific talent which can flow between countries without visas or points systems and which can assemble bespoke constellations of cutting-edge labs, industry and small businesses to tackle challenges local and global. Across the 500m populace

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of the EU (plus the Associated Countries which buy into the EU science program), there is a capacity to pick n’ mix the best labs to do the job – and apply for funding from a single source. Given that the European Research Area produces a third of the world’s research outputs (see quote and reference above), this communal spirit provides a powerful environment to combine leading players across borders to common advantage. So large is the programme that top teams in 170 other countries\(^6\) in the world are easily taken on board as secondary participants. This, in a nutshell, is how a collection of countries converts its critical mass into a critical research advantage, globally.

1.1.3. Twenty-first century science often has to go big to go small and increase the resolution of our understandings and capacity. Developing new nano-materials or discovering ever-rarer particles often requires more expensive machinery to establish more extreme conditions. In health, identifying ever-smaller contributory effects (e.g. multiple interacting genes in disease development) requires ever larger sample sizes of patients. Increasingly complex models require larger collections of expertise and shared resources. This is more than an appealing narrative: The drive to big networked science is also borne out in the data on the rising internationalisation of science and the associated impact. Below we demonstrate how the international networks uniquely supported by EU funding have driven the UK into global pole position for productivity.

**Increasing internationalisation**

1.1.4. Since the 1980s, global research has become rapidly more international. The prevalence of scientific research papers co-authored by researchers from more than one country has risen sharply. However, some countries have seen this increase more than others. Since 1981, the UK has risen from 15% of its papers being international (and 85% domestic authors only) to over 50% international today. In fact, almost all the growth in UK output is in the form of international collaborations.

\(^6\) [https://ec.europa.eu/research/evaluations/pdf/archive/fp7_monitoring_reports/7th_fp7_monitoring_report_draft.pdf]
1.1.5. This rate of increase can be compared to the US, which has seen a rise in internationally co-authored papers from 6% in the 1980s to 33% currently.  

Internationalisation and impact

1.1.6. Multiple sources have identified international co-authored papers as having substantially higher impact than domestic-only papers.  

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7 https://www.britishcouncil.jp/sites/default/files/pro-he-international_collaboration_and_research_strength-presentation_mr_jonathan_adams-feb17.pdf
8 ibid
9 ibid.
1.1.7. The UK’s strong lead over the US on proportion of international output interacts with the added impact of international output – resulting in the UK science base now measuring as more productive than that of the US. This is despite the US’s domestic-only papers showing more citation impact than UK domestic-only papers. International collaborations give the UK the research quality edge.

1.1.8. How much of this increase in internationality can be attributed to participation in the EU science programme? Approximately 10% of UK public funding for science came from the EU during 2007-2014 (see answer to Q1 in Section 2), this amount has been rising sharply recently (Q1 in Section 2) and, pertinently, Horizon 2020 funds are predominantly for international
collaborations. Of the UK’s international collaborations, 80% include an EU partner. Therefore, it is not too adventurous a conclusion to state that participation in the EU science programme looks highly likely to have helped the UK science base become more productive than the US.

Other benefits of a pan-European science programme to EU and UK productivity

1.1.9. Beyond the cross-border collaborations themselves providing more impact than domestic-only work, there are multiple additional properties of a pan-European science programme that confer increased science capacity and productivity to its members:

- The presence of a pan-European fund helps prevent duplication of activity.

- The spread of good practice is facilitated 1) by collaboration and researcher interactions and 2) by adoption of successful policies from one country (e.g. open access, open data) into a funding body present in multiple countries.

- Such a large comprehensive programme covering the gamut of research and innovation areas sets a common framework for funding categorisation and comparisons; a spine against which national funding schemes can be benchmarked.

- A single one-stop shop for international collaborations removes a vast amount of bureaucracy that would be incurred otherwise. Without the EU common pot of funds and common administration, a UK lab looking to partner with, for example, teams in four other countries would encounter serious trouble in finding full funding. The UK government (or any other) would be unlikely to fund a five-way collaboration on which the UK partner undertook 20% of the work. Similarly, all five partners attempting to obtain matched funds from their governments means five times the administrative loads, aligning five timelines of funding applications and work, and five times the jeopardy in getting the monies through. If each of the five applications had a 20% chance of success, then the overall chance of getting funding for all five partners would be $0.2^5 = 0.00032$. The EU, however, regularly funds teams of many partners. This is because the governments of the EU members and associated countries have committed money to a common administration that can choose to fund constellations of labs, regardless of team composition, based solely on competitiveness of the proposal.

1.2  “Brexit”\textsuperscript{10} and free money for science

“Our current assessment is that leaving the EU would be likely to impose substantial costs on the UK economy and would be a very risky gamble.”

\textit{Analysis by economists at the Centre for Economic Performance (CEP)}

\textsuperscript{10} “Brexit” is the shorthand for a British exit from EU membership.
1.2.1. Stocktaking the current benefits of EU membership to UK science is not enough. Content from this House of Lords inquiry will be used to inform the debate on whether to stay in the EU or leave. To adequately address the role of UK science in the debate, we must compare realistic models of UK science continuing within the EU against realistic models of UK science moving to a position outside the EU.

1.2.2. As an analogy: When evaluating the utility of any new drug or treatment, the medicine at hand must be compared not only with a placebo, but also with the best competing medicines on the market. In the case of EU membership, we must compare the current trajectory within the EU against more than flat-cash reimbursement of EU funds through UK funding mechanisms (placebo). We must compare UK science in continued EU membership with the most seductive alternatives being offered on the market.

1.2.3. To summarise those alternatives; we have widely encountered two notions:

Firstly, that because the UK is a net contributor to the EU budget, then the UK could leave the EU and the surplus money gained from the transition could be channelled into research and innovation. In short, leaving the EU frees up money for UK science.

Secondly, that because non-EU countries such as Norway and Israel can have full participation in EU science programmes such as Framework 7 and Horizon 2020, therefore there is no threat to the UK’s relationship to the EU science programmes continuing as is. On leaving, we simply buy back into EU science programme participation as the other countries do.

Combined, the claims amount to an appealing package: On leaving the EU, the UK could continue reaping all the benefits of full membership on the EU science programme whilst having significant extra cash-in-hand to boost public investment in R&I at the national level.

Both these notions are dangerously – and demonstrably – misinformed.

1.2.4. In this section, we deal with the first claim of free money for science. In the next section, we utilise the clear precedent of Switzerland to explain why full membership is not an entitlement, why the UK is a special case, and why negotiations following a Brexit would result in a much diminished role for the UK on the EU science programme.

The availability of money on a departure from the EU

1.2.5. There is a claim by the campaign *Vote Leave* (which use the slogan “Vote Leave – take control”) that a Brexit will free up money for R&I investment\(^\text{11}\). This claim is based on the UK being a “net contributor” to the EU budget as a whole.

\(^{11}\) [https://www.youtube.com/watch?v=0titgGcWVHw](https://www.youtube.com/watch?v=0titgGcWVHw)
1.2.6. The size of that net contribution varies, but according to analysis by economist Roger Bootle in his 2014 book “The trouble with Europe” (which, incidentally, contains no analysis of EU research and innovation in its 201 pages), the UK paid a net £9.6bn into the EU in 2012, about 0.6% of nominal GDP.

1.2.7. Models of impact to the UK economy on Brexit vary. The Centre for Economic Performance (CEP), calculated the UK could suffer income falls of between 6.3% to 9.5% of GDP under a pessimistic scenario. CEP calculate loses of 2.2% GDP under an “optimistic scenario” (a free trade agreement with the EU). The think tank Open Europe calculate UK GDP could be 2.2% lower in 2030 if Britain leaves the EU and fails to strike a deal with the EU. In a best-case scenario (liberal trade arrangements with EU and globally, with large-scale deregulation at home), Britain could be better off by 1.6% of GDP in 2030.

1.2.8. Importantly, even the more optimistic assessments of the UK’s economic performance following a Brexit (such as the “best case” +1.6% GDP increase by 2030 by Open Europe) all analyses model an immediate loss in GDP for the transition years following a Brexit. The size of that loss is substantially larger than the current net contribution of the UK to the EU budget.

1.2.9. The triviality of the UK net contribution relative to the greater economic forces around transitioning out of EU membership have been noted by Eurosceptic economist Roger Bootle: “These are not the sort of sums on which the fate of great nations depends – nor on which momentous decisions about EU membership should be made.”

1.2.10. Therefore the attempt to financially gain in the short term via a Brexit is akin to killing the goose that lays the golden egg. It is a sure-fire short term loss, wiping any free money for R&I investment until at least a decade down the line – according to the most optimistic scenarios. This strongly counters any claim that voting to leave the EU provides immediate funds for a shot in the arm of national science. The extra money simply will not be there for science as the UK economy is hit by huge transition costs.

1.2.11. Even if it were the case that there were free cash-in-hand on a Brexit, the individuals offering this money to science (as part of their campaign) would have no power over its allocation. None of them have any track record in science policy or impact on national science budget allocations. They are simply in no position to offer money to national R&I – even if that money were available.

1.2.12. It is worth taking a moment to consider where the UK’s net contribution actually goes. The UK net contribution (and similarly, the net contributions of the other wealthier countries in the EU, such as Germany – which contributes the most) has risen in recent years due to the

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EU’s expansion eastwards, taking in new member states that are less developed than western Europe. Regional development funds are being used to support their development.

1.2.13. A huge transition from the FP7 to the Horizon 2020 timeframes concerns the use of regional development funds alongside the science programmes to support research and innovation capacity building. So while eastern (and southern) Europe’s under-competitiveness does not interfere with the EU’s criterion of funding “excellence” in science (a decision which benefits the UK greatly), nevertheless, it is important that those EU countries which came into the competitive funding environment late receive adequate support to be competitive. Otherwise brain drain and disillusionment will drop capacity in those regions and for the EU overall.13

1.2.14. Therefore, the new focus of the Commission to dedicate regional development funds to R&I means that the whole EU ecosystem of science is strengthened in all parts. The UK, as the EU science programme’s leading player – benefits strongly in the long run when it can participate in and lead (more than any other country) ever more capable teams from an ever stronger region.

1.2.15. Much of the “net contribution” being promised by Vote Leave to UK R&I is currently deployed to strengthen the pan-EU science hub that boosts the UK’s global leadership in science. Therefore those monies are already being strategically invested in the UK’s R&I future. Ultimately, we see further by standing on the shoulders of a giant.

1.3 A case study of Switzerland as a model for UK science outside the EU

1.3.1. The contention that the UK can leave the EU and then re-join (or continue full member participation on) the EU science programme without notable difference from the current situation is addressed here.

1.3.2. Fortunately, this discussion is not purely hypothetical, but rather based largely on the precedent of Switzerland’s relationship with the EU science programme. Given Switzerland’s high competence in science, geographical location in Europe, non-EU status and political difficulties with issues of EU immigration – Switzerland is a helpful model for the UK’s re-negotiation of science programme membership following a Brexit:

1.3.3. Synopsis of the Swiss-EU science story:

1. Switzerland is not a member of the EU but since 1992 has obtained full access to Framework Programmes, as part of agreements that also guarantee free movement of persons, contributing to the FP budget alongside other EU members.

2. In 2014, a popular vote to limit mass migration was passed by a margin of 50.3 to 49.7%

3. The Swiss government was then unable to commit to ratification of a free movement accord with Croatia.

4. Switzerland was suspended from access to Horizon 2020.

5. The Swiss government was forced to replicate at national level a temporary programme to replace immediate access to the ERC programme and subsequently negotiated limited access to H2020, with much reduced access to programmes, exclusion from the new SME Instrument and loss of ability to coordinate collaborative research within H2020. This is reliant on continued freedom of movement. Switzerland also funds Swiss participants in EU collaborative programmes directly at national level, requiring parallel domestic administration and an agreement to accept all funding decisions made in Brussels, effectively losing control of its national science budget.

6. The Swiss were also not included on Erasmus+. They chose to ensure continuation of the scheme by paying nationally both for students leaving and for those coming in (i.e. paying double what they would as a member of the international programme).

7. Negotiated access to H2020 will end in 2016, when Switzerland must either ratify the Croatia treaty or lose access to H2020 plus risk its bilateral trade agreements with the EU.

8. Switzerland must contribute to H2020 based on GDP and population and has no role in developing funding topics.

1.3.4. This case study of Switzerland represents an instructive set of circumstances for the UK with regard to Horizon 2020 access post-Brexit. Switzerland’s current participation is dependent on free movement. Should the UK leave the EU and restrict freedom of movement, it will have no access to Horizon 2020 beyond third country status (Afghanistan, Argentina etc.). However, as detailed further on, the sheer size of the UK causes problems for re-joining the EU programme after rejecting the EU.

1.3.5. The UK must consider that a withdrawal from the EU, followed by Horizon 2020 ‘buy in’ such as that of the Swiss model, will require continued EU budget contribution. Switzerland makes a contribution to the Horizon 2020 budget based on its GDP and its population, but the UK may have to pay more than its current contribution and/or accept limited involvement, due to its size, so as not to be so overtly disruptive (without the counter-balance of net contribution investment into less competitive regions).

1.3.6. It will also have to follow Switzerland in creating domestic administration structures for programmes where it will fund UK participation in Horizon 2020 collaboration from domestic budgets. This has the double disadvantage of replicating a complete administration structure in the UK that operates on EU financial and legal rules without any role in creating those rules, and it must agree to a single evaluation decision made in Brussels to avoid damaging the partner-worthiness of UK participants with an additional UK level of evaluation.
1.3.7. The requirement to agree to implement funding decisions made in Brussels will ensure that the UK cannot control budget allocated to such collaborations. This creates a scenario in conflict with claims by anti-EU groups. The UK will still be contributing to EU science financially, it will have no control over domestic budget for collaborative research and it will have to sustain a parallel administration structure. This combination of factors means that the UK cannot make a simple financial calculation on financial contribution to EU science nor estimate how much it would retain to find UK research post-Brexit.

![What is each Member State's share of signed grant agreements?](image)

**Figure 4: The UK is now the leading country in terms of number of projects won from Horizon 2020**

1.3.8. Important considerations pertaining exclusively to the UK’s relationship with the science programmes must be addressed upfront. Unlike Switzerland, Norway, Turkey or any of the non-EU countries that hope to become full Associated Countries on the EU science programme – the UK has a lot more to lose.

1.3.9. The UK is currently a full member of the EU, meaning that it has a political say in the development of the science programme. It is also the leading player on the EU science programme, winning more grants than any other country during Horizon 2020 so far. That means it has overtaken Germany, which was the leading country on FP7 (see Figure 4 above).

1.3.10. This combination of the political input (and the UK has, due to its population size, the third largest delegation to the European Parliament), and the UK’s science prowess means that the UK has the kind of status and power on the programme that no non-EU participating country has. These other countries are easily absorbed into the overall programme at a cost.
Whether they are EU members or not, they would not command much of a political say on overarching science direction and management.

1.3.11. This commanding position for the UK means that, on Brexit, a buy-back into the programme as a full Associated Member would have several major flaws:

- The largest player on the programme would have no political say about its formation.
- Playing by the same rules as others means a 12% contribution of funds for 16% gain of competitive funds – a very damaging ratio to the other countries given the UK’s size, given also that it is no longer a net contributor to an EU budget and therefore not supporting the R&I of other EU countries.
- The threat of the UK changing its immigration policies at any stage offers major disruption to the programme, which must respond according to the precedent with Switzerland.

1.3.11. In conclusion, the UK acquiring full Associated Country status on Brexit is not an option. The EU has already introduced and used the concept of Partial Association with Switzerland and would do the same with the UK, tailoring a deal to maximise its own interests.

The impact on Swiss science of a partial access deal

1.3.12. Although it is early days in Horizon 2020, nevertheless, data available clearly show the disruption caused to Swiss science performance on the EU program (Figure 5)\textsuperscript{14}. The uncertainty and renegotiations, despite clawing back participation on areas of the program critical to Switzerland’s interests, has taken a marked toll.

**What about participations from the Associated countries?**

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<th>Share of participations in signed grant agreements per Associated country: Horizon 2020 compared with FP7</th>
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<td>Figure 5: Comparison of participation levels during FP7 and the latest figures from H2020. Switzerland indicates a 40% drop in participation.</td>
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1.3.13. Swiss participation in H2020 and financial benefit has declined significantly, despite negotiated access. The above graph suggests a drop in participation by over 40% for Switzerland – highlighting the cost of renegotiation confusion even for a highly-competitive scientific community.

1.3.14. Swiss sources (private communication) report a declined trust in Swiss research partners and rapid reduction in their engagement in collaboration – the Swiss science sector is reliant on immigration and its innovative performance is likely to decline, particularly if it must completely exit Horizon 2020 membership in 2016.

1.4. Retaining EU membership: Is the EU headed in the right direction for UK science?

![Output Number of Articles Per Year](image)

**Figure 1** — European and US output per year, 2003-11, with compound annual growth rate (CAGR).

Outputs included are articles, reviews and conference papers indexed in sources covered by Scopus, primarily journals, conference proceedings, book series, and trade publications.

**Figure 6: Retaining EU membership: Is the EU headed in the right direction for UK science?**

*Figure copied from Science Europe & SciVal report (2013). “Europe” denotes all countries that paid into the FP7 science programme (ie. 27 member states plus 14 associated countries)*

1.4.1. The UK is currently in the driving seat of a global hub of research excellence that is larger than the US in output size, growing faster than the US (see diagram above), and with a far higher rate of international collaborations at a time when the impact of international collaborations are bringing increasingly high impact.
From Eurocracy to leadership

1.4.2. However, the benefits of the UK remaining within the structure of the EU go beyond the clear internationalisation-impact dynamic. The increasing competence of the EU in science management is beginning to be felt.

1.4.3. Whether one considers the bold commitment to increasing science investment despite shrinking overall budgets, a holistic and well-articulated vision for science, closer democratic accountability for the budgeting and priority-setting within science, success in linking universities with small businesses, open data, bold infrastructure, the European Research Council and plans for a similar innovation council, or newfound transparency around its science programme outputs – it is clear the EU has discovered an appetite for science leadership. The body has transitioned from a painful bureaucratic funder\textsuperscript{15} poorly copying a US lead into a true leader confidently setting its own agenda.

1.4.4. UK politicians even act as a barrier to UK science’s capacity to fully harness the benefits of the EU. The low participation rate of UK SMEs on Horizon 2020 relative to our universities is directly attributable to very poor advertising through channels such as BIS and Innovate UK.\textsuperscript{16}

1.4.5. Any pride that British politicians may feel about the quality of British science in comparison to other countries in the EU should have their mood strongly tempered by the realisation that in the eyes of many British scientists, the EU is stealing a march on the UK in science policy leadership. New directions and capacities that our UK scientists argue for are now rapidly adopted within EU thinking, whilst in the UK, common knowledge about core needs (e.g. a funding increase to a 3% target) often circulates perennially with inaction by the parties in power and their appointees.

Section 2: Direct answers to the questions set by the inquiry

2.1 Funding

Q1: What is the scale of the financial contribution from the EU to science and research in the UK? How does the financial contribution the UK receives compare with other member states in terms of, for instance, population, GDP, scientific strength or any other relevant indicators?

2.1.1. The UK receives funding for R&D from the EU primarily in two ways: EU frameworks such as FP7 and Horizon 2020 provide direct funding for international research and Cohesion Funding may optionally be spent on R&D by the UK government.


\textsuperscript{16} http://www.theguardian.com/science/political-science/2014/feb/18/eurosceptics-could-damage-british-science-and-innovation
2.1.2. Over the course of FP7 the UK obtained the second highest level of funding of €3.9bn.\textsuperscript{17} Of the €10.6bn Cohesion Funding, €4.5bn was spent on R&I.\textsuperscript{18} Not accounting for the vagaries of changing exchange rates, that equates to £5.88bn (today’s rates) over the 2007-2013 term of FP7. \textit{This is equivalent to 10\% of the total spend on R&I (in all sectors) of UK government, RC’s, HEFC’s and HEIs for the full period of 2007-2013.}

2.1.3. The scale of the EU financial contribution to UK science is also increasing. This is particularly salient against a backdrop of under-funding from our own government. The EU expenditure on research and innovation under the Framework Programmes and their successor, Horizon 2020 has risen sharply recently, more than tripling over the last 10 years.

\textbf{Table 1: The EU Science Programmes from Framework Programme 5 (FP5) onwards.}

<table>
<thead>
<tr>
<th>Programme</th>
<th>Years</th>
<th>Budget (€B)</th>
<th>Av spend/year (€B)</th>
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<tbody>
<tr>
<td>FP5</td>
<td>1998-2002</td>
<td>15.0</td>
<td>3.0</td>
</tr>
<tr>
<td>FP6</td>
<td>2002-2006</td>
<td>17.9</td>
<td>3.6</td>
</tr>
<tr>
<td>FP7</td>
<td>2007-2013</td>
<td>53.2</td>
<td>7.6</td>
</tr>
<tr>
<td>Horizon 2020</td>
<td>2014-2020</td>
<td>80.0</td>
<td>11.4</td>
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2.1.4. The impact of this recent surge can best be seen in funding profiles provided by the most recent Research Excellence Framework (REF) documents. The REF 2014 analysed the research of 154 UK universities with 1,911 submissions covering 52,061 academic staff, 191,150 research outputs and 6,975 impact case studies.\textsuperscript{19} The panel overview reports from the REF (published in Jan 2015) contain figures showing the sources of funding for UK university research from 2001 up to the year 2013 (the last year of FP7). We have compiled those graphs into a single diagram (see on next page).

\textbf{Extrapolating the REF funding diagrams to now and the future}

2.1.5. Given the increased funding for Horizon 2020 from FP7 – and given the increasing proportion of money won by the UK, it would be fair to continue the extrapolation of the “EU government” funding line upwards in all four panels. That means that by now, in the year 2015, “EU government” is the second largest single funding source in 3 out of the 4 REF panels. Only Panel A (Life and medical sciences) shows a relatively low projected influence of EU funding.

\textsuperscript{17} \url{http://ec.europa.eu/euraxess/pdf/research_policies/country_files/United_Kingdom_Country_Profile_RR2014_FINAL.pdf}
\textsuperscript{18} ibid.
\textsuperscript{19} \url{http://www.ref.ac.uk/}
2.1.6. The UK is the lead performer within EC funding programmes across the spectrum when it comes to applications and participation rate. As noted earlier in this submission, although Germany won the most projects during FP7 overall, the UK has overtaken Germany to pole position on Horizon 2020 so far (incidentally, the UK overtook Germany in the last 2 years of FP7, according to a speech by Commissioner Moedas to the Royal Society\textsuperscript{20} in March 2015). Nevertheless, Germany remains in the lead (and extends the lead in Horizon 2020) with actual amount of funding won.\textsuperscript{21}

2.1.7. The Horizon 2020 First Results report\textsuperscript{22} shows UK in 10\textsuperscript{th} place for success rate of applications (a measure of quality of applications). Although it should be noted that the range of success rates is narrow for the 28 EU member states (11-17%), unlike under FP7 where there was greater variation (14-26.5%). The same report shows the UK in 16\textsuperscript{th} place for application rate per capita and 21\textsuperscript{st} place out of 28 for SME instrument participation per capita (although Germany was 23\textsuperscript{rd} and France 24\textsuperscript{th} indicating probable disconnect of small business awareness of EU funds in larger countries).

2.1.8. The UK is particularly dominant in two areas; winning European Research Council grants and playing the coordinator role on multinational health projects.

2.1.9. Within the European Research Council grants allocated from 2007 to 2014\textsuperscript{23} the UK obtained over 30% more grants than the nearest competitor, Germany (1225 vs 808) across the five grant types (Figure 8).

![Allocation of ERC grants (total number) 2007-2014](https://erc.europa.eu/projects-and-results/statistics)

\textbf{Figure 8:} Numbers of grants allocated by the ERC to individual countries. Grant types are: ADV, advanced; CONS, consolidator; POC, proof of concept; STRT, starting; SYN, synergy.

2.1.10. ERC grants are particularly important because they are 1) generous in funds, 2) are awarded by a panel of leading scientists, 3) investigator-driven, 4) highly-competitive, 5) attract top talent from anywhere in the world to work in the EU and the science programme’s Associated Countries. Therefore, it is a global brand of excellence facilitating the attraction of world-leading talent.

\textbf{Health Project Coordination}

\textsuperscript{22} \url{https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/horizon_2020_first_results.pdf}

\textsuperscript{23} \url{https://erc.europa.eu/projects-and-results/statistics}
2.1.11. UK researchers have particular expertise in health. Under FP5 and FP6 combined, UK institutions coordinated just over 20% of all health-related projects.\(^{24}\) Under FP7, that coordination rate rose to 23% and under Horizon 2020 it stands so far at 34%\(^{25}\)

**Q2: What is the scale of the financial contribution from the UK to the EU that supports science and research activities?**

2.1.12. The UK economy regularly makes payments of around 1% GDP to the EU budget. This is very similar for all EU member states. The overall EU budget therefore stands at around 1% of EU GDP, although a system of additional “own resources” and special considerations/corrections (including the UK rebate) make the finances more complex\(^{26}\).

2.1.13. To understand the proportion of the funds that support R&I activities, one needs to look at the EU budget itself – or more specifically, the multiannual financial framework (MFF). It is not just Horizon 2020 that supports current science and research activities.

2.1.14. Outside the €79bn Horizon 2020 are also: Copernicus (€4.3bn; a European system for monitoring the Earth), COSME (€2.3bn; Competitiveness of Enterprises and SMEs), Erasmus+ (€14.8bn; professional development and cooperation between universities, schools, enterprises, NGOs), Galileo (€7bn; state-of-the-art global satellite navigation system), ITER (€3bn; nuclear fusion project in collaboration with US, China, Japan, India, Russia & South Korea), and other programmes that overtly or indirectly support science and technology. The programmes of the 2014-2020 MFF and their allocations are listed on the Commission website\(^{27}\).

All of the MFF programmes listed as science and research activities above, including Horizon 2020, fall into the 1a heading of the pie chart above (“Competitiveness for growth and jobs”), that collectively accounts for 13% of the budget spend. Very importantly, however, Heading 1b (“Economic, social and territorial cohesion”) is filled with programmes like the €185bn “Less developed regions”, the €55bn “More developed regions” and the €75bn “Cohesion fund” – all of which aim to drive economic growth primarily through capacity building of research and innovation.28

2.1.16. Yet even headings like “Security and citizenship” contain programmes such as the €449m Health programme which aims to “promote health, reduce health inequalities, protect people from serious cross-border health threats, encourage innovation in health and increase the sustainability of their health systems.” A mission that clearly has a health research focus.

2.1.17. Therefore it would take painstaking classification work to go through the entire set of programmes and designate whether they support “science and research activities” and to what degree. However, as a crude rule of thumb, we can say that Heading 1 (entitled “smart and inclusive growth” and comprising 1a and 1b from the pie chart) is targeted at driving stable economic advancement primarily through capacity-building in research and innovation

activities. That means that 47% of the EU budget has a clear emphasis on supporting science and research activities.

2.1.18. This is a shift away from Regional Development Funding during the FP7 timeframe where R&I activity was recommended, but not directly supported, leading to expenditure on physical (eg transportation) infrastructure. The current 2014-2020 MFF is clearly geared to research, innovation and small businesses through regional specialisation. Thus it will strengthen the EU’s capacity in this area.

Q3: What is the effectiveness and efficiency with which these funds are managed in the EU compared to the management of science funding in the UK? Particularly, when administrative overheads, quality of decision-making and advisory processes are considered?

2.1.19. Management of large scale collaborative research from multiple countries, using taxpayers’ money, is inevitably complex and leads to complaints of slowness (often justified) in processing reporting and finances. This is more a challenge for SME participation where cashflow is critical, than for universities, which can manage cashflow over longer periods. The European Commission budget for such management has declined (under pressure from countries such as the UK) to reduce costs and project administration is increasingly carried out through external agencies to the EC.

2.1.20. UK project administration is on a different scale to EU administration – projects are smaller, with fewer partners and primarily within domestic institutions, bound by the same legal and financial laws. They cannot easily be compared to administration of EU programmes. However, the experiences of applicants can be fairly compared.

2.1.21. Previous incarnations of the EU science programme came in for many complaints concerning complexities, pointless timesheets and unduly long time-to-grant processing periods.29 The Commission’s interest in bringing increased numbers of SMEs into Horizon 2020 meant that the programme absolutely had to drop bureaucracies in order to make the programme attractive to the desired audience.30 For Horizon 2020, the widely-hated timesheets for full-time employees on projects were dropped and strong emphasis placed on time-to-grant targets, despite a huge surge of applications. The Commission now claim that they have met their 8 month time-to-grant target in 95% of cases.31

2.2 Collaboration

Q4: What are the benefits to UK science and research of participation in EU collaborations and funding programmes such as Horizon 2020 and the European Research Council?

2.2.1. The UK achieves a huge benefit from access to collaborative research programmes and the ERC funds. This submission has already fully documented the huge reputational and impact advantage that such multinational projects confer. The size and increasing brand of the ERC grants also ensures the UK has an attractive mechanism to bring to its labs the world’s leading talent. However, maybe the largest advantage the Horizon 2020 framework confers is the leadership/coordination role on multinational projects.

2.2.2. Probably the most detrimental impact to UK science following a Brexit would be the loss of coordination roles. It is hard to tell if this would occur per se or only in response to immigration quotas. Of the projects in which the UK participated in the FP7 Health program, it coordinated almost 23%. In H2020, the coordination percentage is 34%, ahead of Germany (29%)\(^{32}\). The UK is an extremely good project coordinator, with a keen market drive and an entrepreneurial ecosystem. These coordination roles are almost always taken by universities, which have developed experienced and sophisticated management teams that not only deliver a solid project but also apply their expanded skills into business planning and a more strategic development of university key strengths.

2.2.3. There are fundamental advantages to coordinating international collaborations, and such a loss would reshape the UK research landscape. Inevitably, there will be a loss of revenue. Coordinating an international partnership brings significant additional income and can fund management, business development or technology transfer posts, enabling universities to scale up their professionalism in research management and exploitation.

2.2.4. The coordinator also invariably drives the science in a project – they are the ones that initiate the project idea, develop the consortium and undertake most of the proposal development. This loss of coordination will also damage the UK’s ability to develop, attract or retain leading researchers, whether established group leaders or ambitious young scientists. The world of academic research is driven by striving to lead your field. Coordinating large teams of labs is a clear path to establishing leadership. Losing a mechanism to coordinate international projects will reduce the quality of research leaders in the UK, with the inevitable slide in global research rankings as a direct result.

2.2.5. EU membership also brings access to a scale of international collaboration that the UK cannot replicate, in terms of scale or access to skills. The emergence of public private partnerships within the EU, with the Innovative Medicines Initiative (IMI) being the most significant example, This funding programme engages major pharma companies and the European Commission to target bottlenecks in drug discovery. This programme funds projects worth hundreds of millions of euros and engages all the pharma companies currently in the UK. These companies are not going to disengage from IMI in the event of a Brexit in order to

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replicate programmes at a national level. Switzerland currently has access to IMI through its negotiated Horizon 2020 access but it will lose that access if it restricts freedom of movement.

**Q5: What is the influence of EU membership on bilateral collaboration between the UK and other EU member states? Are collaborations with member states stronger than with non-EU countries as a result of EU membership? Or, are bilateral collaborations with member states inhibited by requirements to work through EU mechanisms?**

2.2.6. The question focuses on bilateral collaboration, suggesting a mechanism beyond the broad multinational research projects of Horizon 2020 where two countries work together. There are already mechanisms such as the Eureka programme and ERANets within Horizon 2020 which provide a platform for bilateral research, primarily between SMEs, utilizing local or national funding sources and managed at funding provider level. EU countries also undertake bilateral research outside Horizon 2020, particularly in research areas of specific interest e.g. regenerative medicine. These are often driven at cluster or regional level, making use of local funds, rather than national sources. Bilateral collaboration within the EU is not hindered by EU membership, indeed there are no differences between EU or non-EU collaboration beyond national legal requirements.

2.2.7. Bilateral collaborations beyond the EU are also undertaken regularly, both as a mechanism to access novel innovation and also to open access into new markets – the US and Canada are particularly strong targets for market access and investment reasons. Bilateral agreements are normally on an industrial basis, for SME collaboration primarily. Israel has a number of collaborations with Europe.

2.2.8. Non-EU partnerships are often more effectively created through EU mechanisms as many non-EU countries have defined access to Horizon 2020 projects. For example, US organisations in Horizon 2020 are funded directly by Brussels, rather than through their own US funds. The structure of NIH funding does not encourage collaboration and this Horizon 2020 is a more powerful mechanism for building partnerships.

2.2.9. It must be confirmed here that the level of regional or national funds allocated to bilateral agreements is usually low, both inside and outside Europe and the agreements short term. The presence of Horizon 2020 as a substantial collaborative funding programme negates the need for smaller scale collaboration and is considered a strong tool for effective collaboration. If the UK were to leave the EU and Horizon 2020, its ability to create bilateral agreements would be limited by the willingness of other EU countries to invest in such agreements to the detriment of their participation in Horizon 2020.

2.2.10. The ease of collaboration both legally and physically is represented in the UK’s success with research outputs. An investigation of the publications recorded in the online index
PubMed shows that outputs where the UK is partnered with at least one of the other 27 full EU member states more than doubles the number of collaborative outputs with the United States (Table 2). Collaborations with China are a quarter the number of those with the USA and collaborations with India are around a third of those with China.

2.2.11. Of special importance is the observation that of those collaborations with either the USA, China or India, about a third also include another EU member state (nearing a half for USA). It has been stated recently by several countries that the UK is their access point to the EU but it is also true that the EU is the UK’s access point to wider international collaboration.

<table>
<thead>
<tr>
<th>UK partner</th>
<th>Number of publications (2014)</th>
<th>Number of publications where at least one other EU member was also listed as author (2014)</th>
<th>% of collaborative papers that include an EU partner.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU*</td>
<td>13,336</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>6,242</td>
<td>2,850</td>
<td>46%</td>
</tr>
<tr>
<td>China</td>
<td>1,432</td>
<td>468</td>
<td>33%</td>
</tr>
<tr>
<td>India</td>
<td>563</td>
<td>202</td>
<td>36%</td>
</tr>
</tbody>
</table>

* (at least one of the 27 non-UK, EU members)

Q6: How is private investment in UK science and research influenced by EU membership? Is international investment leveraged on the basis of this membership? How does EU membership affect the growth of research-intensive UK companies?

2.2.12. The UK attracts a significant amount of private investment into its life sciences sector. A July 2015 report from the BIA and Evaluate\textsuperscript{34} recorded IPOs valuing a total of over £340 million in 2014 and private investments of $430 million. This investment is based on a diverse number of factors:

- Strong science base with knowledge transfer into start-ups and spin offs
- Development of a sustainable commercial lifescience base during the 1990s which reached maturity in a number of clusters across the UK
- Creation of a critical mass of business skills in scientific company management, avoiding many of the issues in emerging regions
- Association with strong legal and financial centres such as London
- Seen as a friendly point at which to enter the EU.

\textsuperscript{33} By Rob Davidson, using: http://www.ncbi.nlm.nih.gov/pubmed
\textsuperscript{34} BIA and evaluate report: UK Biotech A 10 year horizon: http://www.bioindustry.org/document-library/uk-biotech-a-10-year-horizon/
2.2.13. All of these points are linked to EU membership. The UK will still be a strong target for investment outside Europe but it will be considerably diminished as all of the points above become diminished outside EU membership:

- Strong science base and knowledge transfer: Loss of collaborative leadership will be a significant blow to the UK research base, with associated loss of knowledge transfer capability as management budgets decline alongside scientific budgets. The loss of international project leadership will also reduce the production of patentable research outcomes in the UK.
- Sustainable life science base: As the patentable outcomes decline from universities through loss of research leadership, start-ups and spin-offs will start to decline and this will feed into the pipeline. This will result in fewer service providers and a general decline in the cluster landscape. Companies in the UK are likely to create EU research bases in order to access H2020 and this will lead to movement of skills and resources away from UK bases.
- Business and research skills: The loss of international collaborative leadership will result in the reduction of senior researchers developing in universities and also moving to the UK (although immigration restrictions will also achieve this). Within the business community, fewer start-ups will start to reduce the population of skilled managers and also reduce the skills within the service community. This is a trend that is very hard to reverse.
- Association with strong financial and legal centres: Lack of access to Europe will reduce the value of the UK as a financial or legal centre, particularly as these centres will not be directly engaged in the EU.
- Point of access to the EU: This will be a strong dis-incentive to investment because the market options are restricted and it is no longer an entry point to the EU.

2.2.14. In UK expenditure it can be seen that the UK Research Councils have been increasing their spend on Knowledge Transfer (KT) since 2008 despite a stagnant or falling overall budget at constant prices (Table 3). Whether this is linked to EU policy or simply coincidence is unclear but the existence of the EU recommendations in this area is very welcome.

Table 3: UK Research Council budget and expenditure on Knowledge Transfer (Constant prices)

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK RC expenditure on KT(^{35}) (£millions)</td>
<td>44</td>
<td>51</td>
<td>83</td>
<td>95</td>
<td>195</td>
<td>184</td>
</tr>
<tr>
<td>UK public funding of RCs (^{36}) (£millions)</td>
<td>3,079</td>
<td>3,157</td>
<td>3,125</td>
<td>3,053</td>
<td>2,722</td>
<td>2,899</td>
</tr>
</tbody>
</table>

2.2.15. In terms of more general private investment aided by EU membership, a recent article discussed the case of the ~2,500 German companies that employ 500,000 people in the UK and their spokesperson highlighted the benefits that came from ease of movement of talent as well as the stability and facility of the current EU-wide trade agreements37.

Q7: How does the UK participate in the creation and operation of international facilities that are available as a consequence of our EU membership? Are there any restrictions in the creation and operation of international facilities outside the EU as a consequence of our EU membership?

2.2.16. The UK has been a major actor in the hosting and development of international infrastructures, such as the European Molecular Biology Laboratory (EMBL), based in Cambridge and The European Medicines Agency38 is also based in London. This attracts relevant knowledge and industry into the vicinity. A loss of EU membership would most probably move such institutions outside the UK.

2.2.17. The UK is also an integral partner in facilities open across Europe, giving access to facilities and skills that would be hard to replicate in the UK alone, even if funding was ploughed into new facilities at a scale never seen in the UK. Facilities such as CERN, European Space Agency, European Southern Observatory, European Synchrotron Radiation Facility and the Institut Laue are all connected into the UK and represent decades of partnership.

2.2.18. The loss of EU membership will make access to such facilities significantly more complex, as benefit of EU membership will have to be replicated, if possible, as an external partner, rather than an EU partner. It would be likely that greater direct costs for access to facilities would be incurred, no ongoing relationships for research through channels such as H2020. The UK could no doubt recreate partial access from outside the EU but it will be a partnership more in line with non-European partners such as the US.

2.2.19. In terms of hosting academic or business meetings, the current Freedom of Movement arrangement of EU membership means that the UK is an attractive place to host meetings. Very few participants (especially for Europe-based work) need visas. This would change dynamics should the UK leave and negate FoM arrangements with the EU.

Q8: What contribution does EU membership make to the quality of UK science and research through the free movement of people? How does this compare with flows of people between the UK and non-EU countries such as the USA, India, China and Singapore?

2.2.20. According to the report “International Comparative Performance of the UK Research Base – 2013”, prepared by Elsevier for the UK’s Department of Business, Innovation and Skills (BIS), 71.6% of UK researchers were internationally mobile between 1996-2012. The UK currently has a significant percentage of non-UK scientists (15% from the EU) within its universities and companies and a strong performance for UK scientists internationally also. The freedom of movement of people within the EU has underpinned economic and scientific development in all countries. Science is international by its very nature and if universities cannot attract the best researchers globally, they will not compete.

2.2.21. Of the last 10 UK Nobel Prize winners within scientific fields, five held non-UK passports and eight had worked outside the UK before their Nobel Prize. It would be reasonable to ask how many would have been in the UK at all if there were restrictions on movement. Not only because they may have not been able to take up a post in the UK but also because they would not be able to lead international research projects (funded through the EU) or recruit the best researchers to their laboratories.

2.2.22. Cluster development is also linked to mobility of skilled personnel and not just the researchers themselves. People don’t move to places where their families will not have a good quality of life – if the partner of a researcher cannot work, there are short term visa restrictions, or there are constraints on access to schooling or social benefits, then the researcher will not move there.

Q9: Does EU membership inhibit collaborations with countries outside the EU, for example by requiring the UK to adopt EU-wide immigration policies rather than bespoke ones for the UK?

2.2.23. The UK does produce many collaborative research outputs with non-EU participants. What has also been stated in relation to that table is that international collaborations with non-EU states often involves EU member states (45% in the case of UK/USA collaborative publications). This shows that EU membership does not inhibit collaborations with countries outside the EU. In fact, there is demonstrated facilitation through the Horizon 2020 framework.

2.2.24. It is true that the UK collaborates most with other EU members but this is far from an imposition. The EU is, after all, the most productive research bloc in the world and so it is natural that the UK should want to engage most with EU members, especially given its frequent leadership role in these successful projects.

2.2.25. The ‘GlobSci’ survey39 studied international flow of researchers and noted that “For many countries, ‘neighbors’ are the most likely source of immigrants”. This is observed in the frequent exchange of researchers amongst EU member states. The UK bucks this trend somewhat by sending most of its own scientists to far away Anglophone countries like USA, Canada and Australia. The UK still receives most scientists from relative neighbours Germany.

39 http://www.nature.com/nbt/journal/v30/n12/pdf/nbt.2449.pdf
and Italy. The point being that it should be expected that the UK would do most collaboration with other EU members due to the geographic proximity, cultural similarity and human nature which ultimately prefers to stay close to home – in the survey, the primary reasons for researchers to leave a country were to join family, highlighting the importance of being close to family in general.

2.2.26. The only way for EU migration policy to restrict the UK’s ability to attract talent is when the UK itself puts restrictions on total net migration.

2.2.27. The UK has enforced such restrictions despite widespread reporting that international students are a boon to the economy and take out little from public services due to their low age and lack of dependents. A detailed report from Sheffield University claimed that their 8,200 international students would bring £136.8 million to the local economy[^40], a figure that when extrapolated to the successful reduction in student immigrants approaches £1 billion per annum lost. It can be surmised that if the UK were to leave the freedom of movement agreement it would not be to allow larger scale immigration from the rest of the world even where the economy, public purse, public services or science desperately required it.

2.2.28. There have been several high profile calls for the UK to adopt an Australian-style points based system to help the UK to select only ‘good’ migrants. However, the UK has had a points-based system for non-EU migrants since 2008. The number of ‘exceptional talent’ scientists allowed into the UK is capped at 700[^41]. More than 700 scientists will arrive in the UK each year but the UK persistently fails to improve its international perception by setting salary thresholds for Tier 2 visas that are beyond most post-doctoral researcher wages and rather than creating a ‘science visa’, instead providing an ad hoc exemption for PhD level jobs.

2.2.29. The government has copied the Australian model by providing these ad hoc exemptions via the ‘skills shortages list’[^42]. The Australian system shows is that not only does it often produce greater net migration than the UK’s current mixed systems but also that skills shortage lists may include traditional skilled working class roles[^43]. Rather than allow market forces to determine who is likely to come and stay, such systems are slow and bureaucratic with endless micro-management.

2.2.30. In conclusion, enhanced collaboration with the EU does not inhibit collaboration with non-EU members and in fact appears to be a positive feature for global science collaboration. The unrestricted immigration from EU member states only impacts the UK’s ability to attract talent from elsewhere when the UK puts limits on net migration figures. Researchers are willing more to cross borders for employment when their access to their home countries or their ability to take family with them is less of a concern.

[^40]: [http://www.shef.ac.uk/polopoly_fs/1.259052!/file/sheffield-international-students-report.pdf](http://www.shef.ac.uk/polopoly_fs/1.259052!/file/sheffield-international-students-report.pdf)
2.3 Regulation

Q10: What are the key EU regulatory frameworks/mechanisms that directly affect the science and research community in the UK?

2.3.1. There are key regulatory frameworks that directly affect science within the UK. The UK was involved in the development of all EU legislation and, as an advanced scientific nation, the UK was able to make a highly positive contribution to their development.

2.3.2. Examples of regulatory frameworks that commonly influence UK research include:
- Clinical trials Directive 2001/20/EC
- Protection of personal data Directive 95/46/EC
- Protection of animals used for scientific purposes Directive 2010/63/EU
- Medical device Directive 2007/47/EC

2.3.3. The Commission will only develop new regulations when 1) it is asked to do so, 2) the treaties agree that the EU has competence to set regulation in the area, 3) there is sufficient agreement from the member states (not always the case, as with certain alcohol policies). Therefore the notion of Brussels pushing its own rules undemocratically on member states is plain misleading. Oftentimes the governments and societies within the EU take credit for pushing through successful legislation, but blame “the EU” when the interests of other parties in the negotiations have trumped their own interests in an outcome.

2.3.4. Data protection and copyright are two key areas critical to the future of UK research and also to the research of other countries in the EU. In such cases, the battle is not against “the EU” per se, but other interest groups/stakeholders within the EU. Such examples highlight the importance of UK research community maintaining influence in the EU institutions.

Q11: If the UK were not a member of the EU, could regulations be reformed to give greater benefit to UK science and research? For example, in areas such as data regulation, VAT on shared facilities, and the use of the precautionary principle?

2.3.5. If the UK were not a member of the EU, in theory it would be able to create beneficial regulatory positions for research and science e.g. within the field of clinical trials. However, deviating from regulatory positions held within the EU would make market access substantially harder, with the burden of additional research required to satisfy EU requirements, in addition to UK requirements.

2.3.6. The same would be applied to data regulation, particularly within the fast growing field of ‘big data’ for research. Different data regulatory requirements would make it harder to access EU data sources and also add UK data into EU-wide efforts.
2.3.7. It must be emphasized that the EU and other major agencies, such as those in the US, work closely together to harmonise regulatory requirements in target fields, research being a key area. The UK outside the EU would have little choice but to follow decisions made by non-UK entities in order to maintain competitive environment for its companies, decisions in which it would have no part in making.

**Q12: How is the innovation landscape affected by EU membership?**

2.3.10. The innovation landscape is affected in its entirety by EU membership, from the first principles of research through innovation delivery to value creation. It is particularly impacted by changes at the beginning of the chain.

2.3.11. The following stages in the innovation landscape are impacted by EU membership:

<table>
<thead>
<tr>
<th>Basic research: Researchers access the European Research Council as a major source of funding (highest recipient in Europe) plus ability to recruit the most talented researchers across the world. Access also to world class facilities and integration into later stages of the value chain.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied research: Access to diverse international funding programmes that enable collaborative research with SMEs, large companies, end users etc. Increased access to knowledge transfer and exploitation skills and routes plus opportunities to create SMEs supported at EU level. Access to talented researchers from across the EU.</td>
</tr>
<tr>
<td>SMEs: Access to research funds plus international business and research collaborations. Access to EIB investments to bridge the funding gap to exploitation requiring large scale investment. Access to skilled researchers and business managers through freedom of movement.</td>
</tr>
<tr>
<td>Large companies: Ability to access funding and drive collaborative research through programmes such as the Innovative Medicines Initiative. Ability to operate across multiple EU sites and access a single market from any point. Access to skilled researchers from any country within the EU to build centres of excellence with critical mass.</td>
</tr>
</tbody>
</table>

2.3.12. There are many more aspects of the innovation landscape that are affected by EU membership. We now consider the above in the circumstance of the UK leaving the EU.

2.3.13. The responses of the innovation landscape are predictable in the case of EU exit, partly substantiated by activities already taking place in Switzerland in response to its changed H2020 access and threat of exclusion from the EU single market in 2016.

2.3.14. The earliest points in the innovation landscape are the least able to proactively compensate for the loss of benefits should the UK leave the EU. Universities, following what is already happening in Switzerland, will face an immediate shortfall in funding, even if the UK secures access to H2020. In the best case scenario for access to EC funds, which include no research leadership, universities will rapidly see a loss of skilled and ambitious research leaders, followed by a decline in exploitable outcomes.
2.3.15. A proportion of the SME community may seek to gain access to the single market and EU funds. They could do this by creating additional sites within the EU where there are also no issues with recruitment. EU countries such as Ireland, the Netherlands, Germany, France and Belgium would work hard to attract UK SMEs. Should Scotland split from the UK, it may also provide a home for SMEs inside the EU in the longer term.

2.3.16. Many larger companies would shift work outside the UK. This is already taking place in Switzerland, primarily as a result of uncertainty over access to the EU market. Research programmes will move to EU-based sites and current expansion within the UK would likely decline at least in the short term.

2.4 Scientific advice

Q13: How does the quality and effectiveness of scientific advice on matters of public policy compare between the EU and the UK? What are the effects, if any, of differences in the provision of scientific advice between the EU and the UK?

2.4.1 The EU gathers advice on science from a broader spectrum than the UK. The EU regularly seeks a range of voices, including young researchers, and their input to panels and groups – or as advisors, rapporteurs, evaluation observers and consultants over a wide area of science and policy. This is notably different from the "great and good" advisors so often favoured in the UK. We prefer the model of broader and more inclusive science community engagement in policy matters.

2.4.2. The appointment of the Chief Scientific Adviser (CSA) to the European Commission President Jose Manuel Barroso in 2012 was a welcome step, as it moved towards a clearer structure of high-level advice by a scientist to the EU leadership. The position was under-resourced, but clear progress was made. Although some fair criticisms were raised about the single-person role, nevertheless, the abrupt abolition of the new position without due consultation or explanation was a notable error of judgement.

2.4.3. The response to the science community outcry concerning the abolition of the CSA role was competent, however. Appropriate experts were rapidly called in for consultation on science advice structure. The Commission has now established a new Scientific Advice Mechanism (SAM), with well-designed structure and a seven-member panel of recognised experts from the science community to provide scientific advice on policy. SAM is better designed and resourced than the CSA role, with links to Europe’s national academies of science and €6 million available to the academies’ networks consortium for the purpose of in-depth studies on issues that require additional evidence. This networking of pan-European academies and learned bodies with a common purpose to provision advice to the top levels of the EU looks to be a very competent structure. However, its functioning remains as yet untested.
Q14: To what extent does EU membership enable UK scientists to inform and influence public policy at EU or international levels? To what extent does EU membership inhibit UK scientists from influencing public policy at EU or international levels?

2.4.5. UK scientists are fully engaged in EU policy development, as are scientists from many other countries. Types of input include: Positions on expert advisory committees and scientific panels, contribution to reports for policy development, panel discussions with policy officials, and assessment of research impacts and programme objectives. In particular, this broad diversity of input trains our young scientists to be policy engagers much more effectively than in the UK alone. It allows them to engage with international counterparts and think bigger on issues of global science direction and international policy engagement.

2.4.6. UK scientists have also taken top roles in advising EU scientific policy. The first Chief Scientific Advisor to the European Commission President was Professor Dame Anne Glover (British). When this role was cancelled, causing uproar in the EU science community, scientists including Sir Paul Nurse (British) were called in to advise on the structure of scientific advice in the EU. This led to the development of the Scientific Advice Mechanism and the seven-member panel of advisors which includes Professor Dame Julia Slingo (British) in the ranks. The presence of British advisors at the highest levels has been and will be, if we remain, fairly constant.

2.4.7. The structure of the Scientific Advice Mechanism (SAM) is such that it will draw its own input broadly from the academies and learned societies of Europe, not just the EU. Fortunately for the UK, this means that even if we do leave the EU, our leading scientists and our communities will still likely have relevance and influence on the Commissioner for Research, the President of the Commission and the Commission itself through the SAM. Possibly in future, this may include the Parliament also. However, this connection is indirect and it would be unlikely that new appointees to the SAM would be British.

2.4.8. The largest loss of influence of our scientific communities and learned bodies on the EU would be the channel that we now have into the decision-making of the European Parliament via our MEPs. Currently the UK has 73 MEPs; the third largest delegation. Losing their roles on Committees cuts out a deep level of engagement that is currently possible.

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