

Immigration: Keeping the UK at the heart of global science and engineering



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for Science and Engineering
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Executive Summary

The UK is a world-leader in science and engineering. Our research base is responsible for 16% of the world's most influential academic papers and more Nobel Prizes than any other country bar America. This research base underpins an industrial sector with global reach. One eighth of the world's most popular medicines were developed in the UK and the technology that drives 95% of the world's smart phones, 80% of digital cameras, and 35% of all electronic devices was developed here.

The UK's strength in science and engineering helps us live healthier and happier lives. It provides high-value jobs. It makes our society more resilient to global challenges. And it is a major driver of economic growth.

These benefits are the product of many centuries of research and innovation, which themselves are products of an open and curious society. Technological progress has been helped at every stage by Britain's global reach and welcoming attitude. Immigrants to the UK have made world-changing discoveries, founded successful, innovative companies, and helped shape modern Britain. From the structure of DNA to the design of the Mini, new people have brought new ideas to our shores.

In light of this valuable contribution, CaSE set out to examine the role of immigration in UK science and engineering today, and

question whether current immigration policy is supporting the Government's aims to make Britain the "best place in the world for science and business".

It is clear that the UK remains a global hub of science and engineering. A quarter (26%) of academic staff in our universities are non-UK nationals and more than 13,000 scientists and engineers came from outside the European Union to work in the UK in 2014/15. But despite this, the UK's share of the global science and engineering talent pool is decreasing against strong competition from emerging economies, such as China.

Foreign scientists and engineers bring new ways of thinking and novel skills to the UK research community. They help to establish new international research collaborations and open up overseas markets for British businesses. Immigration is inherently valuable to the UK's research endeavour. Institutions with greater proportions of internationally-mobile researchers are rated higher for their scientific excellence, and research papers published with overseas collaborators are, on average, more impactful. Continuing to attract the world's top talent to the UK is therefore critical to maintaining our world-leading position in science and engineering.

The UK also has a critical shortage of science, technology, engineering, and maths (STEM) skills. Our growing economy means more and more vacancies are being created with no-one to fill them. And the pipeline of young STEM apprentices and graduates is not well-stocked enough to meet demand in the short term. As a result, the STEM skills shortage will not be solved overnight and immigration will continue to be essential to plug the gap.

Net migration is rising, along with public and political concern. But the Government should be cautious with its policy prescription.

The public support more researchers coming to the UK: 35% of those asked in a 2013 YouGov survey would like to see higher levels of immigration of researchers, against 20% wishing to see lower.

Despite the myriad benefits of immigration for UK science and engineering, and considerable political and public support, many employers in both academia and industry have serious concerns over current immigration policy. There are many faults with the visa system and rules that need to be addressed.

The Government's anti-immigration rhetoric is the science and engineering community's primary concern. It is widely felt to be damaging the UK's reputation and risking our status as a global research hub.

Through consultation with the science and engineering community, we identified a number of policies and visa rules that are preventing scientists and engineers coming to the UK and restricting international collaboration. Other policies pose strong disincentives to international researcher mobility. And as a result of the Government's anti-immigration rhetoric, there is considerable fear of further tightening of immigration policy that could damage science and engineering.

The Government's cap on skilled workers is starting to bite, with employers missing out on engineers they wish to hire from abroad. Inflexible visa rules, stringent requirements, and disproportionate risk-profiling were also among the top reasons scientists and engineers are prevented from obtaining visas. There were also disincentives to use the immigration system, which included bureaucracy, high visa fees, and slow decision making in the Home Office.

It is impossible to know how many talented scientists and engineers the UK has lost out on as a result of these problems. But there is considerable concern that damage is being done. The community is clear that a change in the Government's approach to immigration is needed.

The Government has put science centre stage of its long-term economic plan. And George Osborne himself has repeatedly said that science is a personal priority. But currently there appears to be a disconnect between Government departments.

For the UK to reap the health, social, and economic benefits of being a world-leader in science and engineering, immigration policy in the Home Office must complement wider Government strategy. The issues identified in this report are soluble if the political will exists. To support the Government's stated aims, we propose the following recommendations to ensure the UK remains a world-leading international hub of science and engineering.

Recommendations

Actively promote the UK as a place to learn, earn, and contribute
(page 37)

Support international researchers to maintain links with their home
countries to promote international development (page 38)

Protect the free movement of people in Europe (page 70)

Harmonise with EU legislation to support researcher mobility (page 70)

Fast-track peer-reviewed applicants through Tier 1 (Exceptional
Talent) (page 71)

Abolish the Tier 2 (General) cap (page 89)

Permit research activity overseas in Indefinite Leave to Remain rules
(page 89)

Create a new Tier 5 (Temporary Worker – Science, Research,
and Academia) visa route (page 89)

Allow trusted Sponsors to certify visitor visas for low-risk researchers
(page 89)

Extend the international graduate job search period (page 103)

Improve online visa information to make it more user-friendly (page 103)

Reform the Resident Labour Market Test and increase the frequency
of Certificate of Sponsorship allocations (page 104)

Foreword from our sponsor



Digital Science strongly welcomes this CaSE report on the value of immigration to the UK research base. Younger researchers and established academics from other countries have made profound contributions to knowledge, innovation and economic impact in the UK with pervasive benefits that have spread the UK's influence worldwide. Any policy that restricts this channel of opportunity is to be deplored. It is essential to our business of creating software and technology solutions for researchers at Digital Science. Typically around a quarter to a third of our UK-based staff were born outside of the UK, they have come from afar afield as South America and New Zealand and we are personally all the richer for their arrival.

The CaSE report provides examples of these contributions and backs them up with detailed statistics to provide general support for the argument. It notes that the Crick Institute, soon to open in London, has already recruited research staff from 65 other countries. The institute will be a powerful global axis for the further development of molecular biology and related sciences in which the UK has a record of excellence. It is a reflection of the confidence and esteem in which the research enterprise is held. Francis Crick worked, of

course, in Cambridge in an environment constantly refreshed and enriched by immigrant arrivals. Apart from Jim Watson (USA), the success of Cambridge and its Nobel Prize track record – which the CaSE report also identifies – was also driven by Max Perutz (Austria) and Sydney Brenner (the Baltic and South Africa). That excellent tradition continues and is reflected in other fields essential to the UK's future, like innovative materials at the National Graphene Institute in Manchester driven by Andre Geim (Russia, Netherlands) and Konstantin Novoselov (Russia).

In the 1950s communication took time. Now it is instantaneous. We are in a Fourth Age of open collaborative science. Research organisation has moved from expert groups in universities, to state-prioritised programmes, to an international collaborative network. Less than half the UK's journal articles have only UK authors, and that fraction is lowest amongst the leading research institutions. The groups and institutions that are not part of that network risk being marginalised in the knowledge and innovation race. It is essential for the well-being of not just the research base but the economy, culture and society that we remain openly and actively engaged, that we participate, and that the UK welcomes visitors, partners and recruits who want to be part of this.

Acknowledgments

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Martin is also grateful to the many people and organisations that responded to the call for evidence and subsequent requests for further information. And to the Institution of Chemical Engineers for covering the costs of the stakeholder meetings and Digital Science for sponsoring the design, printing, and launch of the report.

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The Advisory Group offered comment and guidance on the report's content. Their contributions were based on their personal expertise and experience. They were not formally representing their organisations. The report does not necessarily represent their views or those of their organisation. Any errors remain solely the responsibility of CaSE.

Introduction

The UK is a world-leader in science and engineering, a position that has numerous benefits: economic, social, and cultural. The UK's strength is the product of many centuries of research and innovation, which has been helped at every stage by Britain's global reach and openness to the world.

In the 2010 General Election, the Conservative Party promised to bring net migration down to the levels of the 1990s – “the tens of thousands a year, not hundreds of thousands”. Having missed this target, they reaffirmed their commitment in their 2015 manifesto (1).

Now with a majority Government, the Conservatives are committed to achieving this goal. In May 2015, shortly after his re-election, David Cameron announced a new “whole-Government approach” to controlling migration (2). This policy objective will have far-reaching impacts, including on UK science and engineering.

The purpose of this report is to explore the role immigration has played, and still does play, in making the UK a world-leader in science and engineering. It aims to provide a comprehensive overview of the issues surrounding immigration in the context of science and engineering, from skills shortages to the attitudes of the public. It then examines how the Government's immigration policies are affecting the science and engineering community and makes recommendations for how they may be refined to support

the Government's aim of rebalancing the economy with a greater emphasis on science and innovation (3).

Many reports have been published in the past few years assessing student immigration policy in relation to science, technology, engineering, and maths (STEM). This report is therefore focussed on workforce immigration but there are overlaps with education, which are discussed.

This report is informed throughout by a comprehensive review of the published literature, one-to-one interviews and stakeholder meetings with science and engineering organisations from the public, private, and charity sectors, and a call for evidence which attracted over 100 responses from organisations and individuals. Quotes throughout the report are taken from submissions to CaSE following the call for evidence and stakeholder meetings.

The importance of science and engineering in the UK

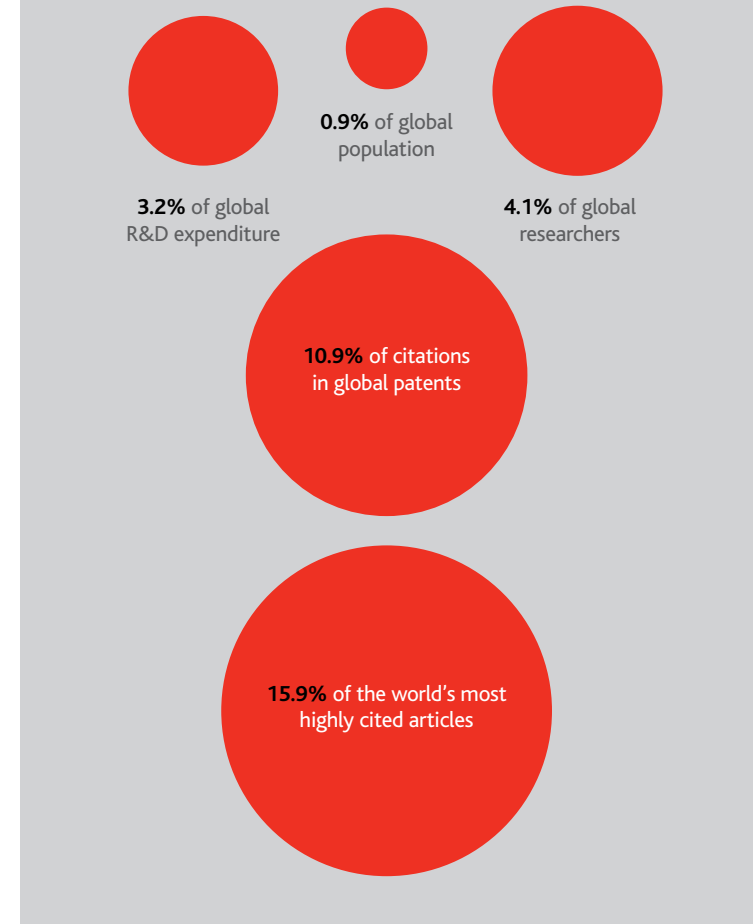
The UK is a world leader in science and engineering

The UK has a long and proud history in science and engineering excellence. We invented the steam engine, created the first vaccine, and developed graphene. Science and engineering have transformed the way we live and underpinned our fastest period of economic growth in recorded history.

With only 3% of global funding and 4% of the world's researchers, the UK research is responsible for 11% of citations in patents worldwide and 16% of the most highly-cited academic papers (Figure 1) (4). The UK is also ranked 2nd globally for the quality of its scientific institutions, with 76% of university research outputs considered to be of the highest international standard (5, 6).

Based on this foundation of excellence, the UK is home to some of the world's most well-respected universities and successful multinational companies. Four of the global top 10 universities are in the UK and R&D-intensive companies like Rolls Royce, ARM, and GlaxoSmithKline were founded here and have grown to become hugely profitable companies with a global market base. One-eighth of the world's most-used prescription medicines were developed in the UK and the technology that drives 95% of the world's smart phones, 80% of digital cameras, and 35% of all electronic devices was developed in the UK (8, 9).

Figure 1: The UK punches above its weight in research output



Source: Adapted from *The National Academies* (7)

UK excellence in science and engineering brings social and economic benefits

Today, the UK's world-leading research base makes an irreplaceable contribution to our economic, social, and cultural well-being, and our health. Working together across the full spectrum of disciplines, UK researchers address the major national and global challenges of our time; from sustainable economic development to ageing; from national security to climate change. This international excellence brings financial rewards for the UK. The R&D-intensive aerospace and pharmaceutical industries, for example, generated a trade surplus of more than £5 billion and £3 billion, respectively, in 2013 (8, 10). And the higher education sector, where a large proportion of publicly-funded basic research is performed, generated more than £73 billion of output and contributed 2.8% of UK GDP in 2011/12 (11).

The fruits of science and engineering enrich our lives in countless ways. Technology helps make the air we breathe cleaner by using new energy sources and waste-filtration systems, machines leave us more leisure time by reducing domestic work, and a better understanding of our environment helps us preserve the woodland and animals that we treasure.

With all the benefits that it brings, it's no wonder the public are supportive of scientific research and value scientists and engineers. Research by Ipsos MORI in 2014 found that more than 80% of those asked agree that science makes people's lives easier and around 90% believe that scientists and engineers make a valuable contribution to society (12). The same survey found that two-thirds (65%) see investment in science as a priority for the Government and 81% think that the UK needs to develop science and technology in order to enhance its international competitiveness.

Science and engineering are vital for the UK's future prosperity

The UK cannot compete on cheap labour, capital reserves, or mineral wealth. We must instead play to our advantages in science and engineering. In an increasingly competitive global economy, they will be the drivers of future innovation, productivity gains, and high-value job creation (3).

"The UK's science base is extraordinary – our cutting edge research base is world leading, our universities are world-class, we develop and attract the world's brightest minds and we are second in the world when ranked by Nobel prizes. Science is one of our clear comparative advantages in the global race."

HM Government, *Our plan for growth: science and innovation*, 2014

Countries with high R&D intensity, such as the US and Germany, have higher labour productivity levels and their businesses have a higher proportion of turnover based on new-to-market innovations (13). UK firms that persistently invest in R&D have, on average, 13% higher productivity than those with no R&D activity (14). Innovative products and business processes derived from R&D will allow UK companies to export more and compete in global markets. This is essential if the UK is to repair its trade imbalance and provide rewarding and well-paid jobs for its citizens. Around 20% of the workforce is employed in science and engineering roles, a total of 5.8 million people, and the Science Council predicts that this will grow to 7.1 million by 2030 (15). But there is no reason we shouldn't aim higher.

The Coalition Government of the 2010-15 Parliament put science at the heart of its long-term economic plan: *Our plan for growth: science and innovation* was published in 2014 with the aim to “make the UK the best place in the world for science and business” (3). And the Chancellor, George Osborne, has repeatedly stated that “science is a personal priority” (16). Science and innovation is to be the “fuel” for the Northern Powerhouse, the Treasury’s flagship scheme to rebalance the economy (17). And the 2015 Spending Review announced strategic investments to support high-growth sectors such as aerospace and the digital economy, which rely on high-level science and engineering skills (18).

For these ambitions to be achieved there must be a whole-Government approach to science and engineering. Policies across all departments must be coordinated to support the overarching mission of nurturing and growing the research base. Nowhere is this more apparent than the workforce: the fundamental component of a successful economy. There is substantial overlap in responsibility for skills policy between the Department for Business, Innovation, and Skills, the Department for Education, and the Home Office. Synergy between these departments is essential to ensure that the UK has the most competitive science and engineering workforce in the world to secure the UK’s future prosperity.

As this report will detail and evidence, the UK’s science and engineering workforce has always been an internationally-open and dynamic one. There have been seismic changes in the way research is conducted over the past 100 years but these have made it more essential to be open, not less so. If the Government’s ambition to make the UK the best place in the world to do science and business is to be realised, we will need the world’s best scientists and business

people here to do it. Getting immigration policy right is vital to the Government’s wider economic strategy.

How immigration shaped UK science and engineering

The UK has always welcomed and benefitted from immigrant scientists and engineers

Science and engineering are international endeavours. Long before Charles Darwin set off on his adventures of discovery aboard the Beagle, scientists travelled between countries to conduct research and share knowledge. With its long-standing strength in science and engineering, its liberal society, and its prestigious institutions, the UK has always attracted the world's best researchers. Indeed, 40% of all living British Nobel Prize winners were born overseas¹ (7).

Some of Britain's most successful scientists of the 20th Century were immigrants. Potentially the most important breakthrough in biology – the elucidation of the structure of DNA – was made by an American, James Watson, with the help of British scientists Francis Crick and Rosalind Franklin. Furthermore, the Laboratory in which Watson and Crick were working at the time was even founded by an immigrant, Max Perutz (see case study 1).

Watson was one of many scientists who immigrated to the UK in the 20th Century and laid the foundations for the country's modern scientific strengths. Conflict in Europe in the first half of the century resulted in a great influx of scientists to the UK. They were aided to

¹ Based on affiliation at the time of award and country of birth. Excludes prizes in literature and peace.

a large extent by the Society for Protection of Science and Learning (SPSL), which was founded by William Beveridge in 1933 (19). Some two thousand academics were helped by the SPSL in the 1930s and 40s, many of whom would go on to make great discoveries in British laboratories. They included sixteen Nobel Laureates, eighteen scientists who were knighted for their work, and over a hundred Fellows of the British Academy and the Royal Society. Much like today, these experts were welcomed to the UK by their British colleagues and, again as with today, were valued as they brought new skills and different ways of thinking (20). The Council for At-Risk Academics, as the SPSL is now known, continues this work today.

Many great innovators of UK industry were also immigrants (21). The Mini was designed by a Greek, Alec Issigonis. Triumph, a company that designed and built cars synonymous with British culture, such as the Stag and Spitfire, was founded by Siegfried Bettman, a German. And the chemical company ICI was founded in 1873 by German chemist Ludwig Mond with his British colleague Sir John Tomlinson Brunner.

Throughout the 20th Century, science and engineering has become ever more globalised and interaction with international peers ever more important to scientific success and innovation. In the 1950s, just 11% of Royal Society Fellows – Commonwealth scientists considered to be leaders in their field – were practicing outside the UK; in 2010 this number had almost tripled to 27%² (Figure 2) (22). This reflects the growing scientific strength of other nations but also the internationalisation of scientific research. Indeed, the new President of the Royal Society, Venki Ramakrishnan, was born and educated in India and worked in America, before moving to the UK.

² The rise in Fellows abroad was not driven by more Commonwealth Fellows, the number of which increased from 8% to 14% during the same period, but from increased scientific activity of other countries, particularly America, drawing UK scientists overseas.

CASE STUDY

European refugees and the foundations of the UK life sciences industry³

Biochemistry and genetics were disciplines in demand in 1930s Britain, with opportunities in medicine, nutrition, and pharmacology. UK academics, among them the Director of the London School of Economics, William Beveridge, and MP for Cambridge and Royal Society Fellow, AV Hill, saw how European refugees could fill skills shortages and take a role in transforming the scientific basis of British medicine. As a result, immigrant biologists and pharmacologists went on to play a central role in establishing the UK as an international leader in the life sciences.

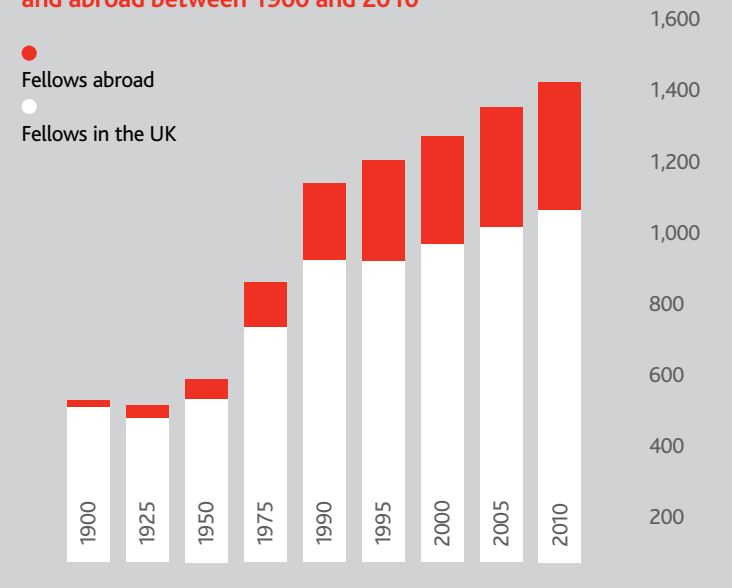
German-born Ernst Chain was one such pharmacologist. Chain, who was Jewish, fled to Britain in 1933, where he got a job at University College London before studying for a PhD at the University of Cambridge. In 1939, Chain joined the laboratory of Australian-born Howard Florey and together they discovered the anti-bacterial properties of Penicillin, which won them both a Nobel Prize in 1945.

Austrian-born molecular biologist Max Perutz was another scientist who immigrated in the 1930s to study for a PhD at Cambridge. He went on to found the world-renowned Medical Research Council's Laboratory of Molecular Biology in Cambridge, which is responsible for more Nobel Prize winners than any other UK institution, and himself received a Nobel Prize for his studies of haemoglobin using X-ray crystallography in 1962.

³ Adapted from Paul Weindling (20).

Britain has in the past worried about the drain of its top brains, particularly to the US. In the 1950s and 60s Britain was perplexed by the number of top scientists emigrating, leading the then Minister of Science, Lord Hailsham, to attack the "parasitising of British brains" (23). By the end of the 1960s, policy makers began to recognise that the brain drain was simply one of the growing pains of globalisation, which can be mitigated by the immigration of foreign researchers to the UK (24). However, such brain circulation, as it is known, is dependent on investment in the UK's research base to ensure it remains internationally attractive.

Figure 2: Fellows of the Royal Society based in the UK and abroad between 1900 and 2010



Source: Peter Collins (22)

“To me as a foreigner, the attraction of living in this country was not the physical environment or the cultural things like music and art and education, indeed I believed other countries either equalled or surpassed the UK in some of these aspects. However, there was one public good that I believe has never been surpassed anywhere, and that is the culture of science. This is what made my decision to stay so very easy. The scientists around me were very welcoming and many were foreigners like me.”

Professor Uta Frith, Emeritus Professor of Cognitive Development, University College London, and pioneer in the treatment of autism

The UK is an international hub of science and engineering

The UK enjoys a central position in the global network of scientists and engineers. Whereas once, policy makers worried about the brain drain of the UK’s top talent, now there is greater recognition of brain circulation (24, 25).

International mobility is incredibly important to researchers both in academia and industry. According to a study by Elsevier, almost 72% of UK-based researchers⁴ spent time at non-UK institutions between 1996 and 2012 (4). This mobility is not because scientists and engineers are particularly fickle about where they live. It is because it is integral to their work; internationalism brings huge benefits to their own research and the productivity of science and engineering as a whole. Recognising this, the think-tank Demos coined the term “knowledge nomads” in 2009 to describe

⁴ Includes UK and non-UK nationals. Only published researchers from academia and industry were able to be analysed.

those who travel the world in pursuit of scientific excellence (25). Demos found that scientists in both academia and industry are motivated by the desire to work with great researchers in highly respected institutions where the science is of the highest quality. The country’s culture or language was secondary. A 2013 study of more than 16,000 international scientists supports this conclusion, with career prospects, the quality of the faculty and colleagues, and the scientific excellence of the institution being the top three motivating factors for emigrating to another country for research (26).

A quarter (26%) of academic staff in UK universities are non-UK nationals (27). In 2013/14, there were more than 22,000 academic workers (12% of the total) from outside of the EU and more than 29,000 from within the EU (16% of the total). Looking specifically at those working in STEM, the percentages are slightly higher, with 13% from outside the EU and 17% from within.

It is more difficult to get a comprehensive picture of the workforce makeup of science and engineering businesses. Anecdotally, the proportion of non-UK workers employed by companies varies widely depending on the firm’s size and sector. Some firms responding to CaSE’s call for evidence had workforces of more than 50% foreign nationals, particularly in the digital technology and computing sector.

CASE STUDY

The Francis Crick Institute

The Francis Crick Institute is the UK's new, world-leading biomedical research centre. It is the largest of its kind in Europe.

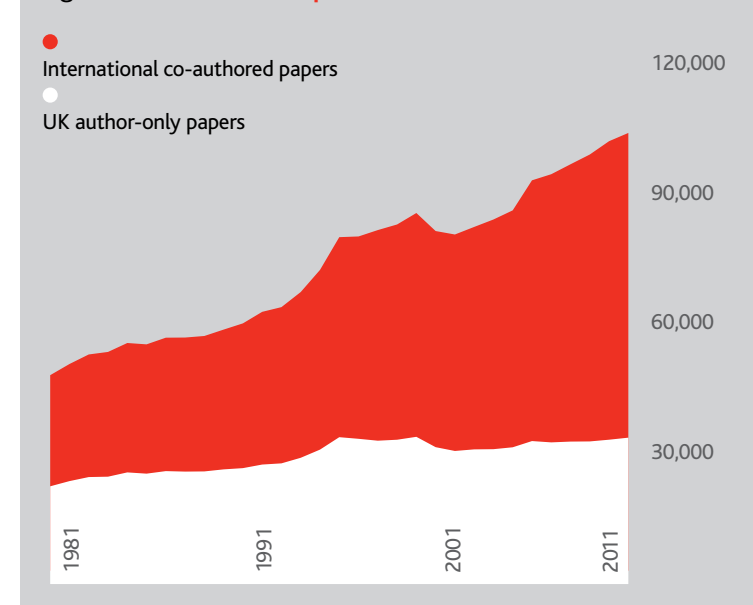
The Crick is funded by Cancer Research UK, the Wellcome Trust, the Medical Research Council, University College London, King's College London, and Imperial College London. Together, the consortium is investing over £650 million. When fully operational, the institute will employ more than 1,500 staff, including 1,250 scientists, and have an operating budget of more than £130 million per year.

The Crick's explicit strategy is to attract the brightest and best scientists from around the world and build global collaborations (28). Its central London location, close to international transport hubs, aims to facilitate this.

There are currently 65 different nationalities employed at the institute. Among them is Dr Tomas Lindahl, a Swedish researcher who won the 2015 Nobel Prize for Chemistry for his work on DNA repair. The international reputation and competitiveness of the institute depends on having the flexibility to recruit the very best from around the globe.

The dynamic nature of research also means researchers need to migrate in or out of the UK for short periods for the purposes of their work. Although 72% of researchers affiliated with UK institutions had spent time outside the UK between 1996 and 2012, for many the time spent in or out of the country was reasonably short. More than a third (36%) were based mainly outside the UK and spent two years or less in the UK, while 14% were primarily UK-based and worked abroad for only two years or less (4).

Figure 3: UK research output between 1981 and 2011



Source: Thomson Reuters Web of Science; Analysis: Jonathan Adams, Digital Science

An internationally-dynamic science and engineering workforce has great benefits

Foreign skilled immigrants contribute to UK science and engineering in myriad ways. They bring new skills and ideas to the workplace, they open up new global markets and collaborations, and they also fill skills shortages. Likewise, British scientists and engineers moving overseas during their career allows them to gain new skills, which they can bring back to the UK, and opens up new markets and opportunities for collaboration. In a world now dependent on globalised science and business, the UK will lose out if it is not part of the dynamic global research community.

The UK has benefitted from internationalisation and increased collaboration through an increase in research output in the form of published papers. The UK's output has tripled since 1980 but the rise has been almost-wholly created by a rise in international collaboration (Figure 3) (29).

There is a large body of evidence showing that international connectivity aids the impact and productivity of research (4, 25, 30, 31). A recent study by King's College London found that high-performing institutions in the 2014 Research Excellence Framework assessment had more staff with non-UK nationality and more staff whose previous appointment was overseas than the average (31). Around half of UK academic publications are co-authored with international collaborators and such papers are associated with 61% greater citation impact when compared to papers published by authors all from one institution (4). It is therefore not surprising that the most common benefit of immigration listed by respondents to our call for evidence was that it supports international collaboration.

"An international team is also much better placed to benefit from much wider international collaborations than a UK-only team. It also allows us to access, through personal knowledge and contacts, non-UK sources of funding and research facilities such as non-UK telescopes."

**Alfonso Aragon-Salamanca, Astronomy Group,
University of Nottingham**

International mobility does not just benefit academia. Science and engineering companies benefit from the sharing of knowledge and complementary skills provided by foreign workers. These companies are often international and need to be able to move workers around the globe to work with and train others.

"GSK has an extensive footprint in the UK with six R&D sites and nine manufacturing sites, as well as our global headquarters. Many aspects of training and development take place in the UK... Investing in our future talent is a key driver for success at GSK and it is vital that we are able to continue to bring future talent to the UK for development purposes."

GlaxoSmithKline

Many studies have found that migrants boost their company's productivity through drivers such as innovation, increasing market access, and complementing local skills (32, 33, 34, 35, 36, 37, 38). The contribution of migrants to innovation and business growth has been evidenced by the higher involvement of migrants in

patent applications and in bringing new products to market (38). In agreement with the published literature, our call for evidence identified examples where foreign workers have opened up new markets for the companies they worked for, either through their links back home or language skills.

“Working for a Chinese customer is especially difficult when it comes to communication, and communication is key when it comes to engineering. Our direct customers generally don’t speak any English and all the aircraft standards are written in Chinese. We recruited five top quality mechanical engineering graduates from the University of Sheffield who were all born, raised, and educated in China to help us with a £25-million Chinese contract. These graduates were integrated into our design teams and have been a key part of the project. I would go so far to say that it would have been impossible to complete the project to any high standard without their help... It also makes it more likely for us to get future work in China as we develop an important commercial relationship with the Chinese customer and start an Electroimpact ‘China Office’.”

Barry Richards, Chief Engineer, Electroimpact

The specific contribution of immigrant scientists and engineers to productivity and job creation has been most widely-studied in the United States (33, 39, 40). According to a 2011 study by the American Enterprise Institute for Public Policy, every foreign-born student who

graduates from a US university with an advanced degree and stays to work in a STEM career creates more than two and a half jobs for American workers on average (41). Far from crowding out native workers, immigrants created more jobs not only for highly-skilled Americans but for lower-skilled ones too. Indeed, one study in 1998 found that Chinese and Indian engineers were senior executives in one-quarter of Silicon Valley’s technology businesses (42). These immigrant-run companies collectively accounted for more than \$26.8 billion in sales and 58,282 jobs.

In the UK, the Department for Business, Innovation, and Skills analysed businesses established or taken over by immigrants using the entrepreneur visa route between 2008 and 2015 (43). Of the 1,580 businesses analysed, 380 (24%) were in the professional, scientific, and technical sector, which places it second only to the wholesale and retail trade.

In general, immigrants make a net contribution to the UK economy. Between 2001 and 2011, conservative estimates predict that European Economic Area (EEA) immigrants paid in 34% more than they took out, with a net fiscal contribution of about £22.1 billion (44). At the same time, recent immigrants from non-EEA countries made a net fiscal contribution of £2.9 billion, thus paying into the system about 2% more than they took out. Analysis by the Office for Budget Responsibility (OBR), the government’s independent economic forecasting body, showed that Britain’s finances would not be forecast to hit a budget surplus by 2019/20 without recent upward revisions to net migration (45). The report also notes that net migration is predominantly concentrated among people of working age, which boosts the employment rate, GDP, potential output, and tax receipts.

There are no studies of the fiscal contribution specifically made by immigrant scientists and engineers to the UK economy but as they are more likely to be higher-skilled and employed in an above-average wage job, it can be assumed that their net contribution is higher than the average immigrant. It is also worth noting that the UK has not had to invest the significant sums of money required for the education of scientists and engineers coming from overseas, yet is able to benefit from their intellectual, cultural, and economic contributions.

However, this benefit to the UK can be at the expense of the home countries of migrant scientists and engineers. Less-economically-developed countries, in particular, can suffer from brain drain if migration is heavily skewed in one direction (46, 47, 48). But countries can benefit by maintaining links with scientific diaspora and through the skills and knowledge brought back by returning nationals. China, India, and South Korea, for example, have countered brain drain by creating mechanisms and policies to build collaboration with nationals working abroad and to attract them back home (49). By encouraging international collaboration and brain circulation, the benefits of science and innovation can be spread more equitably and aid international development (39, 50).

The international reach of the UK science and engineering community also helps the UK diplomatically (51). UK nationals moving abroad to work, and migrant workers who have come to the UK and then left again, are transmitters of British culture and soft power.

“The shared values of science can be important in diplomacy and keep doors ajar even at times of the greatest divisions between nations... We must continue to encourage the interchange of UK scientists with their counterparts from around the world.”

HM Government, *Our plan for growth: science and innovation, 2014*

STEM international students contribute to the UK

The benefits of immigrants to the UK are not limited to workers. International students, of which there are presently around 435,500 in the UK, contribute more to the economy than they take out through the services they use (10). There is also a growing global market in higher education: in 2005 there were 3 million students enrolled in universities outside of their country of citizenship, in 2012 this figure had risen to 4.5 million and is expected to continue growing (52). In 2011, this market was estimated to be worth \$11.6 billion (53).

About 30% of international students in UK universities study STEM subjects (54). International students make up approximately 20% of the STEM undergraduate student population and almost 60% of the STEM taught postgraduate (masters) student population (55). 42% of STEM masters students are from outside of the EU and therefore pay international fees, typically between £10,000 and £20,000 per year, although it can be much higher. Indeed, many postgraduate courses would not be financially sustainable, and therefore available to UK citizens, without the fees of foreign students.

“The financial sustainability of our university, as well as that of most others, depends almost completely on income from international postgraduate taught students. Each international student (outside the EU) is worth around £18,000 for a year to the university.”

Anonymous, Professor in Computing Science

Due to the geographic spread of the UK’s universities, foreign students are particularly valuable to regional economies across the UK. For example, foreign students contributed £120 million to Sheffield’s GDP in 2012/13 and £137 million to the wider Yorkshire and Humber region (56). £98 million of this comes direct from the students themselves through spending and fees paid.

Nor do the economic benefits of international students end once they leave the UK. Like with skilled workers, the connections and shared understanding developed during their stay in the UK contribute to the UK’s international soft-power. Indeed, some 55 current world leaders from 51 countries studied at British universities, according to the Higher Education Policy Institute (57). And a survey of students and alumni by London First and PwC found that 60% said they were more likely to do business with the UK as a result of studying here, as they went home understanding British values and principles (58). Another study found that 92% of postgraduate research students would like to develop professional links with UK organisations after leaving, this is despite only 47% wishing to seek long-term employment in the UK (59).

Remaining attractive to international researchers is crucial to the UK’s continued success

Countries around the world are rapidly developing their science and engineering capabilities through greater investment. Unfortunately, the UK’s investment levels lag far behind (60). Britain risks losing its share of international research talent and, with it, its world-leading position and economic advantage gained from science and engineering.

There were 262,303 researchers⁵ in the UK in 2011, representing 4% of the global total (4). The UK’s researcher population increased at just 0.9% per year between 2007 and 2011. This growth rate is well below the 2.9% for the G8 countries in the same period, but is higher than that for the EU27 and OECD countries, and is similar to the growth of the global researcher total. We are therefore keeping up with the world but many of our peers (the G8 countries) are securing a greater stake in the global talent pool. To maintain or grow our share of global researchers, the UK must remain attractive to these knowledge nomads. Unfortunately, the UK had a net outflow of researchers between 1996 and 2012 of 3.3% (4).

A number of studies show that scientists at the top of their field moved to their country of residence earlier in their career before becoming world-renowned (35, 61). Researchers early in their career are much more likely to be internationally-mobile and the UK’s excellence in science and engineering can be a great draw for the world’s promising talent. Indeed, 38% of Nobel Prize winners who studied abroad when they were younger studied at UK universities, according to the British Council (62). It is therefore important to have policies that attract promising talent and not just the already-elite.

⁵ Full-time equivalents. Includes UK and non-UK nationals in industry and academia.

It is tempting to think that UK scientists and engineers will step into the breach to fill spaces not filled by international workers, but this is not the case. As we shall see in the next chapter, the STEM skills pipeline does not suggest there will be enough people with the right skills in the near future. The UK's relatively small and ageing population also puts it at a disadvantage in this regard. What's more, UK scientists and engineers are also internationally mobile and will go where the best opportunities are for them. If the UK research environment is not filled with the great minds that they want to work with, they will go abroad.

"The best jobs often depend on who else is working there, so if we restrict ourselves to UK-only scientists, not only will we not have the best the world can offer, the best British scientists will also leave."

Jenny Clark, Lecturer, University of Sheffield

Throughout its recent industrial history, the UK has seen great benefit from being open to highly-skilled scientists and engineers. A global race is underway to secure a leading position in a future built on science and technology. A workforce with the world's most talented people will be essential to the UK's success.

Recommendations

Actively promote the UK as a place to learn, earn, and contribute

– The Government's Britain is GREAT campaign promotes the UK as a destination for business "investment, tourism, and study"⁶. And Ministers, including the Prime Minister, have been proactive in promoting UK business on overseas trips. The Government should also be more pro-active in promoting the UK as a welcoming destination for the world's best science and engineering talent to work.

The British Council and UK Trade and Investment are already active in this mission and should be supported to fly the flag further. Ministers must also talk more positively about migration when addressing the British public, recognising the benefits that skilled migrants bring.

The UK science and engineering community can also be ambassadors for the UK as a destination to learn, earn, and contribute. Positive changes to Government policy and making the visa system work better for researchers will give the community the confidence in the system to do this.

⁶ <https://www.gov.uk/britainisgreat>

⁷ <http://www.newtonfellowships.org/>

⁸ <http://www.vliruos.be/en/project-funding/overview-of-programmes/>

⁹ <http://cooperation.epfl.ch/page-64291-en.html>

Support international researchers to maintain links with their home countries to promote international development

– Foreign researchers in the UK, especially those from developing countries, should be supported to maintain and build their networks with their home country so that both the UK and originator countries benefit from brain circulation.

There are already a number of positive Government-backed initiatives that promote the involvement of the UK science base to support developing countries. And the 2015 Spending Review announced a £1.5-billion Global Challenges Fund to “ensure UK science takes the lead in addressing the problems faced by developing countries while developing our ability to deliver cutting-edge research” (17). The fund could be used to support researchers to collaborate with their home countries, in an extension of schemes such as the Newton Fellowships⁷. In Belgium, the VLIR-UOS programme⁸ supports research partnerships between universities in Flanders and the global south at every level from the individual to the institutional. After training in Belgium, international researchers return to their country of origin with a budget to create their own labs. Another example is the Swiss Network of Scientific Diasporas which specifically engages expatriate researchers⁹. This scheme, led by the École Polytechnique Fédérale de Lausanne has sought to transfer knowledge and skills between Colombian, Indian, and South African researchers in Switzerland and their countries of origin.

The skills shortage

The previous chapter examined the economic and scientific benefits of an internationally-dynamic science and engineering workforce. Some of these benefits are due to the novel skills and ways of thinking that foreign researchers contribute. There is also an inherent scientific value in collaboration, which is aided by the UK being a global hub.

However, there is also a clear STEM skills shortage in the UK’s workforce that creates more demand for migrant scientists and engineers. This chapter explores the skills shortage crisis that is widely-recognised as limiting economic growth and increasing our dependence on immigration.

The UK needs more people with STEM skills

The UK has a long-standing STEM skills shortage. The 2015 CBI/ Pearson skills survey found that among engineering, science, and hi-tech firms, nearly half (44%) report difficulties in finding experienced recruits with the right STEM skills, particularly high-level STEM skills (63). This is a long-standing problem evidenced by many past surveys (64, 65, 66, 67).

There are widespread difficulties in recruiting people with STEM skills at every level. 20% of firms told CBI and Pearson that they struggle to find suitable new recruits to train as apprentices.

And 32% report problems finding people with more than five years' experience in work (63). These problems were echoed at the stakeholder meetings that informed this report.

“We offer high-quality apprenticeship programmes in engineering, finance, and IT and these programmes are a great start to a career. However, attracting enough suitably qualified candidates who meet the selection criteria can be challenging.”

Ford Motor Company

The greatest reported prevalence of skill shortage vacancies is among engineering specialists, with the UK Commission for Employment and Skills finding that close to 60% of vacancies in this area are difficult to fill due to a lack of skilled candidates (65). For mechanical engineers, for example, this proportion rises to close to 70% across the country. Around 40% of vacancies for IT professionals and science and engineering technicians were also found to be difficult to fill. Unfortunately, there are not currently enough apprenticeships in these professions to meet demand (68).

These general statistics cannot give the full picture of skills requirements faced by UK employers, however. Science and engineering roles require highly-specialist skills, which are often few and far between in national workforces. For some roles there may only be a handful of people in the world qualified to do the work. The huge range of these precise specialisms cannot easily be reflected in general skills surveys.

The Royal Academy of Engineering and Big Innovation Centre estimate that demand for new workers will average 104,000 STEM graduates and 56,000 STEM technicians (with National Qualifications

Framework Level 3 skills and above) in each year between now and 2020 (64). Based on this prediction, the Social Market Foundation (SMF) estimates that there is an annual shortfall in domestic supply of around 40,000 STEM graduates, who would be considered to have high-level skills (although not yet experience) (64). To close this shortfall with domestic employees, the number of UK STEM graduates would have to increase by about 50%. The SMF also points out that this shortfall does not take into account the expected increases in demand for STEM skills that will arise from the Government's mission to promote science and engineering as a strategy to rebalance the economy (3).

The STEM skills shortage is a major impediment to economic growth. It is estimated that failure to meet demand for engineering skills alone will cost the UK £27 billion a year from 2022 (69). In its international benchmarking study, the Department for Business, Innovation, and Skills found that the UK's science and innovation system is hampered by weaknesses in its STEM talent base (12). The report highlights a problem of insufficient domestic human capital to exploit science and innovation, including deficits of domestic STEM talent and of masters and PhD graduates working in research.

Skills demand and shortages vary across sectors and regions

The UK industrial sectors and regions have different skills demands and shortages. These are influenced by a number of factors, including the growth rate of industries, local and national skills supply, and the desirability of the employer and area.

According to the UK Commission on Employment and Skills (65), manufacturing has the largest share of high level STEM employment of any sector, at around 18% of the total. Two other sectors account for similar, if slightly smaller, shares: information and communication;

and the professional, science, and technical sector, which includes scientific and engineering R&D.

Despite relative parity in STEM employment, the professional, science, and technical sector has twice as many vacancies going unfilled due to skills shortages than information and communication, and nearly three times as many as manufacturing. This is largely due to the high-level skills required and pace of job creation in the science and technical sector (65).

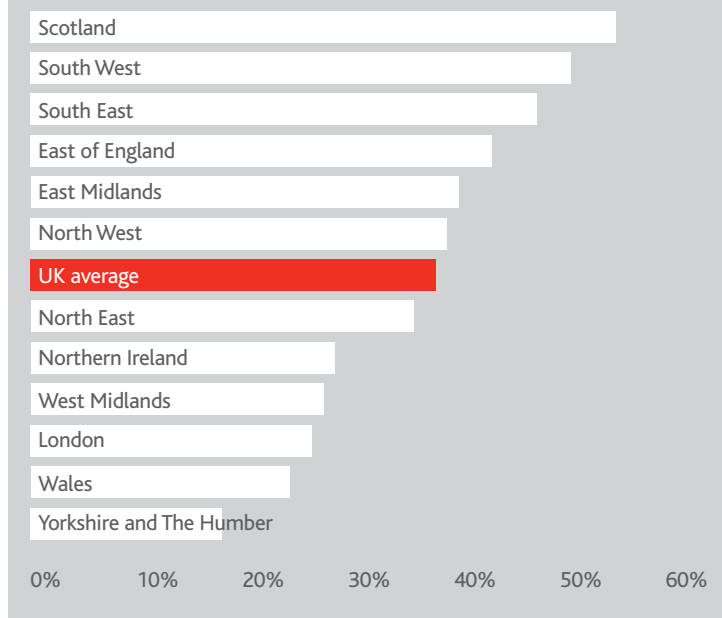
Looking within sectors, the size and public visibility of a company heavily affects their ability to attract the best talent. It is often smaller businesses that struggle most from the STEM skills shortage due to their reduced ability to compete for limited human capital or set up their own training programmes (70). One well-known international technology company told CaSE that they do not struggle to recruit software engineers, who make up the vast majority of their 500 strong UK workforce. However, more broadly in the digital technology sector, small start-ups report problems recruiting staff with the right technical skills (71). Public research institutions, such as universities and charity research institutes, can also struggle due to the lower salaries they are able to offer.

“It is very hard to find high quality candidates, and especially in the research space in which we operate, where the draw from industry is strong. We cannot compete with the salaries being offered by Google or Facebook, although we need that level of candidate in order to conduct world-leading research.”

Owen Nicholson, Manager, Dyson Robotics Laboratory, Imperial College London

London and the South East together account for more than one third of high-level STEM jobs, with combined employment of more than 900,000 (65). However, this pattern is broadly in keeping with the distribution of employment as a whole, with only a slight over-representation of STEM jobs in the region.

Figure 4: Vacancies going unfilled due to STEM skills shortages as a percentage of all vacancies



Source: UKCES (65)

Despite this greater demand, London has fewer job vacancies left unfilled due to skills shortages (65). In fact, interviews with STEM employers consistently indicate that London acts as a magnet to STEM workers at the expense of other parts of the country and may help to explain shortages of skilled workers in some regions (72). The All-Party Parliamentary Group on Migration highlighted this skilled worker immigration bias towards London in their 2015 report, noting that London and the South East accounts for 63% of active Tier 2 sponsors (73).

This means that different regions of the UK have different immigration needs. Scotland and South West England are particularly susceptible to STEM vacancies going unfilled due to skills shortages, and, perhaps surprisingly, the South East also has a large number of unfilled vacancies (Figure 3). This may be due to the pull of London for those living in the South East but able to commute to the capital where salaries are higher (73, 74).

Universities and other public research institutes are not so susceptible to regional skills shortages despite often being based away from major cities or in regions generally associated with skills shortages. At one stakeholder meeting, a number of academic sector employers told CaSE that this is because they draw from a small but international pool of highly-specialised workers rather than the local population. These UK institutions are highly respected so they are recognised by, and attract, the best researchers in the world.

Skills policy is not yet delivering for UK science and engineering

Employers that CaSE spoke to while researching this report were concerned that current vocational education and training policy is not sufficient for up-skilling the UK workforce. For a country that

already has a critical STEM skills shortage, this will only increase reliance on immigration to fill skills gaps.

The Government has set itself a target of creating three million apprenticeships by 2020 (1). The target is not specific to STEM apprenticeships, however. An Apprenticeship Levy and an Immigration Skills Levy¹⁰ on employers have been proposed to finance them (17).

In 2013/14, a total of 440,400 apprenticeships were started. 64,830 (15%) were in engineering and manufacturing, and only 360 (0.1%) in science and mathematics (75). Between 2011/12 and 2013/14, enrolments for apprenticeships in engineering and manufacturing decreased by 7% and starts for science and mathematics apprenticeships fell by 3%. Higher-level engineering apprenticeship¹¹ starts did, however, increase from 120 to 270 during the same period; this signals welcome progress towards the skill levels demanded by employers but still falls depressingly short of the quantity that is needed (68).

Firms worry that the three million apprenticeships target lacks the policy behind it to ensure that the apprenticeships benefit the sectors that need them most. There is a danger that the levies will not be targeted to areas where the greatest skills shortages are. They may instead just fund more apprenticeships in the service sector, which are cheaper than those for science or engineering (68). Within academia, there is also a concern that universities will be subject to the Immigration Skills Levy, despite the necessity and accepted benefit for the country of an international academic workforce. Levying universities would be perverse, given their role in up-skilling the workforce already; it would also be a poor use of public money.

¹⁰ The immigration levy was under consultation at the time of writing this report.

¹¹ These are NQF level 4, equivalent to a Foundation Degree.

Apprenticeships are not the only important training route to consider. Following 27% real-terms cuts in Government funding, further education colleges, which deliver the bulk of vocational and non-degree STEM education are struggling financially, with the National Audit Office concluding “The further education college sector is experiencing rapidly declining financial health, and lacks a clear process to inform decisions about local provision” (76, 77). The 2015 Spending Review provided some security, including flat-cash settlements for the adult skills budgets and the extension of loans to 19 to 23-year-olds on NQF Level 3 and 4 courses (78). But many colleges will still struggle financially to deliver vital STEM training (79).

More positively, STEM subjects at university are increasing in popularity. UK undergraduate applications for courses starting in 2015/16 were up from the previous year by 28% for engineering, 23% for biological sciences, 11% for physical sciences, and 33% for computer sciences (63). In contrast, the increase in applications across all subjects was only 7%. However, with STEM courses being more expensive to deliver, universities do face financial pressures to deliver them to a high standard.

The skills shortage is not necessarily due to a lack of people with STEM qualifications but rather their skill level and specialism. Employers perceive that, in some specific disciplines, a very limited number of universities give the rigorous foundation of knowledge and skills required by industry (66, 72, 80). There are also broader concerns about a lack of “well-rounded candidates with technical skills, broader competencies, such as mathematical capability, and practical work experience” (72).

The science and engineering community, with welcome support from the Government, has responded to the growing skills crisis in recent years with many initiatives aiming to increase the number of pupils taking STEM subjects at all levels and raising the quality of the education being delivered. Universities are addressing employers’ concerns about the quality and skill level of graduates (81). Accreditation of degree courses by learned societies using frameworks co-developed by academia and industry is becoming ever-more popular. And many universities are involving industry directly in the design and delivery of courses¹². It is too early to say whether these efforts will result in greater numbers of graduates who meet the needs of employers but they are welcome steps.

Solving the STEM skills shortage will not happen overnight

Projections of future employment requirements predict a large increase in demand for STEM-qualified workers, even before the Government’s stated policy aim to foster growth in science and engineering sectors is taken into account (64).

It is important to remember that the training of scientists and engineers takes many years, and involves undergraduate and post-graduate study, as well as on-the-job training. According to the Institution of Chemical Engineers, it takes approximately five years of work after graduation before an engineer achieves Chartered status. It will therefore take a number of years until today’s graduates have gained the experience that employers say is currently hard to find (63).

¹² University Alliance has collated a range of examples on its website: <http://www.unialliance.ac.uk/campaigns/jobready/>

“There was a lost generation in the 1990s when enrolment of engineers at university dropped, we are still seeing the effects of that break in the pipeline. It takes seven or eight years just to train an engineer, and then longer still for them to gain all the skills needed to do the job.”

Dianne Jennings, Administrator, Ground Forum

The pipeline is by no means sufficiently stocked and both the Government and science and engineering community will need to redouble efforts. Children must be engaged early and encouraged into STEM careers but it will be 10 or more years before they enter the workforce, and many more years until they have gained valuable experience. Filling the STEM skills shortage will not happen overnight. As a result there is a continued need for immigration to bridge the skills gap in the short to medium term as well as the indefinite need for the UK science and engineering base to be able to access the world's top talent and benefit from international collaboration.

Immigration in the UK

The benefits of an international science and engineering workforce in the UK – and the need to fill skills shortages – demonstrate a clear need for an immigration policy that welcomes international workers with STEM skills. But immigration policies must reflect the wishes of citizens and carry their confidence. This chapter looks at UK immigration policy and the current visa system, its use by the science and engineering community, and the public's views on immigration.

UK immigration policy and the visa system

As a member of the European Union, the UK is subject to the free movement of people between member states. This allows EU citizens to travel, live, and work in the UK without a visa. The principle also applies to countries in the European Economic Area (EEA) and Switzerland¹³. The free movement of people between member states is greatly valued by the UK science and engineering community: 75% of respondents to a CaSE/Engineering Professors' Council survey agreed that EU membership facilitates access to specialist skills through the free movement of people (82).

¹³ The EEA includes EU countries and also Iceland, Liechtenstein and Norway. Switzerland is neither an EU nor EEA member but is part of the single market, which gives Swiss nationals the same rights to live and work in the UK as other EEA nationals.

Citizens from all other countries are subject to the UK visa system, even if they hold a visa awarded by another EU member state. Between 2008 and 2010, the Labour Government phased in a substantial overhaul of the visa system. This introduced a points-based system (PBS) to regulate the number of migrants coming to study and work. There have been a number of changes and refinements to the system since 2010 but this basic architecture remains.

The government cannot restrict migration of EEA workers, due to EU law. As there is currently no route for low-skilled labour migration into the UK, any measures to reduce immigration must involve cuts in migration routes intended for high-skilled non-EEA nationals.

Visa routes and the points-based system

A work or study visa applicant must reach a certain level of points to be awarded a visa. Points are allocated according to various criteria depending on the visa required, including, but not limited to, skill level, salary, and holding a job offer. Visitor visas are not subject to these tests.

The table overleaf shows the five tiers of the visa system, each with their own sub-tiers, specifications and tailored requirements. Only visa routes relevant to science and engineering are shown. Tiers 1, 2, and 5 are used by scientists and engineers wishing to work in the UK and Tier 4 is for students at UK educational institutions. Tier 3 is for unskilled work but has never been opened. Short stay visas are also available for visitors, such as scientists or engineers attending meetings, lecturing, or presenting their research at a conference.

Sponsors

Applicants to Tiers 2, 4, and 5 require a Sponsor, which has certain responsibilities for monitoring the visa holder. Sponsors Licenses are awarded by the Home Office. Employers must have one to be able to recruit workers through the visa system. Sponsors must prove that they have a suitable system in place to monitor sponsored employees and appoint an individual with responsibility to be the link between the sponsored employee and UK Visas and Immigration (UKVI). There are fees associated with becoming a Sponsor and issuing Certificates of Sponsorship (CoS), which are used by visa applicants in the application process.

The Resident Labour Market Test

Before issuing a CoS under the Tier 2 (General) route, employers must conduct a Resident Labour Market Test (RLMT) to prove they are unable to recruit someone suitably skilled and already present in the UK, EEA, or Switzerland. The RLMT consists of advertising a position in two mediums for at least 28 days, one of which must be JobCentre Plus if the salary on offer is under £71,500. In most instances an employer can only sponsor a Tier 2 worker if there are no suitable applicants but this condition does not apply to PhD-level jobs. The RLMT is valid for six months for all occupations except those at PhD-level, which are valid for twelve months.

The Shortage Occupation List

The Shortage Occupation List (SOL) details the occupations considered to be in short supply in the UK labour market that would be sensibly filled using non-EEA labour (83). The content of the list is recommended to the Home Secretary by the Migration Advisory

Visa route	Purpose	Features	Length of stay permitted
Tier 1 (Exceptional/Promising Talent)	For individuals judged to be leaders or future leaders in their field working in academia or industry.	Applicants must be endorsed by one of five Designated Competent Bodies (DCBs): the Royal Society, Tech City UK, Royal Academy of Engineering, Arts Council England and Wales, and British Academy. 1,000 visas available annually.	Five years with option to extend for two years provided the visa holder is working in their field of expertise. Can apply for Indefinite Leave to Remain after five years.
Tier 1 (Entrepreneur/Graduate Entrepreneur)	For individuals wishing to establish a business in the UK.	Applicant must have £50,000 of their own investment funds or £200,000 from approved investors, and a business plan approved by the Government.	Graduate Entrepreneur: Two years with option to switch to the Entrepreneur visa after two years if the business is successful. Entrepreneur: Three years with option to extend for two years if conditions are met. Can apply for Indefinite Leave to Remain after five years.
Tier 2 (General)	For skilled workers with a job offer for a graduate-level or above role.	Subject to minimum salary thresholds of £20,800 or the prescribed salary for the job, whichever is higher, and a Resident Labour Market Test. There is currently a cap of 20,700 visas per year. (See following pages for more details.)	Five years with option to extend for two years. Can apply for Indefinite Leave to Remain after five years.
Tier 2 (Inter-Company Transfer)	For skilled workers transferring to a UK branch of their current overseas employer.	Subject to minimum salary thresholds of at least £24,800 for short term staff or £41,500 for long term staff.	Short term visa holders: 12 months. Long term visa holders: five years. Nine years is permissible for those earning over £155,300.
Tier 4	For students with an offer to study at a UK educational establishment.	Only students at a Higher Education institution can work, and only part time during term time and full time during holidays.	For the duration of their course and for up to four months after if studying for longer than 12 months.
Tier 5 (Government Authorised Exchange)	For temporary workers and students on approved schemes for work experience, internships, special training, or research placements.	There are a number of Authorized Exchange schemes for science and engineering including the Sponsored Researcher, available to all higher education institutions; Sponsored Scientific Researcher Initiative, run by Shared Business Services (affiliated to Research Councils UK); Erasmus studentships, run by the British Council; and the BAE Systems Training, Intern, and Graduate Programme.	For the duration of the scheme.
Standard visitor visa	For business visits, including meetings, conferences, and training	Visa holder cannot be paid	Usually up to six months, 12 months if an academic on sabbatical coming to do research.
Permitted Paid Engagement visa	For specific paid work without having to be sponsored under the Points Based System	A limited amount of paid work, such as lecturing or examining a student, is permitted. As are subsistence and travel costs paid for by the conference organisers or host institution.	One month

Committee and those recommendations are revised periodically. Examples of occupations on the list are chemistry and physics secondary school teachers, mechanical engineers, and physical scientists. Sponsors are not required to conduct an RLMT for SOL positions and applicants with an offer of employment in a shortage occupation are eligible for a reduced application fee.

The Tier 2 Cap

Tier 2 (General) is the only visa route in the UK system subject to a limitation on the number of visas available. There is currently a cap of 20,700 per year. The Conservative Manifesto committed to maintaining this cap for the duration of the 2015-20 Parliament (1).

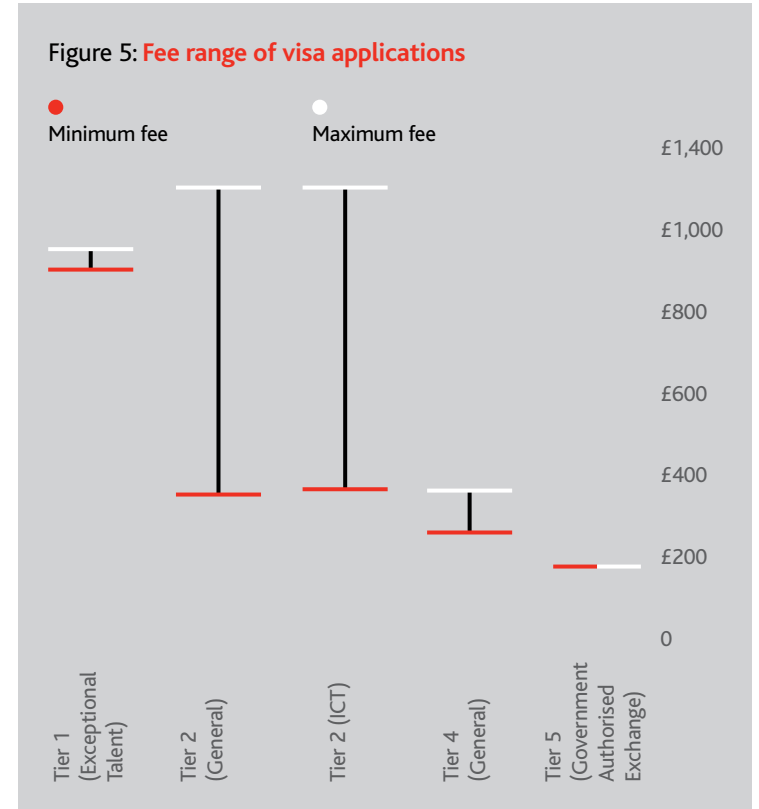
Visas for workers paid more than £155,300 are excluded from the cap, as are applicants applying from within the UK with the exception of dependants of Tier 4 students switching to Tier 2. If this monthly limit is reached, jobs are prioritised on a point scoring basis that favours those with jobs on the Shortage Occupation List and those at PhD-level¹⁴. Salary is then the final determinant. PhD-level occupations with salaries of £23,000 or more are placed equivalent to other occupations with salaries between £75,000 and £100,000.

Dependants

Spouses, children under 18, and unmarried partners who have been cohabiting for two consecutive years can also obtain visas as dependants of the main visa holder. Dependants have the right

¹⁴ Note: these are occupations that generally require a PhD, it does not mean that the visa applicant must have a PhD. PhD-level occupations are SOC codes: 2111 (Chemical scientists); 2112 (Biological scientists and biochemists); 2113 (Physical scientists); 2114 (Social and humanities scientists); 2119 (Natural and social science professionals not elsewhere classified); 2150 (Research and development managers); and 2311 (Higher Education teaching professionals).

to work in the UK, but not as dentists or doctors in training or as professional sportspersons. Most international students below master's level are not able to bring dependants with them to the UK. International postgraduates can currently bring spouses and other



Source: Home Office (84). The fees are for illustrative purposes only, other charges and discounts may apply to individual applications.

dependants if their course lasts a year or more, as well as students who are fully sponsored by their government for a course longer than six months. Dependants of students cannot work.

CASE STUDY

How much it would cost for a researcher to come to the UK on a tier 2 visa and bring their husband and child?

A young physicist starting her first research position in the UK would face an upfront cost of £3,492 in visa charges to cover application fees and the healthcare surcharge for herself and her family. As a new post-doc, her salary would be about £27,000. Her family would also likely pay for their flights, transport of their possessions, and accommodation. Some or all of these costs might be borne by the employers, who would also have to pay the £199 CoS fee and potentially the Priority Service fee of £120. On top of this, she must have £945 in maintenance funds to support herself and £630 for her husband and her daughter.

	Main applicant	Dependant #1 (Spouse)	Dependant #2 (Child)
Application fee	£564	£564	£564
Healthcare surcharge (£200/year)	£600	£600	£600
Total per person	£1,164	£1,164	£1,164
Entire upfront cost	£3,492		

Visa costs

Most visa applicants must pay a number of fees and charges (84). Application fees for visas vary widely depending on the tier, the nationality of the applicant, and a number of other variables. Table 5 shows ranges for the main visa routes.

Visa applicants must pay a Healthcare Surcharge of £150 per year for students and £200 per year for workers. This charge must be paid upfront to cover the full period on the visa application. Tier 2 ICT visas¹⁵ plus Australian and New Zealand nationals¹⁵ are among a small number of groups that are not subject to this requirement. It also does not apply to visitor visas.

Visa applicants, including visitors, must also prove that they will be able to financially maintain themselves during their stay without support from the state. Primarily, applicants must show they have a set amount of money in their bank account (the amount required varies between the tiers) or have proof of income from the Sponsor (usually the employer).

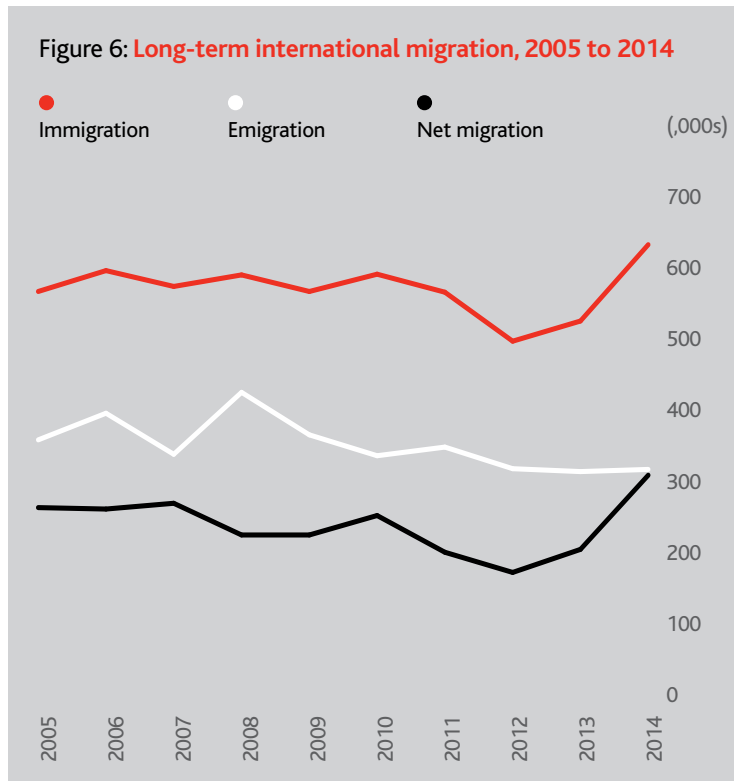
UK migration statistics at a glance

Estimates by the Office for National Statistics (ONS), suggest that general immigration has been rising since 2012 (85). In 2014 it passed its 2010 peak of about 600,000 per annum¹⁶ (Figure 6). Emigration has held fairly steady during this period meaning net migration has risen considerably. In 2015 net migration (immigration minus emigration) hit an all-time high at an estimated 330,000

¹⁵ The Migration Advisory Committee was reviewing this exemption at the time of writing this report.

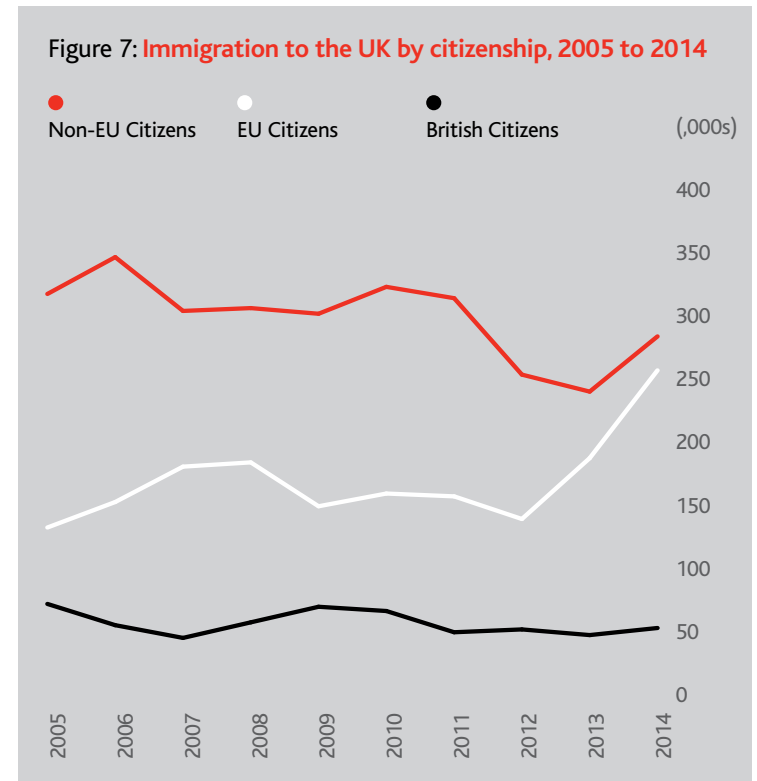
¹⁶ ONS migration figures define a migrant as "a person who moves to a country other than that of his or her usual residence for a period of at least a year (12 months), so that the country of destination effectively becomes his or her new country of usual residence."

(April 2014 to March 2015), up by 94,000 from the previous year. EU migration has contributed most significantly to the rise in immigration (Figure 7). Migration from other EU member states increased by 66% between 2012 and 2014. But there has also been a steep rise in non-EU migration, which rose by 10% over the same two-year period.



Source: Office for National Statistics (85)

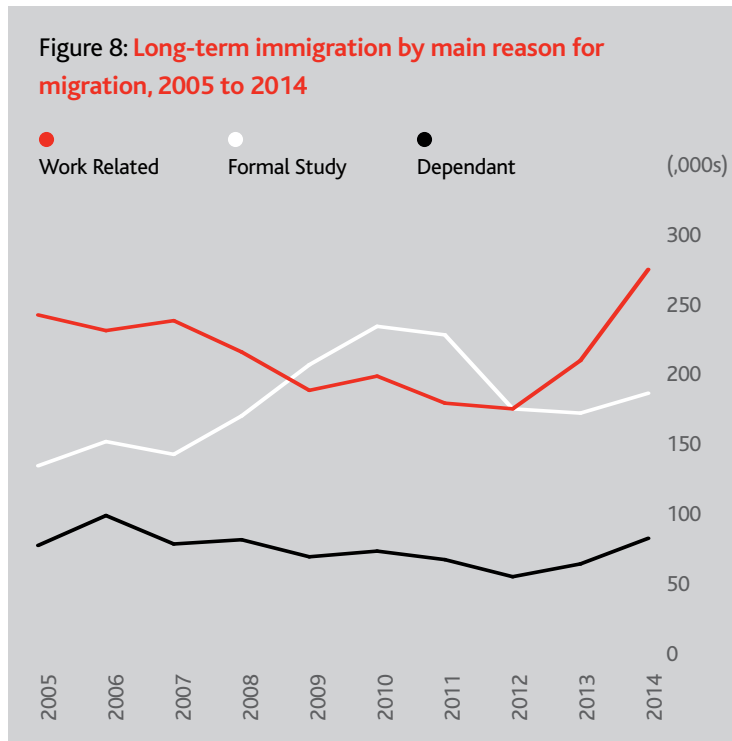
Since 2012 there has been a 54% increase in migration for work purposes (Figure 8). Student immigration has risen slightly but is still 20% below its 2010 peak. However, much of the drop in student immigration has been due to a reduction in further education students coming to the UK; visa applications for study at UK universities increased by 18% in the four years from 2010 (85).



Source: Office for National Statistics (85)

Use of the visa system by scientists and engineers

To determine the extent to which scientists and engineers use the different visa tiers, we asked the Home Office Performance Reporting and Analysis Unit to provide breakdowns by Standard Occupation Classification (SOC) codes¹⁷ of all CoS used to obtain visas. These were then further analysed by CaSE.



Source: Office for National Statistics (85)

¹⁷ For more information on these see: <http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/soc2010/index.html>

For the tiers where the data is available, it is possible to say that more than 13,000 work visas were issued for scientists and engineers to come to the UK in total. Data is not collected for scientists and engineers coming from within the EU to work in the UK, as they do not require visas.

Tier 2

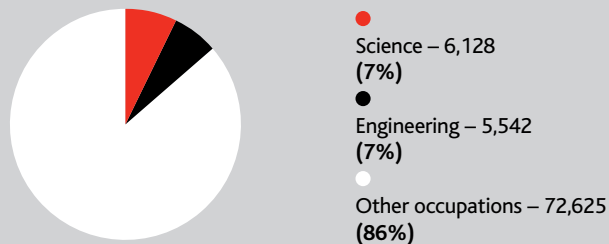
The majority of scientists and engineers entering the UK to work, and who require a visa, use the Tier 2 route. Scientists and engineers accounted for 11,625 (14% of the total) of all CoS used under the whole of Tier 2 in 2014/15¹⁸. However, there is a significant difference in use of the General and the Inter-Company Transfer (ICT) routes. Scientists and engineers accounted for 8,598 General visas (21% of the total) and 3,072 ICT visas (7% of the total). There is also notable difference in use of visa routes between science and engineering, with the former accounting for 14% of General visas but only 1% of ICT visas. Conversely, engineering occupations accounted for 7% of General visas and 7% of ICT visas.

The natural and social science professionals SOC code 2119, which covers most academic research staff, was the most commonly used occupation code for the General visa route in 2014/15, with 3,557 CoS used. Higher education teaching professionals (SOC 2311) also used 1,235 CoS and was the tenth most commonly used. No other science or engineering occupations appeared in the top ten.

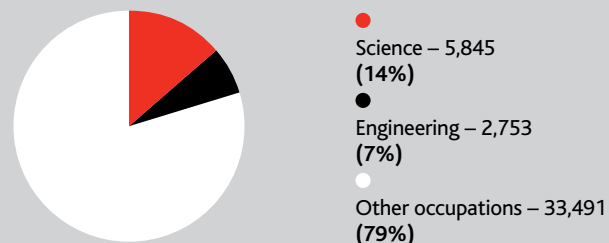
Looking specifically at the use of the SOL route within Tier 2 (General), four of the top ten user codes were science or engineering occupations. In total, science and engineering accounted for 1,407 visas obtained using the SOL route, 44% of the total.

Figure 9: Use of Tier 2 by scientists and engineers, 2014/15

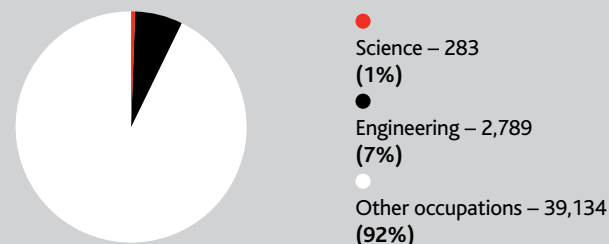
All Tier 2



Tier 2 (General)

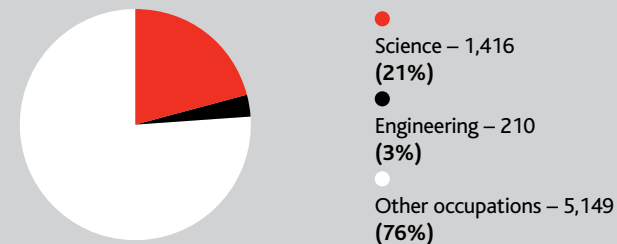


Tier 2 (ICT)



Source: Home Office Performance Reporting and Analysis Unit (unpublished)

Figure 10: Use of Tier 5 (Government Authorised Exchange) by scientists and engineers, 2014/15



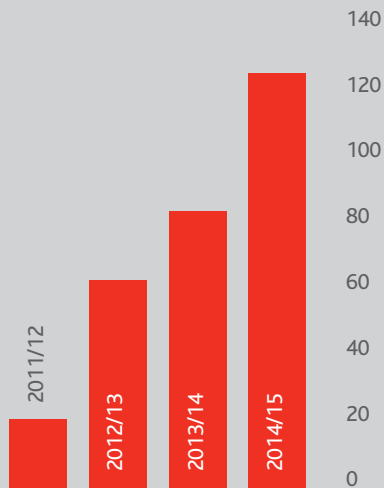
Source: Home Office Performance and Reporting Unit (unpublished)

The ICT route is heavily used by the information technology sectors but there is still significant use by the science and engineering sectors (Figure 9). 1,510 engineers used short-term ICT visas in 2014/15 and 1,279 used long-term ICT visas. Science is a much lighter user of these visas, using only 98 short-term and 185 long-term ICT visas. This should not be taken as an indication that the route is not important to the science sectors, however, as these few users may be highly-skilled experts unable to be sourced any other way.

Tier 5

After Tier 2, Tier 5 (Government Authorised Exchange) is the second most-used Tier route for scientists and engineers, although it is predominantly used by scientists (Figure 10). Scientists and engineers accounted for 1,626 (24% of the total) CoS used under Tier 5 (Government Authorised Exchange). The heaviest users of the route are Natural and social science professionals (SOC code 2119), with

Figure 11: Tier 1 (Exceptional Talent) visa approvals and endorsements by Designated Competent Bodies, 2011-2015



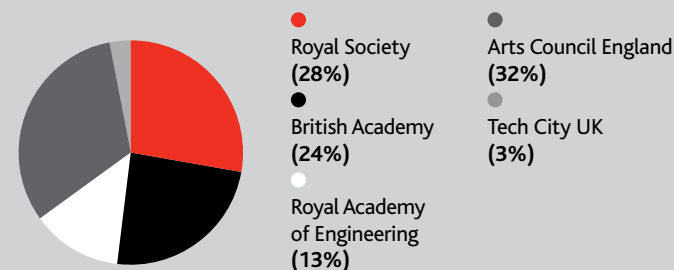
Source: Home Office Performance and Reporting Unit (unpublished).
Figures are rounded to the nearest 5.

1,057 CoS used with this code. This suggests that the route is very important to academics coming to work in the UK on a temporary basis. The second highest users are medical practitioners (SOC code 2211), with 507 CoS used.

Tier 1

The Tier 1 (Exceptional Talent) route has a total of 1,000 visas available per year. Although its use by the community is increasing, it is still

Figure 12: Tier 1 (Exceptional Talent) visa approvals and endorsements by Designated Competent Bodies, 2011-2015



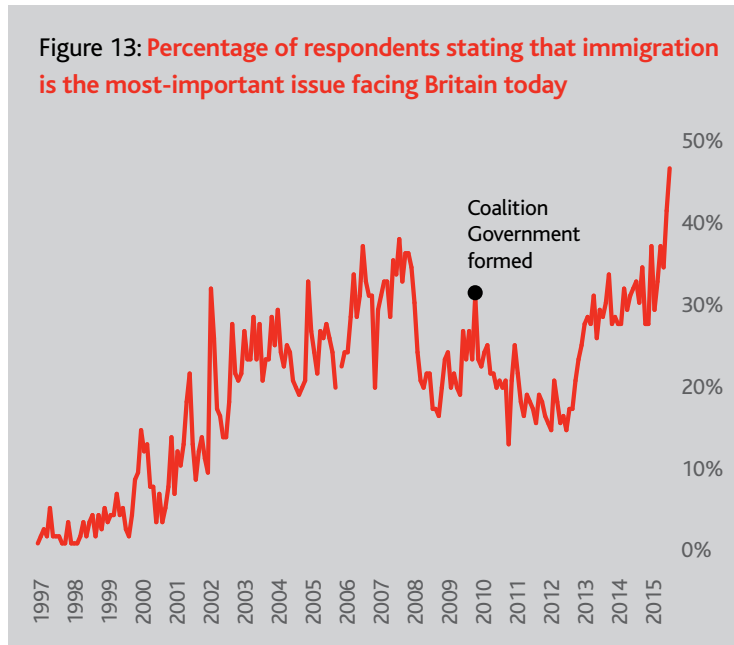
Source: Designated Competent Bodies (unpublished)

relatively under-used, with only 120 visas granted by the Home Office in 2014/15 (Figure 11). The Home Office was not able to provide data to reveal how many successful applicants were scientists and engineers.

However, by looking at the proportions of endorsements by the Designated Competent Bodies – elite institutions that must endorse the candidate as a leader or potential leader in their field – it is possible to get an indication of the level of use by scientists and engineers. Since the route has opened in 2011, 28% of endorsements have been by the Royal Society (for scientists) and 13% have been by the Royal Academy of Engineering (Figure 12). The arts is in fact the heaviest user of the route, responsible for a third (32%) of endorsements. Tech City UK, has only started endorsing applicants for the route in 2014, hence its lower use.

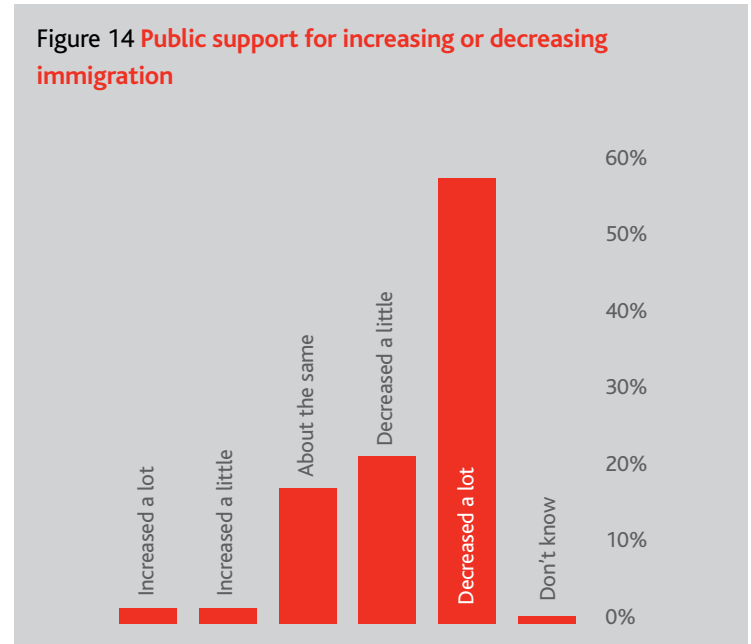
The public's views on immigration

Immigration is the British public's number one concern, according to polling by IpsosMORI (Figure 13) (86). And in the 2013 British Social Attitudes Survey, more than 56% of those asked said immigration should be 'reduced a lot', while a further 21% said 'reduced a little' (Figure 14) (87). In a number of recent surveys, majorities of respondents said that there are too many migrants in the UK, that fewer migrants should be let into the country, and that legal restrictions on immigration should be tightened (88, 89). However, there are important nuances to these views.



Source: Ipsos MORI (86)

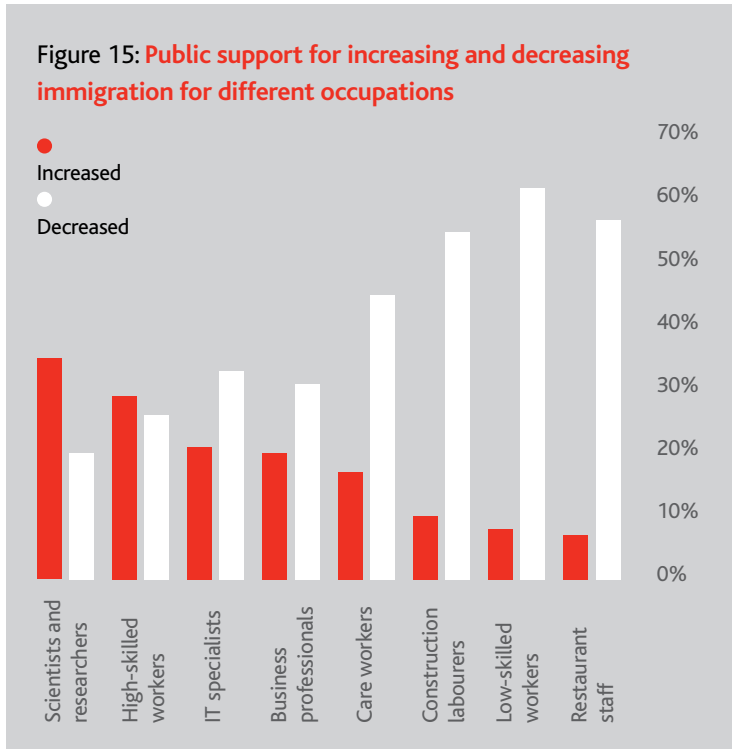
Figure 14 Public support for increasing or decreasing immigration



Source: NatCen (82)

In its longitudinal survey, Ipsos MORI reported that 41% of people say their views on immigration have changed since the 2010 election, with 86% of these becoming more worried (90). The same survey found low satisfaction with the Coalition Government's handling of immigration, with just 12% satisfied.

Despite the clear opposition to general immigration, attitudes depend on the type of immigrant in question. A 2011 Migration Observatory/IpsosMORI study found that attitudes toward low-skilled labour migrants, extended family members, and asylum seekers were much more negative than attitudes to high-skilled migrants,



Source: Migration Observatory/YouGov (87)

students, and close family members (91). This general pattern was found again in a 2013 Migration Observatory/YouGov study (92).

The 2013 study also found that scientists and researchers are the most favoured skilled migrants in the minds of the British public, with almost 35% of respondents saying they support greater numbers coming to the UK, against 20% opposing (Figure 15) (92). This suggests that the British public see scientists and researchers

as more valuable than other high-skilled workers, who garnered 29% support for higher levels of immigration. The public also view students favourably, with a 2014 poll conducted by British Future and Universities UK showing that only 22% think of international students as immigrants at all (93).

Beyond students and high-skilled migrants, those living in respondents' own neighbourhood attract the least hostility in the 2013 British Attitudes Survey. In something of a paradox, while many view migration as harmful to Britain, few claim that their own neighbourhood is having problems due to migrants (88). There are also regional differences, with people in Scotland and Wales generally viewing immigration more favourably than those in England (89, 94).

Scientists and engineers are heavy users of the visa system. But available data does not suggest that this is resented by the British public. Indeed, as this chapter and previous chapters have shown, there is considerable support and demand for researchers coming to the UK to work.

Recommendations

Protect the free movement of people in Europe – The ability of European scientists and engineers to travel freely between countries supports collaborations and knowledge sharing. This supports Government policies to promote these activities and is extremely valuable for UK science and engineering. The free movement of people principle must be protected in the event of a British exit from the EU.

Harmonise with EU legislation to support researcher mobility –

A draft new EU Directive is currently progressing through the European Parliament and Council of Ministers to improve the EU visa system for researchers (95). The UK Government's current position is to not opt into the legislation (96).

The legislation aims to stream-line visa applications for international researchers and their families, and make it easier for researchers to travel between member states for their research. The UK Government should consider implementing these parts of the Directive to support researcher mobility.

Fast-track peer-reviewed applicants through Tier 1 (Exceptional Talent) – The accelerated endorsement process for Tier 1 (Exceptional Talent) should be expanded, to include Professorial and research-leadership appointments by universities, charities, and research institutes, where those institutions meet the gold-standard peer review¹⁹, equivalent to the processes of the DCBs. This could make the route more attractive and increase its use.

Many individuals eligible for Tier 1 (Exceptional Talent) have already undergone stringent peer-review as part of the recruitment process for their role. They have therefore already gone through a very similar process required to gain a DCB endorsement. Duplication of this process is unnecessary and the proposed fast-track would reduce cost and bureaucracy for applicant, employer, and the DCBs. Similar to the RLMT process in Tier 2, documentation could simply be retrained for audit purposes with the onus being on the employer to ensure compliance.

¹⁹ <http://www.rcuk.ac.uk/funding/peerreview>

Impacts of current immigration policy on UK science and engineering

The preceding chapters illustrated how immigration has supported UK science and engineering, examined how the visa system is used by scientists and engineers, and explored public attitudes to immigration.

This chapter asks how current immigration policy and the visa system is affecting UK science and engineering today and what the implications could be for academia and industry, wider society, and the UK's economic future.

The impact on science and engineering academia

The UK's academic science and engineering research base is greatly enriched by foreign researchers. They come to Britain to conduct research, share ideas and skills, and build cross-border collaborations that can last and grow over a researcher's career. As a result, the UK is a global hub of science and engineering. Our call for evidence, answered by more than 80 practicing scientists and engineers in a personal capacity, plus responses from learned societies, charities, and universities, found overwhelming support for this positive view

of immigration within the research community. There was no suggestion that academic scientists and engineers believe immigration is crowding out British academics.

We found widespread frustration with current policy, especially with the Government's perceived anti-immigration rhetoric. This appears to be damaging the UK's reputation and risking our status as a global hub. Inflexible visa rules, stringent requirements, and disproportionate risk-profiling were among the top complaints of restrictive policies we uncovered.

While serious problems preventing academics from obtaining a visa are relatively rare, we uncovered many instances where researchers had suffered significant delays and disruptions to their work. Problems affected work, student, and visitor visas. Academic research, by its very nature, involves irregular and dynamic working arrangements. These are difficult to fit with a visa system that attempts a one-size-fits-all approach. However, the problems we identified appear on the whole to be avoidable and in many cases could be corrected by only small changes to the visa rules and system.

The impact on the science and engineering industries

Our research has found strong support within industry for immigration policies that allow science and engineering firms to recruit the skilled workers they need from outside of the UK and EEA. However, companies we spoke to emphasised that they do not recruit through the visa system if they can find the skills in the UK and EEA workforce, due to the cost and bureaucracy involved.

In contrast to academia, there appears to be a greater belief that immigration policy is already causing problems for the UK's science

and engineering businesses that need to bring in workers from abroad. There was also an overwhelming belief that the Government's anti-immigration rhetoric is damaging British business. However, the experiences of individual firms using the visa system were mixed, with some reporting problems while others finding the process satisfactory.

As in academia, the science and engineering industries rely on a workforce with highly specialised skills, many of which are in short supply in the UK. But there is a much wider range of occupations required in industry than in academia, and the training routes and qualifications workers will have are much more varied. Some highly-skilled workers will not have a university degree, for example, and fewer still will have PhDs. This means they generally aren't prioritised. Many instead have vocational qualifications not so well recognised by the system. Salaries are also much more varied and not dictated by national pay scales, as is mostly the case in academia. This introduces some recruitment challenges not so prevalent in academia, but also greater flexibility to meet visa requirements.

Findings

The findings for academia and industry are presented together. Most issues and concerns are shared by both sectors, but some are more relevant to one or the other. It should be noted, however, that with both an increasing tendency for university-business collaboration being driven by the sectors themselves, and a Government policy push to increase this type of collaboration, no issue or concern will solely affect one sector.

It is clear that the Home Office is very willing to engage and work with the science and engineering community to improve

the system. Over-arching bodies representing both business and academia reported to CaSE examples of successful constructive dialogue that has led to improvements. The issues highlighted in the following pages are therefore soluble, if there is the political will.

We have classified the problems and concerns identified through our research into three categories:

- **restrictive policies**, which actively prevent scientists and engineers from obtaining visas;
- **disincentives**, which make it harder to get a visa or put-off scientists and engineers from coming to the UK; and
- **future concerns**, which are not yet problems but have the potential to become so.

Restrictive policies

There are some policies and rules in the visa system that are actively preventing scientists and engineers from obtaining visas to come to the UK to work or visit. They are therefore in contradiction of wider Government policies to promote research and business (3).

The Tier 2 cap

In June 2015 the monthly cap on Tier 2 (General) visas was reached for the first time since its implementation in 2011. As a result, applicants with a salary of less than £46,000 were rejected in June and had to reapply for the following month (97). In total almost 2,500 applications were rejected in June and July, including 66 engineers, according to figures released by the Home Office (98).

This figure may seem small, but it is more than double the 30 higher-level apprenticeships²⁰ that were completed in 2013/14 (68). With such a short-supply of home-grown engineers, choking off international supply will have serious consequences.

“We are in the position now where we are heading rapidly towards having to make a choice between nurses for NHS hospitals and engineers to keep our great manufacturing industry on the road. That seems to us to be a ridiculous position.”

Neil Carberry, Director, Employment, Skills, and Public Services, CBI

As employers already report difficulties recruiting to the STEM vacancies that they currently have, the cap will mean roles left unfilled or filled by workers with the wrong skills or level of skills. This will make businesses less productive (99). As the economy grows, jobs will be created and demand for skills will increase; as shown in earlier chapters, the UK’s skills pipeline is not adequate to meet this demand. Further restrictions not set out in the manifesto that could be introduced, including on Tier 2 (ICT) visas, would put extra pressure on the cap, resulting in more skilled workers being turned away. Rejection of any skilled workers due to an arbitrary cap also adds to the negative perception of the UK system.

Nor is the cap likely to help the Government achieve its target to reduce net migration to few than 100,000. A 2015 study suggests that the UK experienced a migration policy ‘balloon effect’ after the policy was introduced (100). Squeezing immigration at one

²⁰ These are NQF level 4, equivalent to a Foundation Degree.

end (restricting the number of non-EEA skilled workers) led to an increased size at the other (inflating the number of EEA skilled workers).

PhD-level roles²¹ receive priority when the cap is reached and we have not identified any cases of academic researchers being rejected due to the cap. Similarly, many – but not all – engineering occupations are on the Shortage Occupation List and also get prioritised. As long as the Tier 2 cap policy remains, it is critical that these special exemptions continue and are expanded where necessary for the science and engineering community. For example, Chartered Engineer status, which is awarded by a number of Government-certified professional bodies, could be used as an indicator of high-skill and economic desirability. However, reliance on special dispensations for specific occupations also raises concerns of vulnerability for employers, which is discussed later in this chapter.

Rules on working outside the UK for long periods

The careers of scientists and engineers are dynamic and internationally-mobile. Their work often requires travel to work on temporary projects abroad, use specialist equipment, or conduct research that cannot be done in the UK. This can put them at odds with a rigid one-size fits all visa system.

In 2011, the Government introduced new requirements for Indefinite Leave to Remain (ILR) applications, including that the

²¹ Note: these are occupations that generally require a PhD, it does not mean that the visa applicant must have a PhD. PhD-level occupations are SOC codes: 2111 (Chemical scientists); 2112 (Biological scientists and biochemists); 2113 (Physical scientists); 2114 (Social and humanities scientists); 2119 (Natural and social science professionals not elsewhere classified); 2150 (Research and development managers); and 2311 (Higher Education teaching professionals).

applicant must not have spent any more than 180 days out of the UK in any one year of the previous five. This rule was applied retrospectively, over-ruling conditions on visas issued before 2011. For scientists and engineers who regularly have to travel, often for prolonged periods, as part of their research, this can be an almost-insurmountable barrier to obtaining ILR, and a major disruption to their work and career.

“I moved to the UK in 2006 to take up a research position in particle physics at Oxford University but my work regularly required me to travel to the Fermi accelerator laboratory in the US, and to CERN in Geneva. Under the initial rules of my visa, work-related travel was allowed while establishing residency in the UK. When I eventually applied for ILR in 2013 the rules had been changed and my application was rejected because I had been out of the UK on work for seven months in 2008.

From the time I applied in Jan 2013 until the successful appeal in March 2014, my whole family’s passports were confiscated. I therefore could not travel for work for 15 months, and my wife and I could not visit our families in the US. I was offered a team leadership position at CERN, only to have it rescinded when I told the group organisers that I was not allowed to travel. This has held back my career as I was turned down for a professorship at Oxford due to lacking this experience. My appeal for indefinite leave was finally granted after I hired a barrister. I am glad to be able to stay and continue my work in the UK but the whole

process has been very difficult for my family and has cost me over £5,000 and the department more than £2,000, as it has covered my recurring visa costs.”

Dr Chris Hays, Lecturer, Particle Physics sub-Department, University of Oxford

ILR is not just for people who wish to settle in the UK. It is necessary for anyone who wishes to work in the UK for more than seven years (the limit permitted on a Tier 1 and 2 visa), regardless of whether they intend to return home or not. Travel and temporary overseas work is an essential part of most researchers’ work. The 180 day rule therefore unfairly penalises scientists and engineers and is at odds with other Government policies aiming to promote international collaboration (3). Notably, it would penalise researchers who wish to maintain research links with their home country (as recommended by this report) where those links require working in their home country for extended periods.

While Dr Hays’ experience is not unique²², the policy is likely to affect a reasonably small number of researchers. However, for those highly-desirable individuals, the problem can be very disruptive. It also clearly provides no benefit to the UK. Furthermore, the confiscation of passports and taking the case to court suggests the Home Office is not taking a proportionate approach.

The ILR policy will affect any employer, in academia or industry, wishing to employ workers who will need to spend long periods abroad for work. The Government set out a strategy in 2013 to

²² In a well-publicised case, Dr Miwa Hirono, an expert in China’s foreign peacekeeping operations at the University of Nottingham, was refused ILR after the retrospective application of the 180 day rule to her visa application. After losing a lengthy court case Dr Hirono moved to Japan where she continues her academic research.

encourage more UK universities to establish institutions overseas to facilitate greater export of British higher education (52). The problem could become a more common occurrence if that strategy develops.

Temporary research collaborations not covered by Tier 5

The Tier 5 (Government Authorised Exchange) visa route supports universities and public research institutes to bring in researchers for temporary research placements. There are also industry-specific routes. However, due to complexity and diversity of research collaborations, the available schemes in the route are not meeting all of the public and private research community's needs. Cracks in the system can mean some temporary placements cannot be sponsored or gaining sponsorship is a bureaucratic and costly barrier. This lack of agility can result in the UK missing out on valuable research collaborations.

Home Office-approved organisations can sponsor Tier 5 (GAE) visas for other organisations wishing to host a researcher. Universities are also able to sponsor. However, there are cracks in the definitions of what type of temporary placements can be sponsored, meaning research institutes and businesses can be left without a clear visa option. Furthermore, unclear rules governing who can be sponsored and what activities the visa holder is allowed to undertake mean that hosts and sponsors can both be risk-averse. The cost of sponsorship – around £1,000 – is also barrier for researchers, especially in the public sector and for overseas research groups.

A new 'research' Tier 5 route is needed to ensure all research collaborations can be supported by the visa system. Furthermore, as Tier 2 evolves, it will become increasingly important to ensure that Tier 2 and Tier 5 routes are complementary. Any action taken

as a result of the recent review of Tier 2 by the Migration Advisory Committee must include a review of the operation of Tier 5 to ensure there are no cracks in the system.

Disproportionate risk-profiling for visitor visas

The UK is a global hub of science and engineering excellence. Scientists and engineers from around the world have a regular need to come to the UK for meetings, conferences, and as unpaid guest speakers. This benefits the UK research base and business as well as contributing to global research efforts. However, many research institutions have reported to CaSE problems where academics have been refused visitor visas.

The problems appear to be the result of over-cautious immigration officials. In some cases, visitor visa applications for world-renowned experts have been rejected. Busy researchers may be required to travel to other cities, or sometimes even back to their home country if they work abroad, for interviews or to provide original documentation. This creates unnecessary and sometimes impossible barriers for these people wishing to visit the UK. The risk profiles of these scientists and engineers are extremely low and they are often attending meetings with well-respected organisations like universities or royal colleges.

“Dr Mohammadi is President of the Global Health and Security Consultants. He was invited by Chatham House to attend a workshop in 2014 by the Centre on Global Health Security to draw on his expertise in biological risk management. Dr Mohammadi is Iranian and holds Swiss residency. Despite his dual residency status, frequent travel

to Europe, and multiple efforts at UK embassies in Turkey and Paris he was denied a visa to attend the workshop in London without explanation. Dr Mohammadi ended up spending a lot of money on applications in addition to time. He was interviewed for several hours at one point, during which he tried to explain his multiple residency and frequent travel to Europe. In addition, staff at Chatham House contacted multiple UK embassies by phone and email/fax, but was never able to speak to anyone nor did they ever hear back from the embassies.”

Chatham House

The Royal College of Physicians of Edinburgh report that their Diploma ceremonies and Fellows days are almost always disrupted by the refusal of visitor visas for three to four doctors per event. These highly-qualified doctors, certified by the College, are trying to attend their own celebration but appear to be considered too much of a risk. These problems also affect training that the College delivers.

“Another problem has been for delegates from less-developed economies seeking visas to attend our international courses. Visas for doctors from Australia, New Zealand and Canada are never a problem but from other countries can be, and recently doctors from Sudan and Uganda have been refused.”

Royal College of Physicians of Edinburgh

Not only is this a huge disruption and frustration to the visa applicants, it is an embarrassment for the UK and its institutions.

The work of UK scientists and engineers is also being hampered unnecessarily as the problems impact on their meetings and collaborations. It therefore appears that the UK Government’s stated policy aims to foster greater international collaboration are being undermined by an over-cautious visa approvals policy.

“I work on a European project involving 23 partner organisations in 10 Member States. The UK is the only country where scientists from certain countries cannot attend meetings or conferences... We have to carefully plan meetings to ensure colleagues can attend but sometimes meetings in the UK are unavoidable and these project partners must dial in to the meetings. It is embarrassing. It has affected the running of the project somewhat. And the scientists fear for their future travel plans with a rejected short term UK visa application on their record.”

Anonymous, EU Research Project Manager

New Home Office guidance was introduced in April 2015 and some rules have been modified. Anecdotal evidence received during the research for this report suggests that these have led to some improvements, although there have still been rejections. The Royal College of Physicians of Edinburgh, for example, report a guest’s visa was rejected because he had too much money in his bank account. It is of course understandable that the Home Office has strict rules to prevent abuse but they must be proportionate, applied fairly, and be sure not to penalise bona fide applicants.

Salary requirements

Scientists and engineers are relatively low paid for the amount of training and experience required to do the job. The research 'apprenticeship', from starting an undergraduate degree to finishing a first post-doc (by which point the researcher has gained theoretical and practical experience) is over ten years, for example. Equally, to gain Chartered Engineer status, one must qualify either with a degree or apprenticeship and gain several years of practical experience in the workplace. This puts these professionals at a disadvantage in an immigration system that largely uses salary as a proxy for skill level and economic desirability. We heard repeatedly from organisations across academia and industry that salary is not a proxy for these in science and engineering professions.

Although rare, we did find some instances when current minimum salary thresholds were a barrier to recruitment of scientists and engineers. There is much greater concern, however, over potential future increases, which are discussed later in this chapter.

Current salary thresholds for Tier 2 visas are generally in line with current pay scales in academia²³. But in rare instances, some researchers can fall below the requirements as a result of the irregular project funding that their salaries are dependent on.

"The minimum salary thresholds for Tier 2 sponsored staff are problematic when staff are on a small full-time equivalent salary. Many of our academic staff are funded by external grants, so fluctuating FTE salaries are not uncommon. Under current rules, we can no longer sponsor

²³ Salary thresholds were under review by the Migration Advisory Committee at the time of writing this report.

staff if their FTE causes them to fall below the minimum salary threshold. We have lost two key academic staff as a result of this restriction. In addition, we do not consider salary, within the Higher Education sector, to be a good proxy of skills or expertise."

Joanne Hunt, HR Partner, London School of Hygiene and Tropical Medicine

Some science and engineering companies also view the current thresholds as too high, both for new entrants and experienced workers. This was not a common problem identified in our research but is particularly acute among start-ups, which cannot offer high salaries. Often, these companies instead compensate staff with shares or other less-tangible benefits.

"A company based in Yorkshire and Humber told us that the main cost barrier they face as a business when recruiting is the salary thresholds set by the Home Office for various engineering job roles. They stated that the salaries were several thousand pounds more than what they were paying for a similar employee with similar skills and experience."

EEF, the manufacturers' organisation

Visa rules define an experienced worker as anyone with three years' experience in work and place a higher salary threshold on their application. This rule does not take into account the long training period and considerable on-the-job experience required in many science and engineering professions before an employer would consider the worker to have enough experience to command

a higher wage. Science and engineering graduates are thus hard-pushed to win enough salary increases in three years to reach the experienced threshold salary. This acts as a barrier for scientists and engineers who wish to come to the UK after working in their profession for a short period in a different country, meaning the UK can miss out on these individuals just as they are nearing the point when they become highly-productive workers.

International companies wishing to use the Tier 2 (Inter-Company Transfer) route to fill specific short-term skills gaps can also be restricted by current salary threshold. Despite being skilled, some workers may not be paid enough in their native country to reach the threshold.

“There have been occasions where employees from other GSK sites have very specific, and in some cases, very unique skills that are needed in the UK. For example, one employee was brought to the UK to train a UK site team on a new piece of scientific machinery in which he was an expert. As a manual operator, the individual’s salary was relatively low in his home country. With a salary of approximately £20,000, this individual was only able to come to the UK on an international assignment with the assistance of additional allowances in order to reach a minimum salary threshold.”

GlaxoSmithKline

As with researchers’ careers, described above, the salary requirements in the visa rules are not in alignment with the reality of science and engineering professions. Low relative pay, longer training periods, and international operations can all result in barriers

to obtaining visas due to the current salary thresholds. The danger of raising salary thresholds is widely felt across the sector as posing a serious threat and is discussed in more detail later in the future concerns section.

Skill level, specialisation, and combination

Roles in science and engineering often require niche or rare combinations of skills. This is true for both academic and private sectors. Our findings suggest the visa system is not adapted as much as it could be to account for this skill diversity.

Complex skill sets are not always reflected in the occupation classifications used in the visa system, meaning they may not be eligible for visas or can be subject to inappropriate salary requirements. SOC codes that do not fit the multi-disciplinary nature of many modern science and engineering roles can cause confusion for applicants and employers alike. Moreover, the growing necessity for a combination of language skills and technical ability in workers, largely as a result of the global marketplace, make it even harder to find the right skill complement in the UK. The example of Electroimpact’s need for Chinese-speaking mechanical engineers in chapter one is a case in point (page 30).

Jobs that are considered too low-skilled for the Tier 2 route may still involve a rare and desirable skill of critical value to academia and industry. In many circumstances these skills are still in short supply. For example, a machine operator may appear low skilled but if they are the only person who knows how to operate a machine that is essential for the manufacture of a new antibiotic in the UK, the worker becomes highly desirable. Science, engineering, and production technicians (SOC code 3119) are classed as an NQF3 job

and reported by some skills surveys as being in short supply (74). Despite this they cannot be brought in through the Tier 2 (General) route, which is only open to NQF6+ roles with a few exceptions.

“Due to the nature of the roles that are available within a global company such as GSK, it is often the case that lower NQF level roles require a specific skill set that cannot always be sourced from within the EU and UK labour market. These roles would include specialised machine operators.”

GlaxoSmithKline

Research and innovation is constantly creating new technical subjects in which to specialise. In somewhat of a paradox, there is a necessity for workers to be extremely specialist but their expertise must also span multiple disciplines. Again, this is difficult to represent and classify using the current SOC codes.

Science and engineering roles requiring high-level computational skills are becoming increasingly common. The IT SOC codes do not necessarily reflect or meet the more specialist skill set for emerging research disciplines. This can cause confusion when navigating the visa system. Furthermore, the visa requirements resulting from the use of the SOC codes are based on commercial rates of pay and not reflective of the moderate salaries paid to all professions in the academic research sector. Thus researchers or research support workers can be subject to salary requirements not attainable in their specific line of work.

The visa system needs to account for these evolving and nuanced roles so that academia and industry can efficiently access the skill sets they require.

Recommendations

Abolish the Tier 2 (General) cap – The arbitrary Tier 2 (General) cap of 20,700 sends a strong negative message to global science and engineering talent and business. It also poses a direct threat to the recruitment of the skilled workers needed to support growth, with valuable workers already being turned away. Therefore, to further Government policy of improving productivity and supporting businesses and science, the Government should reconsider the Tier 2 (General) cap.

Bringing net migration down to the “tens of thousands” was in the 2015 Conservative manifesto, as was maintaining the Tier 2 cap until 2020 (1). However, much can change in five years and the Government should provide itself opportunity to be flexible and be able to respond to a changing economy. Changes to other parts of the visa system, such as Tier 2 (ICT), could also put extra pressure on the cap, increasing the need for its reassessment.

Permit research activity overseas in Indefinite Leave to Remain rules – The Government has an explicit policy objective to promote international research collaboration and international development through science (3, 17). Preventing researchers wishing to obtain ILR from spending more than 180 days overseas is a strong disincentive against these policies. The rules should be amended to permit time spent overseas for validated research activity.

Create a new Tier 5 (Temporary Worker – Science, Research, and Academia) visa route – To improve the coverage of Tier 5 for the whole research community, a new scheme should be introduced. This would be specifically-designed to enable the research community to self-sponsor, rather than requiring an over-arching sponsor as under Tier 5 (Government Authorised Exchange). This would allow sponsors to engage researchers providing support to international collaborations and/or facilities within universities, research institutes, and industry R&D teams.

Providing a sector-wide route under Tier 5 would align the research community with others that have unique routes, including Tier 5 (Temporary Worker - Creative and sporting) and Tier 5 (Temporary Worker - Religious Worker). The new scheme would replace Tier 5 Sponsored Researchers (HEIs) and the Tier 5 sponsored Scientific Researcher Initiative (overarching sponsor UK SBS).

Allow trusted Sponsors to certify visitor visas for low-risk researchers – Universities and public and private research institutes should be able to sponsor visitor visas for researchers, including scientists and engineers, guaranteeing them entry to the UK for meetings and conferences. This would mean they are not required to provide documentation or attend interviews that are disproportionate to their risk profile. This would reduce the workload for UKVI and the unnecessary scrutiny and bureaucracy for low-risk individuals.

Disincentives

Disincentives are barriers created by the visa system that make the act of hiring a skilled worker from abroad or make coming to the UK more difficult and less attractive. As a result, the UK could be missing out on the world's top talent of scientists and engineers who are crucial to maintaining our status as a global hub and capitalising on this economic advantage.

Anti-immigration rhetoric

The perception that the UK is unfriendly to foreign students and workers was the most common issue raised by respondents to our call for evidence and in meetings and interviews. A quarter (26%) of submissions to our call for evidence raised it as a concern. Many individuals and organisations said they believed the Government's strong anti-immigration rhetoric is a strong disincentive for scientists and engineers considering moving to the UK. The tough requirements on visa applications described in this report only reinforce this perception. Alongside academia, businesses have repeatedly called for the UK Government to promote a more welcoming image of the UK (101).

Official Government policy is to be welcoming to students and skilled workers (3, 52). However, the Conservative Party's pledge to reduce net migration to the "tens of thousands" is intended to send a strong message to the British electorate that the Government is serious about stemming immigration (1). It is not surprising that scientists and engineers around the world also hear this and believe that it is them who are not wanted.

"The CBI has offices in New Delhi and in Beijing. There is an assumption that what is said on immigration for domestic audiences is not picked up in markets around the world, and it is."

Neil Carberry, Director, Employment, Skills, and Public Services, CBI

A more nuanced and evidence-rich approach to talking about immigration is needed. Nuanced rhetoric should be matched by more-nuanced policies that allow science and engineering to make a full contribution to British culture and economic growth.

"The Government should encourage qualified, experienced foreign professionals to move to the UK, not restrict it. As a group, we make a major net contribution to the economy. That's how the US built its dynamic economy. Anything else is a recipe for stagnation."

Dr Alan Reid, geophysical consultant, private business owner, and immigrant to the UK

Closure of the Tier 1 (Post-Study Work) visa

The prospect of staying on in the UK following study to work is part of the attraction for some international students (58). It is also the means by which science and engineering employers can benefit from our higher education sector's ability to attract the world's brightest students. Unfortunately, in 2012, the Government closed the Tier 1 (Post-Study Work) visa route, which had allowed former students to stay in the UK for up to two years in order to seek employment. Both academia and industry feel that this move has harmed Britain's

reputation and resulted in the loss of talented graduates to the United States and other countries.

Former students must now secure a graduate-level job and switch to Tier 2 (General) visa. This must be done within four months of the end of the student's Certificate of Acceptance of Studies with which their Tier 4 student visa is associated. However, the rules for switching are not clear and can be misinterpreted by universities, employers, and visa applicants.

The cancellation of the Tier 1 (PSW) visa route has been comprehensively assessed and criticised by the House of Lords Science and Technology Select Committee and the All-Party Parliamentary Group on Migration (73, 80). But, in its response to the Select Committee, the Government refused to reinstate it (102).

Closure of the route has made the UK a less-attractive destination to study. The Hobsons/Times Higher Education 2015 international students survey found that 36% of students who chose not to study in the UK after considering it said that post-study work options were the reason for deciding against the UK (103). 23% blamed the UK's attitude to international students more generally. These students are a valuable source of income for universities and make many post-graduate STEM courses financially viable. Without international students, UK students would not have such a wide range of postgraduate STEM courses available to them. This would affect the STEM skills pipeline and exacerbate the skills shortage.

"Although post-study work rights may be off the table for most institutions, the Government must be sent a clear message. Failure to improve post-study work opportunities will see revenue generation from international students rapidly decline, with this revenue something UK institutions have long relied on. The long-term effects and rebuild could last decades. Without this form of revenue, governments will be forced to provide additional institutional funding – without it, institutions may not survive."

[Hobsons/Times Higher Education International Students Survey 2015](#)

The APPG on Migration found the route's removal resulted in an 88% reduction in former foreign students getting visas to work in the UK (73). Students who go elsewhere to work may have a more negative impression of the UK as a result and will not become so integrated with UK business. This will reduce the likelihood of future collaboration and custom for UK science and engineering.

Companies that gave evidence to the group's inquiry expressed frustration with a system that provides the world's most-talented young people a world-class education but then pushes them overseas rather than capitalising on this valuable human resource. Indeed, countries such as America, Canada, and Australia have enacted policies to encourage international students, especially STEM students, to stay following graduation (104). In a client survey conducted by global law firm Squire Patton Boggs with the manufacturer's organisation, EEF, 88% of employers surveyed said that they wanted the Tier 1 (PSW) visa to be reinstated (105). And, according to a 2014 British Futures/Universities UK survey, 75% of

the public would like the Government to allow students to stay on to work after their degree (93).

In 2013, the Tier 4 rules were modified to allow PhD graduates to stay to work for up to twelve months after their studies. This is a valuable and welcome exemption, as many PhD researchers will have unfinished research from the PhD even after submitting and it is right that they have the opportunity to finish this off and find work.

The closure of the Tier 1 (PSW) visa route was intended to prevent abuse by students overstaying their visa or working in non-graduate level jobs. However, it is widely viewed to have hurt both higher education and employers as an unintended consequence.

Prior to the 2015 election, the Home Secretary, Theresa May, was reported to have floated the idea of requiring international students graduating from UK institutions to return home before applying for a job in the UK (106). This was blocked by her Coalition partners and fellow Conservative ministers, including George Osborne. However, the rule was implemented for international further education students in the summer of 2015. It would be a further highly damaging step for universities and employers alike if this were to be extended to higher education.

Bureaucracy

The amount of paperwork and stringency of requirements for visa applications across all tiers, including visitor visas, is a much-maligned barrier for workers and employers. It adds both administrative and financial burden to the recruitment process. The level of detail required also appears punitive to some applicants and adds to their sense that the UK is not welcoming to skilled foreign workers and visitors.

“One of my most talented researchers was put through a long series of humiliations before he could get a work permit, despite being a named researcher on a £1 million EPSRC project.”

Professor Lawrence Paulson, Professor of Computational Logic, University of Cambridge

In a survey by the manufacturers’ organisation, EEF, almost half of companies disagreed that the process of recruiting a non-EEA graduate was easy, and over half (53%) found the process very-time consuming (107). According to EEF, these difficulties and the current negative rhetoric around immigration is the reason why reliance on non-EEA workers is relatively low among their members – at 11% – despite four in five saying they are experiencing recruitment difficulties. CaSE heard many similar views in responses to our call for evidence.

“It is cumbersome to employ people outside the EU to work in a scientific UK company. There is a lot of paperwork even when it is demonstrable that hiring a certain non-EU candidate is the best option.”

Albert Vilella, Bioinformatics Scientist, Cambridge Epigenetix

Many employers in both the public and private sector have to seek external help with visa applications. Small and Medium-sized Enterprises (SMEs) and research institutes, particularly small ones without access to a university’s human resources team, do not always have the expertise in house to navigate the visa system, with its multiple routes and varying requirements. These small organisations

can ill-afford lawyers to help them. For many large firms it is an unnecessary burden and cost that makes operating in the UK less attractive.

“Employers navigating Tier 2 of the Points Based System must have a working knowledge of Part 1, Part 6A, Part 9, Part 10 of the Immigration Rules, all with reference to over ten Appendices. They should also have a clear understanding of the Tier 2 policy guidance and sponsor guidance, among other areas of policy. Home Office application forms contain additional requirements.

The same will arguably be true across every area UK regulation – the law will always be complicated, and for good reason. But there is scope to simplify the system. The Home Office did a good job simplifying the rules for visitors. Repeating that exercise for business immigration would ease the burden on employers and users of the system, increasing their confidence and reducing the risk of misunderstandings and delays.”

Fragomen Worldwide Immigration

Since its introduction in 2012, the current visa system has been modified multiple times, often to improve function but, in some cases, also to restrict immigration further (108). Constant changes have exacerbated the difficulties employers experience; it was the top complaint among companies identified by a recent London Chamber of Commerce and Industry survey (109). While refinement of the system is welcome, effective stakeholder consultation prior to policy implementation could alleviate these pressures.

Bureaucracy, excessive requirements, and slow processing times are also a problem for those using visitor visa routes. Face-to-face meetings, conferences, and placements are essential for academics and companies alike; international collaboration is integral in science and engineering. However, many academics and companies told CaSE that short-term visits are prohibitively bureaucratic. This impedes research and business, and means the UK misses out on the economic gain of hosting international conferences.

“We have had problems with the ability of project partners to obtain visas to attend meetings in the UK - and when they are granted, it is only after a very rigorous and complicated process, requiring them for example to travel to a neighbouring country and then wait several days for an interview. This means we have to hold partner meetings in other countries. Partners have persuaded us to agree to hold major consortium meetings Brussels and Paris, rather than London, partly because of the perception that getting UK visas is so difficult.”

Dr Deborah Watson-Jones, Principal Investigator, Ebola Vaccine Trials Consortium

Parts of the visa application process are contracted out by the Home Office to local agencies. These are often not very “local”, however, as they are not in every country, particularly in less-developed regions. These disjointed organisations can cause delays and inflict further bureaucracy or problems, such as the over-charging of fees. Visa rules also do not take into account that many researchers will legitimately not be in their home country when applying for

visas – African scientists working in the United States, for example. They cannot reasonably be expected to return home for the purpose of their application. As a result, these experts do not come to the UK and our researchers and students miss out on opportunities to learn from them or collaborate.

“Currently, visa processing takes at least three weeks, meaning that one cannot travel elsewhere nor do anything requiring a passport during the three weeks as the passport is away in Pretoria, South Africa. One also has to travel to the capital city for biometric tests. The need to keep re-applying for a visa every six months and having to undergo the same process as above is tiresome.”

Anonymous, Researcher based in Tanzania

Application costs and other fees

Both employers and workers found the cost associated with visa applications to be a disincentive. It was the second most-mentioned issue with current immigration policy and the visa system in responses to our call for evidence. As shown on page 57, the immigration charges for a small family can be in excess of £3,500.

On top of application fees, many respondents highlighted the maintenance funds and Health Surcharge as posing financial barriers to the applicant, especially for researchers with multiple dependants on early-career salaries.

“The recent policy to charge non-EU workers £200/year per person for NHS is putting off my colleague to continue his contract to work in the UK. He has a family of four, and

has to pay an extra £1,000 each year for the NHS charges even though he pays all the taxes to the same level as UK workers.”

Yan Ma, PhD student, Sainsbury Laboratory, Norwich

In academia these costs are usually borne by the worker. An informal survey of the Russell Group universities in 2015²⁴ found that only 13% pay for visa fees, and none pay the NHS surcharge. 88% do however pay relocation costs. Departments within universities, and even individual research groups, may have varying policies, however.

Sponsor status

Smaller firms find the bureaucracy and cost of obtaining sponsorship status a barrier. This problem is particularly acute for start-ups, which can experience rapid and unpredictable growth leaving little time or man-power to navigate the sponsorship designation process (71, 110). An EEF survey found that four in every ten companies had difficulties securing a sponsorship licence (107).

“The process of getting licensed to sponsor Tier 2 visas is not cheap, can be exceptionally complex and bureaucratic, and is time consuming. The government says 20% of applications take over 8 weeks but evidence from start-ups suggests in some case it can be much longer as the Home Office policy is to visit start-ups before they issue their sponsor licence.”

The Coalition for a Digital Economy

²⁴ Unpublished survey conducted by Ruth Austin at the University of Edinburgh and provided to CaSE by the University of Cambridge.

Tier 2 sponsorship imposes costs and risks on to the employer as sponsor. Sponsor registration fees are between £550 and £1,400 per year and the employer must maintain strict records of the workers activities. We found anecdotal evidence to suggest that smaller and/or younger enterprises, in particular, are unable or reluctant to bear these. Instead they are forced to go without the skilled workers they need. Sherry Coutu’s Scale-Up Report concluded that young firms’ inability to quickly recruit foreign skilled workers at short notice is a major impediment to scaling-up a business in the UK (110).

Resident Labour Market Test

British workers must have the opportunity to apply for jobs that they are qualified for. This view was widely held by science and engineering employers CaSE spoke to while researching this report. And as mentioned earlier, the visa system is often a last resort for employers, especially in industry. The Resident Labour Market Test (RLMT) therefore serves a useful purpose but employers across the spectrum believe there is room for improvement.

Because of the rarity and high degree of specialism of the skills required in many science and engineering roles, employers are often proactive in searching for them, rather than just advertising the role. Successful firms have become very efficient at this and often have dedicated teams for the purpose. Unfortunately, this does not satisfy the RLMT under current rules. In many cases this means the test only serves to prolong the search period and thus the time employers are without the skills they need.

The same media outlets for advertisement are not appropriate for all sectors or employers, and the media type is strongly dependent on the nature of the role advertised. Most science and engineering

employers find that advertising in JobCentre Plus never yields any suitable candidates as it is not where scientists and engineers look for jobs. Advertising on sites such as ResearchGate or LinkedIn²⁵ may be more appropriate and allow for proactive identification of suitable candidates.

Once the RLMT has been satisfied, the employer must wait for the Home Office to allocate a CoS. At the moment, this only occurs once a month, meaning recruitment can take several months if it is not perfectly aligned with the Home Office's timetable. More frequent allocations would reduce the recruitment time.

"Increasing the frequency of CoS allocations would make a really big difference to employers"

Verity O'Keefe, Senior Employment and Skills Policy Adviser, EEF, the manufacturers' organisation

²⁵ See <http://www.researchgate.net/> and <https://gb.linkedin.com/>

Recommendations

Extend the international graduate job search period – The UK should benefit from the education of foreign graduates by encouraging them to stay in the UK where they can continue to contribute to our economy through skilled graduate-level work. Allowing graduates 12 months stay in the UK – as is already provided to students finishing their PhD – to secure a graduate-level job through the Tier 2 route would send a strong signal that the UK values the world's best and brightest.

Improve online visa information to make it more user-friendly – The visa system is likely to be the first interaction a migrant scientist or engineer has with the British State. It should be a positive one. The Home Office is making welcome strides in refining the application process and improving information on its website; resource and effort must continue to be allocated to this. But with so many visa options, the choice is bewildering for potential applicants. A more systematic process is required that uses a series of questions to guide users to the correct visa for them.

It is not only the Home Office that should improve its online information. Tech City, a Designated Competent Body for Tier 1, has recently redesigned its website to help potential applicants²⁶; this should serve as a blueprint for other sector websites.

²⁶ <http://www.techcityuk.com/government-resources/#workvisas>

Reform the RLMT and increase the frequency of CoS allocations

– Employers must currently wait up to a month to be awarded a CoS to allow their candidate employee to obtain a visa. This adds unnecessary delays to recruitment and negatively impacts research and business productivity. The cap has made this situation worse for unsuccessful applicants who must wait a further month to reapply. The awarding process should occur twice a month, as used to be the case, rather than once.

Employers use a range of methods to identify potential job candidates, especially when rare and highly-specialised skills are required. Rules for the RLMT should reflect this to allow the employer to demonstrate that suitable candidates are not available in the UK or EU more efficiently. The search period should also be reduced to 14 days where the employer has used a comprehensive search method to prove suitable candidates are not available.

Future concerns

Our research has identified several areas of concern over the direction of travel for Government immigration policy in addition to those raised above. As a result of official announcements and tough anti-immigration rhetoric, there are fears within the science and engineering community that policy and rules may be tightened to the detriment of science and engineering.

Recommendations are not made at the end of this section. However, the damage that could be caused if these concerns become a reality should not be under-estimated. By raising them, we hope the Government will be able to ensure that such damage is avoided.

Salary threshold rises

Current salary thresholds for Tier 2 visas are on the whole appropriate and do not negatively impact on UK science and engineering (the few exceptions were described earlier in this chapter). Increases to the thresholds, however, have the potential to introduce extremely-damaging barriers to recruitment.

For most sectors, salary rates for new entrants and experienced workers are set at the 10th and 25th percentile, respectively, of the occupation. Salary data is compiled from the Annual Survey of Hours and Earnings (ASHE) (111). To restrict the number of foreign workers eligible for Tier 2 visas – both the General and Inter-Company Transfer routes – the Government may potentially set higher percentiles as new thresholds.

“Scientists have a high value to the wider UK economy, but the salaries paid to scientists are not a good proxy for their value. Raising the minimum salary threshold so that non-EU scientists could only be recruited to higher paid roles would not be equivalent to selecting for those scientists from whom the UK stands to benefit the most.”

The Royal Society

As academia largely uses Government-set national pay scales, it has little flexibility to meet rising salary thresholds. Industry has the ability, in theory, to raise the salaries they offer. But this would likely impact their competitiveness and many businesses may not be able to absorb the cost of substantial increases.

“The salary threshold is also a barrier for many start-ups as often initial salaries are low, compensated by employees receiving equity in the start-up.”

The Coalition for a Digital Economy

In 2012, the Government announced that from April 2016 Tier 2 visa holders who apply for Indefinite Leave to Remain in the UK will be required to meet a minimum annual salary requirement of £35,000 (112). PhD-level roles and those in shortage will be exempt from the £35,000 threshold. This exemption is necessary and welcome but, as described above, many other valuable workers not currently covered by these exemptions will be affected and the UK may miss out on benefitting from their skills. This is particularly true in the engineering industry, where PhDs are not so prevalent in the most highly-skilled jobs.

With a few exceptions, current salary thresholds do not distinguish between public and private sector earnings, which already differ considerably in some cases. As the economy and Government spending fluctuate, salaries in these sectors could begin to diverge significantly and invalidate the thresholds. This would impact on whichever sector has not seen larger pay rises. There are also notable differences within the private sector and between different regions in the UK that could mean some employers would struggle to offer the threshold salary if they were to rise. It is therefore important to consider the minimum salaries of the whole ASHE distribution when setting thresholds, unless a more nuanced approach can be developed.

Limits of dependants' rights

Currently, the dependents of Tier 2 visa holders have the right to work in the UK. In June 2015, the Home Office commissioned the Migration Advisory Committee (MAC) to consider the impact of removing this right (113). Many organisations and individuals have told CaSE that restricting the right to work for dependants would be a serious obstacle in attracting top global talent, which would, in turn, affect the economy.

The Permits Foundation recently surveyed Tier 2 work visa holders, including 222 working in universities and research institutes. Of the 222 academics, more than 40% said that they would definitely not have accepted their current role if their partner did not have the right to work in the UK, and a further 40% said that they would probably not (114). Respondents to the survey cited concern for their partners' careers and emotional wellbeing should they not be allowed to work, as well as the struggle to meet the UK's high living costs on one salary.

"I had a colleague whose spouse was unable to work due to visa restrictions and it caused a lot of friction and the eventual breakdown of the relationship. The emotional stress of course had a very negative impact on his research."

Anonymous, academic researcher attending CaSE stakeholder meeting

Highly-educated individuals tend to partner with other highly-educated individuals. The Permits Foundation survey found that 37% of Tier 2 visa-holding academic's partners had a masters degree and 33% had a doctorate. As a result, almost 80% of employed partners were working in professional roles requiring a high degree of education and/or training. There is therefore a multiplier effect in attracting these couples, both of whom will be able to make a substantial contribution to the economy and knowledge-base through their skilled employment.

The rights of dependants of students are also under threat. Most international students below master's level are already banned from bringing dependants. But international postgraduates can currently bring spouses and other dependants if their course lasts a year or more. However, in July 2015 it was reported that Theresa May circulated proposals to ban dependants from being employed in low-skilled jobs (115). This is particularly concerning for PhD students, who are on Tier 4 visas but are of working age and conducting important research. Their work is, in essence, a job. They therefore reasonably have the same family needs as Tier 2 visa holders. The 2015 Spending Review stated that "dependants of postgraduates on courses lasting more than a year will be welcome to come and work" (17). This is welcome reassurance but the Government must

commit to not restricting this right to work to only professional jobs or introducing other similar draconian measures.

Targeting the dependants of workers and students is a very harmful way of discouraging immigration. It would have significant personal and social impacts for the families affected, and would be a very strong disincentive for scientists and engineers looking to work in the UK. This would be highly damaging to our scientific and economic success.

Prioritisation in the points based system

The current Points Based System prioritises occupations on the shortage list and those at PhD level. This recognises the economic importance of these roles. Employers depend on the Shortage Occupation List (SOL) to make it easier – and in some cases possible – to recruit the skilled workers they need in a timely fashion.

The continued inclusion of occupations on the list and the designation of other roles that are prioritised (i.e. PhD-level roles) was therefore a key concern among the employers we spoke to in both academia and industry. They were clear that this prioritisation must be maintained as the system evolves. There may also be benefits in expanding the range of economically-important occupations prioritised to better support UK science and engineering. However, attendees to the multi-stakeholder forums hosted by CaSE also raised concerns that reliance on special dispensations for shortage occupations and PhD-level occupations creates vulnerability for employers.

The effectiveness of current immigration policy and the priority it gives to selected occupations depends on a valid, responsive, and flexible system for identifying required skills. The current UK

approach is informed by the Migration Advisory Committee (MAC) but inclusion on the SOL is ultimately a ministerial decision. It is essential that there is a robust and transparent system for prioritising the skilled workers needed in the UK. This must provide long-term confidence that priority treatment will not be lost overnight but also be responsive to the constant evolution of science and engineering. Although those CaSE spoke to were positive and appreciative of the work of the MAC, the current system of sporadic consultation with employers is slow and unpredictable, and excludes those without the resources to fully engage.

It can take over a year, or even many more, to collect the employment data required to prove a shortage exists. With such a lag, the damage of the skills shortage is already done by the time action is taken. This problem is particularly acute in science and engineering, where rapidly-evolving disciplines can quickly create demand for skills not abundant in the UK. This makes skills demand forecasting extremely difficult. For example, the Association of the British Pharmaceutical Industry's recent skills survey highlights the need for skills in bioinformatics, statistics, and data mining (116). These were not even highlighted as issues in 2008, the year the survey was last conducted (66).

The suggestion of a "Sunset Clause", which would automatically remove jobs from the Shortage Occupation List, adds to the employers lack of long-term confidence in its ability to recruit the skilled workers they need. The time limit was considered and rejected multiple times during the 2010-2015 Parliament but was recently raised again as potential Government policy (113). Employers view the Sunset Clause as a blunt tool likely to harm the UK's ability to compete internationally.

Conclusion

As a result of the issues identified in this report, the UK is undoubtedly missing out on some of the world's top international talent in science and engineering. In some circumstances, the candidate most suitable and most able to contribute to the UK's academic excellence and industrial success will not have been hired or will have chosen a more welcoming country. The full extent to which this has happened is not recorded and will never be known.

"I got through two interviews where the professors told me to my face that they would have hired me if I had an EU passport or a work visa, but because of the policy, to avoid potential 'trouble' for the future, they would go for another EU candidate."

Anonymous, post-doctoral researcher

Beyond the individual anecdotes of negative experiences and ordeals presented in this report there are wider impacts on UK science and engineering, society, and the economy.

This report does not aim to paint a Doomsday scenario. Immigration of scientists and engineers will not cease because of the Government's immigration policies or faults with the visa system. Scientists and engineers from around the world will not

en masse decide to boycott Britain as a place to work or study. But the cumulative effects of the many issues identified in this work could have long-lasting impacts if not addressed. In today's highly-competitive global economy, the Government must ensure there is a coordinated effort across all departments to support scientific, social, and economic progress.

Scientific impacts

This report has set out the great benefits – past and present – of immigration for science and engineering. Internationally-connected science tends to be more innovative and impactful (4) (31). Policies and problems that reduce the numbers of foreign researchers coming to the UK are therefore highly likely to reduce the excellence of UK research.

While there is clear evidence that some foreign researchers are being prevented from making a full contribution to UK science and engineering, the problems are not currently critical or insoluble. These problems can and must be addressed by the Government. And there must not be further changes to immigration policy that will harm science and engineering.

Prolonged and more-draconian restrictions and disincentives for immigration could ultimately reduce the volume and quality of UK academic output, the number of patents filed, and the growth of innovative start-ups. The UK's world-renowned higher education sector could lose its lucrative status; if universities are unable to attract top international academic talent and fee-paying international students, they will struggle to maintain the high level of education and training that they currently offer the next generation of British scientists and engineers – our future wealth creators. The

problems with short-term visas that disrupt academic conferences and scientific meetings are already reducing the opportunities for knowledge-exchange for the UK's researchers, students, and businesses.

The UK is currently a world-leader in science and engineering. But fortunes can quickly change. Anything that reduces the competitiveness of the UK research environment makes it a less attractive and rewarding place for UK researchers to work and R&D-intensive companies to locate. Without the world's brightest minds in UK laboratories, the UK's brightest minds and innovative companies will choose to go abroad to find inspirational scientists and engineers to work with. Somewhat ironically, preventing the world's top talent coming to the UK could result in a brain drain of Britain's top talent too.

Social and cultural impacts

If the UK lost its world-leading science and engineering base, the British public would still be able to enjoy the fruits of research and innovation originating from elsewhere in the world. But there are great benefits for society of having science on our doorstep. Museums could lose the academic expertise and kudos to put on exhibitions that exhilarate and inspire children and adults alike. Our hospitals could lose the life-saving and world-leading doctors attracted by a thriving research ecosystem. And our natural environment could lose the conservation scientists who work to ensure it is preserved for us and future generations to enjoy. Without a thriving research base, the UK will always be one step behind. The UK will lose the ability to help shape global development and will instead only follow it.

As we saw in chapter one, there is evidence that immigrant scientists and engineers have a positive effect on the economy

and job creation, including lower-skilled jobs (page 30). A popular rationale for reducing immigration is that it suppresses or even lowers local wages due to a higher supply of labour. However, using both pre-existing published evidence and its own analysis, the Migration Advisory Committee has twice concluded that skilled migration does not negatively impact on UK wages (118, 119). World-leading, high-value manufacturers base their facilities where there are the skills they need and where innovative technologies are being created. Making the UK more attractive to internationally-mobile scientists and engineers could therefore boost employment to provide UK citizens with rewarding jobs in a high-tech economy. Conversely, the impact of fewer immigrant scientists and engineers would likely be felt most-acutely in communities that are heavily supported by local research-intensive universities, institutes, and industry. The Northern Powerhouse project, championed by the Chancellor, George Osborne, and intended to rebalance the economy and drive growth in the North of England, would be stymied.

The inability to bring in foreign experts quickly and easily also means the UK is not able to respond to some national emergencies, such as ash clouds or Ebola. In these situations there is a need to bring together experts from across the globe quickly to provide advice and develop solutions. The UK has excellent facilities to do this but there may only be a few experts globally. Delaying their arrival due to immigration could have serious public health, social, and political consequences.

Economic impacts

The UK's economic strength is a direct result of innovation emanating from a dynamic, internationally-open research community. The

restrictions, disincentives, and future concerns identified in this work put future economic progress at risk.

Universities and the international students they attract are great economic contributors in their own right (page 33). But universities also stock the pipeline of discoveries and innovations that feed British businesses and provide them with local access to expertise. These catalysts of regional economic development are all dependent on an international workforce, which is currently being restricted by the issues identified in this report.

Unlike universities, science and engineering companies are free to move overseas if the UK is not able to provide the skilled workforce and access to experts they require. This is a real danger - a manufacturing sector survey by EEF found that skills are the third most important consideration when deciding where to make investments such as establishing headquarters (118). For firms that remain, the lack of skilled workers in the labour market will result in increased skills mismatch in roles or job vacancies going unfilled, both of which lower productivity (99). Access to essential skilled workers via immigration improves productivity, underpinning many more British jobs and continued direct investment.

"Many of the UK's leading engineering firms are not British and have no allegiance to the UK. They are here because of our engineering excellence but if they can no longer find the skills they need they will move overseas"

**David Brown, Chief Executive,
Institution of Chemical Engineers**

George Osborne has repeatedly said that science lies at the heart of his long-term economic plan (15). Numerous Government policy documents describe its valuable contribution (3, 13, 119). Yet the result of the restrictions, disincentives, and future concerns for scientists and engineers identified in this report will be reduced competitiveness and a loss to the economy in the long-term.

Future generations want to be creators – not merely consumers – of technology and innovation. To secure this bright future, a whole-Government approach is needed to ensure the UK remains at the heart of global science and engineering.

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www.sciencecampaign.org.uk/casemmigrationreport2016.pdf

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