Written Evidence to the Science and Technology Committee for the "Closing the STEM skills gap" Inquiry

From
Arkwright Scholarships Trust
Registered Charity Number 1091988

Executive Summary

The Arkwright Scholarships Trust is a registered charity that runs a well-established, highly-respected, globally-unique, UK-wide Scholarship scheme to nurture the country's 'brightest and best' sixth form STEM students to take up engineering careers in engineering-reliant industries. Through the 25 years of our existence we have found that our 160+ partners, from across many engineering-reliant sectors of the economy, have main concerns over the **quantity**, **quality** and **diversity** of young people coming through the STEM talent pipeline:

- **Quantity** of young people to meet the STEM recruitment needs of poorly-known or rapidly-expanding industries
- **Quality** of young people seeking to enter STEM higher apprenticeships in every industry, or STEM higher education
- **Diversity** of young people (sex, ethnicity, socio-economic background) to meet organisations' workforce diversity needs.

We are funded by our partners who donate to us to enable their access to a diverse pool of high-quality STEM students at age 16 to 18, and access to our 982 affiliated secondary schools. Our unique offering of a two-year Scholarship to nurture students' soft and technical skills, particularly their knowledge and experience of 'real world' engineering, results in a **diverse** group of 18-year-old students who have a much higher **quality** than the 'norm', who will better meet the needs of the industry higher apprenticeships and university degree courses which they will apply to. Our partners value this highly.

1. About the Arkwright Scholarships Trust

1.1 The Arkwright Scholarships Trust (www.arkwright.org.uk) is a registered charity founded in 1991 and headquartered in Leamington Spa, Warwickshire. We have 8 permanent staff and 18 regional Liaison Officers. We run a highly-prestigious, globally-unique Engineering Scholarship scheme for 16-18 year old school STEM students which is highly respected and broadly supported across the UK's engineering-reliant sectors of the economy. We work with schools, students and funding partners across the UK and Channel Islands. Our globally-unique offering means that we are starting to work with British Overseas Schools at the request of our multinational sponsoring companies e.g. Weir Group plc and Deutsche Bank.

1.2 The Arkwright Engineering Scholarships do not provide a mechanism for young people to first get interested in STEM (though this is of course important). We work further along the talent pipeline, providing an avenue to capture the 'brightest and best' 15/16 year old students already keen on STEM (very often having been enthused by early-years STEM outreach) and ensuring they are given the support, inspiration and nurturing during their sixth form years so that they remain keen on a career in STEM, specifically **engineering**, when they move on to university or higher apprenticeships. The aim is to stem the leakage of the 'brightest and best' students into careers such as medicine, veterinary science, dentistry, finance & accountancy, and law. Worthy though these careers are, it must be recognised that, to be a world leader, the country needs to secure **quality** of STEM practitioners as well as **quantity** and we need to ensure that more of the 'brightest and best' stay within the STEM talent pipeline and become future **leaders** of the UK's Engineering Profession across all the industries that engineering enables. We interpret engineering widely to include bio, computing/software and technical product design as well as traditional disciplines such as mechanical, electrical, civil. Our work is therefore of value to engineers working in such industries as banking (we are supported by e.g. Deutsche Bank), cyber security (we are supported by e.g. GCHQ), medical technologies (we are supported by e.g. DePuy Synthes) as well as 'traditional' engineering sectors.

1.3 We have no financial endowment and must fundraise for every Scholarship that we award. We have the broadest set of sponsor of any UK STEM outreach charity – over 160 different organisations sponsoring Scholarship or providing core donations (in this document we shall refer to these organisations as **partners**). We also work on a number of joint programmes with other outreach organisations such as The Smallpeice Trust, STEM Learning, Villiers Park Educational Trust, North Tyneside Learning Trust and the Nuffield Foundation.

1.4 For 25 years the Arkwright Scholarships Trust has been successfully operating to close the STEM skills gap in relation to high-quality future leaders of the engineering profession. We therefore feel it important that the Science and Technology Committee takes our work into consideration in its current inquiry into the STEM skills gap.

2. The STEM Skills that are in Short Supply

2.1 The Arkwright Scholarships Trust has 25 years of experience working with a broad and deep range of 160+ organisations for who engineer skills are important. In recent years, the main STEM talent pipeline issues that our partners have asked us to help solve revolve around **quality**, **quantity** and **diversity**:

1. The inability of higher apprenticeships schemes to attract applicants with a high academic ability, due to university being seen by many high-ability students, their parents and teachers as being the preferable route to a senior engineering career
2. A lack of ability of many higher apprenticeship applicants and new graduates to apply their academic knowledge in a day-to-day job because of a lack of understanding and,

most critically, experience of 'real world' job roles (this criticism is particularly aimed at engineering graduates from the more 'academic' universities)

3. A lack of 'soft skills' needed in engineering roles: timekeeping; team working; communication skills; respect; working independently but knowing when to seek advice and help
   (points 1, 2 and 3 above combine to form what many of our partners refer to as the **quality** of young people in the STEM talent pipeline. We shall use the word **quality** to mean a combination of points 1 to 3 above, throughout this document.
4. A lack of **quantity** of STEM-trained students applying for jobs in some industries caused by a lack of clear messaging into schools and universities about the industries and their locations where STEM skills are most in demand, and the job opportunities within them
5. A lack of **diversity** in the STEM talent pipeline (mirroring the lack of diversity in the UK's engineering workforce) – too few females and too few people from 'less advantaged' backgrounds

3. How the Identified Skills Needs have been Addressed

3.1 We work closely with D&T, Science, Maths and Computing teachers to seek Scholarship applications from the country's 'brightest and best' 15/16 year old school students. We then assess the student applicants and award Arkwright Engineering Scholarships as follows:

- assesses students through a unique and rigorous selection process, honed over 25 years with input from our industry and academic partners, to identify the most promising future leaders of the engineering profession: detailed online application form; a teacher reference; two-hour problem solving written engineering exam; university-hosted interview; careful matching of student capabilities to the STEM talent needs of a sponsoring organisation
- Award the successful applicants a highly-respected Arkwright Engineering Scholarship at prestigious national Awards Ceremonies with high-profile speakers (Robert Hannigan, Director of GCHQ in 2016 and Sir John Armitt, Chair of the Olympic Delivery Authority in 2012, are two examples)

3.2 We are told by teachers and parents that this rigorous selection process is, in itself, of significant benefit to the job-ready skills of student applicants, irrespective of whether they receive a Scholarship or not.

3.3 Each Scholarship then nurtures the Scholars during the two-years of their A levels, BTEC level 3s or Scottish Advanced Highers to arrive at a **diverse** group of 18-year-old students who have a much higher **quality** than the 'norm', who will better meet the needs of the industry higher apprenticeships and university degree courses which they will apply to. Each Scholarship lasts for two years and consists of:

- Links to a Sponsoring organisation: work experience, mentoring, invitations to corporate events; help with soft skills and UCAS personal statements
- access to a diverse programme of high-quality Arkwright-organised and third-party STEM enrichment and experience events in the UK and overseas (e.g. exclusive tutoring

on the use of light microscopy for engineering applications hosted by the Natural History Museum, London; free places to exhibit at the annual Mexico Expo Ciencias)
- Interaction with like-minded students through Scholar networking
- £600 funding to support each Scholar's studies and activities relevant to engineering
- £400 funding to each Scholar's school to support the teaching of STEM subjects to all students in that school

3.4 We currently work with 982 affiliated secondary schools across the UK, growing at the rate of about 60 schools per year (we have no problem recruiting new schools). Currently, these schools are split:

- 56% state non-selective
- 25% independent (fee paying)
- 19% state selective (predominantly grammar schools)

We attract i.r.o. 1600 student applications each year (growing each year); interview about 40% of these, and award i.r.o. 400 Scholarships per year. Over the 25 years of our existence we have awarded 4567 Scholarships. Our 3758 Scholarship Alumni are now aged 19 to 41.

How do we help where <u>both</u> quantity and quality of young people in the STEM talent pipeline is the issue?

3.5 Business & Industry's needs change much faster than the educational system can track, so emerging issues and policy can result in a dearth of **quantity** and **quality** of young people in the STEM talent pipeline in some industry sectors. The nuclear industry and cyber security are two current examples where we receive funding and in-kind support to help promote opportunities in these industries to our Scholars, scholarship applicants, and students and teachers in our affiliated schools, to address a lack of **quantity** and **quality** of young people in the STEM talent pipeline feeding these industries:

- we work with nuclear companies through the conduit of the Nuclear Institute
- we work across the cyber security sector with organisations such as GCHQ and Deutsche Bank

3.6 Whilst 'High Street' names in popular, well-known sectors of industry have much fewer issues with **quantity** and **quality** of job applicants, many companies who we work with are unknown to the 'boy/girl in the street' and struggle to draw students through the STEM talent pipeline to meet their recruitment needs. E.g. when young people, teachers and parents think of the automotive industry (which is an extremely popular sector with young males) they think in terms of employment at Jaguar Land Rover and Formula 1 teams and have very little concept that motorsport and car manufacturing includes a diverse supply chain of smaller, lesser-known companies that need strongly-skilled STEM employees. Much of our support comes from these supply-chain companies who cannot get to students through the careers advice provided in schools and do not have the budget for major, UK-wide marketing campaigns.

Examples in the automotive sector include Bourns Inc (automotive electronic components) and Cytec Solvay (high-end automotive and motorsport composite materials). We address a similar situation in many other industry sectors.

How do we help where quality of young people in the STEM talent pipeline is the issue?

3.7 For many of our partners, **quantity** of applications to their early-career STEM vacancies is not a major issue, but they are always striving to increase the **quality** of applicants, even 'High Street' names in popular sectors of engineering. An example is the Royal Air Force which has ~92 applicants for every Engineering Officer vacancy, but is always striving to increase the overall **quality** of applicants. Other partners in a similar position include the Royal Navy, Jaguar Land Rover, BAE Systems and Rolls Royce. Also, many companies who are now setting up Higher Apprenticeship schemes often say to us that they get plenty of applicants but not many of a high quality because of the remaining – but rapidly improving - perception with teachers, parents and high-ability students that apprenticeships are a tier down from graduate-level roles and only for students not capable of going to university. For such organisations, the Arkwright Engineering Scholarships are a way of generally promoting their STEM opportunities to a quality-validated, high-potential group of 16-18 year old students and, through sponsorship of Scholarship, obtaining direct access to our group of ~800 Scholars.

How do we help where diversity of the STEM talent pipeline is an issue?

3.8 Arkwright Engineering Scholarships are designed to be attractive to females and 'less advantaged' students by communicating the excitement and reward of an engineering career for <u>everyone</u> irrespective of their sex, ethnicity or socio-economic background (we do not operate any kind of positive discrimination towards girls or 'less advantaged' students). We communicate this message to students, teachers and parents through direct interaction with schools by our network of 18 regional Liaison Officers and through our online presence. Balfour Beatty, Rolls-Royce Controls and Data Services Ltd., the Royal Air Force, BAE Systems, Laing O'Rourke and Nissan Technical Centre Europe are examples of our partners who support us to enthuse girls about engineering careers to meet these organisations' **diversity** needs. The Lloyd's Register Foundation, the Royal Commission for the Exhibition of 1851, ARM plc and Imperial College, London are examples of organisations who support us to help 'less advantaged' students to meet these organisations' **diversity** needs.

4. Cost and Funding Source

4.1 The Arkwright Scholarships Trust has no financial endowment and must secure Sponsorship for every Scholarship that we award. Each Scholarship requires £2,200 of funding from a sponsoring organisation. We award i.r.o. 400 Scholarships per year. The Trust is run efficiently and 87% of this sponsorship money goes to benefit the Scholars and their

schools; 9% covers Arkwright's fundraising cost and only 4% goes on day-to-day operating costs. We also have a number of organisations that provide core funding, separate from sponsorship of Scholarships. Over 25 years we have built up a sector-leading group of over 160 supporters across: commercial companies (from local SMEs to large multi-nationals), industry regulators, trade associates, Livery Companies, professional engineering institutions, government organisations, universities (we work with 27 of the UK's top engineering universities), charitable trusts and foundations, all three armed services, personal donors (professional engineers and members of the general public). Our expenditure is just over £1million per year and it, and the number of Scholarships that we award, has grown steadily over the 25 years of our existence. We have never relied on direct Government funding.

4.2 Our view is that if an organisation provides a STEM talent service that actually meets the recruitment needs of industry and academia, then industry and academia will pay for it, and individuals will donate to it. In this context, Government funding is part of, not the whole, solution.

5. Measurement of Outcomes

5.1 We monitor many aspect of our applicant pool and subsequent Scholar group, such as gender, ethnicity, socio-economic background and home location. Our three-year average for female applicants is 23.2% female; for the resultant Scholars it is 27.9% female. We adjust our annual school/student recruitment efforts each year as a result of the demographics of each year's applicant pool, to best met the STEM talent needs of our 160+ partners e.g. we currently work directly with all three Girls Schools Associations in the UK (GSA,GDST, ASGS) to recruit more all-girls schools to the Scholarships.

5.2 Like all STEM outreach organisations, Arkwright collects feedback from its Scholars during its activities. This feedback is used to help continuous improvement of our offering and to identify beneficial outcomes for the Scholars. Key benefits that Scholars themselves say they receive from the Arkwright Engineering Scholarships are (in order of prevalence):

1. Improved confidence (surprisingly, low confidence in academic high achievers is quite common)
2. Increased knowledge and experience of a range of engineering disciplines (to help Scholars identify what they might and might not like as a future career, and to make them aware of industries and geographical locations where STEM skills are in high demand)
3. Provide information on next career steps (especially opening Scholar's eyes to the fact that higher apprenticeships are a legitimate alternative to university for high flyers.)
4. Improved organisational skills

5.3 Feedback collected during or immediately after a STEM outreach activity has limited use however. What is needed is evidence of longer-term effect, or evidence of successes secured away from that activity, but influenced by the benefits obtained from that activity. Arkwright tracks its Scholars and alumni through their careers. We record the many

instances of Arkwright Scholars and Alumni winning national and international STEM competitions, academic and industry awards and prizes – often attributed by the Scholars/Alumni themselves to the skills and confidence instilled in them by the Arkwright Engineering Scholarship.

5.4 E.g. current Scholar Qutaiba Al-Nuaimy of Liverpool College has just won a place and a £260,000 undergraduate bursary to study engineering at New York University – won against stiff global competition. To quote Qutaiba*: "I owe it all to the drive, passion, confidence and focus that the Arkwright Scholarship has distilled within me, and for that I am hugely grateful".*

5.5 Arkwright Scholars now occupy increasingly-senior roles in many industries (our oldest alumni are now 41). They continue to state how beneficial their Arkwright Engineering Scholarships were in kick starting their careers in engineering and, on occasion, in other sectors from medicine to accountancy, marketing to law.

5.6 E.g. Sumit Rai (Arkwright Scholar 1996-1998), now Chief Experience Officer, Qumu Corporation. To quote Sumit: *"I am now considered an expert in visual effects and have worked on many TV and film productions. Even now, when I am pitching an idea or managing my team, I often think of the Arkwright Scholarship for that first experience of having to present and explain my ideas".*

6. Recommendations

6.1 To position the UK as a world leader, the Government must recognise that effort must be made to ensure young people of sufficient **quality** are entering STEM careers to meet the need for leadership roles, in parallel to making sure that there is a sufficient **quantity** of young people entering STEM careers to meet recruitment needs. Some STEM outreach schemes must be focussed on the 'brightest and best' who are already enthused about STEM. This is not "preaching to the converted", it is safeguarding the high-quality STEM talent pipeline and preventing leakage into competitor careers.

6.2 Government must encourage an increase in **diversity** of the STEM talent pipeline.

6.3 Government should target STEM Skills funding predominantly on STEM outreach organisations that:

- have well-established schemes with proven outcomes, who work collaboratively with other such organisations – industry and academia often berate the plethora of well-meaning, but limited impact and often poor return-on-investment (ROI) STEM outreach schemes that exist. Our Partners often want to see fewer, higher-quality, proven-track-record outreach organisations, preferably working together on coordinated programmes.
- have demonstrable strong, sustained financial support from industry, the armed services and/or academia. Schemes that cannot provide evidence of such financial

support are probably not providing a STEM skills product/service that is meeting the skills needs of organisations that employ skilled STEM staff.

6.4 Do not provide any single STEM outreach organisation with so much Government funding that it no longer needs to seek funding from STEM employers. Too much Government funding can create inefficient organisations where ensuring a product/service meets end users' needs is no longer a pre-requisite for financial survival. Make sure organisations remain hungry to secure funding from STEM employers.

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