Disruptive Diversity

An external perspective on ways to increase Diversity and Inclusion within the Institution of Civil Engineers and Beyond

October 2015

Dawn Bonfield CEng FICE FIMMM FWES
President, Women's Engineering Society

This report has been commissioned by David Balmforth during his Presidential year at the Institution of Civil Engineers to look at what can be done to promote gender diversity in engineering. It has been carried out by Dawn Bonfield, President of the Women's Engineering Society in collaboration with a number of contributors. October 2015

Executive Summary

Diversity in engineering is not improving fast enough. After years of effort, the engineering and construction sectors are still struggling to get the proportion of women engineers above one in ten, with other under-represented groups equally poorly represented. Indeed the number of female construction workers on site is only one in a hundred.

Time has come for a concerted and co-ordinated effort to address this. Individual pockets of excellence exist within the industry and much money has been spent on outreach activity to persuade the next generation of boys and girls that engineering is for them. But what has been lacking is the culture shift and the co-ordination that brings the need, and indeed the desire for diversity into core business.

Diversity and inclusion principles need to be pervasive - part of every decision that is made, and constantly referenced. The philosophy of the removal of barriers to diversity, in the hope that this is enough to actually create diversity, is not sufficient. The door needs to be unlocked, of course, but it has also got to be opened, and diversity invited in. This is not favouritism to women and under-represented groups - this is business. Lack of diversity is costing the industry money in terms of lack of skills, productivity, staff safety and morale, innovation, profit and creativity. The industry is changing. The world is changing. Disruptive technology, big data, the lifestyle, values and aspirations of young people all point to a future which is different from the past. Engineering needs this diversity and this creativity to thrive and the UK to remain competitive in the international marketplace, and we need to act now to attract this future workforce.

If that alone wasn't enough to stimulate action, other arguments should. We have a skills shortage in engineering which is predicted to get worse over the next ten years. We will not be able to fill these jobs if we recruit from only half of the population.

And finally, and crucially, women and certain groups of society (including lesbian, gay, black, transgender, ethnic minority, and certain classes of society) are being denied equality of choice. Girls do not see engineering as being suitable for them, and other under-represented groups do not see engineering as being inclusive enough for them. These inequalities are often compounded in people who have the characteristics belonging to more than one under-represented group (intersectionality), and these people are doubly disadvantaged. These groups often do not feel comfortable in the sector, they are not respected sufficiently, and do not progress equally. They are being disadvantaged in their career and life choices because the industry is inadequate at attracting them, reluctant to promote them, and not sufficiently caring to support them back to work after career breaks. This is not good enough. Something needs to be done to address these inequalities, and to ensure that we work in an industry which can hold its head up and claim that it is truly welcoming and inclusive of a diverse workforce.

Although these inequalities are not deliberate or malicious, as an industry we are guilty of complacency in not addressing them adequately; in not caring sufficiently to do something fundamental about it; in assuming that it is a problem which needs solving by women, a diversity committee or an outreach activity. In fact it is an issue that every one of us needs to address in every decision that we take and every project that we work on. Just as we need to be sure that we are following the principles of health and safety in everything we do, we need to follow the principles of respect, diversity and inclusion.

This report, commissioned by ICE President David Balmforth, looks at practical ways that this culture shift can be achieved both within the Institution of Civil Engineers, and more broadly in the industry as a whole. Action is recommended on many levels to change practices and behaviours so that diversity and inclusion becomes embedded in the Institution and its membership. This is not an evidence based report nor an

overview of the industry. The case has been made and the evidence has been recorded extensively elsewhere. This report represents the views of the author and is intended as a thought piece to stimulate further action. The report is limited to practices and solutions relevant to the UK. It concentrates predominantly on measures that can be taken to address the lack of women in the sector, but many measures recommended will be equally relevant to diversity and inequality in general and will benefit other under-represented groups.

The recommendations and suggestions given in the report are an indication of what can be done to build upon and increase the good work that is already underway at the Institution of Civil Engineers both internally and in collaboration with the Royal Academy of Engineering Diversity Concordat. As a leader in the construction sector and a membership organisation, the adoption and endorsement of these best practices has the potential for much wider reaching change within the industry as a whole. Not all recommendations will be feasible and change will not be immediate. What is important is that a plan is developed and owned by the ICE, and its success will rest on this ownership, accountability and desire to change at every level.

The recommended actions for the Institution, which are also appropriate for the whole industry, fall into the categories below:

- **Measuring** - regular benchmarking, tracking and reporting against diversity criteria for both staff and members. Analysing trends and taking mitigating action.
- **Changing** - changing the culture of the Institution to reflect the importance of diversity as an over-riding principle of best practice. This will impact on accreditation, professional review, reporting, communication, campaigns and project work. Change will also come by learning from best practices shared by other Professional Institutions through the Royal Academy of Engineering Diversity Concordat, for example. Challenging poor practice, and zero tolerance for bias.
- **Educating** - training to educate staff, committee and council members, volunteers and other partners at all levels to ensure and instil best practice and develop diverse teams
- **Inspiring** - use of targeted outreach, careers guidance and role models to inspire the next generation of diverse talent, and finding a way to reach parents and teachers as well as students
- **Supporting** - ensuring that under-represented groups are supported and developed through the establishment of special interest groups, but not relying on these groups to be the owners of change
- **Influencing** - using external influence and collaborative partnerships to campaign for bigger changes and make progress more widespread by sharing knowledge, best practice, and resources.

Finally some additional ideas are given which could lead to step changes in the industry. Recommendations are given which are actionable by the corporate sector, the education sector, and the government or other sectors. A selection of these recommendations includes:

- **Changes in legislation** to drive behavioural change, including the mandatory reporting of gender pay and gender diversity ratios in each occupational level; the use of government procurement contracts to embed diversity and inclusion best practice; a tighter framework to the Equal Opportunities Employer Mark with guidelines for Diversity and Inclusion; financial incentivisation of Higher Education courses that are of direct benefit to the economic future of the UK linked to the register of strategic skills shortages; requirement of the Athena Swan Bronze award for all Institutions receiving research funding from the Engineering and Physical Sciences Research Council (EPSRC).

- **Promotion of industrial best practice** including 50/50 male to female targets for job shortlists; sign up to the Industry Ten Steps or the Think, Act Report frameworks; senior and board level diversity targets in line with the Davis Report; flexible and part time working as the norm for all employees; benchmarking the business cost of the lack of diversity; the establishment of support networks as best practice for under-represented staff; the establishment of widespread Returnship programmes to bring women back into engineering.

- **Improved careers support** for schools including a dedicated careers service for the 14-18 year age range, and their parents, offering specific advice for careers in the engineering sector; more work experience opportunities in engineering offered for students; establishment of more non-linear routes into the engineering sector to include conversion courses, joint courses and more collaboration with the creative industry.

- A **visible and long term commitment to a co-ordinated and collaborative plan of action** by professional bodies, industry, education and the media, and a dedicated media centre for engineering.

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Introduction

Diversity in engineering is crucial if we want the quality and quantity of skills required to fulfil the growth potential that has been predicted for the UK economy. Women make up only 11 per cent of the construction workforce and just 1 per cent of workers on site. In engineering more generally only 7% of the workforce are women and this lack of gender diversity is the biggest example of an industry which is not equal to all. In addition, many other inequalities exist including discriminations against the LGBT community (Lesbian, Gay, Bisexual and Transgender), BAME employees (Black and Minority Ethnic), the aging population, and also discrimination against people from different educational backgrounds. Some employees are at an even greater disadvantage if they have a combination of traits that fall into a number of protected characteristics, and they will be at an even greater disadvantage.

By continuing to be inert to this social injustice we are condoning an industry which allows discrimination, and denying significant numbers of the population the opportunity to shape the world that we live in through engineering. But not only that, we are denying ourselves the opportunity to be the best that we can, as we have growing evidence[1,2] to show that diverse teams are more profitable, more productive, and more sustainable. Disruptive technologies and an ever changing set of global challenges are likely to mean that future engineers will need a different set of skills and capabilities from the ones we recognise from the past, and we need to scope, address and prepare for this requirement And finally, from the perspective of numbers alone, we will not be able to fulfil the predicted skills requirements from only half of the available population.

So we need to make a commitment to a vision of a fully inclusive and diverse industry, and take some bold steps to address the issues that are currently preventing this. We need to make this a business priority, and ensure that it is forefront in the future strategy of the industry and integral to all decisions that are taken. We must be clear and articulate in this vision and take disruptive measures where appropriate.

This report has been commissioned by David Balmforth, President of Institution of Civil Engineers (2014-2015) and concentrates predominantly on measures that can be taken to address the lack of women in the sector, but many measures recommended will be equally relevant to diversity and inequality in general and will benefit other under-represented groups. This report is not a review of the literature nor an overview of the industry, which has been done extensively and excellently elsewhere[3,4,5], but represents the views of the author and is a thought piece to stimulate further action.

One of the main recommendations of the report is that diversity and inclusion should pervade everything that is done within the Institution and the industry, in the same way that we consider health and safety. It should be a consideration in all projects and decisions, and not an add-on activity which has no impact on day to day business. Whilst the Institution of Civil Engineers (ICE) is not accountable for the actions of the entire industry, leadership from the industry's main professional body sets the tone for the industry in the same way as has been done with the campaign for health and safety, or ethics. The provision of relevant diversity and inclusion training, the compilation and celebration of best practice across the industry, and the intolerance of poor practice will stimulate a culture that drives inclusive behaviour and demands change. It is acknowledged that the Institution has made very good progress in recognising the need and value of a focus on diversity in recent years, and has made a demonstrable commitment to change through a number of joint and internal initiatives already being rolled out.

The next step is to increase this activity in order to promote a lasting cultural change within the Institution itself and to pass on this best practice to the industry more widely. A Diversity Action Plan with clear targets and deliverables will enable this work to be visible, managed and integral to the main Institution of Civil

Engineers' Business Plan. This report gives some examples and recommendations of what could be included in the Plan, responsibility for the delivery of which should rest with the Executive Team through the appointment of a dedicated member of staff.

General Engineering Facts and Figures - Some Background

In engineering in general 7% of professional engineers are women, the lowest proportion in the EU. 17% of engineering undergraduates are women, 8% of engineering professors and 4% of engineering apprentices are female. Only 12.8% of the STEM workforce (Science, Technology, Engineering and Maths) are female, an increase of only 0.2% since 2012[6]. But the only graph that you will need to remember is the one which shows the change in number of women in engineering over the past 7 years, which could very easily be extended to the past 97 years - things are just not changing fast enough, if at all (Figure 1).

In 2015 - despite much recent activity to encourage more girls to continue with STEM subjects - only 44 more girls took physics than the previous year at A level in the UK[7], and they make up only 21% of the total. But even from the ones who do take physics we persuade only 3% of grade A* and 5% of grade A female students to chose engineering.

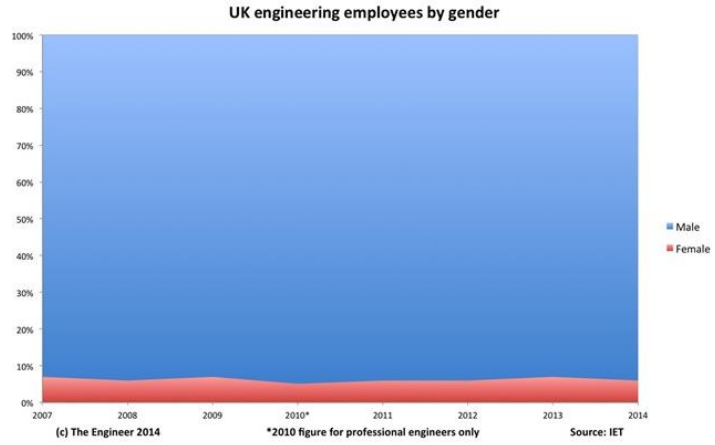


Figure 1 UK Engineering Employees by Gender

The UK construction industry employs more than 2.5 million people. Women make up 11% of the sector, with 1.2% working in manual labour trades and it has been predicted that the construction industry will need 200,000 new workers by 2019. The number of female apprentices in construction is the lowest of all apprentices at only 1%.

In civil engineering we can see that the percentage share of both male and female applications to University is dropping (Figures 2 and 3)[8,9].

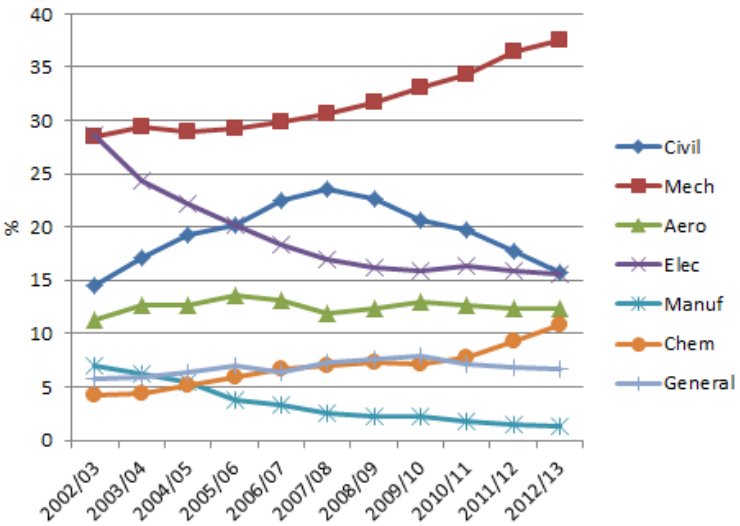


Figure 2 Percentage Subject Share of UK Engineering Applicants

So it is clear that additional action is needed. What is the change that we are advocating therefore, and how will we deliver this? There are a number of approaches that can be taken. Some are obvious and difficult to dispute if we really want change. Others are more disruptive and will be divisive, but are necessary. We need to employ actions on a number of levels from the simple to the disruptive to make the difference required.

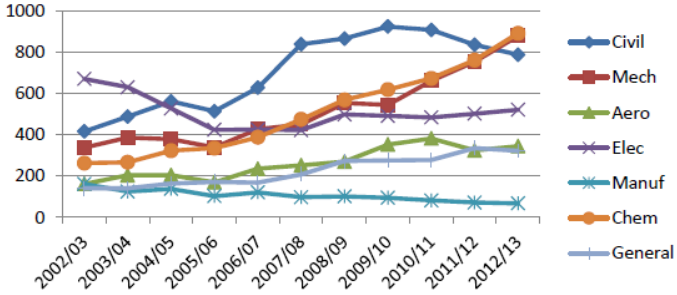


Figure 3 Female Engineering Applicants by Discipline (all domiciles)

This paper is intended to take a provocative look at what we can do differently to encourage more gender diversity within the civil engineering sector as a whole, how we can attract, support and retain the under-represented members of the ICE, and why we need to take these steps *in addition to* the work that we are already doing to encourage more recruits into the profession in general. Angles of attacking the problem need to be multiple and we need to pursue a number of different approaches in order to see success. So it's not enough to put all of our efforts into persuading the next generation of teenage girls that engineering is a great choice for them if the reality of their university experience or apprenticeship is being marginalised (half of qualified women engineers chose not to pursue a career in the profession compared to approximately a third of men); their career progression is capped financially (the gender pay gap in the UK is currently 19.1% across all sectors)[10]; the workplace is an unsupportive and culturally unwelcoming place; and their chances of returning to the profession after a maternity break are low. So we need to work on corporate culture, the business case, and ways of supporting women engineers just as much as we need to work on outreach activities in schools.

And we must understand there are two distinct types of work involved here to attract and retain a diverse talent. Firstly, improved diversity is good for business and we need to understand and build the business case around why we need diverse and inclusive teams, and what needs to be done to address this. Secondly we need to support the women and other under-represented groups that are currently in our industry or training to enter it. This is because they are in a minority and often have different needs to their male colleagues, especially when it comes to on-site working practices, career progression, and maternity/career breaks. For example, typical career progression requires time and effort during an employee's late 20s and early 30s – the exact time that women are having children. We should find ways of ensuring that alternative career journeys are supported and equally valid. (For both of these issues there is plenty of good practice around in the construction industry which can be drawn upon and used effectively.)

It is often unhelpful to mix initiatives which amalgamate these two distinct and different needs, both of which are crucial for change, but getting the former right (the acceptance of the business case) should in time remove the need for the latter (additional support for under-represented groups). If we confuse the two then the result is the majority groups see this as a problem belonging to the minority group, and leave the solutions to them without the engagement we need to change our culture. This leads to resentment of the under-represented group due to what is seen as special treatment, and a promulgation of a 'them and us' culture.

The report considers a number of strands. It will look at what can be done within the ICE, by its staff, its governing bodies, its volunteers, and its members, and it will look at what can be done externally - within the industry and more widely - that ICE can support and influence. ICE has a major leadership role to play and by setting the agenda for diversity and inclusion it will be at the forefront of best practice and current thinking. This will not only allow it to fundamentally influence the future of the engineering and construction profession, but it will allow it to attract and retain new members who see it as leading the way amongst the professional bodies.

Until now diversity and inclusion work within ICE has been about ensuring that there are no barriers in place which prevent diversity. From now on however it needs to be about ensuring that not only are there no barriers, but that there is a positive programme of support for diversity and inclusion and that it becomes mainstream to the business of ICE. It's not just about unlocking the door, it is about opening it up and inviting people through.

ICE has a large number of mechanisms through which it can make change, which can be linked to its four strategic strands: Educate and Inspire; Qualifications; Professionalism and Knowledge; and Inform Opinion.

- Membership Services: Benchmarking; Training; Informing; Supporting; Retaining
- Professional Review of Engineering Competence
- Accreditation of Degrees
- Staff and Governance: Appointment and Training
- Educational Outreach Work and Careers Advice
- Publications, Conferences and Awards
- Campaigns, Projects and other activities
- Influencing and campaigning for change as one of the leading Professional Engineering Institutions through partnerships and the promulgation of best practice

Each of these areas will be considered in turn and some suggestions and recommendations for each are made. Building on the suggestions of this report there is a lot that can be done, and a cohesive Diversity Action Plan (of which these recommendations can form the backbone) is required - with relevant timescales - to bring all of this work together. The key point is that this plan is developed, owned and implemented by ICE and its principles are incorporated into daily business.

Outside ICE there are many excellent initiatives already being implemented in the industry[3] which are not referenced explicitly in this report. This very good work is crucial to the widespread change that is needed across the sector, and these schemes all represent excellent ways of making a difference and should be supported. This report builds on these industry initiatives and gives some further suggestions that can be adopted at government level which have the potential to make bigger and more disruptive changes.

Membership Benchmarking

"What gets measured, gets managed. What gets publicly reported, gets managed even better."

Membership benchmarking and monitoring is key to ensuring that the membership and development of female members is progressing at the same rate as male members, and that membership amongst other ethnic and minority groups is consistent with the population as a whole. Data from the ICE's own membership database should be readily available to Council, Executive Board members and the Senior Management team, and this should be reported regularly as an agenda item at board level meetings. A template of relevant data will ensure that we are measuring and tracking the correct data, and this should be standardised for all Professional Engineering Institutes (PEIs) to allow comparisons and transparency. A template has been developed by the Royal Academy of Engineering's Diversity Concordat[11], of which the ICE is a founder member, which covers all diversity, but much deeper analysis would give a clearer picture of trends and anomalies, and allow more focused action to be considered.

At present 11.2% of members of ICE are female. Of these, their age distribution is shown in Figure 4.

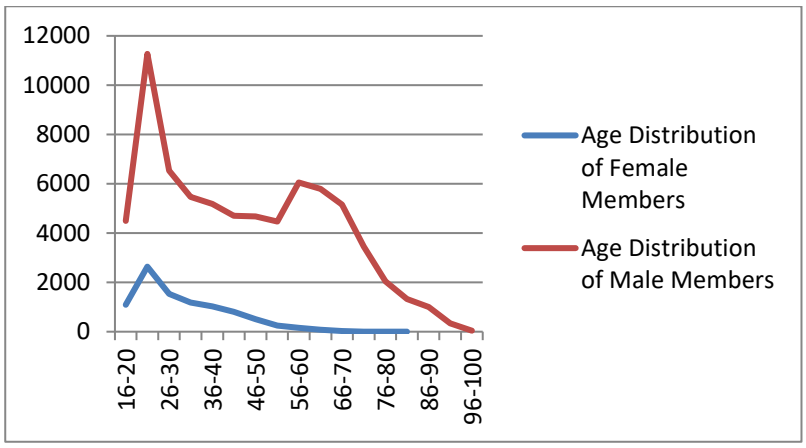


Figure 4. Age Distribution of Members of ICE

It can be seen that the majority of members join the Institution as student members, and then the retention of these members, for both men and women is a challenge. Student membership is free of charge, so it is unsurprising that there is a big uptake of student membership and this provision is obviously a strategically successful way of attracting and supporting members. Figure 5 shows the ages of members when they join the Institution. It appears that fewer reasons exist to encourage women

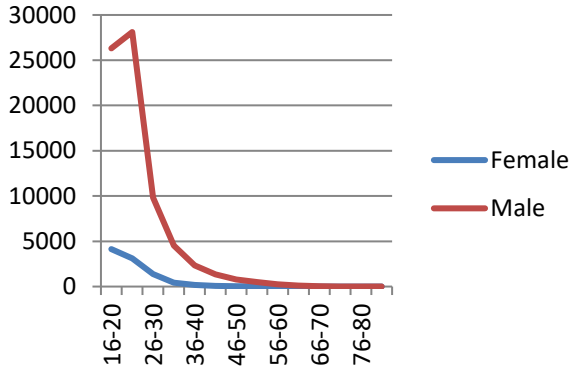


Figure 5 Ages of members when they join ICE

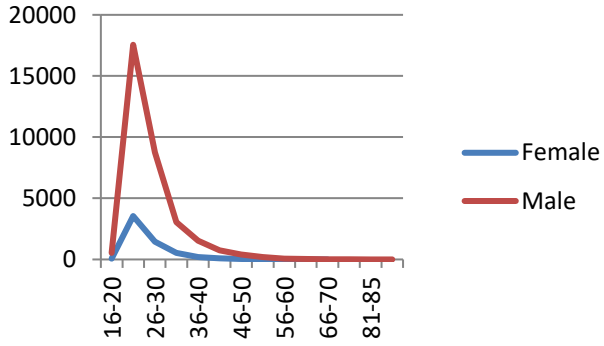


Figure 6 Age profile of lapsed members of ICE

to join at a later stage of their careers than men, and above the age of 40 very few female members join, which is an indication of the low numbers of women with relevant degrees from twenty plus years ago, but routes into the profession should not only be linear.

It appears from Figure 6 that male members retain their membership for longer than female members. We know that fewer women remain in the career in which they have obtained their qualification than men (in engineering as a whole about half of women remain in the profession compared to two thirds of men), but do we know what this looks like for civil engineering, and has anything been done to measure and address this issue? What is the student to graduate transfer rate and what longer term trends are occurring, and how does this look for male members compared to female or LGBT members, for example? What happens to the members who don't transfer, and do we ask them why they don't transfer? Has enough been done to track this and act on the findings?

More emphasis also needs to be placed on gathering a wider set of statistics relating to ethnicity given that ethic minority pupils make up almost a third of primary school children in the UK. Disability and age are other important criteria given the aging nature of the workforce, the prevalence of disability amongst older

people and the raising of the retirement age. These and similar questions are just an example of the type of analysis and tracking that needs to be done on a regular basis to ensure that membership statistics are able to provide information on issues and trends amongst all of the under-represented groups, and action can be taken to address any anomalies that are found.

	EngTech		IEng		CEng		ICTTech		Total			TOTAL	% Female
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Not declared		
Group A													
IET	3,978	82	12,365	111	44,195	1,519	179	14	60,717	1,726	55	62,498	2.76%
IMechE	1,479	44	1,155	44	36,042	1,680			38,676	1,768	98	40,542	4.36%
ICE	787	91	2,478	177	33,065	2,487			36,330	2,755	3	39,088	7.05%
IChemE	15	3	46	2	9,711	1,357			9,772	1,362	-	11,134	12.23%
IStructE	100	3	984	15	8,838	456			9,922	474	1	10,397	4.56%
CIBSE	688	14	1,192	20	5,520	328			7,400	362	2	7,764	4.66%
IMarEST	411	3	2,101	18	4,614	88			7,126	109	2	7,237	1.51%
IOM3	72	1	451	10	5,439	312			5,962	323	2	6,287	5.14%
SOE	2,814	18	2,323	9	719	15			5,856	42	6	5,904	0.71%
BCS			171	4	5,315	345			5,486	349	44	5,879	5.94%
RAeS	190	2	724	11	3,232	134			4,146	147	4	4,297	3.42%

Figure 7. Annual Registration Statistics from the Engineering Council showing Total Number of Final Stage Registrations by Institution

Obtaining professional qualifications is one of the main reasons cited for female engineers joining a Professional Institution and retaining their membership, according to the 2014 survey Women in STEM: Are you IN or OUT?[12]

From the 2014 Engineering Council data in Figure 7 it can be seen that of the professionally qualified members of ICE 7% are female and 93% are male. This represents 31% of the total female membership of ICE compared to 49% of male membership (see the data Tables below), so there is a significantly lower number of female members with professional qualifications than male. Is this because many professionally qualified female members will lapse their membership during maternity breaks? Is this because female members don't have time to complete their qualifications before their maternity break? Is this because female engineers are less likely to be motivated to obtain professional qualifications than men? Is there a need therefore to ensure that female members obtain their professional qualifications as quickly as possible to ensure that they are qualified by the time they reach a maternity break, and does this require special training or support? Further recommendations related to career breaks are given in the next section, but the questions raised by these membership statistics need further analysis and response.

The establishment of a set of benchmarking statistics that can be reported, tracked and appropriately addressed should be regularly reviewed at Board level to ensure that trends are spotted and action taken where necessary. Statistics can be compared with other Institutions through the Diversity Concordat and targets set and for improvement.

Females	Total[1]	CEng[2]	IEng[2]	EngTech[2]	Student	Graduate	Member[3]	Fellow[3]	Other[4]
Number	9396	2674	128	131	3422	2817	2809	124	93
Percentage	100%	28.5%	1.4%	1.4%	36.4%	30.0%	29.9%	1.3%	1.0%

Males	Total[1]	CEng[2]	IEng[2]	EngTech[2]	Student	Graduate	Member[3]	Fellow[3]	Other[4]

Number	74126	34164	1519	1015	15274	15151	35529	5077	2080
Percentage	100%	46.1%	2.0%	1.4%	20.6%	20.4%	47.9%	6.8%	2.8%

[1]This is made up of adding together EngTech, Student, Graduate, Member, Fellow and Other

[2] This is CEng or IEng or EngTech regardless of ICE membership grade, so they are either MICE or FICE or Technician

[3] This includes CEng/IEng numbers as well as just MICE or FICE

[4]This comprises of Affiliate, AMICE, Companion and Honorary Fellows

Figure 8 Membership Statistics for the Institution of Civil Engineers in 2015

The data above also shows that there is a much lower percentage of female fellows than there are male fellows, at 1.3% compared to 6.8% of male members. This is understandable given the problems we know exist in women achieving senior positions in the industry, but has the procedure for obtaining fellowship been reviewed to ensure that it is equally valid for non-linear career paths (which women often follow), or does it preferentially reward a straight line career from start to finish? Women's career paths often look very different from their male counterparts, but their experience, influence, seniority and their service to the industry are often no less valid than their male counterparts.

Retention of Members on Maternity/Paternity or Other Career Break

As part of the Royal Academy of Engineering Diversity Concordat a RETURN programme is being co-ordinated by the Women's Engineering Society which looks at the role of the Professional Institution in supporting women engineers on maternity breaks, or any members on a career break for whatever reason (and this is becoming increasingly common with male and female members who take breaks for caring responsibilities linked to parents, as well as to children)[13]. The reason Professional Institutions are so important in supporting these members is that many members will have left employment if the break extends beyond the statutory maternity entitlement, so the PEI will effectively be the last point of contact that these members have with the engineering sector. The Engineering Council reported last year that 57% of professionally qualified women engineers drop off the Engineering Council register under the age of 45 compared to 16% of male registered members. A huge and unacceptable loss.

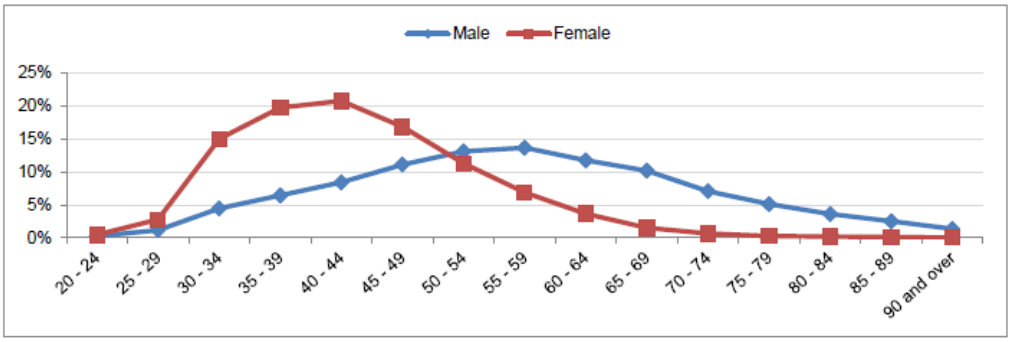


Figure 9 Age profile in percentages of male and female registrants (Engineering Council)

ICE statistics for 2015 show the age distribution of female members (Figure 10) and the age distribution of professionally qualified female members (Figure 11). It can be seen that a big drop off occurs in professionally qualified (CEng) members at around the age that they are due to be returning from a career or maternity break (after the age of 40). A properly managed programme of support at this stage could go some way towards preventing these members from leaving ICE and leaving the profession, and this can be piloted through the Diversity Concordat RETURN Project.

Returnships

Returnship programmes are short term placements (6 months to a year) within industry for women returners - equivalent to internships for students - and these programmes are relatively new to the UK. These are extremely valuable for returners from maternity/paternity breaks as they offer a low risk step back into the profession which is formalised and offers relevant training and support, and allows the returner to manage the return to work in a supported environment. Professional Institutions can have a role to play in matching relevant members to these returnship programmes, as has been the case recently with the Thames Tideway Returnship programmes, and this is another mechanism for ICE to support its members back to work.

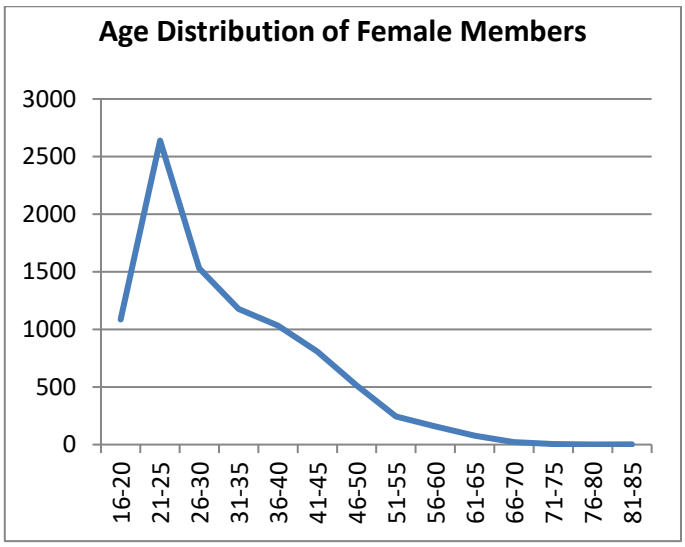


Figure 10 Age Distribution of Female Members of ICE

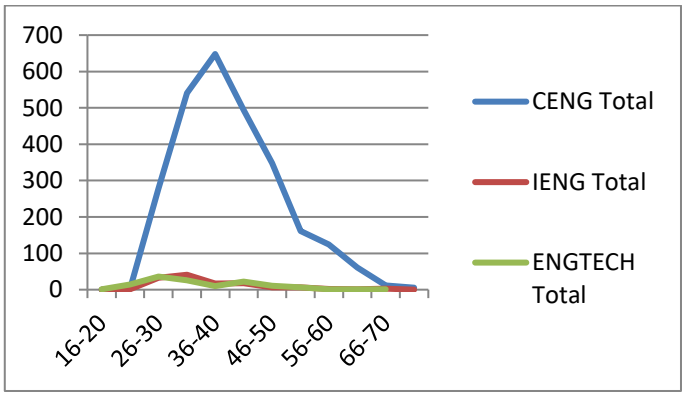


Figure 11 Age Distribution of Professionally Qualified Female Members of ICE

A benchmarking questionnaire as part of this RETURN programme identified that ICE does not monitor numbers of members on maternity/paternity or career break and does not have the capability to record this information on the membership database. These members who then lapse their membership and are taken off the register are in danger of becoming subsequently lost to the profession as there is no way of re-contacting them at a later date when they may be more likely to wish to return. Much more can be done to support these members, and initiatives have been identified by the RETURN project which include:

- Support of members through maternity/paternity or other career breaks with a mentor - either from within ICE or external to it - who has been through the same experience. This facility is available through the MentorSET mentoring scheme.
- Training for members to enable them to return to work after a maternity/paternity or career break. Suitable training is currently available through ICE's Benevolent Fund but this has not been specifically targeted at maternity/paternity returners, and with some repackaging could be ideally suited to this group of members.
- Identification of roles for members on career breaks which allow them to utilise the vital links that they have with schools and the community. Engagement here with partners such as School Gate SET are possible to maximise this resource.

- Provision of specific and targeted CPD provision to enable members to either progress their professional qualifications (e.g. apply for chartership) or progress their career development whilst on a career break. This will both allow them to retain a connection to their career, maintain their confidence and their contacts, and will prevent them from losing out on their career progression whilst away.
- Increased involvement in local and regional activities to maintain links and increase networking opportunities whilst on career break
- Financial incentive to retain membership during maternity leave including provision of free membership, free conference places, or support from the Benevolent Fund (reduced rate membership is currently available for members not working or earning less than £12K). It is worth considering whether membership fees are paid by the employer subsequent to the maternity break, in which case is this the reason why it is not maintained when the member leaves employment?

In summary, simple but specific initiatives that are packaged together to form a support service to members taking maternity/paternity or career breaks would be invaluable in ensuring that these members are given as much chance as possible to maintain their professional status and remain within the engineering sector. Even where members do not feel able to continue to retain their membership whilst on an extended career break, steps could be taken to ensure that these members are retained on a database for occasional contact at a later date.

Establish an ICE Women's Network and Other Special Interest Groups

From a survey of over 5000 qualified women engineers in 2014 called Women in STEM: Are you IN or OUT?[12] it was established that only 52% of the respondents were members of a Professional Institution. Professional Institutions like ICE need to ask themselves why so few qualified female engineers feel that membership is worthwhile and what could be done to encourage, attract and support new members. A survey of current female members of ICE would be one way of establishing what it is that women members value about their membership, and what else they feel could be done to support them. Professional qualification are the number one reason for women (and men) joining Professional Institutions, but what else can an Institution provide to attract and retain female members? Certainly a Women's Network is something that many would value. A network of Female Fellows is another group that would be welcomed by many.

The reason women - and other under-represented groups - need a support network is that they are in the minority, and any minority groups benefits from a representative group with whom they share characteristics in order to thrive. This is support that is needed on a professional basis, offering business and networking opportunity for these women members which gives them contacts beyond the walls of the company for which they work. In addition it can also be a friendship network which goes beyond the business and professional boundaries and allows these women to interact on a personal and social level with a group of like-minded professionals that they value and identify with.

A women's networking group is a forum for women to find mentors, and to get informal advice that they may not have access to otherwise. Evidence shows that women are often more comfortable with a mentor of the same sex, as they are often more likely to share the same experiences and challenges as one another, and in such a non-traditional career as engineering these can be multiple. Many of the ICE women members may already belong to a corporate women's network, and it would be interesting to measure the numbers who are - but many will be employed at smaller companies which do not have the means or the

Reciprocal Mentoring

Reverse mentoring is a form of mentoring which is gaining support in many technology companies as a way of bringing different ideas together which is of mutual benefit to the mentor and mentee. It is often used to allow senior executives to see things through a fresh pair of eyes and give access to new ideas and technologies. For the junior member of the partnership it allows them access to senior level experience and behaviour. The effect is that it brings generations and diversities closer together and generates emerging leaders, at the same time as keeping current leaders in touch with the future. It can be used effectively to encourage diversity as it will allow greater visibility to problems and issues that they would not otherwise be aware of.

number of women (or any other under-represented group) employees to make this viable, and these members are likely to lack the support and networking opportunities that they would value. Even women who are members of their own corporate women's networks will find benefit in a network where members come from a range of companies in different sectors.

Thriving special interest groups offer opportunities for members with common characteristics to meet, interact and derive professional benefits. Activities could include lectures, training seminars and social activities. They provide a forum for discussion and debate and opportunity to pass on relevant information.

It is important to understand that supporting under-represented groups is completely different to establishing the business case and culture to promote diversity and inclusion, and the two should not be combined or confused.

This recommendation is equally valid for companies in the sector, and where these companies are not sufficiently large as to be able to set up their own support network they should partner with the ICE in order to benefit from support that can be offered through the professional body.

Fairness, Inclusion and Respect Committees

The main and the regional Fairness, Inclusion and Respect (FIR) committees have been set up within ICE to promote a culture of equality and diversity, and to identify and take action to eliminate discrimination. To date these committees have had an important role and have had some clear wins already. One of their successes to date has been to ensure that all ICE committee papers have a section where the impact on Equality and Diversity must be assessed. This has succeeded in focusing authors on some potential unintended consequences of decisions which would be discriminatory or unfair. Other work done has included succession planning guidelines which have been compiled for all ICE Panels and Committees with the intention of broadening the diversity of these committees. Progress on this will be tracked and reported, and this is a medium term goal as members serve for a period of three years. One of the recommendations of the FIR committee to ensure more diversity is to leave positions vacant until a suitable replacement can be found.

Ensuring that the work of the regional FIR committees is linked to the goals and ambitions of the central FIR committee will produce a sector wide collaborative effort that is connected and consistent. And giving the FIR committees responsibility for the delivery of parts of the ICE Diversity Action Plan will ensure regional buy in and widespread support.

Zero Tolerance

Hand in hand with training, a culture of zero tolerance for bias, inappropriate language and behaviour should be the norm, and indeed is included in the ICE Code of Professional Conduct: 'Members must never behave in a way that discriminates against persons because of their race, gender, disability, sexual orientation, age, religion, or country of origin.'

A published mechanism that members, volunteers and other stakeholders can use for reporting bias, non-inclusive behaviour or discriminatory practices should be established, and where this behaviour is found should be treated as any other breach of the Professional Code of Conduct. This has a parallel in the work done by the ICE in ensuring ethical behaviour by its members. The provision of training to establish what constitutes non-inclusive behaviour goes hand in hand with ensuring compliance with this code of conduct.

These schemes for reporting non-inclusive behaviour can also be encouraged within the industry where issues involving lack of respect and inclusivity often go unreported and unchallenged, especially on site. A supportive culture where issues can be reported without blame can help employees feel respected and valued in the workforce, and can also lead to improved and safer working conditions, less absenteeism and a lower turnover of staff.[3]

The ICE could establish an independent “Discrimination Review Group” where men and women could report discriminatory behaviour which they might not wish to report to their employer. The Review Group would keep the information confidential and anonymous but would inform the employer when a certain number of complaints have been made.

Training

Planned new Life Long Learning provision for ICE members to include technical and personal development training will help members to access targeted developmental training at all points of their career, and will be very beneficial to all members. This training will be relevant and appropriate for members who have taken career breaks to return to the workplace.

Other training which will help to encourage and support diversity and inclusion is also vital. For example, a programme of Unconscious Bias (UB) training for all volunteers, committee members, STEMNET ambassadors, staff, reviewers, accreditation committees and other ICE stakeholders is recommended and should be made mandatory for certain groups (including council members). A suitable training module has been developed by the BCS (the Chartered Institute for IT) and is available through the Royal Academy of Engineering Diversity Concordat, as well as a professionally developed training course offered at a reduced rate by the Skill Boosters. These courses could usefully be made available to all individual members for their own professional benefit, and this would be an excellent way of ensuring that members are aware of the importance that ICE places on the promotion of diversity and inclusion. UB training is useful tool in challenging wider beliefs and cultures, but should be the start of a much wider and more embedded series of training measures and programmes to create gender balance and promote inclusivity, and should not be a 'tick box' exercise, otherwise it will have very limited benefit. Inclusive practices come as a result of Awareness, Education and Behaviour and initiatives and training to support these three stages. In terms of awareness there is much that can be done through communication to promote the value of diversity and inclusion, as well as more formal reviews of the financial value to the business. Through education, there are a number of ways to demonstrate the value of diverse teams and cross cultural working practices, and this training will lead to the behaviours that we are seeking to encourage.

Training which is linked to strengths will lead people to ensure that they have the right mix of skills in their team, and this can in turn lead them to realise that their recruitment processes are not resulting in a diverse balance of recruits. (This is a much more positive method of ensuring recruitment for diversity than imposing a 50/50 gender ratio in shortlisting).

Other diversity and inclusion training courses could be made available to members where the emphasis of the training is not only on how to remove barriers to allow more diversity and inclusivity in engineering, but also to ensure that stakeholders are aware of the positive benefits of thought diversity, and indeed its necessity to the discipline of engineering itself, to productivity, to profit, to innovation and to team balance. Training on cross cultural inclusivity and on working in multi-generational teams, and inclusive behaviours can be taught and owned in the same way as engineers are taught to behave ethically, or safely. Inclusive behaviour should be one of the professional competencies that we require of our members.

Reverse or reciprocal mentoring training will enable senior leaders to be mentored by junior team members of a different ethnicity or gender. Training modules linked to the Ten Steps[14] (see page 26) would enable members to implement these recommendations within their own workplaces. Training STEMNET ambassadors and other ICE volunteers on the best way of delivering outreach activity and effectively engaging with the next generation so as to ensure diversity is another example of training that can be provided.

Training for specific sectors of the membership can also be helpful. What it means to take responsibility for diversity in an organisation would be useful for senior men; “Managing talent that’s not like me!” training for managers to help them to manage for inclusivity; media engagement training for under-represented groups would help ensure a wider range of people are available to represent the industry in the media; training for professional reviewers on dyslexia and dyspraxia has been well received previously and this could be offered on an annual basis to new reviewers, or as part of a skills package that they must all complete.

Diversity and inclusivity training as an integral part of the Continuing Professional Development (CPD) could be recommended for all members at both technical and professional level.

The industry itself will also benefit from the provision of this training - provided by ICE - for its employees, since much of the sector's workforce is employed within smaller companies of less than 50 people, and the provision of training for these companies is often difficult. Less than 1% of sector businesses employ more than 250 people and 93% employ less than 10[15]. Could ICE take more of a lead by providing diversity and inclusion leadership for these employers and employees, and thus in addition provide a membership attraction which brings in and supports new members?

Publications

The representation of inclusion and diversity in printed and online publications is an important manifestation of our commitment to diversity, and many engineering publications are guilty of a negligent approach to ensuring that diversity is represented pictorially and through written contribution, and that editorial content is gender neutral. Representation should not merely be at the current levels of diversity, which from a gender perspective is less than 1 in 10, but aspirational targets should be used to show the industry to be a diverse and inclusive place to work. Indeed all ICE publications should be reviewed through a 'diversity lens' before going to print, to ensure that aspirational targets of diversity are represented and that the language is gender neutral.

The New Civil Engineer is an enlightened publication which is well aware of the need for and the representation of diversity. It has recently run a high profile campaign challenging senior members of the industry to come out in support of feminism. Whilst it has received some negative responses to this campaign, it has also provoked a lot of thought and discussion, and has unequivocally given its backing to the need for diversity. As the voice of civil engineering the New Civil Engineer publication offers an excellent opportunity for publication of the ICE work on diversity and inclusion, and its supportive editorial team should be integral to the dissemination to ICE members of information and updates to this diversity work.

Conferences and Events

Conferences and events organised by ICE should aim to have an equally diverse mix of contributors as individual speakers and as panel members. Diversity Codes recently set up by the Women's Engineering Society allow organisations to sign up to agree to Diversity in Print and to Conference Diversity, and it is recommended that ICE follows these codes of best practice.

Equally, members should be aware of this code and should be encourage to challenge other conference organisers at events that they speak at, to encourage them to honour this code.

In order to make this practical ICE can play a role in actively encouraging its female members to speak at events, and this may involve the need for specific training.

Awards and Nominations

ICE Awards can be used to promote diversity. For example, an for Best Inclusive Practices to reward members who are innovative and make significant progress towards the promotion of diversity and inclusion in their work could be established; or a Community Building Award for work done which engages the local community in civil engineering. This is a simple step but one which shows the value placed on the promotion of diversity and will give visibility to best practice from around the sector.

Note, however, that these are not awards for members of under-represented groups, but are awards for any member who works on projects or activities which promote or result in increased diversity.

Ensuring that the nominations committee - and indeed all committees - are themselves made up of a diverse panel is imperative, and steps should be taken to ensure that a diverse range of applicants is nominated for consideration for all of the ICE Member awards. Where this is not the case active encouragement of members to nominate themselves or their colleagues should be undertaken.

Projects and Campaigns

Major projects and campaigns within the ICE, and indeed all decisions, announcements, job adverts and work streams need to be considered through the lens of diversity and inclusion. Not just to ensure that the language used is appropriate and inclusive, but also to ensure that the work of the project itself is diverse. The 'Shaping the World' project is a fabulous opportunity to address the diversity issue and ensure that its objectives are in line with encouraging diversity. Indeed this project is the ideal vehicle for promoting civil engineering to a diverse world.

The One Great George Street refurbishment is also a great opportunity to embed the principles of diversity and inclusion into the very heart of the ICE. Currently the building is an impressive, austere and historically significant building located adjacent to the seat of UK Government, which represents all that has been great in civil engineering since the birth of the ICE in 1818. With its vast number of portraits of Past Presidents and its large paintings of iconic civil engineering structures it is not, however, particularly welcoming to a diverse audience. Indeed it has only two noticeable paintings of women in the whole building, one being The Queen, and the second being Past President Jean Venables. Whilst this is clearly indicative of the history of civil engineering, and not something that is easy to change, an opportunity has arisen for a new face of civil engineering and this opportunity must show a future that is inclusive. Where we can't show diversity in the past we can certainly show diversity in the current and future representations that we make, and we must ensure that we do this.

So in order to ensure that diversity and inclusion considerations are considered in every project, all decision making committees should include members of under-represented groups.

ICE Staff and Governance

It is vital that the Council and Directors of the ICE recognise the value and need for diversity to both the Institution and to the wider industry. In order for a real change of culture to take place every member of the staff and governance team needs to be accountable for the delivery of diversity within the organisation. The success of this, however, depends upon the commitment and the leadership of the Council and senior staff team.

Diversity within the senior executive team at ICE is lacking. Whilst a change in senior staff is not something that can be planned solely for the sake of introducing diversity, there are still some measures that can be taken to ensure that succession for diversity is being addressed. For example, each of the executive team can become a mentor to a more junior member of staff who is of a different ethnicity or gender. A formal programme of mentoring or reciprocal mentoring can be tailored which ensures that diversity is introduced at senior level.

McKinsey recommend asking five questions to stimulate action to increase gender diversity in the senior leadership team[16]:

1. Where are the women in the talent pipeline
2. What skills are we helping women build?
3. Do we provide sponsors along with role models?
4. Are we rooting out unconscious biases?
5. How much are our policies helping?

By answering these questions actions can be identified to improve chances of promoting women to senior leadership positions.

It is understood that ICE is planning to work with a number of partner associations including Non-Executive Directors Association (NEDA) and the National Council for Voluntary Organisations (NCVO) to give young professionals the opportunities to develop their board skills, and this

The Davies Review

The Davies Review[2] was set up by Lord Davies in 2011 to increase the number of women on boards and recommended a target of 25% of women directors serving on FTSE 100 boards by 2015. Through transparency and consistent attention to data this target has been met - an increase from 12.5% in 2011.

Davies is due to publish a new report in October 2015 which is expected to recommend that women make up at least a quarter of *Executive* posts at FTSE 100 companies.

In order to comply with the Davis Report recommendations ICE should set a target for women to make up at least a quarter of the Executive posts by 2020.

type of programme will be very beneficial for the ICE's emerging leaders.

The Fairness, Inclusion and Respect (FIR) committee of the ICE have been working on succession planning guidelines which have been drafted for all ICE Panels and Committees, which will help to ensure that diversity is being introduced in a structured way. Since members serve for a period of three years this is not an immediate fix, but something that needs to be tracked and monitored over time, along with the other benchmarking statistics reported regularly to the Board.

It must be ensured that the accountability for the ICE diversity programme of activity is valued, owned and led by the senior leadership team of the ICE for it to be successful. Whilst a Diversity Action Plan will allow for the practical manifestation of change, real change will only occur if this philosophy is integrated fully at all levels, and of course the same is true if we want to see real change within the industry more widely.

Five Tribes

A recent piece of work by the Institution of Mechanical Engineers on the 'Five Tribes' model of young people[17] has focused some new discussion on our method of engagement with students, and reinforced the viewpoint that something different needs to be done for to attract girls.

The report identifies five groups of youngsters: STEM Devotees, Social Artists, the Enthused Unfocused, the Individualists and the Less Engaged. Within engineering we need to be mainly concerned with the two largest groups, STEM Devotees and Social Artists. The group that we generally draw our recruits from are the STEM Devotees. This group will be determined to follow a career in a STEM discipline no matter what. They have the necessary combination of natural interest and ability, a high degree of science capital within the family, and sufficient determination and support to succeed in engineering or related disciplines without the need for much - if any - additional stimulus. Of this group 32% are women.

The next group in terms of size are the Social Artists - 55% female and the most socially conscious of all of the groups - they are the most creative. They are not inclined generally towards engineering with the exception of engineering which had a relation to art and design, and this tribe comprises many potential engineers who would be more inclined to contemplate what is on offer if the engineering community were better able to promote its creative side.

If we know that we want diversity in engineering, and we want to increase the number of women in engineering, we need to do something specifically focused on attracting this group of potential

Outreach Work and Careers Advice

Attracting the next generation of engineering professionals depends largely on the strength of our outreach activities today. The education programme of the ICE has some excellent examples of successful outreach activity, but this is regionally variable and lacks central coordination. Whilst regional activity meets diversity targets of ambassador recruitment and 50/50 male/female delivery, many of the best examples are not shared widely, and not used effectively to promote the ICE and a career in civil engineering. A centrally co-ordinated approach to outreach would improved this (as I believe is the plan), as well as educational activities and careers advice which specifically address the needs of a wider cohort of youngsters, and promotes a variety of routes into engineering and construction including vocational training and apprenticeships. In addition, it is recommended that outreach which is given by volunteers - often through the STEMNET programme - has a consistent message and a diverse content, which can be ensured through the provision of the appropriate training of those involved.

The Five Tribes work of the Institution of Mechanical Engineers[17] and the recommendations of many gender related engineering organisations such as WES and WISE have shown that it's not enough to continue to market engineering to the young people who are already converted. Instead we need to recognise that something different and specific to the audience we are trying to attract is required. Activities which link to some of the more humanitarian projects - such as mitigation of flooding and disaster relief may appeal to a wider group of students than the more traditional bridge building activities, for example. Disruptive technologies such as the use of Big Data, connected communities, use of robotics, advanced materials and environmental sustainability will also be attractive to the next generation, and these too need to be incorporated into outreach. The use of gaming and other online technologies is another approach to attracting a diverse audience.

One of the biggest co-ordinated educational activities in the UK is the Big Bang fair. Whilst this is a great day out for many schools and families, it is not clear that this has the long term impact on converting young people to a career in engineering who wouldn't have been considering it already. If we are to continue to invest in this model of engagement we need to do much more longitudinal study to see how effective it is for both boys and girls. And if we fail to do any additional work to keep the girls we interact with 'on track' after the one off engagement has finished, then we will certainly have a lower long term uptake amongst the girls than we do amongst the boys, just because of societal and parental stereotyping and tradition. This is where an apparently gender neutral activity such as the Big Bang is

actually discriminating in favour of boys, so we need to counter this by putting something in place (in addition, as opposed to instead) that has an appeal to girls. For example, girls only taster days on construction sites; work placements which are only available if offered to equal number of boys and girls; targeted outreach activities taking place on National Women in Engineering Day (23 June annually); and press releases aimed at appealing to those people who inspire girls, their mothers and their thought leaders i.e. teen magazines. (There has been some good work done by Capita who worked with the Marie Claire editorial team to help them better understand what a career in the army is about, which has helped them to get much more and much better coverage in that magazine.)

Dedicated Careers Service for Engineering

A co-ordinated effort across all of the Professional Institutions to establish an engineering careers advice service for school aged children would be enormously beneficial. This would enable young people to access clear and consistent advice which would allow them to make informed choices between each of the engineering disciplines, without relying solely on the current arbitrary nature of provision which is dependent on their teacher's experience (or not), their parents preconceptions, or the postcode lottery of outreach provision. This service would also serve to promote a range of pathways into engineering including vocational qualifications, apprentices and degree level qualifications, conversion courses and joint cross-disciplinary courses. This service for 14-18 year olds -which is not currently provided by the Tomorrow's Engineers programme to sufficient depth - would be incredibly helpful at a time when careers advice in schools is so inconsistent and patchy. These young people and their parents often need one to one advice, especially those from under-represented groups who require assistance over and above that which is available for students who have the benefit of home or school support.

People Like Me

Professor Averil Macdonald has recently done some groundbreaking work which addresses the issue that prevents many girls from entering engineering[18], which is that they do not identify themselves as being the same as the people who are currently scientists and engineers. And because they don't identify with them, they can't envisage themselves becoming scientists and engineers.

She suggests that people identify themselves in one of two ways: either by using adjectives to describe their personality (such as friendly, honest, imaginative or outgoing); or by describing what they do (such as being a civil engineer, building bridges or being a parent). If people (and this is applicable to boys as well as girls) do not see people *like themselves* (i.e. who describe themselves in the same way as they do) who are happy working in STEM careers, then they are not likely to chose that career themselves. And it is reinforced in the views of parents - and mothers especially - who want to see their children happy in their careers.

What she is suggesting is that we become more familiar with these distinctions between different types of people, and we ensure that our messaging reflects this so that it is suitable for everyone. This applies to the job adverts we place, the outreach activities we provide, and the way we describe ourselves as a group, and it could be something we offer as a training module as part of our Diversity and Inclusion Leadership Training.

If we look at the specific example of the language used by architects compared to civil engineers, we find that architects talk about social interaction, light and space, mood, and how a building affects our senses and emotions. Civil Engineers by contrast talk about structures, project size, large scale infrastructure, dynamics and data. Not surprising the architects get all the attention and glory and don’t have such a problem attracting women to the profession.

Based on this thinking, training materials and activities should be reviewed for consistency to ensure that the language being used is inclusive and attractive to all groups of people.

Partnership with the Creative Industries

The Creative Industries Federation has recently published an *Industry Manifesto for a Creative Education*[19] which sets out how the Government should support creative learning in the UK and give it equal status to STEM subjects. This already has the support of ICE and is an important collaboration in getting more crossover between the arts and engineering, and is a very important step in attracting more diversity to engineering.

This joint initiative references research showing that more than a third of Civil Engineers considered for a top-ranking scholarship studied a creative or design subject to AS/A level, whilst only one in a dozen students in England combine arts and science disciplines at AS.

Research also shows that: there has been a 50% drop in the number of students taking GCSE Design and Technology between 2003-2013, and a 25% drop in other craft related GCSEs from 2007-2013; failure to meet engineering skills demand will cost the UK £27 billion a year; every year, the UK faces a shortfall of over 81,000 people with engineering skills in the workforce; the creative economy accounts for more than 2.5 million jobs and is the fastest growing sector in the UK; for 89% of the Federation's members (creative industries, cultural education and public arts), education is the greatest policy concern.

Routes into Further and Higher Education

Further and Higher Education need of some attention when it comes to attracting both the numbers and the quality of engineering undergraduates and apprentices (both male and female), and developing more diverse routes into engineering. A number of innovative initiatives have had some success in this respect recently.

The Department of Civil Engineering at UCL has identified that we are closing off our options too early by eliminating people who have not taken maths or physics A level. Professor Nick Tyler's Department has changed the entry criteria for the department to ensure that individuals who have the right attitude and motivation are able to apply, with top up training provided to bring their missing skills up to speed once they arrive. This philosophy has caused a degree of consternation, but is exactly the type of disruption that is needed to encourage diversity. Some other interventions may also be necessary to ensure that students do not fail after the first year, such as changing around some of the modules from year one to year two, but these are practical changes which are achievable.

These interventions have also been tried in Canada and the United States. They have found that the removal of the need for physics A level in itself has not resulted in many new applicants, but what they have found is that this has significantly helped with the marketing of engineering courses to students and parents, who now see the courses as much less exclusive. It has allowed them to invite girls to consider engineering who would not previously have thought it was for them. This, in combination with a number of school interventions, has resulted in a rise from 18% female intake in engineering to 30% in 8 years at the University of British Columbia.

Other changes to engineering courses, such as providing the option of combining civil engineering with another discipline such as architecture or environmental engineering may well attract a more gender diverse intake, and these changes should be seriously considered to widen participation. The Innovation Design Engineering Masters course which is offered by Imperial College and the Royal College of Art is an example of a course which has successfully found a way to attract a diverse cohort of students, similarly the Dyson School of Design Engineering which has a gender balanced intake, and the masters for Arts and Science at Central St Martins which appeals to students with a wide variety of backgrounds learning about the benefits of collaboration between the engineering and creative industries.

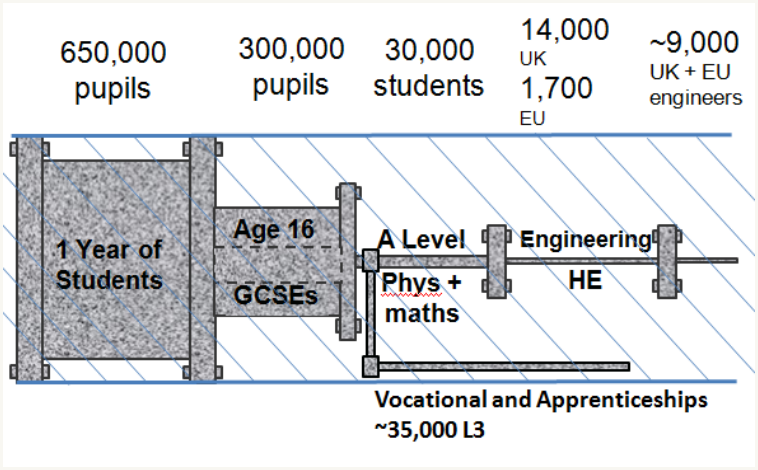
More engineering conversion courses which allow entry from other disciplines would allow employers to recruit graduates with the right

competences and train them in engineering. It is welcome news that the Higher Education Funding Council for England (HEFCE) are funding an engineering conversion course pilot scheme for non engineering graduates for precisely this purpose.[20]

In Hertfordshire a new University called the New Model in Technology and Engineering (NMITE) based on the Olin model of the United States is currently being established with the support of the University of Warwick. This provides an opportunity to rethink current practice and question what is being taught in an engineering degree and how a change of approach could encourage more diversity.

Glasgow City College has set up a new women only HNC engineering course which has made a striking difference to the number of women entering engineering through the course. This initiative is very new, but very promising, and it may be that this approach will succeed where others have failed.[21]

The Leaky Pipeline - Diverse Routes into Engineering



We all know the analogy of the Leaky Pipeline. There are approximately 650K students per school year of which 300K take appropriate GCSEs, 30K take appropriate A levels, 14K take appropriate degrees and then 9K go on to engineering careers, of which only 7% are women - according to the diagram above from the Royal Academy of Engineering[22]. But the trouble with this analogy is that the diversity that we are looking for is not in the solid grey part of the pipeline, but in the shaded area around the edge. We need to do more to attract the students who are in this part of the pipeline by extending the available routes into engineering and moving away from a purely linear pathway.

Alternative routes into engineering are needed and some flexibility about how we provide these is required.

In terms of engineering and construction apprenticeships, women are often doubly disadvantaged here as they have traditionally not been encouraged down either of these routes. Much more work can be done in terms of outreach to explain the benefits of apprenticeships to under-represented groups, and in particular the new Higher Apprenticeship grades.

Accreditation

The accreditation process used by universities to ensure that degree courses are suitably rigorous and capable of generating appropriately qualified engineers is defined by the Engineering Council's Accreditation of Higher Education Programmes (AHEP) guidelines in line with the UK Standard for Professional Engineering Competence (UK-SPEC). In the case of ICE, accreditation is provided by the Joint Board of Moderators comprised of Institution of Structural Engineers, Chartered Institution of Highways and Transportation and the Institute of Highway Engineers). This Board is leading the way amongst the Professional Institutions in mandating that group projects are set which are often inter-disciplinary involving other departments and outreach. These are disseminated to universities annually as best practice. The number of female students in accredited universities is monitored and the data is fed back to the Universities. In addition, the accreditation process will identify and report on any issues of harassment,

abuse or lack of support for under-represented students, and recommendations will be made where problems are found.

An issue that affect women engineering graduates (in general) is that fewer of them progress to an engineering related career than their male counterparts (51% compared to 68%) on graduation; and in addition women are less likely than men to be working in engineering and technology six months after graduating even though women in the final year of engineering courses are as likely as men to express the intention to work in engineering and technology roles[23]. The ICE is addressing this through its QUEST scholarships which partner students with industry, and the accreditation process must continue to address this important issue to ensure that drop off rates for female students are minimised.

It is recommended that ICE continue to build on good practice in this area and uses its influence with universities through the degree accreditation process to ensure; the value of diversity and inclusion in engineering is understood to be inherent to good engineering design, and not just a desirable personal or social skill; courses are available to a wide and diverse group of students, through removing the need for physics and maths as entry requirements to engineering degrees; project work undertaken has a real world relevance and that it is carried out in collaboration with relevant partners; collaboration takes place with the corporate sector to strengthen work experience placements and ensure more female students chose to stay in engineering.

The Athena Swan award is an award which recognises and rewards diversity in University departments, and it would be an ambitious target to challenge all University departments with accredited engineering degrees to achieve the Athena Swan Bronze award, but this would go a long way towards ensuring that these best practices were addressed across all Departments.

In order to bring a more disruptive intervention to higher education, I believe that the courses we want to encourage our young people to pursue, like engineering and nursing for example, should have some level of preferential funding than courses which do not lead to qualifications that are in short supply. Strategically important courses such as these could be incentivised by a reduction in course fees, the availability of interest free loans, or the awarding of a 'golden hello' on entry to the profession.

Professional Registration and Review

Professional Registration with the Engineering Council as an Engineering Technician, Incorporated Engineer or Chartered Engineer is based on demonstration of competence and commitment as described in the UK SPEC (Standard for Professional Engineering Competence)[24]. To be professionally registered candidates must be assessed through professional review against the UK-SPEC which may be adapted by the Institution to relate specifically to the particular technologies or industries with which it is concerned. There is very little in the UK-SPEC which relates to diversity and inclusion, apart from in one section on Personal and Social Skills which states that engineers must 'Be aware of the needs and concerns of others, especially where related to diversity and equality'.

In terms of personal skills, more emphasis should be place on inclusivity. Individuals find it difficult to be diverse - they are what they are, and sometimes the term diversity can be difficult to relate to or comply with on a personal level. Inclusivity, however, is a skill that is able to be possessed and developed by each individual, and just as everybody is expected to comply with safe and ethical behaviours, they should also be expected to comply with inclusive behaviours. These can be trained, measured and encouraged and should form part of the professional review of competencies. More discussion is also needed around the terms diversity, inclusivity, equality, fairness and respect, and engineers should be aware that equality

refers to equality of opportunity, which is not the same sense of the word equality as meaning that everybody has to be the same.

In addition, more guidance on the value of diverse teams on creativity and innovation, on design and development, on behaviours and teamwork, and on inclusive design solutions could be included in the development of professional competencies.

Beyond the current definition of a professional engineer as defined by the UK-SPEC, however, is a broader discussion about what professionally qualified engineers will look like in the future. Technology is moving quickly and already there is an increase in the number of entrepreneurs who use technology differently and interact with clients on a different level. Disruptive Technologies such as advanced robotics, mobile internet, Big Data and the Internet of Things, advanced materials and autonomous vehicles will affect the way we work and do business, and this will in turn influence the need for and look of professional qualifications.

Over time the value of professional qualification appears to be diminishing as we are seeing fewer numbers of engineers registering or retaining their registration. According to the Engineering Council's Annual Registration Statistics[9] the number removed from the professional register in 2014 was greater than the number of new registrants. If we want to reverse this trend and ensure that we register and retain our professional engineers then we need to look at the real value of registration, and work with the corporate sector and the qualifying bodies to ensure that professional qualifications reflect the changing nature of our future engineering discipline. We also need to consider ways of retaining members on the professional register as they wind down their career and move towards part time work and retirement.

Ten Steps

In 2015 Women in Science and Engineering (WISE) and the Royal Academy of Engineering launched the Ten Steps model to sustain the pipeline of female talent in the STEM sector. [14] All ten of these steps are adaptable for Professional Institutions, and these mirror many of the recommendations already discussed.

1. Understand the starting point and put plans in place to improve performance and monitor progress

2. Educate leaders and give them accountability for change

3. Change mindsets by challenging bias and sexism whenever and wherever it occurs

4. Be creative in job design

5. Make flexible working a reality for all employees

6. Increase the transparency of opportunities for progression

7. Sponsor talented women, giving them the same exposure as men and support to develop their career

8. Demonstrate to women that we want to retain them through career breaks and beyond

9. Treat the retention of women as we would any other issue affecting our core business

10. Share learning and good practice with our industry partners

It is recommended that the ICE sign up as a supporter of the Ten Steps.

The Bigger Picture - Beyond ICE

Within the wider engineering sector much work is needs to be done to ensure better diversity at all levels. ICE has a role to play as the leading professional body in identifying, influencing and promoting new ideas. A number of possible disruptions are suggested below which would lead to more rapid change.

These ideas are for wider discussion within the industry, and ICE endorsement where appropriate. It is believed that greater leadership and legislative change is required to make the step changes that are necessary.

Quotas and Targets

The question of whether or not to support quotas to encourage diversity in recruitment is one that is divisive, but unless progress is being made by other measures then legislation may become necessary at some point in the future. There are historical landmarks that prove that legislation brings about desired change e.g. Health and Safety at Work Act, Environment Act, Equal Opportunities Act.

Indeed, in the States it is now commonplace to have 50/50 shortlists for jobs in engineering. This has driven companies to put interventions in place lower down the pipeline (through schools programmes) that will ensure that there is sufficient talent coming through to make this possible. This also has the effect of ensuring that women who have had recent gaps in their experience due to maternity or career break are not filtered out of the selection process unfairly early, as is currently often the case, and is a positive benefit for allowing experienced women back into their careers.

Whilst the negative side of quotas is the risk that people feel that under-represented groups are not recruited on merit but instead as a tick box response, the positive benefits are that companies are forced to measure and address their shortcomings, and this can be an effective way of driving desired behaviours.

Job Descriptions and Recruitment

Clearly - quotas or not - women can't be recruited to jobs where they are not applying for them, but some actions that encourage a more diverse range of applicants will be helpful to discuss.

Job descriptions themselves can seriously limit the diversity of applicants. Jobs in engineering have invariably been done, in the most part, by male employees who have been doing the job in question for a number of years. In otherwords the jobs will have been devised, done, and described by somebody fitting the description of a current (male) engineer. But one of the benefits of diversity is to bring

innovation and creativity to jobs, and so defining a job too closely often means that the opportunity for innovation and hence diversity is diminished. Jobs and job descriptions need to be flexible, and defined in ways which appeal to a diverse group of potential employees. And if we also ensure that we include in our job descriptions the 'person characteristics' that were described earlier from the work of Professor Averil MacDonald, then we will be in a better position to judge our candidates based on these characteristics, and may find that a more diverse range of applicants comes to the fore.

We also know what language is likely to motivate women and what is likely to motivate men (in general terms), so we have a much better chance of devising jobs adverts that attract women to apply.

Other factors which will increase diversity include recruiting graduates from a variety of different Universities rather than the same ones year on year; changing the recruitment agencies that are used; being proactive in advertising in a number of different places; hosting open days for minority candidates before the interviews; and ensuring a diverse interview panel.

Thinking Like an Engineer

What isn't always helpful for diversity is to rigorously define the attributes of the members of the current engineering community - as the Royal Academy of Engineering[26] have done recently with their work on Thinking Like an Engineer - and then try to replicate these traits amongst the next generation. This will have the effect of perpetuating the lack of diversity of the current community rather than attracting the diversity that we crave. Rather, we need to look at what we would like to see in a diverse engineering workforce, and start to work towards attracting more people with these characteristics.

Equal Opportunity Employers

Employers are able to claim to be Equal Opportunity Employers without any formalised requirement to comply with best practice, other than ensuring that equalities legislation has been followed. A more stringent framework should be established by the Government so that employers who wish to use this label are complying with a set of best practice guidelines on diversity and inclusion.

The Royal Academy of Engineering's Diversity Leadership Group has recently carried out a benchmarking survey amongst its members, which is due to be published in November 2015. The ICE could adapt this survey and carry it out with its own corporate partners to establish a baseline of best practice, thus providing leadership of the industry in this area.

Incentivising Training

In order to help convince students and their parents that careers in engineering are valued, needed and will lead to stable and well paid employment, the Government could do more to incentivise students to study these subjects. Reduced undergraduate course fees or interest free student loans would effectively convey this message, as would 'golden hellos' offered by companies to pay off part of the student's debt on joining.

Engineering is not the only profession which is suffering a skills shortage, and the Government's Migration Advisory Committee compiles a full list of the occupations suffering from a shortage of skills[26]. Could this list be used more effectively to alert students, parents and teachers to the careers in most demand, and to incentivise study in these areas, rather than allow students to complete courses which are unlikely to lead to jobs, increasing the longer term burden on the state?

Think, Act, Report

This Government framework is a useful tool for maximising female talent in the workplace by asking the right questions to identify and understand any challenges or barriers that may exist within your organisation[27].

1. The Pledge By signing up, you pledge to:
Think: identify any issues around gender equality
Act: take action to fix those issues
Report: on how your business ensures gender equality
2. Measures Organisations supporting Think, Act, Report should choose to look at a range of measures which they consider to be the most relevant to them. But they are particularly encouraged to consider analysing and publishing one or more of the following types of information:

Policy and narrative measures: these provide useful contextual information. Measures could include:
●Description of overall objectives and key policies;
●Results of employee surveys.

Representation measures: these explain the composition and structure of the workforce. Measures could include: Representation at different levels by role;
●Measures relating to representation at different bands (e.g. £10-20k, £20-30k etc.);
●Composition of the workforce as a whole;
●Measures relating to promotion rates by gender;
●Measures relating to uptake of flexible working across the company;
●Maternity returners;
●Measures relating to representation in different occupational groups.

Pay measures: these directly capture the pay differences between men and women, and also reflect wider pay and benefits. Measures could include:
●Difference between average basic pay and total average earnings of men and women by grade and job type;
●Difference between men and women's starting salaries;
●Reward components at different levels;
●Full-time pay gap;
●Part-time pay gap;

Incentivising Retention

It has been estimated anecdotally that the cost to a company of letting an experienced woman employee go after her maternity leave is as high as £200,000. If this cost to the company is measured and reported more widely then this becomes an enormous incentive to businesses to do more to ensure retention of employees who take career breaks.

Fairness and equality considerations alone dictate that parents, and particularly women should not be disadvantaged by having children. The recent change in legislation which allows fathers to share in the caring responsibilities through paid paternity leave will pave the way for a more balanced distribution of leave, which will be a positive step forward. Beyond this, though, companies can do more to ensure that women are retained at this crucial point in their careers. A number of very comprehensive and effective processes have been put in place by companies such as Atkins to ensure this retention, but what more can be done?

Best practice behaviours include:

- access to childcare provision for staff
- flexible working as the norm for all employees
- returnship programmes to support return to employment after a maternity/paternity break
- extended holiday entitlement for staff with young families
- condensed (term time) employment contracts
- advertisement of inclusive working practices when offering jobs

Small and Medium-sized Enterprises will often find it difficult to put measures into place which support their under-represented staff, often through lack of expertise, lack of resources and lack of sufficient numbers of under-represented staff to establish credible support networks. In these instances it would be beneficial for some co-ordination by the main contractors, and a sharing of training and other support mechanisms would be helpful.

Procurement and Contractual Levers

Incentives for companies which will promote a measure of disruption include the addition to procurement evaluation of stretching targets. Many current Pre Qualification Questionnaires (PQQ) put the emphasis on the elimination of

unlawful discrimination, but much more could be done to promote positive action around equality and diversity. For example, a Transport for London contract with a sub-contractor has identified some Strategic Training Needs and Labour Requirements to promote diversity and inclusion which give commitments including:

- the employment of a set number of apprenticeships
- minimum numbers of jobs created, with a percentage of these going to workless individuals and a commitment to work with local organisations such as JobCentrePlus and the DWP Work Programme to make as many of the job opportunities as possible available to local young people and those from diverse backgrounds
- an agreed number of days of work placement positions offered to local young people
- a fixed number of days of school engagement with a significant emphasis on identifying girls schools and those with a high proportion of BAME pupils, with the aim of creating interest in STEM subjects and careers in engineering and transport in young people from currently underrepresented groups
- an internal focus on attracting more women into engineering, through specific schemes aimed at attracting, supporting and retaining women in engineering. They have recently hosted a Women in Engineering networking event at a Crawley school, where 45 young women came to Thales' site for the day to network with female engineers.
- a commitment to furthering these activities and to becoming significantly involved in the activities with key suppliers to encourage women to consider roles in transport and engineering

This represents a significant commitment to equality and diversity by both the main and the subcontractor which is over and above the legislative minimum that is required.

Main contractors have a real opportunity to support the subcontractors with diversity and equality training. Their support networks for women could also be opened up to under-represented staff from subcontractors.

Indeed ICE has an enhanced responsibility towards members from under-represented groups who work for small employers, as very often there will be few other employees who share the same characteristics and these employees will be very isolated.

Schools Engagement

Industry can play an important role by engaging with local educational establishments to develop partnerships and collaborations where the industrial partner acts as a magnet to influence, educate, and draw through talent from the local community. Even if future talent is not likely to come from the neighbouring schools, if all industries influenced their local communities through a joint commitment then we would very effectively cover the majority of the UK. School/industry partnerships can often be mutually beneficial if a relationship exists where work experience placements are offered (which should be offered to equal numbers of boys and girls), leading to the employment of apprentices, for example. Open days can be organised which are accessible to both students and parents, and STEMNET ambassadors and speakers for schools provided. Industry sponsors can also be used to mentor school students, and with the back-up of a dedicated careers service for engineering we could provide the specific careers support that is currently missing. Industrial partners can be encouraged to become school governors, and provide additional support and resources for the teaching of STEM and other subjects.

Industry also has a role to play in education by collectively advising and influencing the Government on the skills that it needs from students at GCSE, A level and vocational qualifications. For example, the new Design and Technology GCSE qualification due to be launched in 2017 has the opportunity to ensure that young people are learning about areas of technology which are linked to the Government's identified growth opportunities[28]. And the addition of the Design and Technology qualification to the EBacc would be another important way of incentivising students to choose subject which feed directly into our engineering and technology sectors.

Considerate Constructors Scheme

The Considerate Constructors Scheme is an independent organisation which was set up by the construction industry to improve its image. Construction sites, companies and suppliers voluntarily sign up to register with the Scheme and commit to following its Code of Considerate Practice, designed to encourage best practice beyond the statutory requirement. This voluntary scheme has identified that something needs to be done to address a potential threat to the industry through the negative image that construction could cause in neighbourhoods where disruptions can be high and prolonged. The Code is successfully mitigating against this threat. Could the Code be used to introduce more diversity and inclusion best practices which ensure that the construction industry is working towards diversity and that it portrays itself as a diverse industry? It is certainly one of the few mechanisms by which the industry engages with the general population, and consequently could have a greater role to play in both representing a diverse industry and in encouraging future diversity. It already has as part of its monitoring criteria 'How does the company encourage new people into the industry?' Could more be done to actively engage with the next generation through these local community engagement schemes?

Gender Pay Gap Legislation and a Gender Diversity Index

A recent Government consultation on moves to require employers to publish the gender pay gap for staff will have the effect of ensuring that companies measure and report on the pay of their staff in order to drive towards equality. A similar initiative to publish gender ratios for each occupational group would start to build some levels of healthy competition between companies and lead to behaviours which promote diversity. Going one step further, mandatory reporting of diversity data per occupational grade from operator through to board level, published in a company's annual report would force companies to measure and record their diversity, and targets should then be published which show how they will improve their performance.

Whilst unpopular, these legislative measures are arguably what is now needed to ensure that companies take steps to address their lack of diversity.

Athena Swan for EPSRC Grants to Universities

The Athena SWAN Charter was established in 2005 to encourage and recognise commitment to advancing the careers of women in science, technology, engineering, maths and medicine (STEMM) employment in higher education and research.

The charter has recently been broadened to encourage diversity more broadly, and not just barriers to progression that affect women. It consists of bronze, silver and gold awards and is administered by the Equalities Change Unit. A number of the Research Councils, including the Medical Research Council (MRC) mandate that all Universities must have Athena Swan bronze in order to receive an MRC grant. Progress in the number of women in medical careers has grown enormously in the last few years, and the number of women joining UK medical schools continues to outnumber men (in 2012 55% of medical students were female). The EPSRC (Engineering and Physical Sciences Research Council) grants do not have this requirement. An easy win for the engineering profession would be to mandate that all EPSRC grants are given only to University Departments which have an Athena Swan Bronze award.

Indeed, the Athena Swan awarding scheme could - with sufficient funding - be expanded to cover the work of the Professional Institutions (the Royal Society have recently applied for an adapted version of Athena Swan Bronze), and beyond this into the corporate sector where a scheme of recognition is desperately needed. The Institution of Civil Engineers could quite feasibly be the first Professional Institution to lead the way in applying for an adapted Athena Swan award, and this would be an excellent mechanism for establishing and embedding the Diversity Action Plan that is recommended in this report.

Media Engagement

One of the biggest barriers to the public's understanding of engineering comes from the image created through the media and in some ways by the engineers themselves. We have come to associate engineering as being linked to problems, and this is a perception perpetuated by the engineers who see themselves as problem solvers. A small but significant rebranding would establish engineering as profession which *creates solutions*, and this is seen as a

An Image Makeover

If ever there was an indicator of the way UK media view engineering it could be seen in a recent issue of the Daily Telegraph. A single page in the business section presented the 2015 year-end figures of two companies.

"AIM listed handbag maker Mulberry making £1.9m profit on a turnover of £110m, and FTSE250 WS Atkins the innovative engineering company making £122m profit on a revenue of £1.76bn."

Which gets the most airspace? Handbags. Mulberry commands much of the broadsheet page including a large photograph of model Cara Delevingne plus handbag alongside a smaller shot of its CEO Godfrey Davis. Atkins by comparison is tucked in the bottom corner with no pictures.

Atkins is a company at the very forefront of UK civil engineering, highly innovative and constantly pushing construction boundaries. They are also a key mover in efforts to promote STEM subjects in schools and encourage girls to consider a career in engineering.

Why does this matter? With the shortage of new blood threatening the prosperity of the sector it's accepted that Engineering must raise its profile if more of the young, and girls in particular, are to be encouraged into the professions.

But with an endemic trait where even the most respected press can succumb to glamour and celebrity over serious content getting that exposure requires new thinking.

Our engineering companies must acknowledge the image challenge they face and be as innovative with their PR as they are with their technology. To present technical successes in ways that grab the attention of journalists who are the critical link in giving engineering a big voice.

Civil engineering has some major good news stories to tell, and the images that go alongside these are attention grabbing and impressive. This needs to be utilised to best advantage in the press.

(Extracts taken from a post by Barrie Weaver)[29]

much more positive and attractive vocation, and one which is especially appealing to women.

The media can have a huge influence in conveying this positive message, and a concerted effort to work with the mainstream media and journalists to ensure that they represent engineering appropriately is recommended. This approach is likely to have as much impact in the long term as an expensive marketing campaign which - however good - will be shortlived.

The establishment of an Engineering Media Centre would allow consistency of message and also be a way of offering a voice to under-represented groups within the engineering community so that we start to establish a bank of media spokespeople, images and a forward looking public image.

Co-ordinated Effort

One of the most important recommendations that can be made in this report is that the industry co-ordinates efforts and makes calls for change which are ambitious, clear and consistent. A common message is needed and an agreed set of actions that can be championed by the whole industry. Leadership and determination will deliver this change, and this should be our priority until we succeed in achieving the diverse industry we need for our future success. The role of the Institution of Civil Engineers is to identify and influence this change, and lead by example.

Conclusions

In conclusion, this report has outlined a number of ways that the Institution of Civil Engineers can increase and reflect diversity and inclusion within the membership of its own Institution, and use its influence to this effect more widely within the profession as a whole. The report concentrates predominantly on gender diversity, but its recommendations will also benefit other under-represented groups. This report is intended to be a thought piece which should be used as a starting point from which to build a formal plan of action.

In order to achieve the step changes that we are looking for we need to change the culture of the organisation and the industry, and to integrate diversity and inclusion into every decision, every campaign, every appointment and every project that is undertaken. Change will come from the top down but every employee and member needs to understand the value of diversity to the business and the need for inclusive behaviours to achieve this. This will require senior level commitment, leadership and accountability but will need to be delivered and owned at every level of the organisation. By making this visible commitment the ICE will be in a position to lead and influence the construction sector, contributing practically through the provision of training, support, and guidance, and leading through example. Similarly to the way that the ICE has championed health and safety and ethics within the industry it must now champion diversity and inclusion.

Many recommendations and suggestions are given in the report, and the next steps should be to develop an ICE Diversity Action Plan which is able to be integrated into the various strands of the business plan in order for the delivery mechanisms to be established. Not every suggestion will be deemed appropriate, nor can every one be implemented simultaneously, but instead a long term plan which takes change one step at a time will encourage buy-in and allow ownership. Benchmarking and reporting are important steps to start with, followed by a programme of training for staff, volunteers and members. Programmes should be monitored for success and changed if they are found to be lacking impact. The Athena Swan charter (a charter which recognises work undertaken to address gender equality) is a formal and proven way of developing a Diversity Action Plan, and adapting a version of this charter could be a practical way of planning and delivering change.

The Institution of Civil Engineers has the opportunity to become the leading Professional Engineering Institution in the challenge to increase diversity and inclusion within the engineering profession, and it should work in partnership with industry to implement and influence change. This work is imperative if the industry is to grow into the diverse and inclusive sector we need it to be, and the ICE has the chance here to step up to the challenge and lead the way.

Recommendations

Whilst there are numerous suggestions and recommendations in the body of the report, the following list draws the main recommendations together for ICE, the industry, and other stakeholders.

For Institution of Civil Engineers:

The main recommendation for ICE is the development of an ICE Diversity Action Plan which can be owned and implemented by the Institution, and delivered as part of the ICE business plan as a long term commitment. This could include actions in the following areas:

- Membership: Benchmark and regularly report on membership data for all under-represented groups to analyse trends, set targets and implement actions to address particular areas of concern. Work with the other Professional Engineering Institutions through the Royal Academy of Engineering's Diversity Concordat to compare statistics and share best practice
- Professional Review of Engineering Competence: Assess inclusivity as a personal characteristic that is required in each professional member in the same way as ethics and safety are required, and provide training to support this along with other diversity and inclusion training requirements
- Accreditation of Degrees - use influence through the accreditation process to widen participation through inclusive entry to degree courses; the inclusion of contextual based real world projects; non-linear pathways which allow for conversion to engineering at a later stage; the need for support mechanisms for under-represented students; Athena Swan compliance; and the consideration of new and collaborative courses
- Staff, volunteers and governance: Plan for diversity of succession and recruitment through programmes of reverse mentoring; training for committees and volunteers to ensure inclusive behaviours and messages are passed on; flexible job descriptions
- Educational Outreach Work and Careers Advice: Ensure educational outreach is appropriately targeted, accessible and co-ordinated across the regions of ICE, and train volunteers and ambassadors to ensure consistency in the messages they are delivering. Commit to positive action which increases attraction of under-represented groups, in addition to other outreach activity. Check that the language used in outreach materials is inclusive
- Publications, Conferences and Awards: Ensure printed and online publications represent diverse sector both pictorially and through editorial content; set 50/50 targets for conference speakers and contributors, and be prepared to offer training of members to support this; give awards that recognise best practices in diversity and inclusion practices.
- Campaigns, Projects and other activities: all campaigns, decisions, activities and projects must be considered through the lens of diversity to ensure that they are inclusive of all groups of society, and embed this
- Support: Establish special interest support groups which do not hold responsibility for delivering change, merely for supporting the represented groups
- Leading and influencing the industry through partnerships and the promulgation of best practice

For Industry

In addition to the actions listed above, some of which will be relevant for the industry as a whole, the following list compiles the broad recommendations for industry:

- Recognise that the drivers for improving diversity and inclusion are mainstream and effect all areas of the business including profit, productivity, health and safety, staff turnover, staff wellbeing, competitive edge, innovation, and brand

- Measure gender diversity data in each occupational grade and report these figures and improvement targets in the Annual Report
- Expand the diversity monitoring categories beyond gender and age to facilitate more evidence-based targeted action
- Embed diversity and inclusion training to effect a widespread culture change across the industry
- Ensure responsibility for inclusive behaviour is personal to each employee and is implemented at all levels of the organisation
- Establish long term plans to set out and implement diversity targets using tools such as the Ten Steps and the Think, Act, Report Frameworks
- Aim for 50/50 shortlist targets for jobs in engineering
- Commit to board level diversity in line with the Davis Report through reciprocal/senior leadership mentoring and succession programmes
- Establish Returnship programmes to support and maximise the return rate for women returners to engineering
- Establish support groups for under-represented employees
- Improve the image that the industry projects to the general public and be inclusive in the language it uses to describe its work
- Establish relationships with local schools and colleges to create a pull from the workplace, the provision of work experience placements, and the ability to offer careers support, visits and speakers or ambassadors for schools
- Work collaboratively to tackle the lack of diversity and inclusion in a co-ordinated fashion

For Government/Higher Education/Others

- Consider financial incentivisation of engineering (and other) courses which have been identified as strategically valuable to the UK by lowering degree costs, by removing interest on loans or by offering 'golden hellos'
- Set up a dedicated careers service for engineering to support young people between the ages of 14 and 24, and their parents
- Use of government procurement contracts and voluntary schemes such as Considerate Constructors to drive diversity and promote inclusive behaviours
- Develop a tighter framework for the Equal Opportunities Employer Mark to include Diversity and Inclusion
- Establish an Engineering Media Centre to help engage with the mainstream media and improve the image of engineering in the press
- Establish additional routes into engineering including measures to attract a broader range of applicants (e.g. by removing the need for specific A level requirements), increased conversion courses from other degrees, collaborative courses, and vocational entry
- Set a requirement that all Engineering and Physical Sciences Research Council (EPSRC) grants can only be awarded to university departments which hold the Athena Swan Bronze award (the charter which recognises the promotion of gender equality)

Whilst many of these recommendations are quite specific, the important part is that the sector recognises the need for improved diversity and inclusion, and takes steps to own and collectively deliver this outcome together.

Contributors

- Manon Bradley, Development Director, Major Projects Association
- Keith Clarke CBE, Chair, Swansea Bay Tidal Lagoon
- Professor Elizabeth A. Croft, Associate Dean (Education and Professional Development), Faculty of Applied Science, University of British Columbia
- Professor Kel Fidler CEng HonFIET FREng
- Rob Curd, Innovation Manager, Engineering Policy and Innovation, Institution of Civil Engineers
- Peter Finegold, Head of Education, Institution of Mechanical Engineering
- Professor Jacqueline Glass, Professor of Architecture and Sustainable Construction, University of Loughborough
- Stephanie Haywood, President of Engineering Professors Council
- Paula Hempstead, Senior Manager, Supplier Relationship Management, Transport for London
- Daniel Hooper, Catchment Engineer, Environment Agency (and Chair of the Fairness, Inclusion and Respect Committee, Institution of Civil Engineers)
- Jo Hunt, Membership Recruitment, Institution of Civil Engineers
- Helen James , BAM Nuttall Ltd
- Blane Judd, Chief Executive, EngTechNow
- Susan Kay, Executive Director, Engineering Professors' Council
- Victoria Knowles, Public Relations Manager, Considerate Constructors Scheme
- John Laverty, Head of Education and Inspiration, Institution of Civil Engineers
- Gay Lawrence Race, Consultant to the Building Services Industry
- Kate Lloyd, Diversity Manager, CITB
- Professor Averil Macdonald, Professor of Science Communication, University of Reading
- Chrissi McCarthy, Managing Director, Constructing Equality Ltd
- Rhys Morgan, Royal Academy of Engineering Head of Education
- Sarah Peers, Vice President, Women's Engineering Society
- Professor Ishwar K. Puri, Dean and Professor, Faculty of Engineering, McMaster University, Ontario, Canada
- Noreen Shihab, Assistant Design Manager, Carillion PLC
- Tammy Simmons, Marketing and Communications Manager, Engineering Council
- Cathy Sinclair, Field Engineering Group Manager, FM Global
- Dana Skelley, Director of Asset Management, Transport for London
- Andrew Stanley, Head of Education Policy, Institution of Civil Engineers
- David Tullett, Group Head of Human Resources, Institution of Civil Engineers
- Barrie Weaver, Founder, engenius-i.com
- The Diversity team of the Royal Academy of Engineering: Allan Cook, Bola Fatimilehin and Jenny Young

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