ROYAL ACADEMY OF ENGINEERING

Creating cultures where all engineers thrive

A unique study of inclusion across UK engineering

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Name	Organisation	Job title
Catherine Fennell	*Airbus*	Airworthiness Engineer – Wing Structures & Systems Installation
Alison Green	*Airbus*	Head of Engineering; A330neo Outer Wingbox
Terry Inns	*Amec Foster Wheeler*	Commercial Director, Clean Energy
Coral Taylor	*Amey*	Inclusion Business Partner
Lucy Edwards	*Atkins*	Graduate Transport Planner, Transportation
David Jenkins	*Atkins*	Transportation Engineering Practice Director and Diversity & Inclusion Champion
John McCollum	*BAE Systems*	Head of Engineering
Pam Wilson	*BAE Systems*	Engineering Engagement Manager
Michelle Freeman	*Byrne Bros (Formwork) Ltd*	HR Manager
Nick Langdon	*CGL*	Director
Sarah Bond	*for business sake consulting ltd*	Consultant
Dr Gillian Shapiro	*for business sake consulting ltd*	Consultant
Tony Belgrave	*for business sake consulting ltd*	Consultant
Hilary Hill	*KBR*	Senior Engineering Manager
Barry Weightman	*KBR*	Senior Manager, Engineering Operations
Vicky Paley	*KBR*	Process Engineer and Chair of KBRs Gender Diversity Network, Aspire
Justine McLennan	*Metaswitch*	Global Head of Human Resources
Gill Belshaw	*Metaswitch*	HR Officer
Jenny Smith	*MoD, DE&S (Defence Support and Equipment)*	Senior HR Business Partner
Richard Chapman-Harris	*Mott Macdonald*	Equality, Diversity and Inclusion Manager
Sophie Lea	*Mott Macdonald*	Equality, Diversity and Inclusion Advisor
Loraine Martins	*Network Rail*	Director of Diversity and Inclusion
Katy Downes	*Network Rail*	Senior Engagement Manager
Frances McAndrew	*Network Rail*	Programme Manager
Carol Arbon	*Rolls-Royce*	Human Resources Business Partner Engineering & Operations Skills at Rolls-Royce

Name	Organisation	Job title
Philip Greenish	*Royal Academy of Engineering*	Chief Executive
Bola Fatimilehin	*Royal Academy of Engineering*	Head of Diversity
Jenny Young	*Royal Academy of Engineering*	Head of Diversity
Daniel Rossall-Valentine	*Royal Academy of Engineering*	Head of Engineering Talent Project Campaign
Elena Fatisi	*Royal Academy of Engineering*	Diversity Project Officer
Ann Raybould	*Scott White and Hookins*	Partner
Hellen Wollaston	*Women in Science and Engineering (WISE)*	Chief Executive

Terminology used in this report is referenced in the glossary on page 54

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Foreword

Rt. Hon Greg Clark MP
Secretary of State for Business, Energy and Industrial Strategy

The UK has a proud record of achievement in innovation and engineering and we are consistently ranked as a world leader.

In 2017, engineering contributed 26% of the UK's GDP (more than that of the retail and wholesale and financial and insurance sectors combined) . In addition, every job in engineering supports another 1.74 other jobs*.

We have some of the best engineering talent in our country and world-leading industries, from car manufacturing to satellite engineering. However, we should not be complacent in maintaining and extending this advantage; innovation and engineering are at the heart of driving productivity and boosting earning power for everyone across the country.

One of the key opportunities for engineering, and for a successful Industrial Strategy, is reaching and attracting a more diverse workforce. To do that we must ensure that our workplace practices and cultures recognise and value the efforts of all workers, regardless of their background. There are strong anti-discrimination laws in place but in order to make the most of all the potential talent available, we must embrace workplace cultures that go well beyond the legal minimum.

That is why I am delighted that the Royal Academy of Engineering has produced this report under its BEIS funded Diversity and Inclusion programme. This first-of-a-kind survey of engineers' perceptions of the inclusivity of their workplaces creates a baseline from which we can measure progress on how employees with different backgrounds are valued in engineering.

The results from the survey of almost 7,000 engineers show that there is more to do to capitalise on the benefits of inclusivity in the workplace and to ensure that engineers and technicians from all backgrounds feel properly valued and respected in their work.

Equality of opportunity is a critical part of a modern Industrial Strategy, and the progress this report calls for is essential if we are to maximise the potential of the UK's engineering sector to drive productivity and continue to secure our leading position in the global marketplace.

* *Engineering UK 2017: the state of Engineering* (Feb. 2017), EngineeringUK

Executive summary

Key findings

The following observations emerged, based on responses from the 7,000 engineers who took part in this research project:

1. Nine themes describe the overall culture of engineering:
    - six themes describe what is present in the culture: problem solving, safety-conscious, proud, loyal, team oriented and flexible in places.
    - three themes represent tensions in the culture: where it is described as friendly but not personable; where it is solutions focused but has a strong attachment to tradition; and where there are high levels of job satisfaction but a lack of support and clarity in relation to career development.
2. Seven indicators drive perceptions of inclusion in engineering – openness, respect, relationships, career development support, flexibility, leadership and diversity.
3. Inclusion benefits the performance of individual engineers with 80% reporting increased motivation, 68% increased performance and 52% increased commitment to their organisation.
4. Inclusion benefits organisational performance in that the more included engineers feel, the more likely they are to understand business priorities, be confident about speaking up on improvements, mistakes or safety concerns, and see a future for themselves in engineering.
5. Points 3 and 4 above provide a strong business case for taking action to increase inclusion in engineering.
6. White male engineers feel that the culture of engineering is more inclusive than female engineers who in turn feel that it is more inclusive than engineers from black, Asian and minority ethnic (BAME) backgrounds.
7. Specific underlying barriers to progress on inclusion in engineering revealed by this study include:
    - the 'inclusion privilege', which means those who already feel included are least likely to take action
    - the perception that there is no 'crisis of inclusion', or burning platform, to drive action, but a consistent pattern of lower levels of inclusion for BAME and women engineers
    - a perceived need to deliver progress on intangible outcomes related to perception and experience, which may be at odds with engineering culture.

1. Background

Interest in diversity and inclusion as a means to address the engineering skills gap continues to grow. To ensure the profession capitalises on the benefits of inclusion and the role it plays in providing fertile ground for diversity, the Royal Academy of Engineering (the Academy) initiated research to understand the current state of inclusion across the profession, and identify what more can be done to develop workplaces where all engineers thrive.

This report presents the findings of a study into the culture of UK engineering and the extent to which it is inclusive. It was commissioned by the Academy, in a collaboration between its Engineering Talent Project[1] and its Diversity and Inclusion Programme[2]. The Academy hopes that the insights from engineers contained in this report will provide inspiration and encouragement for all engineering employers and beyond to develop more inclusive cultures for the future.

2. Overview

This is not a study of what engineering employers are doing to encourage diversity and inclusion in their organisations or the profession. It is a study of what engineers say when asked about their experiences of culture and inclusion in engineering. It provides answers to three core questions:

- How do people currently working in engineering perceive the culture?
- How inclusive is the culture of engineering currently?
- How can the sector create a more inclusive culture for the future?

This unique bottom-up study of the perceptions and experiences of culture and inclusion among engineers themselves draws on the perspectives of male and female engineers; white and minority ethnic engineers; straight, lesbian, gay, bisexual, trans (LGBT) and cis engineers; engineers of different ages; with and without disabilities; with and without caring responsibilities; those working flexibly and those not; with different religions and none; from different nationalities; working in different engineering disciplines and sectors; and at different companies, locations and grades.

The study is based on findings from focus groups and an online survey conducted with engineers in a three-month period between October 2016 and January 2017[3]. This report presents the findings on similarities and differences in engineers' perceptions and experiences of culture and inclusion by gender, ethnicity, age and company size. This is the first in a series of reports on the findings from the study. Additional reports will focus on disability sexual orientation, religion and belief will be released in 2017–18.

3. Respondents

Over 300 engineers took part in focus groups to inform a project survey that attracted 6,799 responses from people across the UK working in engineering roles, or on engineering projects. The findings in the report are therefore based on responses from over 7,000 engineers. A snapshot of engineering and diversity characteristics of respondents to the survey is presented below. See Appendix 2 for a comprehensive profile of respondents.

Engineering characteristics

- 94% of respondents work in organisations with over 250 people.
- 66% are members of professional engineering institutions and 48.4% are professionally registered.
- Five engineering disciplines represent 49% of total respondents: aerospace and avionics (22%), defence (9%), civil (8%), software (5%), and petroleum, oil and gas engineering (5%).

Diversity characteristics

- In line with the profession as a whole, the majority of respondents to the survey are male (81%), white (92%) and over the age of 35 (67%).
- A higher proportion of women engineers responded to the survey than work in UK engineering (17% compared with 9% of the UK engineering workforce[4]).
- 49% have no religion, 41% are Christian, 1% are Buddhist, 1% Hindu and 1% Muslim.
- 7% of respondents are black, Asian and minority ethnic (BAME), in line with the demographics of engineering overall.[5]

Figure 1: How engineers perceive the culture of engineering

- 4% of respondents are lesbian, gay or bisexual.
- 5% have a disability.

4. The culture of engineering

Each engineering employer has its own culture that determines 'how things get done around here'. However, engineers also share commonalities in terms of their predominant values, beliefs, behaviours, perceptions, experiences and relationships that transcend individual organisations. These commonalities define the culture of engineering in the UK.

Commonalities

How engineers in this study perceive the culture of engineering is described under nine headings (**Figure 1**).

Engineers describe a culture that is **problem-solving** and **safety-conscious**.

The most strongly held belief of engineers is 'we're here to find solutions to problems' (**95%** of engineers agreed with that statement), and **97%** say they would feel confident to speak up most or all of the time 'if I think my own safety or the safety of others is at risk'.

Engineers describe a **proud** profession in which people love their jobs and are **loyal** and committed to engineering and to being engineers.

77% of engineers say they like their job 'most or all of the time', and **82%** would recommend engineering as a great career choice to family and friends. Only **3%** of engineers are planning to leave the profession permanently (for reasons other than retirement) in the next 12 months.

Engineers describe a culture that is **strong, collaborative and team orientated**.

The most commonly chosen descriptor of how engineers relate to each other was **'informal and friendly'**, and the most commonly chosen descriptor of the culture was **'collaborative'**.

Engineers describe a culture where there is quite a lot of **flexibility** in working practices.

56% of engineers work flexibly, either formally or informally, and **81%** of respondents said their manager supports them to work flexibly if they want to.

Engineers describe a **friendly** culture, but one that is **not comfortable with the personal**.

Engineers told us they like to keep themselves to themselves, focusing on **'doing the best job we can, not on who people are or where they are from'**.

Engineers describe a **solutions-focused culture**, but with a **strong attachment to tradition**.

Only **30%** chose 'innovative' among their top descriptors of engineering culture, and half (**48%**) described it as 'slow to change'.

Engineers describe a culture in which they love the work they do, but are often unclear (and less happy) about support for **career progression**.

When asked what changes to the culture would make it an even better environment for engineers to work in, the top response was 'more opportunities to progress as an engineer without going into management roles' (63% included this in their top five changes).

Differences

This study found that gender and ethnicity make a significant difference to how engineers perceive the culture of engineering. Being in a minority in engineering gives women and BAME engineers a consistently different perspective on its culture in statistically significant ways – see section 2 for more information on these differences.

5. Inclusion in engineering

Diversity and inclusion are often grouped together as a single concept. In fact, they are related, but different. While diversity is measured in terms of demographics, inclusion is about how engineers feel, and how they perceive and experience the culture in which they work.

5.1 Inclusion in engineering business case

A growing body of research makes a business case for addressing inclusion in the workplace. Engineers from all backgrounds report that inclusion brings benefits to organisational performance in terms of quality, safety and innovation, retention and engagement. They also report personal benefits, in terms of increasing their motivation, performance and commitment.

- 80% of engineers said that feeling included at work increased their motivation.
- 68% said it increased their overall performance.
- 52% said it increased their commitment to their organisation.
- 50% said it increased their engagement.

However, improving the culture of engineering by increasing diversity and inclusion are not considered priorities by the majority of engineers. When asked to list five top changes to the culture of engineering that would make it a better environment to work in:

- 26% of engineers listed 'more diverse'
- fewer than one in four (23%) listed 'more inclusive'
- male engineers and white engineers are least likely to include 'more diverse' or 'more inclusive'
- 23% of men include 'more diverse' compared to 39% of women
- one-third (34%) of BAME engineers include 'more inclusive'.

5.2 Indicators of inclusion in engineering

This study identified seven indicators of inclusion in engineering and how these are experienced by different groups (**Figure 2**).

i. Openness

The extent to which engineers feel able to be open about who they are and about their life outside work, and confident to speak up on inappropriate behaviour towards themselves or other people, or about mistakes or safety risks.

Findings:
BAME (72%) and female engineers (80%) feel less able to be open about their lives outside work than white (85%) and male (85%) engineers. BAME (72%) and female (72%) engineers are also less likely to speak up on inappropriate behaviour than their white (83%) and male (84%) colleagues.

ii. Respect

The extent to which engineers feel treated with respect by managers, leaders and colleagues – and do not feel that assumptions are made about them because of their gender, ethnicity or any other difference.

Findings:
Male (82%) engineers are significantly more likely than their female (43%) colleagues to say their gender is irrelevant to how they are perceived at work. BAME (85%) engineers are more likely than their white (58%) colleagues to report that assumptions are made about them based on their ethnicity or nationality.

Figure 2: Seven indicators of inclusion

iii. Relationships

How engineers relate to each other, and the extent to which relationships are friendly, collaborative, and free of offensive banter, bullying or harassment.

Findings:
Of the 14% of engineers reporting that they have experienced bullying and harassment in the past 12 months, they are more likely to be BAME (22%) or female (25%) than white (18%) or male (17%).

iv. Career

The extent to which engineers feel supported in their careers, by their manager and by the fair implementation of talent management processes such as promotion.

Findings:
BAME (63%) engineers are less likely than their white counterparts (72%) to think that work is fairly allocated; or that the promotion process is fair (34% BAME compared with 55% white). Women engineers are as likely as their male colleagues to say that the promotions process is fair, but significantly less likely (63%) than male engineers (73%) to say that work is fairly allocated. Where white engineers and older engineers feel less included, it is often related to their perceptions of career support, progression and fairness in talent management processes. 70% of engineers under 25 and 53% of engineers over 55 think the promotion process is fair.

v. Flexibility

The extent to which engineers have opportunities to work flexibly, without it being a barrier to career progression.

Findings:
BAME (50%) and female (54%) engineers are less likely than their white (67%) and male (69%) colleagues to think flexible working is not a barrier to their career.

vi. Leadership

The extent to which engineers are convinced by their managers' commitment and action on diversity and inclusion.

Findings:
Four out of five engineers (82%) agree that their manager would tackle bias including bullying and harassment if brought to their attention. However, female (74%) engineers are much less convinced about this than their male (84%) colleagues, and BAME (75%) engineers are less convinced than their white (83%) colleagues.

vii. Diversity

50% of all engineers put 'A diverse workforce at all levels' as evidence of inclusion.

Findings:
There is wide agreement that more needs to be done to increase diversity in engineering, as well as inclusion.

6. Conclusions

This report identifies nine themes that reveal a distinct engineering culture and seven indicators of inclusion. It highlights similarities and differences between the perceptions of the majority male white engineers and minority BAME and female engineers across different age groups and organisation size. It also describes underlying barriers that need addressing and makes seven recommendation to drive progress towards a more inclusive future.

7. Recommendations for a more inclusive future

Engineering employers reviewing the recommendations in this report should bear in mind that, while an overwhelming majority of organisations aspire to an inclusive culture, actual maturity levels across many organisations attempting to do so are low, according to Deloitte's 2017 report[6].

The following recommendations aim to address barriers and challenges, and the need to increase engineering employer maturity in progressing inclusion. They are detailed in full in Section 5 along with tips and examples to take forward their implementation.

Recommendation 1: Prioritise and reframe inclusion

Engineering leaders must take action to prioritise progress on inclusion, reframing it as an area of concern for all engineers across their organisations. A strategy and implementation plan must be put in place, designed around the seven indicators of an inclusive culture for everyone, with impact on different groups monitored to ensure inclusion is experienced by all.

Who? The Academy, engineering leaders and engineering D&I and HR teams

Recommendation 2: Articulate the benefits

Use findings from this and wider research, to articulate the benefits of a more inclusive culture in ways that are much more convincing and engaging for white and male engineers, as well as those from underrepresented groups.

Who? The Academy, engineering leaders, D&I, HR and communication teams

Recommendation 3: Build a critical mass of white and male allies

Create a critical mass of white and male engineers to become activists and allies of change on inclusion. Without the active involvement of white men, the sector will simply be unable to create a more inclusive engineering culture for the future. However, it is not enough for leaders and managers to commit to inclusion, they must also develop inclusive leadership competencies[7] or traits[8]; and where possible seek feedback to understand their inclusive leadership strengths and areas for development.

Who? The Academy, engineering leaders, managers and HR teams

Recommendation 4: Increase awareness

Do more to raise awareness of how different engineers perceive engineering culture and inclusion. People who already feel included enjoy an 'inclusion privilege', which means that they are least likely to recognise barriers to inclusion faced by other engineers, or the need for action to remove them.

Who? The Academy, engineering D&I, HR and communications teams

Recommendation 5:
Leverage the culture

Leverage the specific strengths of engineering culture to maximise the likelihood of progress. Alongside this, barriers to change presented by some aspects of engineering culture need to be more openly acknowledged and addressed.

Who? The Academy, engineering leaders, D&I and HR teams

Recommendation 6:
Deliver fair and inclusive career support and talent management

Take action to ensure fairness of career support and talent management processes to raise the level of inclusion for everyone, including the majority white engineers and male engineers. This must include development of data driven processes that are transparent, and assess and address differential outcomes for different groups of employees.

Who? Engineering leaders, managers, HR and D&I teams

Recommendation 7:
Take action on all seven indicators of inclusion

Create more inclusive cultures by targeting interventions for women and BAME engineers in particular, across each of the seven indicators driving inclusion in engineering, including openness, respect, relationships, career development support, flexibility, leadership and diversity – see methods for measuring inclusion in Appendix 3.

Who? The Academy, engineering leaders, managers, individual engineers, HR and D&I teams

This report provides a baseline on inclusion across the engineering profession which the Academy will revisit in the next two to three years with a view to assessing the impact of recommendations, and progress towards creating working environments where all engineers thrive.

1. Introduction

1.1 Overview

In response to the need to develop an inclusive profession that attracts, recruits and retains engineers from all backgrounds, this report presents findings from a study into the culture of engineering in the UK. It was commissioned by the Royal Academy of Engineering (the Academy), in a collaboration between its Engineering Talent Project (ETP) and Diversity and Inclusion Programme (D&IP).

This report provides answers to three core questions:

1. How do people currently working in the engineering profession perceive the culture?
2. How inclusive is the culture of engineering currently?
3. How can the sector create a more inclusive culture for the future?

One of the four strategic priorities for the Academy is to help the profession address the well-documented engineering skills crisis. An ageing engineering workforce 'means that hundreds of thousands of skilled technician and professional engineering roles will need replacing over the next ten years'.[9] The ETP is developing a communications campaign to help 'change perceptions of engineering to the reality of the 21st century and to grow interest and demand', contributing to the development of the engineering talent pipeline.

Deloitte's Global Human Capital Trends 2017[10] reports that leading organisations see diversity and inclusion as a comprehensive strategy woven into every aspect of the talent lifecycle to enhance employee engagement, improve brand and drive performance. It highlights the importance of diversity and inclusion for talent acquisition, with millennials expecting inclusion as a mandatory part of company culture. While an overwhelming majority of organisations aspire to more inclusive cultures (71%), actual levels of maturity are low with only 12% reaching level 4, the most mature level in Deloitte's model[11]. If engineering is to be in a good position to capitalise on current and future talent, it must rise to the challenge of creating an inclusive brand that attracts recruits and retains engineers from all backgrounds.

A well-documented feature of the engineering profession in the UK is its low levels of visible diversity. For instance:

- 92% of engineers are men. Only 9% of UK engineers are women compared to 51% of the working age population, and 15% of those with first degrees in engineering.[12]
- Only 6% of engineers are BAME, compared to 14% of the UK population, and 26% of those with first degrees in engineering.[13]
- People with disabilities comprise less than 5% of the workforce, compared to 17% of the UK population.[14]

Considerable attention has been paid over many years by universities, companies, government, PEIs and the Academy, to attracting and retaining a more diverse engineering workforce. The challenges in increasing diversity in engineering are well understood, but far less is known about how different groups of engineers perceive the culture of the profession once they are in it.

The Academy has a vision of an inclusive engineering profession that can inspire, attract, recruit and retain more women, ethnic minority, disabled, LGBT, older and young people from all socioeconomic backgrounds into both engineering employment and professional engineering institutions (PEIs). Therefore, this is a study about the culture of engineering, and how inclusive it is perceived to be, from the perspective of those who work in it. It is a unique bottom-up account of the perceptions and experiences of almost 7,000 engineers, gathered through focus groups and an online survey in a three-month period between October 2016 and January 2017.[15] It draws on the perspectives of male and female engineers; white and minority ethnic engineers; straight, LGBT and cis engineers; of different ages; with and without disabilities; with and without caring responsibilities; those working flexibly and those not; with different religions and none; from different nationalities; working in different engineering disciplines and sectors; and at different companies, locations and grades. It is not a study of what engineering employers are doing to encourage diversity and inclusion in their organisations or the profession. It is a study of what engineers say when they are asked about their experiences of culture and inclusion. It is anticipated that the insights from

engineers contained in this report will provide inspiration and encouragement for the Academy, for engineering employers and for engineers themselves in creating a more inclusive culture for the future.

1.2 Report contents

This is the first in a series of reports on the findings from the study. The focus is on similarities and differences in engineers' perceptions and experiences of culture and inclusion by gender, ethnicity, age and company size. Additional reports will focus on disability, sexual orientation, religion and belief. This report compares and contrasts the findings from men and women, white, BAME engineers, those of different ages, and those working in large and small companies.

Section 2 of this report presents key findings on the first core question: *How do people currently working in the engineering profession perceive the culture?* Nine themes emerged describing the culture of engineering overall, along with similarities and differences in perception between men and women, white and BAME engineers, from different age groups, and working in large and small companies.

Section 3 focuses on inclusion and addresses the second core question: *How inclusive is the culture of engineering currently?* Based on responses from engineers, it describes seven indicators that contribute to inclusion in engineering, presents the current state of inclusion across the profession and sets out evidence that an inclusive culture is good for motivation, innovation, collaboration, engagement – in short, good for business, and good for engineering.

Section 4 considers barriers and challenges to inclusive cultures in engineering and a five-stage approach to progressing inclusion.

Section 5 addresses the third and final core question: *How can the sector create a more inclusive culture for the future?* It draws conclusions and uses feedback from engineers to inform recommendations for a more inclusive culture for the future. The section also highlights similarities and differences between demographic groups in the steps the sector needs to take to create a more inclusive culture for all.

There are three appendices to this report.

- **Appendix 1** describes the methodology behind the study.
- **Appendix 2** provides a comprehensive breakdown of the 6,799 respondents to the survey.
- **Appendix 3** describes two different methods for measuring inclusion: a conversation-based approach (used to conduct focus groups for this study) that may be more relevant to the needs of SMEs; and a survey-based approach (using many of the questions asked in the survey for this study).

In addition to appendices it also includes:

- Glossary of terms
- Endnotes

2. The culture of engineering

Key messages

A. How engineers perceive the culture of engineering can be captured under nine headings: problem-solving, safety-conscious, proud, loyal, team oriented, flexible in places, friendly but not personal, a strong attachment to tradition, and with a tension between job vs career.

B. Despite a great deal of consistency in how different engineers perceive the culture, there is also a pattern of significant differences of perception based on gender, ethnicity and to a lesser degree, age and company size.

2.1 Engineering culture - is there such a thing?

Edgar Schein, Professor of Management Emeritus at the MIT Sloan School of Management, identifies four different categories of culture operating in organisations. These are:

- organisational culture (the values, beliefs and behaviours that are specific to an organisation)
- macro cultures (such as national and ethnic cultures)
- subcultures (the cultures of occupational groups including engineering that he says 'transcend organisations and, for some purposes, can also be thought of as macro cultures, but their main impact is in their operation as subcultures within organisations')
- micro cultures of 'small coherent units' within organisations such as teams and task forces.[16]

In Schein's view, the day-to-day experience of engineers is a combination of: organisational culture; professional, national or ethnic macro culture; the subculture of engineering in an organisation; and the micro culture of the team or group to which an engineer belongs.

One of the underlying assumptions of the Academy in commissioning this project was that there is such a thing as an identifiable 'culture' of the engineering profession, over and above the very different organisational cultures – and engineering fields, sectors, locations and organisation sizes – in which engineers work. It is important to acknowledge that there was some scepticism about this assumption at the outset of the study. This scepticism was expressed by survey respondents, who reported that:

"There is no culture of engineering as the culture is more based around the organisation."

"Every organisation I have worked for/with has a very specific subculture and style. These can differ significantly."

"Each company, or department, has its own 'culture', determined by the people involved in the group."

From the conversations between consultants and engineers involved in the focus groups, two things about the existence of a 'culture of engineering' became clear.

First, that every engineering employer involved in the project does indeed have its own distinct culture. Engineers working in each organisation described its culture, in terms of the values, beliefs, behaviours, systems, processes, relationships and rules that determine 'how things get done around here'. Observational data gathered by consultants who visited each company taking part in the focus groups felt the differences too, for instance they experienced the arrangement and decoration of reception areas, security arrangements, dress codes, the formality and informality of conversation with and between focus group participants.

Second, that there are commonalities in terms of values, beliefs, behaviours, systems, processes, relationships and rules that transcend individual organisations and are shared across the engineering profession. One example of this is a culture of concern for safety, which all engineering employers emphasise, and was raised by engineers in almost all of the focus groups (see below for further details here).

2.2 Perceptions of the culture of engineering

How engineers perceive the culture of engineering can be captured under nine headings (**Figure 3**).

Six of these headings (blue) refer to what is 'present' in the culture. Engineers describe a *problem-solving, safety-conscious culture*. They describe a *proud* profession in which people *love their jobs* and are *loyal* and committed to engineering and to being engineers. It is a culture with a strong, collaborative *team orientation* and quite a lot of *flexibility* in working practices.

Three of the headings (green) describe tensions in the culture where engineers from different backgrounds report very different experiences. It is a culture that is *friendly*, but not particularly comfortable engaging in the realm of the *personal*; there is a *strong attachment to tradition*; it is one in which engineers love their jobs, but are often *unclear* (and less happy) about the route to career progression.

This section reports on similarities in the way that engineers perceive the culture of engineering, and significant differences by gender, ethnicity, age and company size.

Theme 1: Problem-solving

Meaning: the culture of engineering is geared towards understanding problems, exploring solutions and delivering on those solutions for clients.

"There are no problems, just solutions you haven't come across yet."

In the survey, engineers were asked about the beliefs that people in engineering hold. Beliefs were worded based on what engineers had told consultants in the focus groups. One of these beliefs was 'We're here to find solutions to problems'. Overall, 95% of engineers agreed or strongly agreed with this statement, more than with any other statement about the beliefs of engineers.

Engineers were asked what they see as the five most 'valued' behaviours in engineering, from a list of 11 behaviours also generated from the focus groups. **Figure 4** presents behaviours that engineers see as most valued within engineering.

Engineers were asked what they 'really enjoy' about being an engineer, choosing their top five statements from a list of 10 generated by the focus groups. **Figure 5** shows two of the top three responses.

Differences:
All demographic groups **experience the culture of engineering as a problem-solving one**.

Theme 2: Safety conscious

Meaning: the culture of engineering is one that prioritises safety ('making sure what you're designing is safe').

Engineers see integrity about safety is a core value of the profession. Some engineers reported that the profession needs to be more safety-conscious than it already is; others that there is already too much of a focus on safety in engineering to the detriment of innovation.

Figure 3: How engineers perceive the culture of engineering

"All engineers I know are already focused on safety as a top priority."

"Changes in culture, in my opinion should target safety first. My organisation has a very strong safety culture but across industry I think there is definitely room for improvement."

"Cost and time (being easy to measure) take priority over performance (safety, quality), which are more easily fudged/glossed over."

"Current ways of working tend to be very prescriptive and restrictive, with health and safety being over-used as an excuse for delaying innovative/rapid product development."

Overall engineers feel more confident to speak up on safety issues than on any other issue. See **Figure 6** that shows that while 79% of engineers feel confident to speak up on safety all the time, a significant proportion are less confident.

Differences:
There are no significant differences in engineers' perceptions of engineering as a safety-conscious culture.

Theme 3: Proud

Meaning: engineers are proud of the work they do, individually and collectively

"I think: how did they come up with that?! To make that connection is fantastic!"

From the focus groups it is evident that engineers enjoy high levels of pride in their jobs, and have high levels of job satisfaction. Engineers find their work 'technically interesting', 'intellectually challenging', creative and cool.

A question was included in the survey to find out the extent to which that feeling was shared more widely. The overwhelming majority of engineers (77%) responded that they like their job 'most or all of the time'. This is a very positive result by any measure, even more so when compared to the results of a 2015 study of the whole UK workforce, which found that 60% of people are not happy in their current roles.[17]

Engineers said that they specifically enjoy doing a job that makes good use of their skills and abilities. 69% of engineers said that this was one of the things they particularly enjoyed.

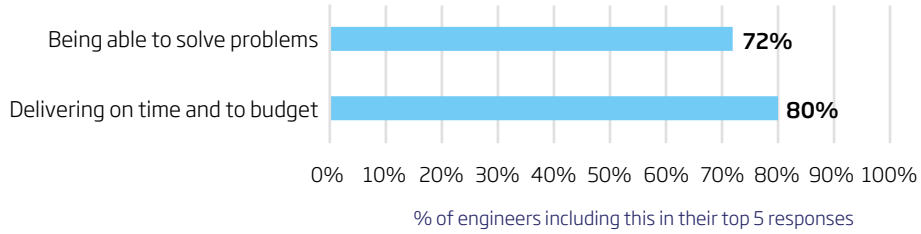


Figure 4: Which of the following behaviours do you think are most valued within UK engineering?

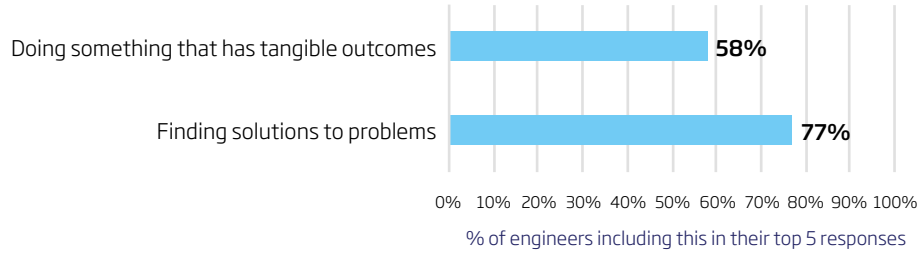


Figure 5: What do you really enjoy about being an engineer?

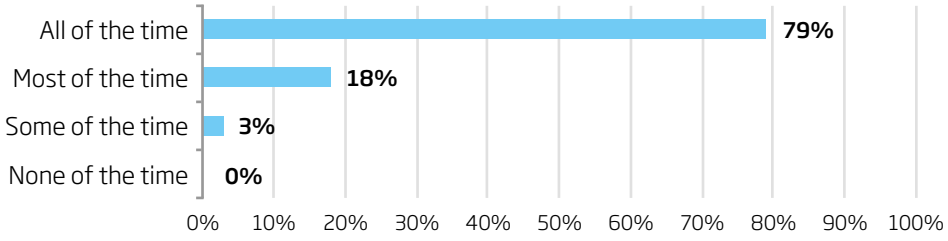


Figure 6: I feel confident to speak up if I think my own safety or the safety of others is at risk

Engineers are also keen to recommend the profession to others. 82% of engineers would recommend engineering as a great career choice to friends and family (**Figure 7**).

"I eat sleep and breathe engineering. It is the best combination of science, art and economics. Every day I get paid to do something I love and that I'm good at!"

"I can take pride in helping the country's infrastructure run smoothly."

"If you like looking under the bonnet and finding out how things work it is great fun. I take pride in being able to see the product and say I designed some of that. Maybe only a small bit but my output helps to keep it flying."

Differences:
There are no differences in terms of gender and age, but BAME engineers, and those from large companies, are slightly less positive than their white colleagues or those working in small companies:

- 78% of white engineers, and 72% of BAME engineers, like their jobs most or all of the time.
- 83% of those in small organisations and 77% of engineers working in large organisations like their jobs most or all of the time.

There are also statistically significant differences when it comes to recommending engineering as a career. More than 8 out of 10 engineers would recommend it as a great career choice to friends and family. There is no significant difference in terms of company size, but:

- significantly fewer men than women would recommend it (82% of men compared to 87% of women)
- significantly fewer BAME than white engineers would recommend it (77% of BAME compared to 83% of white engineers)
- significantly more engineers under 25 would recommend it (92%) compared to all other age groups.

Theme 4: Loyal

Meaning: people stay in the engineering profession for a long time. For many engineers it is a career they choose for life.

"My dad was an engineer and I wanted to get into it."

"I am a recent graduate and plan to stay in the engineering sector for my entire career."

In the focus groups, there were plenty of people with long service and family loyalty to the engineering profession. Engineers feel a strong sense of belonging to the profession, with few planning to leave. Only 3% of engineers are planning on leaving the profession permanently in the next 12 months. This finding is similar to those in a 2017 salary survey[18], which found that 81.9% of its respondents plan to remain in engineering for the next five years, and 8.9% plan to leave within the same period. Both findings compare well with a UK-wide study which found that 'over half of UK workers wish they could change career, rising to 72% for those aged between 25 and 34' (**Figure 8**).[19]

Differences:
While women and BAME engineers are no more likely than others to say that they are planning on leaving, they are more undecided. These differences are numerically small, but statistically significant as illustrated in **Figure 9** (right).

Theme 5: Team-oriented

Meaning: most engineers describe a culture that values friendly and collaborative relationships with colleagues.

"Engineering is teamwork."

"We can only solve problems in a team."

Findings about the friendly and collaborative culture of engineering echo those of other studies which describe everyday practices in engineering as characterised by respectful styles of interaction and 'wide-ranging topics of conversation and humour'.[20]

Figure 7: I would recommend engineering as a great career choice to friends and family

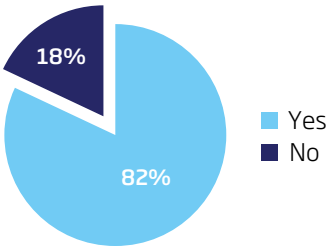
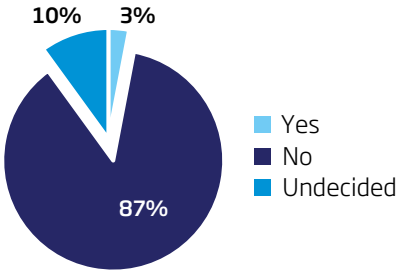


Figure 8: Are you planning to leave engineering permanently for reasons other than retirement in the next 12 months?



Engineers were asked to choose five from a list of 11 descriptions of how engineers relate to each other – based on findings from the literature review, consultant experience and observations during focus groups, and other conversations with engineers. The two most commonly chosen descriptors of how engineers relate to each other in the survey were 'informal and friendly' (55%) and 'able to give and take banter' (defined in the survey as 'playful conversation') (48%) (**Figure 10**).

Engineers are much more likely to describe the culture of engineering as informal and friendly than elitist (only 26% included this in their top five descriptors) or hierarchical (32% included this in their top five descriptors).

Engineers were asked to choose five from a list of 14 descriptions of the culture of engineering. The most commonly chosen description was 'collaborative' (50%). When asked to choose five from a list of 11 valued behaviours in engineering, 57% chose 'the ability to collaborate with other people'.

Finally, engineers were asked about the extent to which their manager and their colleagues treat them with respect in their team. Overall, 92% of engineers said that they are treated with respect by their colleagues most/all of the time, and 88% said that they are treated with respect by their managers most/all of the time.

Differences:
Men (57%) are more likely to describe the culture as informal and friendly than women (48%), and white (56%) engineers are more likely to describe it as informal and friendly than their BAME (52%) colleagues. When it comes to age, 60% of engineers aged 55 and over describe the culture as informal and friendly, compared to 53% to 55% of all other age groups **(Figures 11 and 12)**.

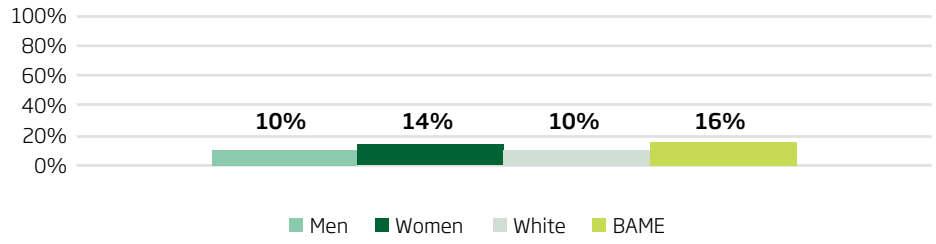


Figure 9:
% of engineers who are undecided about leaving the engineering sector permanently in the next 12 months

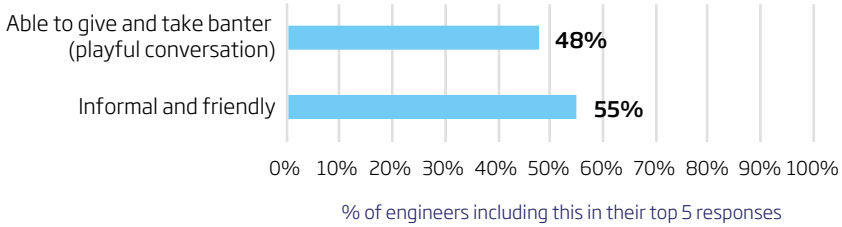


Figure 10:
Which of the following statements best describe how engineers in the UK relate to each other?

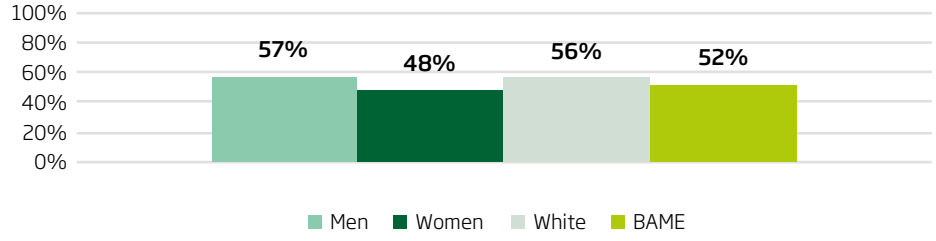


Figure 11:
% of engineers including 'informal and friendly' among their top five responses on how engineers relate to each other

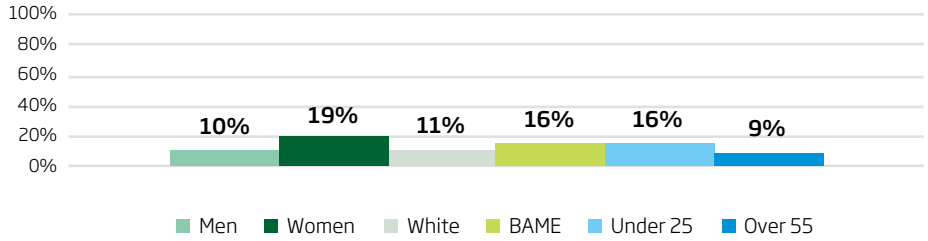


Figure 12:
% of engineers including 'Offensive language and behaviour often get passed off as banter' in their top five descriptions of how engineers relate to each other

Banter - 'Playful conversations' that mask offence?

Overall

Almost half (48%) of all engineers chose 'able to give and take banter' (defined in the survey as 'playful conversation') as one of their top five descriptions of how engineers relate to each other, with little difference in responses by gender, ethnicity, age or company size.

At first glance, it seems that most of the banter is good natured, with only 10% of engineers overall choosing 'offensive language and behaviour often get passed off as banter' as one of their top five descriptions of how engineers relate to each other.

However, only 3% of engineers overall chose 'less banter' as one of their top five changes to the culture of engineering (from a possible 15) that would make it an even better environment for them to work in. As one engineer commented: 'The banter environment of the 1990s has become less abrasive and more friendly over the last two decades; it's a more pleasant environment to work in'.

Differences

Perceptions differ between different demographic groups; 7% of women think that 'less banter' would improve the culture of engineering, compared to just 2% of men. As illustrated in the table below, engineers in the youngest age cohort, women engineers and BAME engineers are significantly more aware than their older, male and white colleagues of the ways in which 'playful conversation' can sometime mask offence.

In fact, women engineers are almost twice as likely as their male colleagues to include 'offensive language and behaviour often get passed off as banter' in their top five descriptions of how engineers relate to each other. In addition, engineers in the youngest age cohort are almost twice as likely to perceive this, as engineers in the oldest age cohort.

"As the only woman on the team I find it tiring to have to banter to get on with the guys – I don't want to be 'horrible' to be respected it doesn't feel natural, I want to converse without the need to be funny, to take an interest in each other's lives. I find it boring and end up having to laugh at their jokes so as not to look rude or not be a team player and take a back seat which makes me look passive. I wish I was in a team with more women or men who don't feel the need to joke about everything."

Theme 6: Flexible in places

Meaning: over half of engineers report some degree of flexibility in when and where they work.

Research from the Institute for Leadership and Management published in 2013 found that "almost all (94%) UK organisations now offer staff some form of flexible working and 73% of managers say their organisation is largely supportive of it. In fact, flexible working is now standard practice in half (50%) of the companies surveyed, with four in five managers saying they had taken advantage of flexible working at some point in the past four years".[21]

The feedback from engineers is broadly consistent with these findings. We found that:

- 56% of engineers work flexibly, either formally or informally
- 59% of engineers who work flexibly do ad-hoc remote working or working from home
- 66% agree working flexibly is no barrier to career progression
- 72% of engineers, irrespective of gender, say they have a work-life balance they are happy with
- 81% of respondents said their manager supports them to work flexibly if they want to most/all of the time.

There was plenty of feedback from engineers confirming that there is still more to be done to fully embed flexible working in engineering, and it is certainly not a universal experience[22], but it does seem that flexibility is an increasingly reliable feature of engineering culture:

"Although marketed as a flexible job, in my experience there is little flexibility afforded to when/where and how a job is done."

"It's my perception that engineering companies are culturally more rigid in working hours engineers are expected to work and has fallen behind other industries/service sectors that offer flexible working."

"Things are greatly improved within the last few years, but more flexible working around e.g. childcare is more and more important."

"The office accommodation and availability of flexible working are still both tailored to a narrow range of personality and lifestyle types. Less formal than it used to be, but could go a lot further."

Differences:
As illustrated in **Figure 13**, significantly fewer women than men agree that working flexibly presents no barrier to career progression, and significantly fewer BAME than white engineers.

Theme 7: Friendly, but not personal

Meaning: the culture of engineers is friendly and informal, team-oriented and collaborative. But it's a culture that is ambivalent about the relevance of the personal to the world of work.

"People keep themselves to themselves."

"People largely aren't interested in relationships with others at my workplace. It's just about doing the job."

"I'm valued for what I deliver not for who I am."

"We're blind to everything else – it's ok not to care."

As stated above, when asked about the beliefs that engineers hold, 95% of engineers agreed or strongly agreed with the statement 'We're here to find solutions to problems'. Personal matters (such as 'who people are or where they are from') are generally considered peripheral or irrelevant.

Survey findings show that:

- 83% of engineers agree or strongly agree that 'we focus on doing the best job we can, not on who people are or where they are from'
- after 'informal and friendly' and 'able to give and take banter', engineers were most likely to choose the following words or phrases to describe how engineers relate to each other: 'more comfortable dealing with facts and figures than people' (45%), and 'see differences such as sexual orientation, religion and belief as private matters, not relevant to work' (40%) (**Figure 14**).

Differences:
Overall, 40% of engineers describe the relationship between engineers as one in which differences such as sexual orientation, religion or belief are private matters, not relevant to work. However, men are more likely to see these differences as irrelevant to work (41%) than women (34%), and engineers working in large corporates are more likely to see these differences as irrelevant (40%) than those working in SMEs (34%) – see **Figure 15** overpage. Engineers working in corporates are also significantly more likely than those in SMEs to describe how engineers relate as 'more comfortable dealing with facts and figures than with people' (46% of corporate engineers chose this as one of their top 10 descriptors, compared to 39% of engineers working in SMEs).

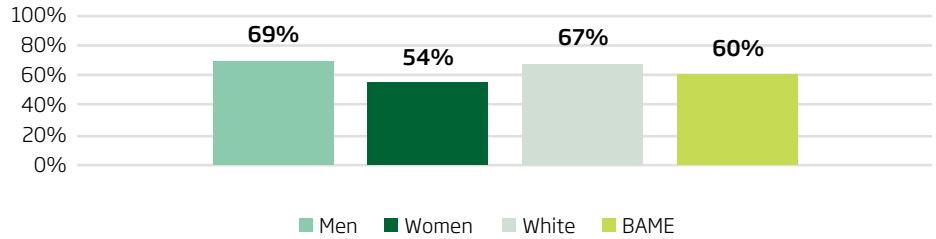


Figure 13: % of engineers agreeing/strongly agreeing that working flexibly is no barrier to career progression

Theme 8: A strong attachment to tradition

Meaning: the engineers in this study are significantly less likely to describe the culture as fast-paced or innovative than to describe it as slow to change.

"Engineering is largely siloed within disciplines and even sub-disciplines. It is very difficult to get the 'traditional' engineering disciplines to work across technical boundaries and explore innovative solutions."

"I work in a large 'traditional' engineering organisation. It is not very good at innovation and risk taking. Because of recent project history it values management of budget and timescales over technical competence."

"We have to break down traditional hierarchal structures that exist across engineering and create quality time to allow innovation and collaboration to flourish."

Consultants heard from the focus groups about a tension in the culture of engineering between tradition and innovation: engineers describe the culture as 'old school' but at the same time see themselves as 'all about ways things could be done better' in the future.

In the survey, engineers were asked to choose five words or phrases to describe the culture of engineering from a list of 14 generated by engineers involved in focus groups:

- Only 18% described the culture of engineering as fast paced.
- 30% described the culture as innovative.
- A significant minority (45%) described it as slow to change.

Only 28% included 'being open to new ideas' as one of their top five most valued behaviours in engineering.

Figure 14: How engineers relate to each other

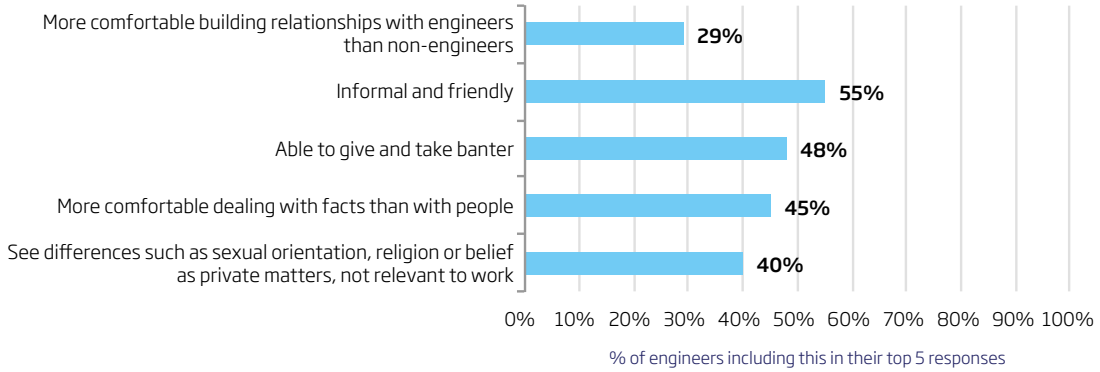


Figure 15: % of engineers who put the statement 'treat differences such as sexual orientation, religion or belief as private matters, not relevant to work' as one of their top five descriptors of how engineers relate to each other

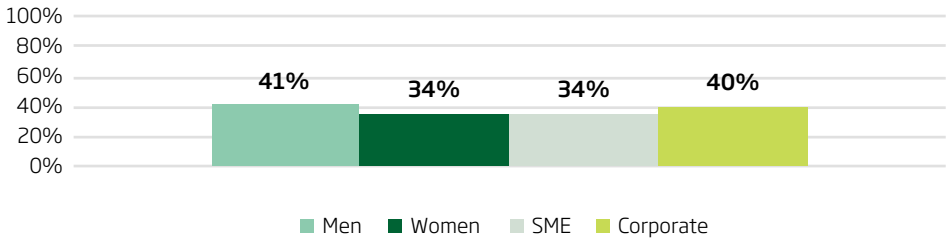
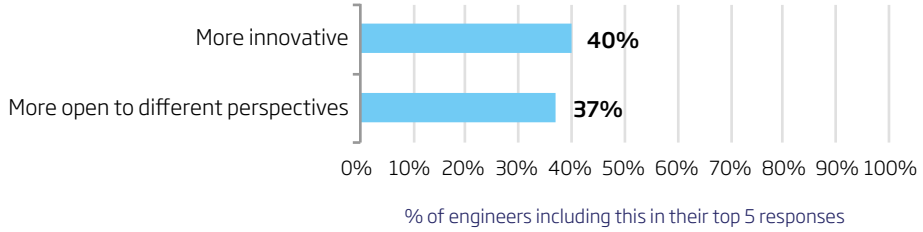


Figure 16: Which of the following changes to the culture of engineering would make it an even better environment for you to work in?



More innovation is what many engineers want: 90% of engineers agree or strongly agree that 'it's great when someone brings a different perspective to a problem'. When engineers were asked what changes to the culture of engineering in the UK would make it an even better environment for them to work in, two of the top five changes were about more innovation (**Figure 16**).

Differences:
Overall, 45% of engineers describe the culture as slow to change. **Figure 17** shows that BAME and women engineers are more likely to describe the culture as slow to change than their colleagues are. Engineers aged 35 and under are also more likely to describe the culture in this way than their older colleagues (**Figure 18**).

Perceptions of how innovative engineering is also vary across different age groups. The youngest age cohort (25 and under) and the oldest age cohort (55 and over) are most likely to include 'innovative' in their top five descriptions of the culture of engineering (**Figure 19**).

There is also a difference in the perceptions of men and women here: men are significantly more likely to describe the culture as innovative than women engineers are (**Figure 20**).

Theme 9 : Job vs career

Meaning: engineers perceive some elements of the culture relating to career progression as 'fair' and clear, but not all.

Survey responses tell us that 77% of engineers like their jobs most or all of the time and 66% feel the performance in the job they are doing is fairly assessed. However, as they look to the future only around half of engineers are clear about how to progress, or feel the promotions process is fair (**Figure 21**).

When asked what changes to the culture of engineering would make it an even better environment for engineers to work in, the top response overall was 'more opportunities to progress as an engineer without going into management roles' (63% included this in their top five changes). Engineers clearly believe that career progression means giving up a job they love.

Differences:
There is a lot of consistency in how different engineers perceive the culture of career progression and support, and some notable differences too, particularly in relation to the fairness of talent management processes. As shown in **Figure 22**, BAME engineers are significantly less likely than their white colleagues to agree that work is fairly allocated, or that the promotions process is fair.

Engineers in the youngest and oldest age cohorts have a more positive view of career support and progression, while engineers in the middle cohort (aged 26 to 55) have the least positive view (**Figure 23**).

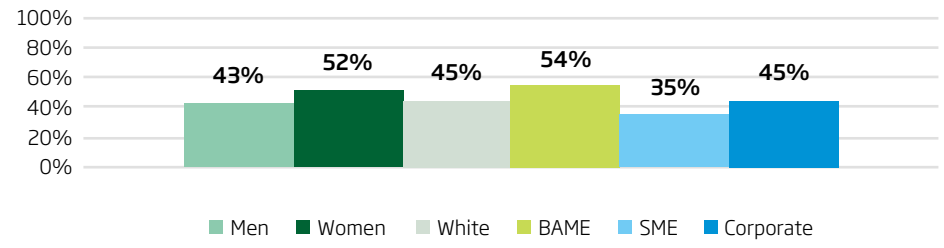


Figure 17: % of engineers including 'slow to change' in their top five descriptions of the culture of engineering

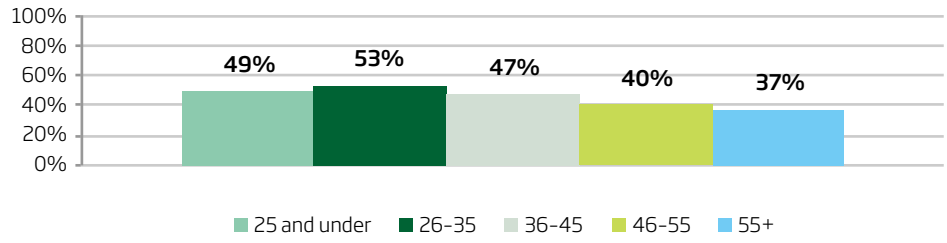


Figure 18: % of engineers including 'slow to change' in their top five descriptions of the culture of engineering, by age

"Career progression halts at a certain point. Highly skilled engineers become people managers who no longer get to do what they love and are good at. There needs to be an alternate path for highly skilled people to progress."

"As your career progresses and experience grows, engineers tend to migrate or get pressured into taking on a managerial role. A management role isn't of interest to everyone and there are plenty of engineers who wish to remain in a 'technical' role performing engineering tasks."

"Career opportunities for engineers can be limited if you want to stay technical."

Figure 19: % of engineers including 'innovative' in their top five descriptions of the culture of engineering, by age

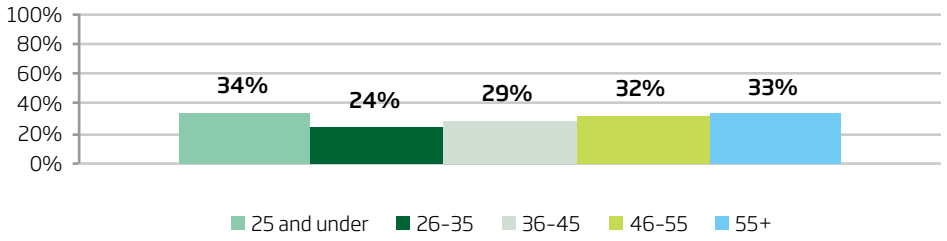


Figure 20: % of engineers including 'innovative' in their top five descriptions of the culture of engineering

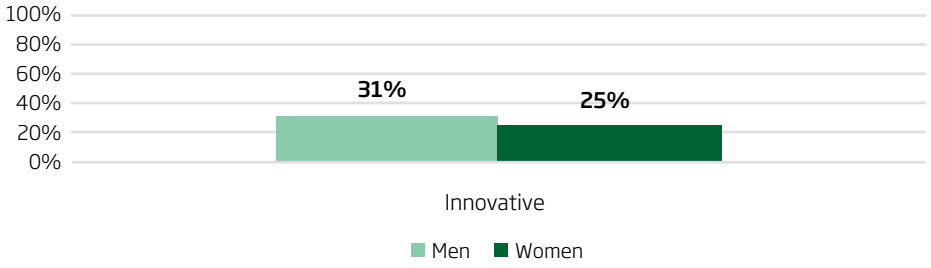


Figure 21: % of engineers agreeing/strongly agreeing with the following statements about where they work

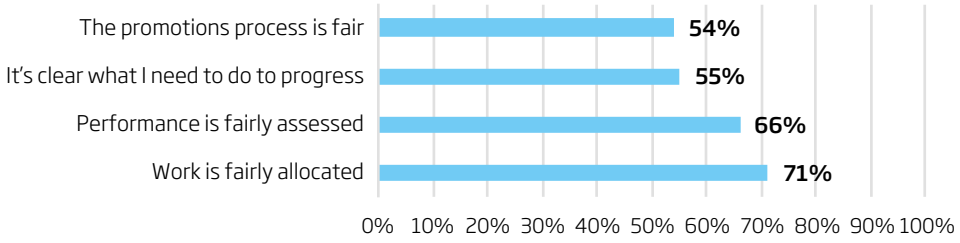


Figure 22: % of engineers agreeing/strongly agreeing with the following statements about where they work

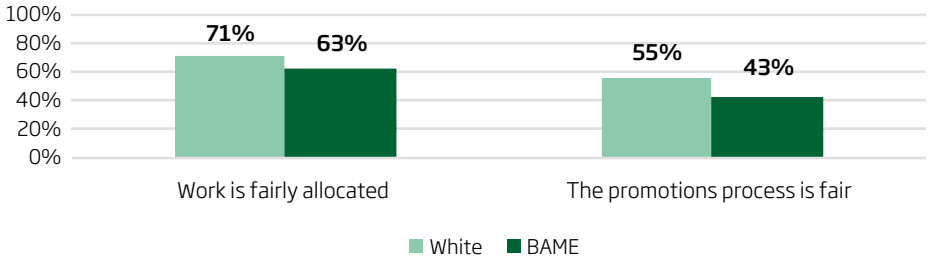
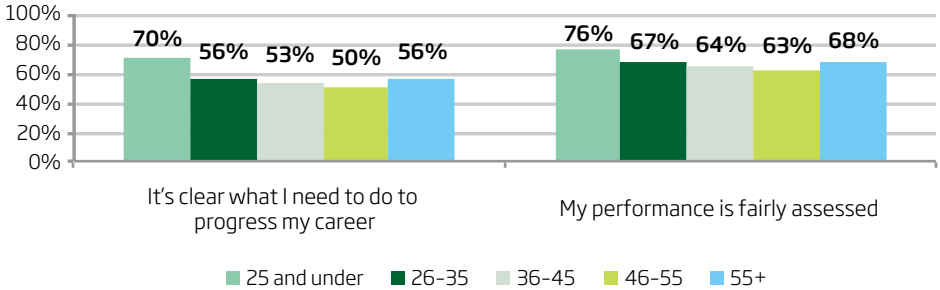


Figure 23: % of engineers agreeing most/all of the time with the following statements




Clare Cordon

3. Inclusion in engineering

Key messages

A. Diversity and inclusion are different concepts. While diversity is measured in terms of demographics, inclusion is about how engineers feel, and how they perceive and experience the culture in which they work.

B. There are seven indicators of inclusion in engineering described as openness, respect, relationships, career, flexibility, leadership and diversity.

C. Engineers from all backgrounds report that inclusion benefits them personally, increasing motivation, performance and commitment. Engineers also believe that higher levels of inclusion benefit organisational performance on quality, safety and innovation, skills retention, skills and career development, and engagement.

D. Most engineers describe the culture as 'quite inclusive', suggesting that while there is no 'crisis' of inclusion in engineering, more can be done to reap the benefits of inclusion for all engineers and the companies that employ them.

E. There is a pattern of significant differences in perception between different demographic groups. In general, white engineers feel more included than BAME engineers do, male engineers feel more included than female engineers, and younger engineers find the culture more inclusive than older engineers.

F. There are similarities and differences in the emphasis that different demographic groups place on which of the seven indicators of inclusion make them feel included. The seven indicators are relevant to all engineers, but their relative contribution to inclusion varies between groups.

3.1 How do diversity and inclusion differ?

The term 'diversity' is used to describe what distinguishes and differentiates one person and/or one group of people from another. The Academy defines diversity as follows: "Diversity considers similarities and differences in terms of age, ethnicity, disability, gender and religion; and less visible differences such as sexual orientation, disability [also], religion, educational background, personality type, nationality etc."

Measures of diversity typically include the numbers and proportions (the 'representation') of different demographic groups at different levels or in different roles in an organisation, or their representation in relation to core 'people' processes such as recruitment, performance management, pay, promotion and attrition.

The term 'inclusion' is used to describe what brings people together – typically referring to workplace culture and the behaviours of leaders, managers and peers that lead to staff feeling included. The Academy describes inclusion as follows: "Inclusion is about the culture, environment and processes created by an organisation. It is measured by how people feel and it needs effort to achieve. Creating a culture of inclusiveness is about establishing behaviours that support inclusion. Leaders have a critical role to play in this as employees will look to the most senior levels as an indication of what is acceptable and what is the norm."

Catalyst[23] provides a helpful definition of inclusion used in the focus groups and the survey. This definition combines 'uniqueness' ('the perception that you are distinct from others and that your distinctiveness is valued by others in the group') with 'belongingness' ('the perception that you are part of a group such as a work team, and that you are an essential part of the group'). According to Catalyst, people feel included to the extent to which they feel valued, and that they belong.

Diversity and inclusion are related, because while 'it is easy to be inclusive with a homogenous group', there is a general understanding that inclusion without diversity is not 'real inclusion'. Similarly, diversity itself is not enough to create an inclusive culture. As Hatmaker[24] writes: 'making engineering more inclusive for women cannot be accomplished by increasing the numerical proportion of women alone; changes in workplace cultures are also required.'

In practice, the extent to which people experience a profession or organisation as inclusive is influenced by a combination of systems, leadership, policies and practices. This includes the systems used to promote fairness and diversity, the leadership and

management philosophy, values, strategies, practices and decisions, the policies, procedures and ways of working. Inclusion is influenced by how people feel and their perceptions and experiences of an organisation or profession, and is therefore hard to measure.

3.2 The business case for inclusion in engineering

There is plenty of evidence that inclusion and an inclusive culture bring benefits both to individual and organisational performance.

- Global professional services firm Deloitte found that when employees feel their organisation is committed to diversity and they feel included, the ability to innovate is increased by more than 80%, responsiveness to changing customer needs is increased by more than 30%, and team collaboration is increased by more than 40%.[25]
- Catalyst found that inclusion contributes to a number of self-reported performance measures including team citizenship and innovation and lower turnover, especially among black employees.[26]
- The US-based Centre for Talent Innovation (CTI)[27] reports that organisations with diverse and inclusive leaders are 70% more likely to have captured a new market in the past 12 months and 45% more likely to have increased market share compared to organisations with few or no diverse and inclusive leaders.[28]
- Research by Opportunity Now and Shapiro Consulting found that employees from all backgrounds experience individual and organisational benefits from inclusive leadership. Over 80% of employees who worked with an inclusive leader reported increased productivity, motivation, innovation, engagement and loyalty to their organisation.[29]

Benefits for individual engineers

This study shows very similar results, with engineers reporting significant impacts on their personal performance.

Engineers were asked to choose up to five improvements (from a list of 15) resulting from feeling included at work. There responses are presented in **Figure 24** below.

- Eight out of 10 engineers said that feeling included at work increased their motivation.
- Nearly 7 out of 10 (68%) said it increased their overall performance.
- Over half (52%) said it increased their commitment to their organisation.
- Half said it increased their engagement.

There were no significant differences in reported benefits for engineers on the basis of ethnicity, but there were some statistically significant differences in perception by company size, gender and age.

Figure 24: % of engineers including the following in their top five descriptions of what is most improved by feeling included at work

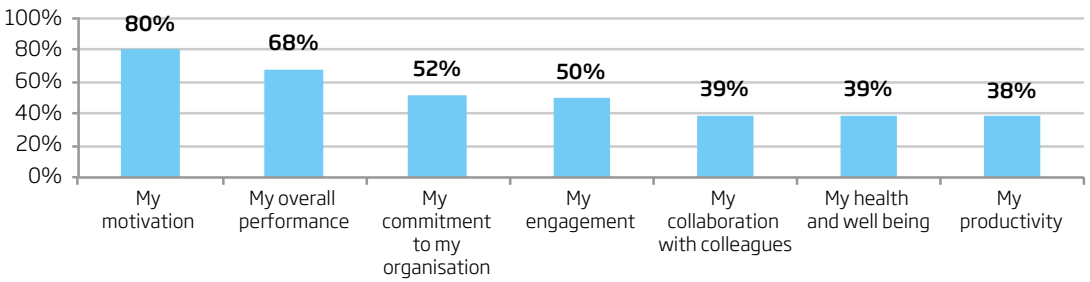
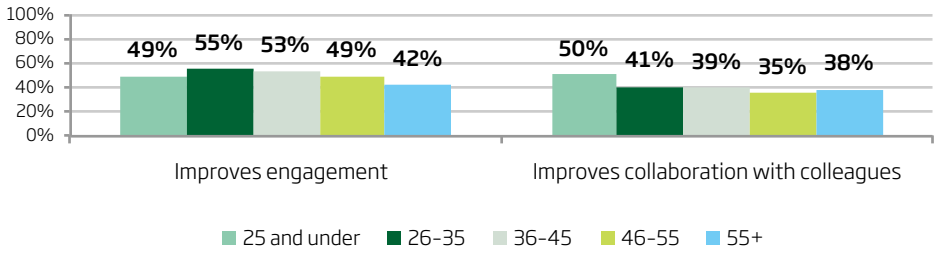


Figure 25: % of engineers reporting that inclusion improves engagement and collaboration, by age



- Half of engineers working in corporates say it is a benefit (49%), compared to 4 out of 10 engineers (39%) working in SMEs (see **Figure 25**).
- Women are more likely than men to say that inclusion improves their engagement (56% of women and 49% of men) and their health and well-being (47% of women and 37% of men)
- 43% of engineers aged 35 and under feel inclusion improves collaboration with colleagues, compared with 38% of those aged 55 and over. This echoes Deloitte's recent research into millennial perspectives on diversity and inclusion, which found that 'millennials view inclusion as having a culture of connectedness that facilitates teaming, collaboration and professional growth'.[30]

Benefits for engineering organisations

Inclusion also contributes to business performance and there is a direct correlation between the two, as illustrated in **Figures 26 to 31**. The more included engineers feel, the more likely they are to:

- understand the priorities of the business
- be confident about speaking up on improvements, mistakes or safety concerns
- see a future for themselves in the profession
- remain in engineering.

3.3 Perceptions of inclusion in engineering

Generic definitions of inclusion are useful, but this investigation aims to better understand more about specific ways in which perceptions lead to feeling included in engineering. What is it about the culture of engineering that makes engineers feel included?

Appendix 3 presents methods for measuring inclusion giving the detail of questions (or factors) that contribute to each of the indicators below.

Similarities:

Engineers were asked two direct questions about inclusion in engineering: one about the extent to which they personally feel included, and another about how inclusive they perceived the culture to be. **Figure 32** shows how they responded. Overall, engineers are more positive about the extent to which they personally feel included than they are about general inclusiveness of the culture.

The figure shows that 33% of engineers feel very included in engineering while 19% feel that the culture is very inclusive. In addition, 82% feel 'very' or 'quite' included while 76% think that the culture is 'very' or 'quite' inclusive. Conversely, a lower proportion of engineers (19%) report feeling personally 'not very' or 'not at all' included while a larger proportion (23%) perceive the culture to be 'not very' or 'not at all' inclusive.

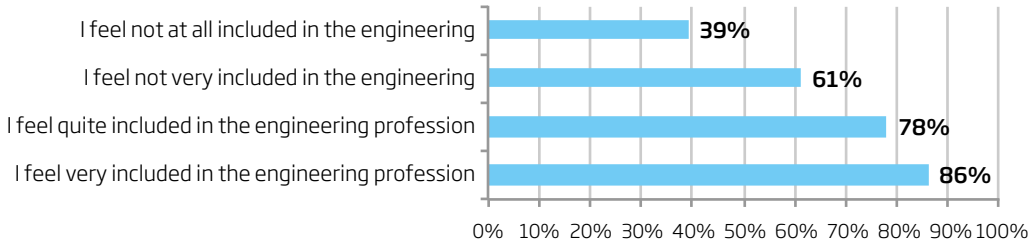


Figure 26: Percentage of engineers who agree/ strongly agree that the priorities and objectives of the business are clear to them

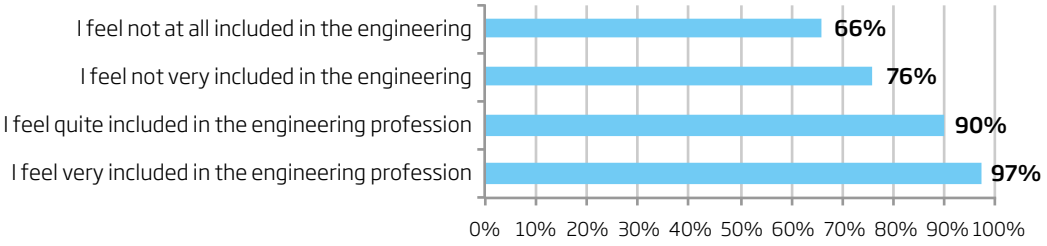


Figure 27: Percentage of engineers who feel confident to speak up all or most of the time if they can see a better way of doing things

Figure 28: Percentage of engineers who feel confident to speak up all or most of the time if they have made a mistake

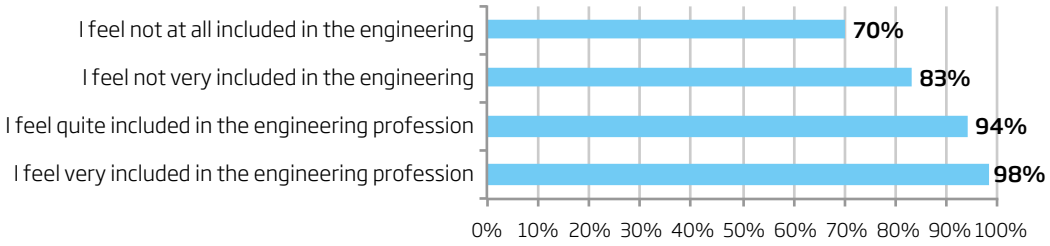


Figure 29: % of respondents who feel confident to speak up all or most of the time if they think their own safety or the safety of others is at risk

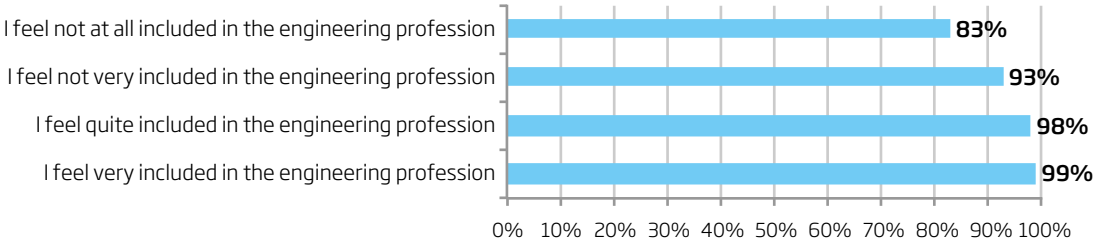


Figure 30: % of engineers who agree/strongly agree that they are clear what they need to do to progress their careers

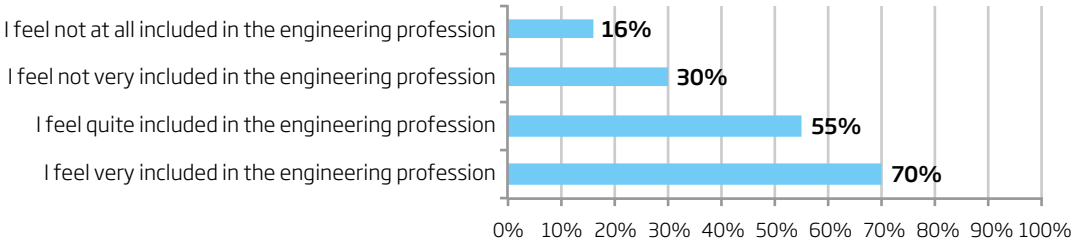


Figure 31: % of engineers who are planning to leave the engineering sector permanently (for reasons other than retirement) in the next 12 months

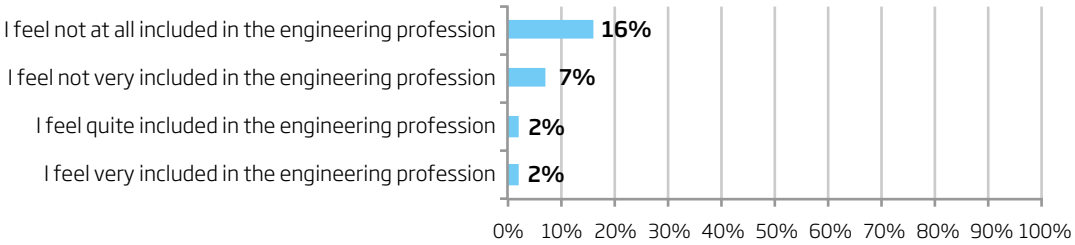
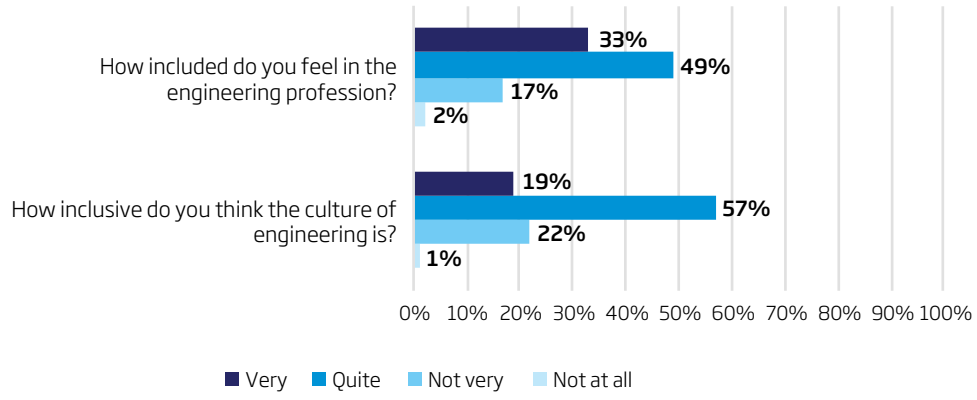


Figure 32: Perceptions of inclusion in engineering



Differences:

As with other aspects of engineering culture, these overall findings conceal differences in the perceptions of different demographic groups:

- Male engineers are almost twice as likely as their female colleagues to perceive the culture of engineering as 'very inclusive' (21% of men compared to 11% of women). They are also more likely than women to say that they feel 'very included' (35% and 23% respectively).
- White engineers are significantly more likely than their BAME colleagues to feel 'very included' in the engineering profession (34% of white compared to 24% of BAME engineers).
- BAME engineers are much more likely than their white colleagues to say the culture of engineering is 'not very' inclusive (33% and 20% respectively), and that they feel 'not very' included in the engineering profession (25% and 15% respectively).
- Engineers aged 46 and above are significantly more likely than those under 25 to say that they feel 'not very included' in the profession (18% and 12% respectively).
- Company size makes no significant difference to engineers' perceptions of inclusiveness in engineering, or to how included they feel in the profession.
- **It is important to note that one in five, or 21%, of white engineers and male engineers think the culture of engineering is 'not very' or 'not at all' inclusive** (Figures 33 to 35).

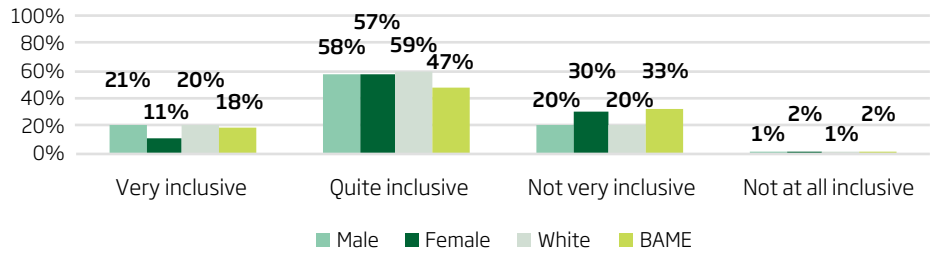


Figure 33: How inclusive do you think the culture of engineering is, by gender and ethnicity?

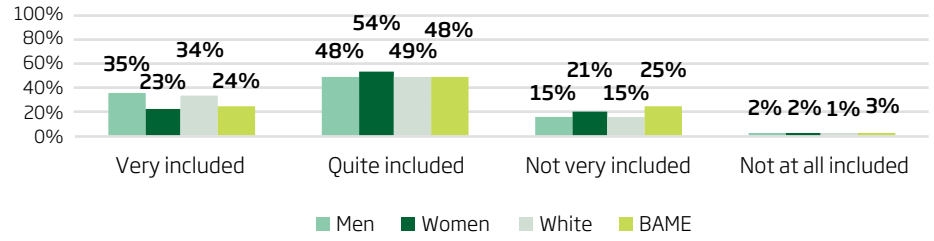


Figure 34: How included do you feel in the engineering profession, by gender and ethnicity?

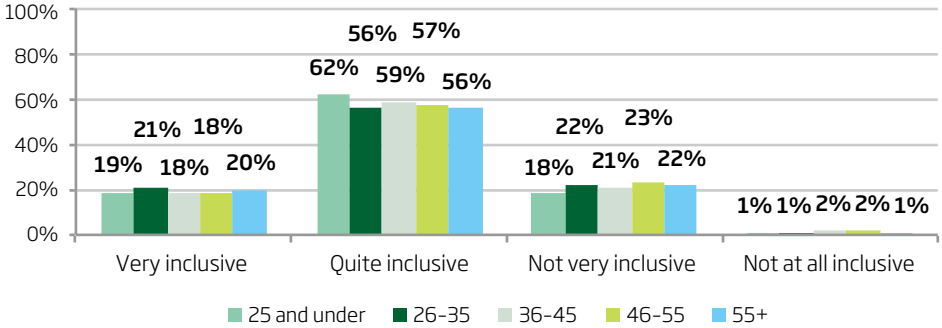


Figure 35: How inclusive do you think the culture of engineering is, by age?

3.4 Indicators of inclusion in engineering

To understand what engineers look for as evidence of inclusion, survey respondents were asked to choose from a list of 20 themes generated through focus groups with over 300 engineers. By analysing chosen themes against responses of engineers who feel most included, and who feel the culture is most inclusive, seven indicators of inclusion have been identified. These are shown in **Figure 36**.

3.5 The state of inclusion in engineering

The balance of the seven indicators for each demographic group is linked to perceptions of inclusion by that group. Each indicator is associated with one or more questions (or factors) in the survey.[31] Responses to these questions by demographic group give further insight into differences and similarities in perceptions of inclusion.

Figure 36

Openness

The extent to which engineers feel able to be open about who they are, and about their life outside work, and the extent to which they feel confident to speak up on a number of issues, for example, inappropriate behaviour to themselves or other people, and mistakes or safety risks. Engineers who feel included are able to be open about who they are, their life outside work and their opinions (on behaviour, mistakes, safety etc.).

Diversity

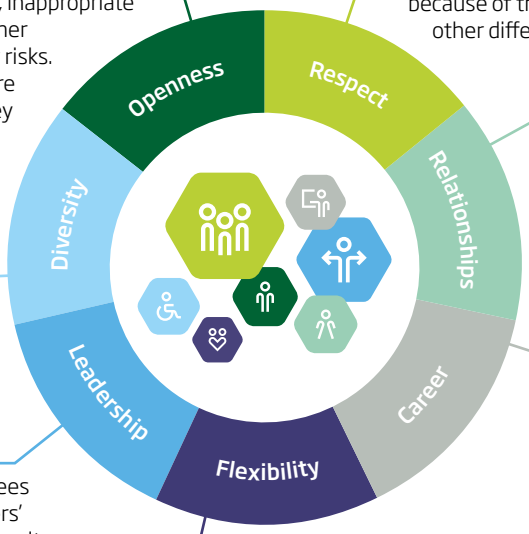
'A diverse workforce at all levels' is what engineers look for more than anything else as evidence of inclusion.

Leadership

In an inclusive culture, employees are convinced by their managers' commitment and action on diversity and inclusion.

Flexibility

There is plenty of evidence of the contribution that flexibility makes to an inclusive culture. Having opportunities to work flexibly is not enough; in a truly inclusive culture flexible working is no barrier to career progression.



Respect

The extent to which engineers feel treated with respect by managers, leaders and colleagues, and do not feel that assumptions are made about them because of their gender, ethnicity or any other difference.

Relationships

The extent to which engineers relate to each other in ways that are friendly, collaborative, and free of offensive banter, bullying or harassment.

Career

The extent to which engineers feel supported in their careers by their manager, and by the fair implementation of talent management processes. People who feel included feel supported in their careers by their manager, feel that talent management processes are implemented fairly, and that they have access to information and decision-making to the degree that they would like.

1. Openness

There are no significant differences between the perceptions of openness by engineers working in corporates or SMEs. However, what the survey responses clearly convey is that BAME engineers and women engineers feel consistently less able to be open about their lives outside work, and to speak up on inappropriate behaviour, than their white and male colleagues (**Figures 37 and 38**).

2. Respect

Women are significantly less likely than their male colleagues to say their gender is irrelevant to how they are perceived at work; women and BAME engineers are more likely than their male and white colleagues to say that assumptions are made about them on the basis of their ethnicity (**Figures 39 and 40**).

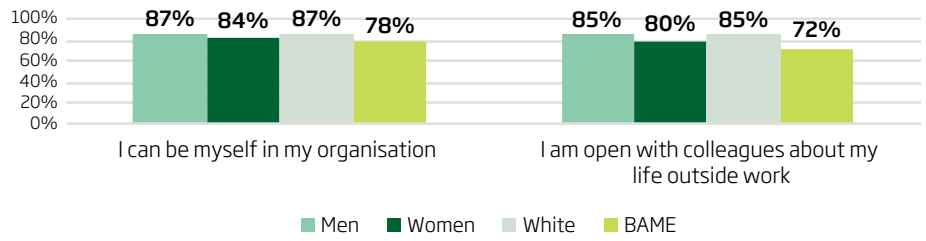


Figure 37: % of engineers who can be themselves, and are open with colleagues about their life outside work (agree/strongly agree), by gender and ethnicity

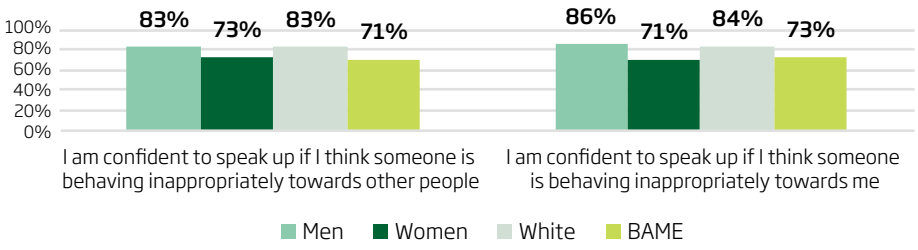


Figure 38: % of engineers who feel confident to speak up about inappropriate behaviour most/all of the time, by gender and ethnicity

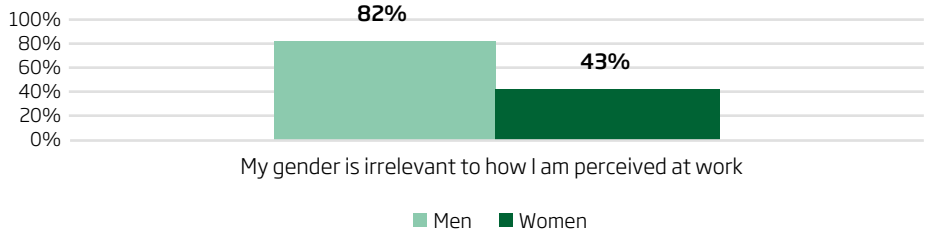


Figure 39: % of engineers who say their gender is irrelevant to how they are perceived at work (agree/strongly agree)

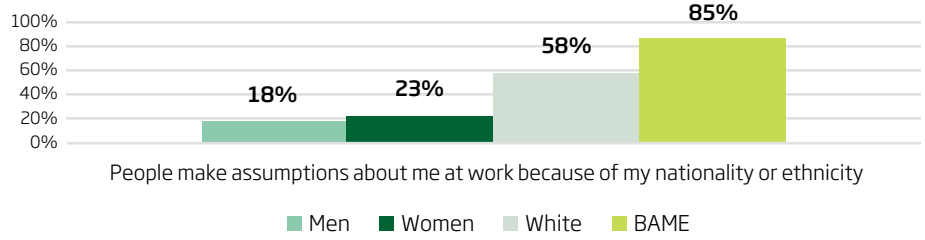


Figure 40: % of engineers who say that people make assumptions about them at work, because of their nationality or ethnicity

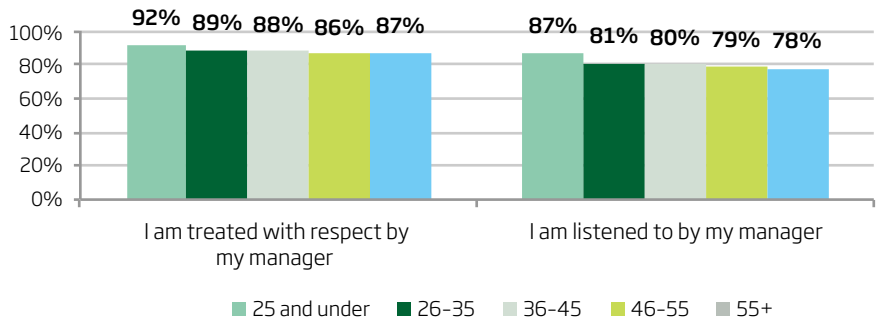


Figure 41: Engineers' perceptions of their manager (most/all of the time), by age

Engineers were asked about the extent to which they feel treated with respect and listened to by managers and colleagues. Around 9 out of 10 engineers (88%) from all demographic groups feel that they are treated with respect by their manager most/all of the time, and 80% of engineers felt they were listened to by their manager most/all of the time. Engineers in the older age cohorts are slightly less positive about being treated with respect and listened to by their manager than those in the younger age cohort (**Figure 41**).

93% of engineers say they are treated with respect by their colleagues and 90% say they are listened to by their colleagues. However, findings in **Figure 42** show that women engineers are less likely than male engineers to say that they are treated with respect and listened to by their colleagues.

"Many failures in engineering occur because of inadequate listening. The responses all relate to better levels of listening... differing perspectives, differing issues from different areas of engineering that all need to be considered in the decision-making processes, fresh ideas and concepts that form the knowledge base of early career engineers often overlooked when they could be of significant benefit ... generally we need to listen more in order to do more."

3. Relationships

Around half of all engineers from all backgrounds chose 'collaborative' as one of their top 14 descriptions of the culture of engineering, and half of all engineers chose 'informal and friendly' as one of their top 11 descriptions of how engineers relate to each other. However, men are more likely to describe the culture as informal and friendly than women, and white engineers are more likely to describe it as informal and friendly than their BAME colleagues.

Overall, 14% of engineers reported experiencing bullying and harassment in the past 12 months, and 12% overall said they had witnessed it. This is considerably lower than

The UK Standard for Professional Engineering Competence (UK-SPEC)

The Standard, produced by the Engineering Council, includes communication and interpersonal skills as one of five core areas of competence required by engineers which include:

- know and manage own emotions, strengths and weaknesses
- be aware of the needs and concerns of others, especially where related to diversity and equality
- be confident and flexible in dealing with new and changing interpersonal situations
- identify, agree and lead work towards collective goals
- create, maintain and enhance productive working relationships, and resolve conflicts.

Figure 42: % of engineers who say they are treated with respect and listened to by their colleagues (most/all of the time)

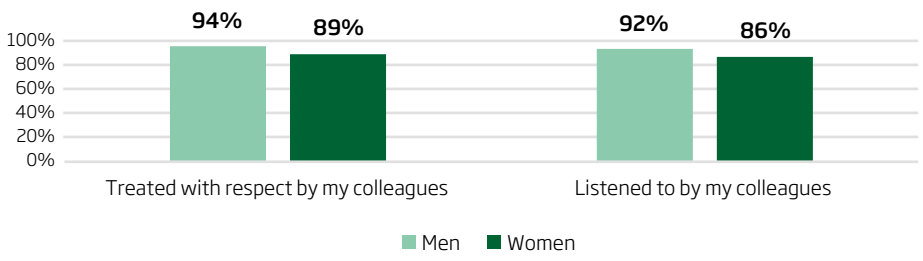
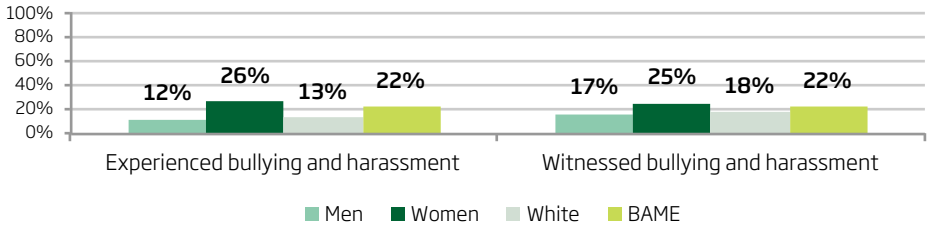


Figure 43: % of engineers who have witnessed or experienced bullying and harassment in the past 12 months



estimates of workplace bullying across other sectors of the UK workforce, where a recent study showed that 'almost 6 in 10 people have witnessed or suffered bullying in the workplace'.[32]

However, BAME and women engineers are more likely to have either experienced or witnessed bullying and harassment in the last 12 months, with female engineers more than twice as likely as male engineers to say that they have experienced bullying and harassment in the past 12 months (**Figure 43**).

4. Career

Engineers overall feel less positive about their careers than they do about other indicators of inclusion:

- 53% of all engineers agree that their manager helps them in planning and achieving their career goals.
- 55% feel it is clear what they need to do to progress their career.
- 54% feel the promotions process is fair.

The survey also shows that different groups of engineers have different perceptions of the career support provided. For instance:

- BAME (63%) engineers are less likely than their white (73%) colleagues to agree that work is fairly allocated, or that the promotions process is fair – 43% of BAME compared to 55% of white.
- Women engineers are as likely as their male colleagues to say that the promotions process is fair, but significantly less likely to say that work is fairly allocated (73% of men compared to 63% of women).
- There is an age-related dip in perceptions of the fairness of talent management processes after the age of 25.
- Engineers working in SMEs are clearer about their career progression and more positive about the fairness of talent management processes than engineers working in large corporates are (**Figures 44 and 45**).

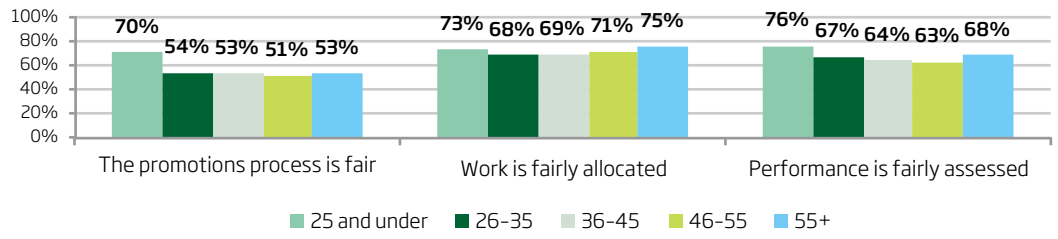


Figure 44: Engineers' perceptions of fairness in employment processes (agree/strongly agree), by age

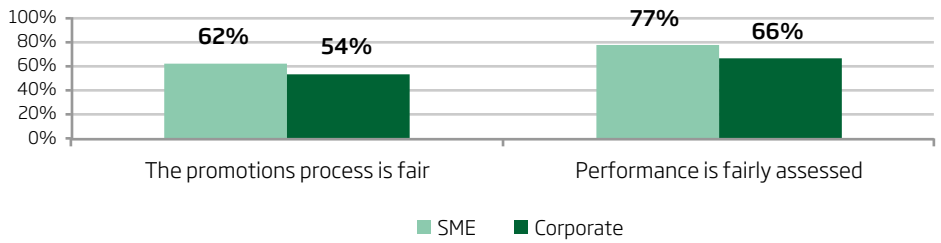


Figure 45: Engineers' perceptions of fairness in employment processes, by company size

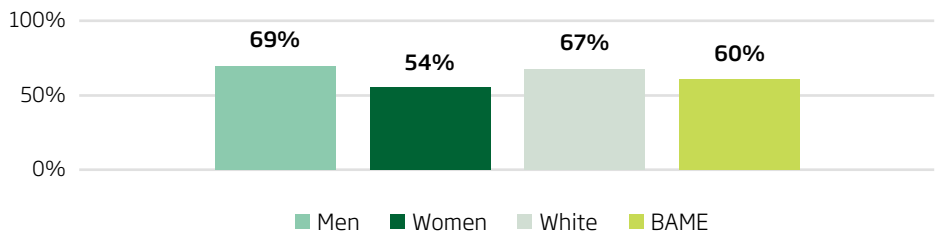


Figure 46: % of engineers agreeing/strongly agreeing that working flexibly is no barrier to career progression

5. Flexibility

Four out of five engineers agree that there are opportunities to work flexibly on a formal or informal basis in engineering. However, **Figure 46** shows that women and BAME engineers are significantly less likely than their male and white colleagues to think flexible working represents 'no barrier' to career progression.

6. Leadership

Responses to the survey show a mix of perceptions towards managers' performance on diversity and inclusion. Overall, 75% of engineers believe that their manager values diversity and difference in the team most or all of the time, but not all engineers are equally convinced that this translates into action to create an inclusive culture.

- 25% of engineers say that their manager never talks about the value of diversity and inclusion to the business.
- Barely half (54%) of all engineers think that their manager sets clear standards for the team on what it really means to create an inclusive environment.
- Four out of five engineers (82%) agree that their manager would tackle bias including bullying and harassment when it was brought to their attention. However, women engineers are much less convinced about this than their male colleagues, and BAME engineers are less convinced than their white colleagues. Only three-quarters of women and BAME engineers agree with this compared to 85% of men and white engineers. 69% of all engineers think that their manager is a good role model when it comes to creating an inclusive environment, but women engineers, BAME engineers and engineers over 55 are much less likely to agree (**Figures 47 and 48**).

Confidence in leadership on diversity and inclusion also decreases with age. **Figure 49** shows that 60% of engineers aged 25 or below agree that their manager sets clear standards for the team on creating an inclusive environment most or all of the time, compared to 53% of engineers aged 55 or over. There is a similar age-related trend in the perception of managers as good role models in creating an inclusive environment.

7. Diversity

Overall, 50% of engineers across all age groups put 'a diverse workforce at all levels' among their top five sources of evidence of an inclusive culture. However, not everybody looks for diversity to the same extent. Women engineers and BAME engineers are significantly more likely than any other demographic groups to look for a diverse workforce, as evidence of inclusion (**Figure 50**).

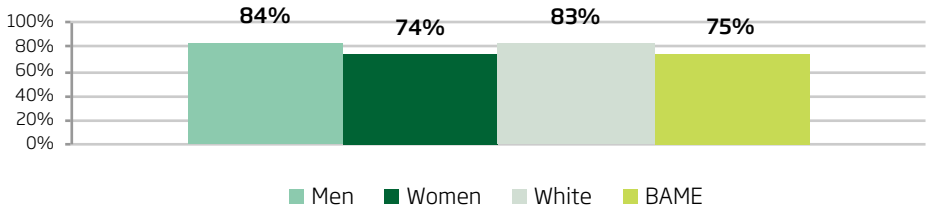


Figure 47:
% of engineers who are confident that their manager will tackle bias including bullying and harassment when it's brought to their attention (most/all of the time)

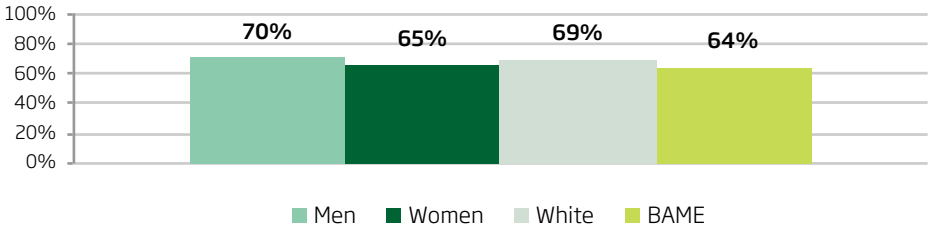


Figure 48:
% of engineers who think their manager is a good role model when it comes to creating an inclusive environment (most/all of the time)

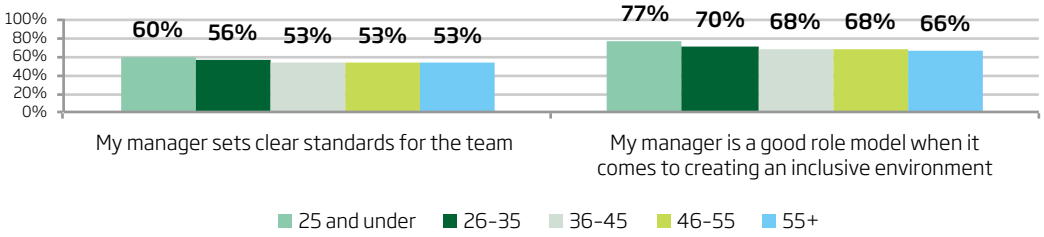


Figure 49:
Engineers' perceptions of manager behaviour on diversity and inclusion (most/all of the time), by age

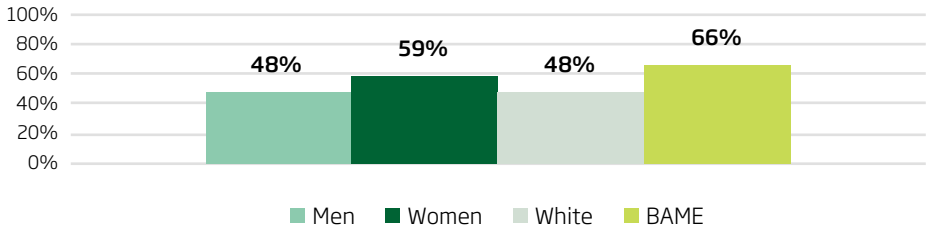


Figure 50:
% of engineers listing 'a diverse workforce at all levels', as one of their top five indicators or inclusion

4. Barriers to a more inclusive future

Key messages

A. There is plenty of evidence of the benefits of inclusion, however, not all engineers see creating a more inclusive culture as a priority.

B. Underlying barriers to progress on inclusion include:

- The 'inclusion privilege', which means those who already feel included are least likely to take action
- The perception that there is no 'crisis of inclusion', or burning platform, to drive action, but a consistent pattern of lower levels of inclusion for BAME and women engineers
- The need to deliver progress on intangible outcomes related to perception and experience which may be at odds with engineering culture

4.1 Underlying barriers to creating more inclusive cultures in engineering

Typically, barriers to inclusion in the engineering profession have been articulated in terms such as a lack of role models, limited opportunities for flexible working and more recently, a focus on unconscious bias. However, this study reveals some underlying barriers that are specific to engineering, relate directly to its culture, and help explain why progress on diversity and inclusion has appeared to many to be so slow.

The inclusion privilege

Understanding the need to act on inclusion is a challenge in a profession where the majority of people enjoy an inclusion privilege. The 'inclusion privilege' means that the people who already feel most included are least likely to see the need for a more inclusive culture. White engineers, and male engineers who are most likely to experience the inclusion privilege are also most likely to be in management and leadership positions, and in the best position to influence change.

No 'crisis of inclusion'

The 'problem' of inclusion is a challenge when there is no real sense of a 'crisis' for the profession. This study has not revealed any 'burning platform', such as headlines on engineers threatening to leave the profession, or systemic bullying and harassment or offensive banter. There is a consistent pattern of lower levels of inclusion for minority populations – BAME and women engineers in particular. Changing demographics and the impact of wider societal changes such as Brexit may mean that the profession needs to do even more to attract and retain more women and more BAME people into engineering. As more diverse people enter the profession, a crisis may be triggered. Acting now will create a more inclusive culture for everyone.

Intangible outcomes

The culture of engineering, as described in Section 2, is geared towards clear solutions and tangible outcomes. It is a proud culture, ambivalent about the personal, with a strong attachment to tradition. Yet addressing the 'problem' of inclusion is about complex change and often about achieving intangible outcomes, related to perception and experience. It requires the expression of humility, trust and empathy. It is very much about the 'personal', and about doing things differently for the future. Making progress on inclusion requires the profession to try out behaviours that might be perceived as at odds with its culture, and that is always going to be challenging.

4.2 Who wants a more inclusive future?

Figure 51 shows that despite recognising the benefits of inclusion, fewer than one in four engineers (23%) listed 'more inclusive' among changes to engineering culture that would make it an even better environment to work in. Added to that, just one in four (26%) included 'more diverse'. That is, most engineers do not consider 'more diverse' and 'more inclusive' among their priorities for improving the culture of engineering.

Figure 52 shows that male engineers and white engineers are least likely to include 'more diverse' or 'more inclusive' among their top five changes that would improve the culture of engineering. On the other hand, BAME and women engineers are more likely to see more diversity and more inclusion as changes that would make engineering a better environment in which to work.

Age makes little difference to how engineers respond on 'more inclusive', although engineers aged 35 and under are more likely to include 'more diverse' than those in older cohorts (**Figure 53**).

Figure 51: Changes to the culture of engineering that would make it an even better environment to work in

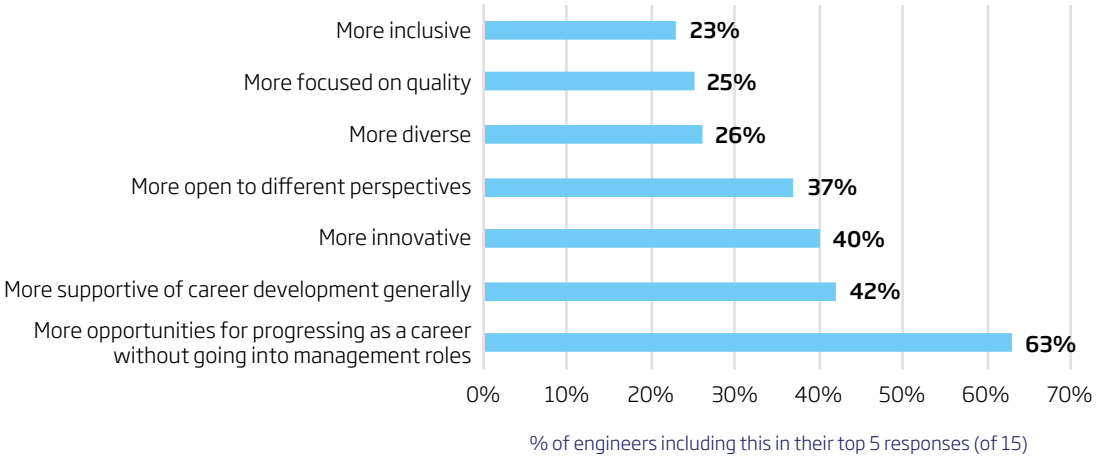


Figure 52: % of engineers including 'more diverse' and 'more inclusive' among the top five changes (of 15) that would make it an even better environment to work in, by gender and ethnicity

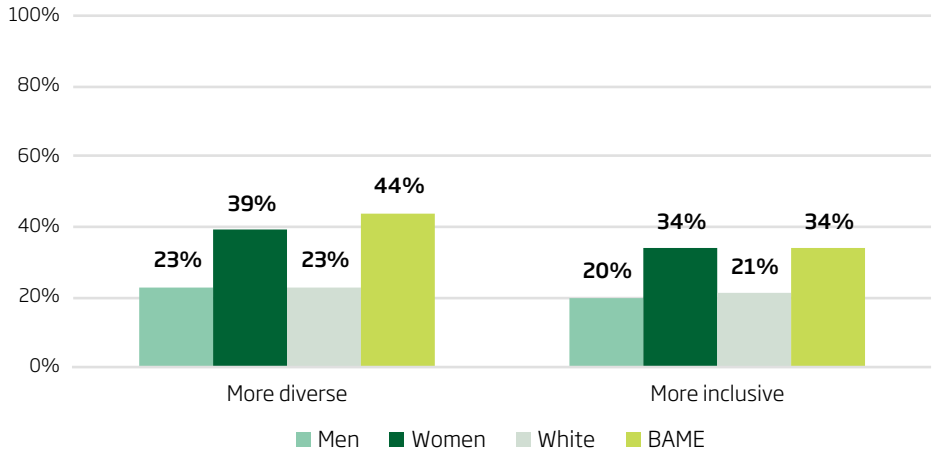
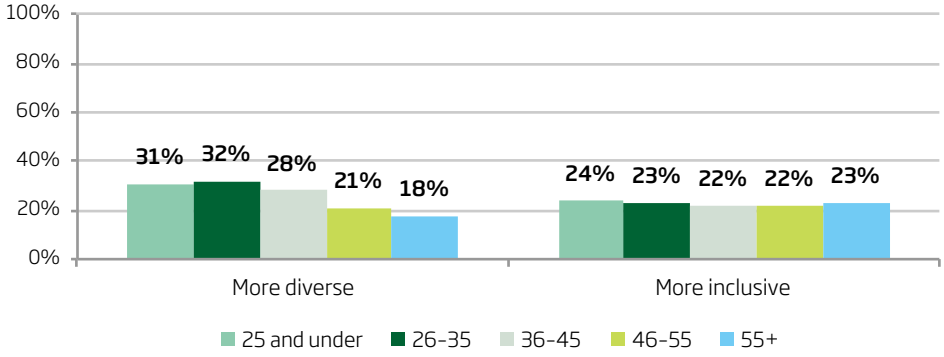


Figure 53: % of engineers including 'more diverse' and 'more inclusive' among the top five changes (of 15) that would make it an even better environment to work in, by age



5. Conclusions and recommendations

5.1 Conclusions

Conclusions on the culture of engineering and the extent to which it is inclusive are as follows.

The culture of engineering

- This study illustrates that there is a distinct culture of the engineering profession that transcends the different disciplines, sectors and organisations in which engineers work. How engineers perceive the culture can be described under nine headings: problem-solving, safety conscious, proud, loyal, team oriented, flexible in places, friendly but not personal, a strong attachment to tradition, and with a tension between job vs career.
- Under these nine headings there are a lot of similarities in how different demographic groups perceive the culture of engineering, and some important differences. This study clearly shows that how engineers perceive the culture of engineering is influenced by their gender and ethnicity, and to a lesser degree, by their age and the size of the company in which they work. Being in a minority in the engineering profession gives women and BAME engineers a consistently different perspective on its culture, in significant ways.

Perceptions of inclusion in engineering

- This study has shown that there are seven indicators of inclusion in engineering. These are openness, respect, relationships, flexibility, career support, leadership and diversity.
- There are many similarities in how different demographic groups perceive and experience these seven indicators. There is also a lot of similarity in what engineers consider is needed to create an inclusive culture.
- There are some important differences in perception. Company size makes very little difference to overall perceptions of inclusion in the profession, although engineers in SMEs are more positive about some aspects of career support, such as the fairness of talent management processes. Age makes more of a difference. Feelings of inclusion decrease with age, so that engineers in the older age cohort

feel less included than younger engineers. For older engineers, it is their less positive perceptions of career support and leadership that make the most difference.

- There is no doubt that being in a minority in the profession gives women and BAME engineers a consistently different perspective on and experience of each of the seven indicators of inclusion. Once again, there is a pattern of significant differences, which means that the perceptions of women and BAME engineers about inclusion in engineering are consistently less positive than those of their white and male colleagues.

- Overall, engineers recognise the value that diversity and inclusion bring to individual and business performance, but do not currently consider increasing diversity and inclusion to be a major priority for improving their working environment. It is particularly not a priority for white and male engineers, who generally feel more included in engineering than other demographic groups.

- It must not be overlooked that one in five white and male engineers do not feel fully included in the profession.

5.2 Recommendations for a more inclusive future

How engineering can create a more inclusive culture for the future is what the Academy's report *Thinking Like an Engineer* describes as a 'wicked' problem. That is, 'a social or cultural problem that is impossible to solve for as many as four reasons: incomplete or contradictory knowledge, the number of people and opinions involved, the large economic burden, and the interconnected nature of these problems with other problems'.[33] It is an adaptive rather than a technical challenge. There is no single 'right' answer to 'wicked' problems, or to most adaptive challenges, or indeed to most engineering problems. This study does not provide all the answers, but by sharing the perceptions and experiences of engineers – men and women, white and BAME, from across the age spectrum and working in both large and small organisations – the Academy hopes to have provided the profession with a unique bottom-up perspective on creating more inclusive cultures for the future.

Based on feedback from the 7,000 engineers who took part in this research, and the need to improve maturity of approach to addressing inclusion in engineering, seven recommendations for creating a more inclusive future are described below.

Recommendation 1:
Prioritise and reframe inclusion

Leaders and managers across engineering must take a long-term view to prioritising action to create cultures that are more inclusive. Resources must be made available to ensure that everyone across engineering organisations understands their role in creating more inclusive cultures; as well as the strategy and implementing plan for achieving change, with impact on different groups monitored to ensure progress on inclusion for all.

Inclusion is most usually understood as being about underrepresented groups. It must be reframed to include everyone who contributes to creating the culture of engineering, and around the seven indicators of inclusion.

Who? The Academy, engineering leaders and engineering D&I and HR professionals

ACTION
Prioritise and reframe inclusion

An example from Network Rail:

Inclusion for all groups is a fundamental part of our 'Everyone Strategy'. One of the ten objectives is – "to develop a safe, inclusive and fair culture where people feel respected, engaged and able to speak out". The methods for achieving this are:

1. Training and development: the roll-out of the Inclusive Leadership Programme, which provides training for leaders on unconscious bias, importance of being an inclusive leader and how to create an inclusive business environment. Four thousand leaders have attended the one-day programme.
2. The Everyone e-learning programme, which all 36,000 employees are expected to undertake. The programme has nine modules, plus a managers' module that covers the protected characteristics and promotes inclusive behaviours.
3. Everyone Week, which is an annual showcase celebrating diversity and inclusion initiatives.
4. Promoting and supporting flexible working.

Recommendation 2:
Articulate the benefits

Using the findings from this and wider research, the benefits of a more inclusive culture must be articulated in ways that are much more compelling, convincing and engaging for engineers. The benefits to white and male engineers (the 'what's in it for me') are not clear enough to drive action and they must be articulated more clearly to enable stronger connections between inclusion and benefits to the profession, particularly in terms of the benefits to individual engineers and organisations at large.

Who? The Academy, engineering leaders and engineering D&I, HR and communication teams

ACTION
Articulate the benefits

Use findings from this report to support a business case for action.

Engineers from all backgrounds report that inclusion brings benefits to organisational performance in terms of quality, safety, innovation, retention and engagement. They also report personal benefits, in terms of increasing their motivation, performance and commitment.

- 80% of engineers said that feeling included at work increased their motivation.
- 68% said it increased their overall performance.
- 52% said it increased their commitment to their organisation.
- 50% said it increased their engagement.

In addition, it is not only engineers from underrepresented groups who report not feeling included. One in five white male engineers also report not feeling included in engineering. Action on inclusion will benefit individual engineers and the profession at large.

Recommendation 3:
Build a critical mass of white and male allies

Create an inclusive culture where a critical mass of white and male engineers must become activists and allies of change on inclusion. This study has revealed a consistent pattern of lower levels of inclusion for women and BAME engineers, and one in five white male engineers report not feeling included. When it comes to developing a more inclusive culture for the future, women and BAME engineers only comprise 9% and 6% of the engineering profession respectively. It is just not enough of a critical mass to drive change. Without more white and male engineers engaging in change, the sector will simply be unable to create a more inclusive engineering culture. To become effective allies, engineering leaders must also develop inclusive leadership competencies, highlighted in the Academy *Diversity and Inclusion Toolkit*, which includes creating inclusive cultures, building relationships with diverse teams and networks, and increasing understanding of how their unconscious biases influence the decisions they make. Deloitte's six traits[34] of an inclusive leader provide another view of essential elements which include commitment, courage, understanding of bias, curiosity, cultural intelligence, and collaboration. Where possible, leaders should actively seek feedback on their inclusive leadership strengths and areas of development so that they can hold themselves accountable, or be held accountable for progress.

Who? The Academy, engineering leaders, managers and HR

ACTION
Build a critical mass of white male allies

An example from Mott MacDonald:

'We hosted an industry forum on Majority Champions of Inclusion (MCOI) focusing on engaging white men who identify as heterosexual and who do not currently have a disability.

This forum was attended by representatives from over twenty organisations resulting in a follow up MCOI report which included recommendations for engaging everyone – and especially the majority demographic – on equality diversity and inclusion (EDI).

Our MD has also been a vocal majority champion and was named in Women's Business Council and Management Today's Male Agents of Change Power list 2017.

As part of our 2017 Inclusion Week we highlighted majority champions in the latest instalment of our diversity role models poster series, with a few of our majority champions of inclusion sharing what they personally do to support EDI.'

Recommendation 4:
Increase awareness

Awareness must be raised on how different groups of engineers perceive engineering culture and inclusion. Engineers who already feel included enjoy an 'inclusion privilege', which means that they are least likely to see either the barriers to inclusion faced by other engineers, or the need for action to remove them. At least part of the solution to creating a culture of inclusion lies in engineers increasing their own awareness and understanding of their colleagues' experiences and perceptions. This ability to understand how other demographic groups understand and experience the workplace has long been recognised as an important intervention to create a more inclusive culture. However, awareness raising through programmes such as *Unconscious Bias* is not enough. Engineering employers must move beyond training to focus on measurement and eliminating bias from talent management processes including recruitment, promotion, performance management, leadership development, succession planning and pay.

Who? The Academy, engineering D&I, HR, and communication teams

ACTION
Increase awareness

An example from Atkins:

Through our unconscious bias workshop, we cover the attitudes and stereotypes that affect our understanding, actions and decisions in an unconscious manner. The programme is intended to influence the mindset of individuals and teams to ensure greater understanding of the impact they have to influence and work with others. In particular, the workshops seek to:

- provide an understanding of what unconscious bias is, and the negative impact it has on performance
- study how bias impacts the decisions we make
- help participants understand how surfacing and acting upon their unconscious bias can improve team performance, client connections and create business growth
- agree an approach (action plan) to combat unconscious bias.

Recommendation 5:
Leverage the culture

Future approaches to creating an inclusive engineering culture need to leverage the specific strengths of engineering culture to maximise the likelihood of progress. The barriers to change presented by some aspects of engineering culture need to be more openly acknowledged and addressed. In terms of barriers, the culture of engineering is geared towards clear solutions and tangible outcomes, but addressing the 'problem' of inclusion is about complex change and often about achieving intangible outcomes, related to perception and experience. It is a proud culture, ambivalent about the personal, with a strong attachment to tradition. However, creating a more inclusive culture requires humility[35], and is very much about the 'personal', and about doing things differently for the future. Making progress on inclusion requires that engineering try out behaviours that may be perceived as at odds with current culture. This may feel uncomfortable but is necessary for change to happen.

Who? The Academy, engineering leaders, D&I and HR teams

ACTION
To leverage engineering culture

There is much in the culture of engineering that can act as catalysts for change.

For instance:

- Linking the benefits of inclusion to issues that matter to all engineers, such as safety, and focusing not just on the benefits of inclusion, but also on the problem to which inclusion may be a solution (such as the need for more innovation).
- Engaging engineers in finding solutions to the problem of creating an inclusive culture, rather than relying on those in non-engineering and support roles to find the answers.
- Taking action in a way that helps engineers build their sense of pride on diversity and inclusion. Taking an appreciative approach to what's already working, or focusing on the competitive advantages of diversity and inclusion, may offer ways forward here.
- Approaching the creation of inclusive culture in a way that acknowledges the value that engineers place on collaboration and team-based working. Creating an inclusive culture in engineering may be more successful if approached as a team (rather than individual) responsibility.

Recommendation 6:
Deliver fair and inclusive career support and talent management

Creating cultures where all engineers thrive requires some actions to increase overall levels of inclusion. Findings in this report suggest that taking action on career support and ensuring the fairness of talent management processes would help raise the level of inclusion for all engineers including white and male majority engineers. Engineering employers must develop and implement data driven talent management processes that are transparent, assess and address any differential outcomes for different groups of employees.

Who? Engineering leaders, managers, HR and D&I teams

ACTION

To deliver fair and inclusive career support and talent management

Examples from Network Rail:

1. We have introduced Diversity Impact Assessments (DIAs), which enable the business to gauge the effect of our work specifically in the context of 'protected characteristics' under the Equality Act 2010. The DIAs is a process that requires those developing policies, projects and programmes to identify the benefits or disadvantages of our approaches and either promote the positives, or remove or mitigate the adverse effects. Employees receive training and DIAs are being integrated into the business as usual processes. DIAs are undertaken on HR policies, training provision, events, and engineering projects. DIAs are available on request.
2. We are accredited by the Disability Confident Scheme because we are positive about employing disabled people, making reasonable adjustments where needed and offering inclusive workplaces.
3. We have a 'reasonable adjustments campaign' that raises the profile, demonstrates the significant impact on employees and positive effect of attracting and retaining excellent employees.

Recommendation 7:
Take action on all seven indicators of inclusion

Creating a more inclusive culture will also require targeted interventions for women and BAME engineers in particular, across each of the seven indicators of inclusion (openness, respect, relationships, career development support, flexibility, leadership and diversity), and measuring and monitoring progress towards inclusion for all. Consider using the methods for measuring inclusion outlined in Appendix 3.

Who? The Academy, engineering leaders, managers, individual engineers, HR and D&I teams

ACTION

All seven indicators of inclusion

The kinds of interventions that this study shows would make a positive difference here include:

- maintaining a focus on diversity. Action to recruit, retain and develop a diverse workforce at all levels remains vitally important in perceptions of an inclusive culture
- highlighting efforts being taken to create an inclusive culture, including making data on diversity and inclusion transparent and available
- taking action to develop a 'speak up' culture, with a particular focus on building the confidence of women and BAME engineers to speak up on inappropriate behaviour, ideas, mistakes and safety concerns
- paying attention to fairness in talent management processes, in particular the fair allocation of work and opportunities, and access to mentors
- ensuring that flexible working opportunities do not become a barrier to career progression
- seeking out and sharing good practice to implement diversity and inclusion.[36,37]

This report provides a baseline on inclusion across the engineering profession which the Academy will revisit in the next two to three years with a view to assessing the impact of recommendations, and progress towards creating working environments where all engineers thrive.

Appendix 1. **Methodology**

This appendix explains the methodology used by for business sake consulting ltd (fbs), the consultancy commissioned to deliver the research by the Academy, to gather and analyse insights from engineers for this study.

1. Project team

The study was delivered by fbs consulting (www.forbusinessake.com), an independent consultancy on diversity, inclusion and organisational change. The project team included Sarah Bond, Dr Gillian Shapiro, Tony Belgrave and Helen Wollaston.

This document is largely based on a report written by fbs consulting using research conducted as described in this section. This report was subsequently edited and prepared for publication by Bola Fatimilehin, Head of Diversity and Inclusion at the Academy.

2. Overview

The project was delivered in four phases:

- **Phase 1:** Literature review
- **Phase 2:** Focus groups with more than 300 engineers from 10 UK engineering companies (plus two additional cross-corporate focus groups hosted by the Engineering Employers Federation (EEF))
- **Phase 3:** Online survey that generated responses from 6,799 engineers
- **Phase 4:** Data analysis and reporting.

The project was supported throughout by two industry groups convened by the Academy and comprising representatives from both large and small engineering companies. These were an action group, chaired by David Jenkins, Practice Director Engineering within Atkins Transportation, and a sponsor group, chaired by Philip Greenish, CEO of the Academy.[38]

The action group comprised representatives from 14 engineering employers, with day-to-day responsibility for engineering, diversity, inclusion, HR and people management. Group members were actively involved in shaping the approach to the project, in organising and hosting focus groups, raising the profile of the survey to encourage responses both internally and externally, helping analyse and interpret the emerging findings from both the focus groups and the survey, and commenting on the first draft of this report.

In general, the sponsor group comprised senior level representatives from the same organisations. In some cases, the same person sat on the action group and the sponsor group.

Phase 1: Literature review

The project commenced with a review of recent literature on the culture of engineering, inclusion and inclusive cultures. Findings were reported under six headings:

1. Definitions (including definitions of 'culture', 'inclusion', 'inclusive culture').
2. The culture of engineering (what the literature says about the culture of engineering, including in relation to inclusion).
3. Measuring inclusion (current approaches to measuring workplace inclusion).
4. Leadership contribution to inclusion (the role of leadership in creating an inclusive culture).
5. Inclusion and performance (the impact of inclusion on individual and organisational performance).
6. Action to create a more inclusive culture (key themes emerging from the literature review about how to create a more inclusive culture for the future).

The literature review helped ensure that the approach to the study was informed by current thinking and good practice on assessing and developing inclusive cultures. It provided a starting point for answering the three core project questions:

1. How do people currently working in the engineering profession perceive the culture?
2. How inclusive is the culture of engineering currently?
3. How can the sector create a more inclusive culture for the future?

The literature was also used to develop working definitions for 'culture' and 'inclusion' for use in the focus groups and the survey.

In communication with engineers in the focus groups and in the survey, culture was defined as the *'day-to-day experience of working in engineering, whether in just one organisation, or more than one. This includes, for example: how people typically behave with each other, values and behaviours seen as important, the rules and routines of people working in engineering'*.

In the early stages of the study a definition of the term 'inclusion' from a US-based campaigning and research organisation called Catalyst[39] was used. This definition combines 'uniqueness' ('the perception that individuals are distinct from others and that individual distinctiveness is valued by others in the group') with 'belongingness' ('the perception that individuals are part of a group such as a work team, and that individuals are an essential part of the group')[40]. As the report explains, a subsequent definition of inclusion was developed that is specific to the engineering profession.

Findings from the literature review are referred to throughout this report. A full copy of the review is available from Academy by emailing diversityteam@raeng.org.uk

Phase 2: Focus groups

In total, 36 focus groups took place with over 300 engineers from 10 different engineering companies, plus two additional cross-corporate focus groups hosted by EEF. Among the 10 were both large and small engineering employers covering a range of engineering fields and sectors (including aerospace, civil engineering, construction, consulting, defence engineering and software engineering).

The purpose of the focus groups was to gather insights from engineers about their perceptions and experience of engineering culture, and to identify key themes and questions for further exploration in the survey. Engineers were invited to attend focus groups by participating companies – their employers. Invitations were extended to engineers including men, women, older and younger engineers, white, BAME engineers, straight and LGBT engineers, engineers with and without disabilities, from a range of engineering backgrounds, at a range of grades, and with varying amounts of experience in the sector.

Each focus group lasted for 60 to 90 minutes, with discussion structured around the three core project questions. The conversations generated rich insights about engineers' perceptions and experiences of engineering culture, some of which were specific to the participating organisations, and many of which related to the profession more generally.

Phase 3: Survey

The survey had several purposes:

- To test the validity of the themes emerging from the focus groups, by considering the extent to which the findings were replicated across the profession.
- To gather and quantify any other insights from engineers into engineering culture and inclusion.
- To extend the reach of the project to engineering employers beyond those involved in hosting the focus groups.
- To gather demographic data to assess how different groups of engineers perceive the culture of engineering, in particular in relation to inclusion.

Wording of the survey questions were based, in many cases, on quotes from engineers themselves, gathered in the focus groups. Most of the questions took one of two formats: asking respondents to prioritise 'top five' responses from a list of alternatives, or to make a choice from a four-point scale asking about levels of agreement with a statement. The survey questions went through a number of review stages before circulation. Draft questions were discussed with action group members in the first instance, amending the wording based on their feedback and on comments subsequently received from their engineering colleagues. The survey was subsequently piloted with a small number of respondents from engineering companies both inside and outside the action group.

In January 2017 the survey was circulated among action group companies, a wider group of companies already working with the Academy on diversity and inclusion (known as the Diversity and Inclusion Leadership Group (DILG)), and via social media (Facebook, Twitter and LinkedIn). It was also hosted on the Academy website.

A total of 6,799 engineers responded to the survey with 78% of responses coming from 28 engineering employers, and the remaining 22% from those working outside these companies. Appendix 2 provides a comprehensive profile of respondents.

Phase 4: Data analysis and reporting

A partnership approach to data analysis was taken, involving the action group at an early stage in interpreting the data from the focus groups and the survey.

Focus groups analysis

Following the focus groups, and as part of the process to ensure the 'interpretative accuracy'[41] of our findings (see below), the overall themes were collated and discussed with the action group, before the survey was drafted. An anonymised summary of key findings was also prepared, which was subsequently shared with the main contact in each participating company.

'Factual' and 'interpretative' accuracy

The focus groups generated qualitative data on how engineers perceive and experience the culture of the engineering profession. Consultants drew on Schein's distinction between factual and interpretative accuracy to test the reliability and validity of the findings.

'Factual accuracy' can be checked by triangulation, multiple sources and replication. Consultants sought to maximise factual accuracy by drawing on themes from four sources of data (the literature review, the survey, the focus groups plus action and sponsor group feedback). Each data source informed the approach to the next, with the findings from each source compared and contrasted for both similarities and differences.

'Interpretive accuracy' can be checked by the predictability of the findings (which Schein defines as the extent to which 'an independent observer going into the same organisation should be able to see the same phenomena and interpret them in the same way'), and by their replication (repeated patterns suggest greater interpretative accuracy). Schein also argues that an additional source of reliability and validity about qualitative data on organisational culture is that the members of an organisation should feel comfortable that the description of the culture makes sense to them and helps them understand themselves. The collaborative approach that was taken to working with focus group participants and the action and sponsor groups, involving hands-on sense checking and meaning-making as described below, was informed by Schein's recommendations for interpretive accuracy.

Three levels of checking were undertaken for interpretative accuracy:

Level 1: Checking back with focus group participants 'in the moment' that the conversation was generating an accurate description of the culture of engineering from their perspective.

Level 2: Sharing an anonymised summary of key findings with the key contact in each organisation that hosted focus groups, to determine if the findings made sense to them.

Level 3: Collating the overall themes for discussion with the action group to determine if the findings made sense and seemed familiar to them too.

Survey analysis

The findings from the survey were analysed, paying particular attention to statistically significant differences in the first instance between respondents according to gender, ethnicity, age and company size (a z-test had been applied to the data to show 95% significance).

The early findings from the survey were discussed with the action group and steering group in two separate meetings. In the first meeting, held soon after the closing date for the survey, emerging patterns from the data were and the action group was asked for its feedback. In the second meeting, held some weeks later, more detailed analysis was shared that included overall narrative, key themes, drivers of an inclusive culture, and practical implications from the study. The action group also commented on an early draft of this report. The feedback and insights from both the action and steering groups at each stage of the process were enormously valuable in helping confirm the validity and relevance of the findings, and in shaping the content of this final report.

Determining contributing factors to, and indicators of, inclusion

To determine what contributes to engineers feeling included in the profession, findings from the literature review, the focus groups and the survey were used.

In the survey, engineers were asked two direct questions about their perceptions of inclusion in engineering to better understand determining factors:

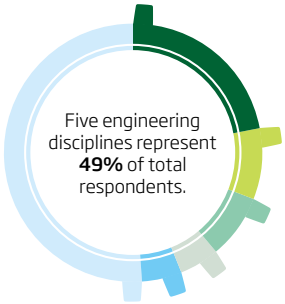
- Overall, how inclusive do you think the culture of engineering is?
- How included do you feel in the engineering profession?

There was particular interest in the responses of people who responded that engineering is highly inclusive and/or that they feel very included in the profession. The responses to these questions were cross-tabulated with responses to other questions about the culture (values, beliefs, behaviours) of engineering, looking for potential correlations. These results were compared with the responses of people who said that they do not think engineering is at all inclusive, and/or do not feel at all included. Finally, the authors took into account what people told them in the survey that they look for as evidence of an inclusive culture.

Appendix 2. Respondents by engineering and diversity characteristic

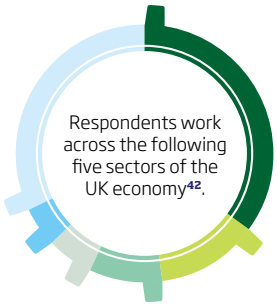
Engineering characteristics

1. Engineering disciplines (*n*=6799)



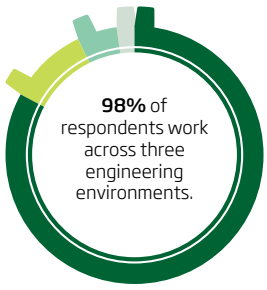
- Aerospace and avionics engineering **22%**
- Defence engineering **9%**
- Civil engineering **8%**
- Software engineering **5%**
- Petroleum, oil and gas engineering **5%**
- Other **51%**

2. UK economy sectors (*n*=6799)



- Aerospace **35%**
- Construction **13%**
- Shipbuilding **9%**
- Utilities **6%**
- Public admin and defence **5%**
- Other **32%**

3. Main job location (*n*=6630)



- Office based **83%**
- Site based **10%**
- Manufacturing **5%**
- Other **2%**

4. Job role (*n*=6631)

- Apprentice **1%**
- Graduate **10%**
- Non-management **53%**
- Management **26%**
- Senior management **8%**

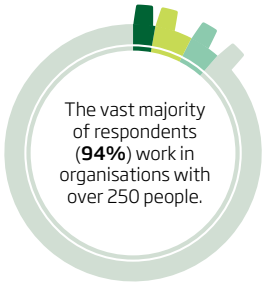
5. Professional affiliation, registration and networks

While **66%** of engineers are members of professional engineering institutions, only **48.4%** are professionally registered.

Member of professional engineering institutions (*n*=6470)

6. Size of organisation (*n*=6638)

The vast majority of respondents (94%) work in organisations with over 250 people.

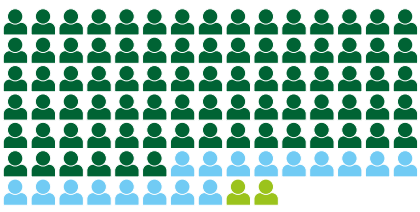


- Less than 50 **2%**
- 51-250 **4%**
- 250-500 **3%**
- More than 500 **91%**

Diversity characteristics

7. Gender (*n*=6631)

Male engineers make up a significant proportion of respondents to the survey. However, female engineers are well represented given they make up between **8%** and **10%** of professional engineers in the UK.

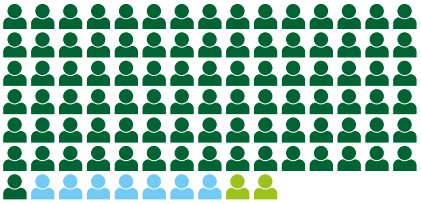


- Men **81%**
- Women **17%**
- Prefer not to say **2%**

Gender different from sex ascribed at birth **0.5%**

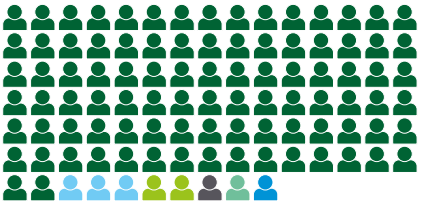
8. Nationality (*n*=6639)

Non-UK nationals make up **7%** of respondents to the survey engineering projects.



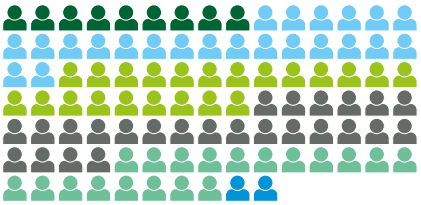
9. Ethnicity (*n*=6040)

BAME engineers make up **7%** of respondents reflecting the **6% to 7%** working as professional engineers in the UK.



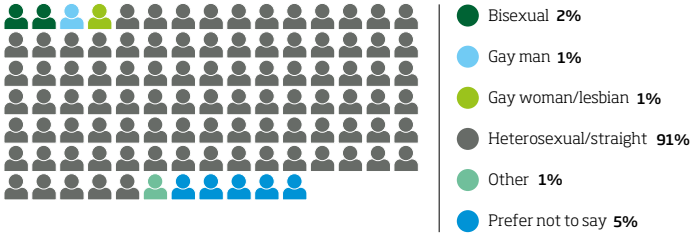
10. Age (n=6524)

66% of respondents are over the age of 36.



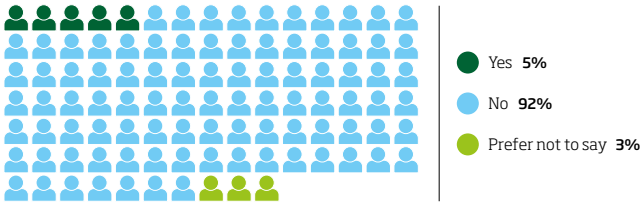
11. Sexual orientation (*n*=6609)

LGBT engineers make up **4%** of respondents with **5%** preferring not to declare their sexual orientation.



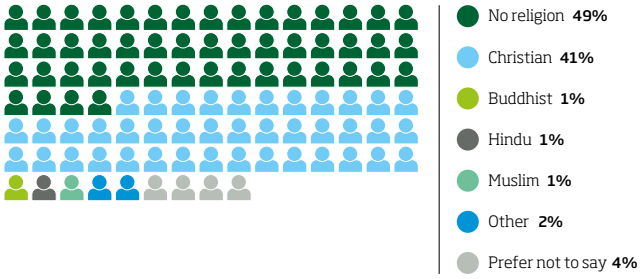
12. Disability (*n*=6619)

5% of respondents declare having a disability.



13. Religion (*n*=6631)

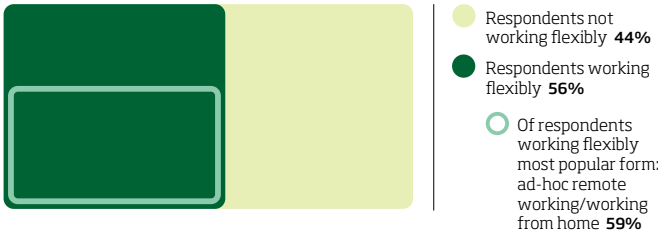
46% of respondents report having a religion.



Work-life balance

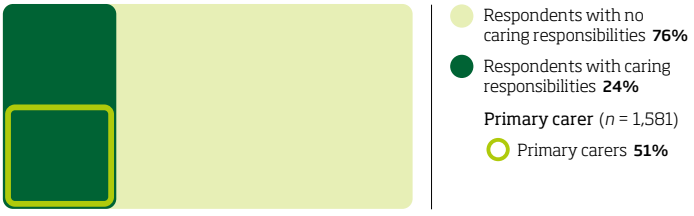
14. Flexible working, either formal or informal (*n*=6639)

More than half of the respondents to the survey report working flexibly.



15. Caring responsibilities (*n*=6626)

More than half of respondents are primary carers.



Appendix 3. Methods for measuring inclusion

1. The conversational approach

One method for measuring inclusion is to talk directly with engineers about their perceptions and experiences of organisational culture. This simple qualitative approach gave some rich and insightful data into their experiences and perceptions.

The set up and facilitation of the focus groups was approached as follows:

2. Set up

Each focus group had one or two facilitators and between 3 and 30 participants. Some of the focus groups were aimed at one particular demographic group, but most were mixed. Each focus group lasted between 60 and 90 minutes.

3. Structure

The focus group discussion was structured around the three core project questions.

Question 1: How do people currently working in the engineering profession perceive the culture?

Participants were asked to think of three words or phrases describing the culture of engineering in their organisation, to write the words on sticky notes and place them on a board or table, where they were then grouped into themes. The group discussed the themes, sharing stories and examples and adding further words and themes until participants felt they had created an accurate 'map' of the culture of engineering in their organisation. The authors did a final check back with participants to ensure that the culture maps they had produced provided an accurate description of the culture of engineering. Photos of the maps were taken for each organisation, and collated to identify similarities and differences across the profession.

Question 2: How inclusive is the culture of engineering currently?

Participants were asked to position themselves physically along two imaginary continuums, with high inclusion at one end and low inclusion at the other. One continuum related to the culture of engineering in their organisation, and the other to the profession more generally. Participants were then asked to describe where on the continuum they had positioned themselves and why. Again, stories and examples were shared, surfacing aspects of the culture that participants associated with greater or lesser inclusion.

Question 3: How can the sector create a more inclusive culture for the future?

This generally took the form of a whole-group discussion, with engineers contributing their ideas, and recording these on a flipchart.

4. The survey-based approach

An alternative method for measuring inclusion is to use a survey. Findings from the literature review and the focus groups were used to help develop an online survey of engineers' perceptions and experiences of inclusion.

The questions in Section 1 below are questions about the experience or perception of inclusion. Each of the questions reflect factors that drive the indicators of inclusion described in this report. They are taken from the longer survey used in this study with some amendments and improvements to wording or response options to make it appropriate for general use.

The questions in Section 2 are demographic questions. Asking these questions will help engineering employers to fully interpret the findings from Section 1, to understand how different people experience the culture, and what actions to take to increase inclusion for different demographic groups.

The inclusion questions can be used in a standalone survey, or integrated into an existing people survey, or employee engagement survey. The results from the survey will enable engineering employers to establish a baseline on inclusion for the future. Conducting the survey annually or every two years will provide engineering employers with insights into the differences their actions are making. The results of the survey can be also used by engineering employers to develop their own recommendations and priorities for action.

Section 1: Questions or factors that drive inclusion in engineering

Openness

Questions	Response options
I can be myself in my organisation I am open with colleagues about my life outside work I am open at work about my sexual orientation I feel I can speak openly about my faith/religious beliefs/non-beliefs at work	Strongly disagree, disagree, agree, strongly agree
I am confident to speak up: ■ If I think someone is behaving inappropriately towards other people ■ If I think someone is behaving inappropriately towards me ■ If I think I've made a mistake ■ If I can see a better way of doing things ■ If I think my own safety or the safety of others is at risk	None of the time, some of the time, most of the time, all of the time

Respect

Questions	Response options
I am treated with respect by leaders in my organisation I am treated with respect by my manager I am treated with respect by my colleagues	None of the time, some of the time, most of the time, all of the time
I am listened to by leaders in my organisation I am listened to by my manager I am listened to by my colleagues	None of the time, some of the time, most of the time, all of the time
People make assumptions about me at work because of my nationality or ethnicity My gender is irrelevant to how I am perceived at work My workplace is inclusive of people with disabilities	Strongly disagree, disagree, agree, strongly agree

Relationships

Questions	Response options
To what extent do the following terms describe how people relate to each other where you work: Informal and friendly Able to give and take banter ('playful conversation') Offensive behaviour and language never get passed off as banter There is a collaborative culture where I work Collaborative behaviours are valued where I work	Strongly disagree, disagree, agree, strongly agree
In the past 12 months I have experienced bullying and harassment In the last 12 months I have witnessed bullying and harassment	Yes, no

Career

Question	Response options
My manager helps me in planning and achieving my current goals My manager is good at providing feedback on my performance My manager shares information openly to the extent I'd expect them to I feel involved in decision-making to the extent that I'd want to be Feedback is valued and encouraged	Never, sometimes, most of the time, all of the time
It's clear what I need to do to progress my career There is support for learning and development The promotions process is fair Work is fairly allocated Performance is fairly assessed It is harder for people with caring responsibilities to progress their career where I work	Strongly disagree, disagree, agree, strongly agree

Flexibility

Question	Response options
My manager supports me to work flexibly if I want Flexible working is no barrier to career progression There are opportunities to work flexibly on a formal or informal basis	Strongly disagree, disagree, agree, strongly agree

Leadership

Question	Response options
I'm confident my manager will tackle bias including bullying and harassment when it's brought to their attention My manager values diversity and difference in the team My manager is a good role model when it comes to creating an inclusive environment My manager sets clear standards for the team on creating an inclusive environment	None of the time, some of the time, most of the time, all of the time

Diversity

Question	Response options
There is a diverse workforce at all levels in my organisation	Strongly disagree, disagree, agree, strongly agree

Section 2: Demographic questions

Question	Response options
What best describes your gender?	Male Female Prefer not to say Prefer to self-describe
Is your gender identity the same as the sex you were assigned at birth?	Yes No Prefer not to say
Ethnicity	White Mixed/Multiple ethnic group Asian/Asian British Black/African/Caribbean/Black British Other ethnic group Prefer not to say
Nationality	Nationality by region: Europe (excluding UK) North America South and Central America Africa Asia Middle East Oceania Prefer not to say
Age	25 or under 26 - 35 36 - 45 46 - 55 55 or over Prefer not to say
Sexual orientation	Bisexual Gay man Gay woman/lesbian Heterosexual/straight Other (please state) Prefer not to say
Do you see yourself as having a disability (eg sensory, mobility, cognitive or developmental)?	Yes No Prefer not to say

Question	Response options
What is your religion?	No religion Christian Muslim Hindu Sikh Jewish Buddhist Other (please state) Prefer not to say
Do you work flexibly, either formally or informally?	Yes No
If yes, which of the following best describes your flexible working arrangement?	Informal/ad-hoc remote working/working from home Contractual agreement to work remotely/ from home Term time only School hours only Compressed hours Part-time (less than 30 hours per week) Other (please state)
Do you have care responsibilities? If yes who are your care responsibilities for? Are you the primary carer?	No/yes Child care/adult care/both child and adult care Are you the primary carer? Yes/no
Which of the following best describes your job level/grade	Intern Apprentice Graduate Non-management Management Senior management
Main job location	Manufacturing Office based Off shore Site based Other (please state)

Glossary

The Academy	Royal Academy of Engineering
BAME	Black, Asian and minority ethnic
Bullying and harassment	'Any unwanted behaviour that makes someone feel intimidated, degraded, humiliated or offended' (definition as used in the survey)
cis	Men and women whose gender identity aligns with the sex ascribed at birth
Corporate	A company with more than 250 employees
Culture	'The day-to-day experience of working in engineering, whether you've worked in just one organisation, or more than one. This includes, for example: how people typically behave with each other, values and behaviours seen as important, the rules and routines of people working in engineering' (definition as used in the survey)
D&IP	Royal Academy of Engineering's Diversity and Inclusion Programme
DILG	Royal Academy of Engineering's Diversity and Inclusion Leadership Group
Diversity	'Diversity considers similarities and differences in terms of age, ethnicity, disability, gender and religion; and less visible differences such as sexual orientation, disability [also], religion, educational background, personality type, nationality etc.' (as defined by the Academy)
Engineer	'People who are engineers, working in an engineering-related role or on an engineering project. This includes: civil/structural, electrical/electronic, mechanical, chemical, process, software/computing, environmental as well as technicians, project managers and students with engineering work experience' (definition as used in the survey)
Engineering	Defined by the Royal Academy of Engineering as 'many different types of activity' by engineers, including 'making things, making things work, and making things work better'. For the full definition visit www.raeng.org.uk/education/what-is-engineering
EEF	Engineering Employers Federation
ETP	Royal Academy of Engineering's Engineering Talent Project
Inclusion	'The extent to which you feel valued for who you are (your personal and professional background, experience and skills) and the extent to which you feel you belong/'fit' in the engineering profession and your organisation' (definition as used in the survey)
Inclusive culture	A culture that supports inclusion.
Inclusion privilege	Meaning that people who are already included are least likely to see either the barriers to inclusion faced by other engineers, or the need for action to remove them
LGBT	Lesbian, gay, bisexual and trans
PEI	Professional engineering institution
SME	A company with fewer than 250 employees
Trans	Men and women whose gender identity is different from the sex ascribed at birth

Endnotes

1. Engineering Talent Project www.raeng.org.uk/education/engineering-talent-project
2. Royal Academy of Engineering Diversity and Inclusion Programme www.raeng.org.uk/engdiversity.
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Royal Academy of Engineering
Prince Philip House, 3 Carlton House Terrace, London SW1Y 5DG

Tel: +44 (0)20 7766 0600
www.raeng.org.uk
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