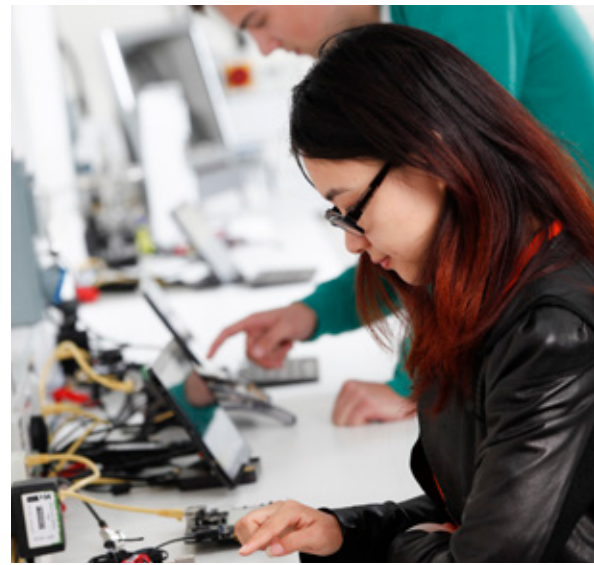


University of  
Hertfordshire



# Ethnic Minorities and Socio-Economically Disadvantaged Groups in Engineering: **A Research Report**

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## Ethnic Minorities and Socio-Economically Disadvantaged Groups in Engineering: A Research Report

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### About The Work and Employment Research Unit

This research has been undertaken by members of the Work and Employment Research Unit (WERU), part of the Centre for Research on Management, Economy and Society (CRoMES) in Hertfordshire Business School, University of Hertfordshire. The Unit undertakes critical and multi-disciplinary research in employment and employment relations and from this basis seeks to make a contribution to major contemporary debates as well as to policy development. More information about the unit can be found at:

**[www.herts.ac.uk/research/ssahri/research-areas/business-management/weru.html](http://www.herts.ac.uk/research/ssahri/research-areas/business-management/weru.html)**

**The main aim of this study was to develop a better understanding of the issues and challenges faced by black and minority ethnic (BME) people and those from socio-economically disadvantaged (SED) backgrounds in engineering as a profession. More specifically, the objectives were to:**

- Increase understanding of the barriers to participation for those from BME and SED backgrounds
- Understand the information key engineering stakeholders would find useful in addressing the lack of BME and SED diversity in the profession
- Identify key themes to act as a catalyst to increasing diversity in engineering
- Identify options to remove barriers for the two groups

The study is set within the context of negative perceptions and invisibility of the engineering profession ( Engineering UK, 2010). Özbilgin and Tatli (2011) state that a diverse workforce is crucial to innovation and creativity in organisations and this underlies the business case for widening access for underrepresented groups into the profession (Castle, 2013; Royal Academy of Engineering, 2013). In spite of this, although 20 per cent of engineering graduates are from the BME community, only 6 per cent of employed engineers are from BME backgrounds (Engineering UK, 2013).

Likewise, SED groups are underrepresented in the professions generally (Milburn, 2012). Of course these two groups are not mutually exclusive and, at the intersection of class and ethnicity, people face multiple disadvantages (Healy and Bradley, 2008). It is evident that there is a disparity between employers' stated and realised equality and diversity objectives and a discrepancy between the aspirations of those from BME and SED groups and their experiences in the engineering sector.

The following draws out the important themes that have emerged from this qualitative study.

## Key Themes

The authors encountered recurrent issues regarding the negative perceptions of engineering as invisible, dirty, poorly paid and too difficult as well as known issues around poor careers' advice and lack of school expertise. We also identified six other major themes as follows:

1. Impact of SED and BME parents on career choice
2. Initiatives and priorities of schools
3. Policies and practices of engineering employers
4. The engineering qualification process
5. Tendency to see diversity primarily in terms of gender equality
6. Policies and practices of professional engineering institutions PEIs

The research found that macro (government, culture), meso (organisations, institutions) and micro (individual agency) themes and sub themes overlap and interrelate to differentially interact with influences related to the intersections of various demographic and social variables. These issues, and the themes themselves, are explored in depth in the main body of the report.



### ***Impact of SED and BME parents on career choice***

The intersection of culture, ethnicity, gender, age and class coupled with strong family ties and community influences can be seen to shape the choice of engineering as a career. This theme also interrelated strongly with perceptions of engineering on the one hand, and school and college initiatives and priorities on the other. For those from 'working class' backgrounds we found there was often a lack of parental influence with regard to the academic route into engineering as many of the parents were unlikely, or unable, to provide guidance that included furthering education through a university. This, combined with the sometimes negative perceptions of apprenticeships and the complexity of routes to professional qualification, made engineering a more difficult career choice

### ***Initiatives and priorities of schools***

This key theme concerned the initiatives, practices and priorities of schools. Participants felt that in many schools engineering was downplayed, although there were some good practice examples of both schools and individual teachers who did promote it. In addition, the focus on the academic and on league tables which, when combined with perceptions amongst some people of STEM subjects as 'hard', led to the focus being on university entry, to the detriment of other routes such as apprenticeship schemes.

### ***Policies and practices of engineering employers***

This formed a large thematic category which included: elitist recruitment practices; working with exclusive schools; the requirement for internships and work experience and the reluctance to provide such opportunities for non-traditional sections of society; the focus of global firms on international recruitment; a tendency to view diversity mainly in terms of gender equality thereby obscuring ethnic and class diversity; difficulty in identifying and quantifying class diversity; exclusionary organisational cultures; a tendency to externalise the problem of lack of ethnic/class diversity and a fragmentation of diversity initiatives.

### ***The engineering qualification process***

The research highlighted the perception of a lack of clarity in the routes to professional qualification and pointed to a view of the traditional academic route into engineering (and subsequent chartered membership) as lengthy, complex and costly.

### ***Tendency to see diversity primarily in terms of gender equality***

It was evident that engineering employers associated diversity almost exclusively with gender equality. There was little understanding of issues around class and ethnicity. The danger of this focus on gender equality is that there may be complacency around other forms of inequality. The treatment of women as a homogenous group is problematic as a perception of gender as the only basis of inequality in all women's lives is misleading. Also this focus may mean that issues related to BME and class disadvantage are eclipsed.

### ***Policies and practices of engineering institutions***

Two contrasting perceptions of the engineering institutions could be discerned. On the one hand they were seen to have a positive role in encouraging professional development, whilst on the other they were seen as 'exclusive' in that they are dominated by white men but also that they are reluctant to open their doors to those from the less traditional engineering routes .

## Recommendations

Based on the above findings we make the following recommendations:

1. Engineering employers and Professional Engineering Institutions (PEIs) need to do more to work with schools to promote engineering as a profession and engage with a broader range of schools and universities.
2. There is a need to clarify, value and promote different routes to qualification, particularly in the light of the Government's renewed interest in apprenticeships.
3. Engineering employers and PEIs should reach out to SED and BME communities and parents. To this end:
  - a. There is a need to ensure that marketing initiatives have relevance for particular communities.
  - b. Existing employees should be involved in the design and delivery of initiatives.
4. Engineering employers need to provide transparent and relevant work experience opportunities through a robust and sustained engagement with the subject communities and employ innovative ways of communicating the existence of such opportunities.
5. With regard to recruitment and retention practices, engineering employers should broaden their recruitment channels in order to reach a wider audience, plus ensure fair and equitable selection through the use of mixed selection panels and properly trained selectors.
6. Training and development opportunities in engineering organisations should be used to develop cultural intelligence in organisations and identify and develop talented employees from under-represented groups.
7. Partnerships and co-operation between employers, institutions and the Academy should be strengthened and targeted at supporting the work of organisations that are focused on increasing diversity in engineering, e.g. social enterprises and specialist recruitment agencies.
8. Collect and analyse statistical data on different strands of equality-protected characteristics in both employing organisations and professional institutions.
9. Identify and appoint diversity champions at the highest level in the organisations and professional institutions.





The aim of this study was to investigate the issues and challenges faced by black and minority ethnic (BME) people and those from socio-economically disadvantaged (SED) backgrounds in engineering, a profession that faces issues relating to both terminology and image. Anyone in the UK can describe themselves as 'an engineer', although the specific titles denoting professional engineering competence (such as Chartered Engineer) are protected by law and their use restricted. Another issue faced by those working or researching in the sector is the sheer size and diversity of types of engineering in the UK, with currently over fifty professional bodies representing the sector. As for image, the relative invisibility of engineering is combined with sometimes negative perceptions, in particular amongst children and young people (Engineering UK, 2010).

Furthermore, skill shortages have been highlighted as an issue in the sector, with some firms having difficulty recruiting sufficient numbers of skilled engineers (Castle, 2013). It is argued that engineering suffers from a lack of prestige, with traditionally many of the best brains opting for careers in law, medicine, the Civil Service and the media, as well as the lure of London's financial centre. The same article quotes the Business Secretary, Vince Cable, describing the dearth of engineers as one of the biggest long-term challenges facing the British economy. According to a study commissioned by the Academy, the British education system needs to more than double the annual number of university graduates in mathematics, engineering and sciences in order to meet demand (Royal Academy of Engineering, 2012).

The above forms a clear business case for widening participation in engineering, quite apart from any ethical or moral imperatives. However, statistics highlight that the profession is dominated by men, is predominantly white, and the workforce relatively old (Royal Academy of Engineering, 2013). Whilst there has been recent focus on gender, at least in terms of research and policy documents, issues relating to ethnicity and class in engineering are relatively unexplored.

**Researchers from the Work and Employment Research Unit (WERU) of Hertfordshire Business School were commissioned to undertake an investigation to ascertain what more could be done to increase the participation of people from BME and SED groups in engineering employment and in Professional Engineering Institutions (PEIs). This report is a result of the study.**

### 2.1 Study aim and objectives

The particular focus of the study was on developing a better understanding of the issues and challenges faced by ethnic minority people and those from socio-economically disadvantaged backgrounds when considering engineering as a profession.

**The research objectives were to:**

1. Increase understanding of the barriers to participation – especially as regards employment and membership of PEIs
2. Engage with key stakeholders to understand the information they would find useful in increasing BME and SED groups in their organisations and membership
3. Identify options to remove barriers
4. Identify key themes to feedback to stakeholders to act as a catalyst to increasing diversity

### 2.2 Methodology

The research was constructed into eight work packages with two fieldwork phases: a scoping phase followed by the main fieldwork phase. Both phases were conducted in accordance with the Hertfordshire Business School ethics protocol.

#### 2.2.1 Project design and timescales

For the purposes of clarification and ease of comprehension, the study was guided by the UK census classifications of ethnicity. 'White' is used to refer to those of white Caucasian descent, 'black and minority ethnic' (BME) or ethnic minorities encompass visible minorities including people of Chinese, Indian, Bangladeshi, Pakistani, Black African, Black Caribbean and mixed race origin. However, we were conscious of the fact that a view of identity as a given fixed essence undermines the fact that social groupings are not necessarily objective nor always clear and obvious.

Furthermore, the ability to determine socio-economic classification of individuals was a challenge. However, since 2001 the Office for National Statistics (ONS) has used the National Statistics Socio-economic Classification (NS-SEC), developed from the Goldthorpe Schema, a sociological classification that has been widely used in pure and applied research ([www.ons.gov.uk](http://www.ons.gov.uk)).

The NS-SEC has been constructed to measure the employment relations and conditions of occupations

which, it is argued, are central to showing the structure of socio-economic positions in modern societies and helping to explain variations in social behaviour and other social phenomena. An NS-SEC category is assigned to a household by deciding which household member best defines that household's position. There is a useful approximation between NS-SEC categories and measures of social class.

Within the overall model there are three variants: an eight-, five- and three-class version of the NS-SEC. The choice of which to use will depend on both analytical purposes and the quality of available data. The five-class variant is outlined below:

## Five classes

- 1 Higher managerial, administrative and professional occupations
  - 2 Intermediate occupations
  - 3 Small employers and own account workers
  - 4 Lower supervisory and technical occupations
  - 5 Semi-routine and routine occupations
- \*Never worked and long-term unemployed

In the 3-class model categories 4 and 5 in the table above are combined into 'Routine and manual occupations'. Depending on usage, those who have never worked and the long-term unemployed may be allocated to the semi-routine/routine and manual occupations category. It is this overall category that could be termed relative socio-economic disadvantage.

For the purposes of the research, respondents self-selected as to whether they considered themselves to come from a 'socio-economically disadvantaged' background.

## 2.2.2 Ethical issues

The project received Ethical Approval from the Hertfordshire Business School Ethics Committee whose guidelines framed the wording of the introductory letter of invitation. Interviewees were guaranteed confidentiality and anonymity and assured that they would not be identified in any of the reports we produced on the project, hence no names of participants have been published in this report. Further, all participants gave their full consent to being interviewed.

## 2.2.3 Research phase one – literature review

The scoping phase of the research was designed to identify the information stakeholders would find useful in increasing ethnic and class diversity in their organisations and to develop a research instrument for conducting the main fieldwork.

As such we firstly undertook a systematic literature review to situate our study more widely in the literature on people from BME and SED backgrounds in the labour market and in employment. The literature review also considered specifically participations rates, patterns of participation and influences on career choice for people from the two subject groups.

### 2.2.4 Research phase one – scoping interviews

In addition to the literature review, this phase included one-to-one meetings with 17 key stakeholders. This phase sought to involve: i) PEIs, ii) Engineering employers, iii) stakeholders directly involved in promoting engineering in schools and more widely and aiming to increase participation rates of under-represented groups, and iv) those with initiatives (e.g. ambassador programmes) which could assist in achieving the practical aims of the project. It was agreed that the key stakeholder sample would seek to reflect some of the main professional engineering institutions, a number of engineering employers from a range of industries (e.g. aeronautics, automobile industry, energy sector, construction) and other organisations interested in the topic. These were to be chosen partly on practical grounds but also in order to be able to offer a geographical spread; for example, to include at least one region outside London. Organisations involved in this phase included four social enterprises committed to supporting underrepresented groups in engineering and/or other professions, six PEIs and six engineering employers, from the aerospace, construction, energy, consultancy, communications sectors and one engineering educational institute.

This phase sought to engage the stakeholders in the process of determining the information they would find useful in increasing ethnic minority/low socio-economic group representation in engineering organisations. It was very much a participatory fact finding phase, which sought to understand informants' perceptions of the key issues and enabled the research team to understand the context of the research.

Each scoping interview lasted about one hour and the majority of the interviews were completed by end of July 2012. The interviews were digitally recorded (with permission) and transcribed verbatim and the interview transcripts were analysed. Most participants agreed to be recorded. The transcriptions were analysed using thematic analysis techniques and emerging themes were identified for further exploration and presented at the Royal Academy's 'Knowledge Sharing - Research and Pilots' event.

One of the aims of the scoping phase of the research was to determine the information key stakeholders would find useful in increasing ethnic and class diversity in their organisations. Below is a list of questions we elicited from the scoping interviews:

- What are the perceptions of people from the two groups of engineering and engineering organisations?
- What can industry proactively do to make engineering more appealing?
- What partnerships can employing organisations enter into to increase diversity in their own companies?
- What kind of working environment would attract BME and socio-economically disadvantaged groups?

These questions were posed to the participants involved in Phase Two of the research and the themes outlined in the findings section address some of these issues.

### 2.2.5 Research phase two – main fieldwork

Phase Two was the main fieldwork phase and was based on the gathering and analysis of qualitative data. It involved two data gathering methods: focus group interviews and one-to-one individual interviews. Phase Two participants were invited to be interviewed mainly through contacts established during the scoping interviews and from personal contacts.

Emergent issues from the scoping phase were used to inform the interview questions for the fieldwork. This phase was designed to establish participants' perspectives on the barriers to participation at the macro (societal/governmental), meso (organisational/institutional) and micro (individual) levels of experience (including government policy, e.g. on education, role models, aspirations, family, stereotypes, organisational issues and support) and whether these barriers were different for different strands of the engineering profession. Another aim of this phase was to identify the impact of the culture of the engineering profession on the representation of BME and SED groups in the profession and whether such barriers are shaped by intersectional experience e.g. ethnicity and class, ethnicity and gender, class and gender etc.

Interviews sought to achieve the following: Elicit information relating to existing initiatives in organisations to remove barriers to participation and determine how these initiatives are applied in practice; identify good practice (if any) in engineering organisations in relation to recruitment, selection and promotion; identify good practice in educational establishments in relation to student recruitment, retention, careers guidance and placement; and determine which strategies for removing barriers are successful and which ones are not – and the underlying reasons for same.

### ***Apprenticeship focus group interviews***

We undertook nine focus group interviews with a sample of young people registered on Advanced Technician Apprenticeships schemes (both BME and white from different socio-economic backgrounds) in Leeds, Liverpool, London and Southampton. A total of 75 people took part in the focus groups. Questions related to their perceptions of engineering and the engineering profession and the influences on their choice of engineering as a profession. We also included questions on their educational and career histories, backgrounds, career prospects, experiences of working in engineering organisations and their experiences of the apprenticeship schemes.

For this part of the main fieldwork, we interviewed 70 men and five women, 64 were from the white ethnic group and 11 were from ethnic minority backgrounds. Clearly the demographic characteristics of the participants in these interviews reflected the general trend in engineering; mainly white and mainly male. A minimum of two researchers attended each focus group and the interviews were digitally recorded and analysed together with researchers' field notes. All interviewees were happy to be recorded. The interviews were transcribed verbatim and analysed using thematic analysis techniques. Each interview lasted approximately one hour.

### ***Individual and further focus group interviews***

We conducted further focus group and individual interviews with a range of participants – A Level students and engineering students; employed, unemployed, self-employed and retired engineers from a variety of backgrounds as well as non-engineers in other technical positions in engineering organisations e.g. mechanics – a total of 65 people. We interviewed people at different points in the engineering qualification process, including engineering technicians, those with Bachelor's Degrees in engineering, others with Masters Degrees and some who were professionally registered.

The interview questions covered a range of themes: life journeys; perceptions of engineering and the engineering profession; influences on engineering as a choice of profession or otherwise; educational and career histories, backgrounds, career prospects and experiences of working in engineering organisations. We questioned those who had left the profession for reasons other than retirement, as to why they had left. Interviewees were also asked to complete a demographic sheet, which identified their demographic characteristics.



Interviewees were given the choice of having the interviews at a time and place of their choosing. The individual interviews were therefore conducted either face-to-face, by telephone or by Skype and all were digitally recorded. One or two researchers conducted each interview. All the recordings were transcribed and researchers also took notes.

Table 1 below sets out the demographic characteristics of those who took part in the individual interview programme. In total 66 people were individually interviewed. 19 women and 47 men, 32 white and 34 from a visible minority, 45 were born in the UK and 21 born outside the UK. As far as diversity was concerned, we would have preferred if our sample had a greater number of those born in the UK, but despite considerable efforts to improve the UK to non-UK ratio, this was not possible. Interviewees were mostly 40 or under (n40), more likely to be married or cohabiting (n41) and as equally likely or not to have children (n32/34). Of the 66 people we interviewed, 38 were educated to degree level or above and 27 had lower than degree level qualifications, e.g. Eng Tech, HND etc.

**Table 1: Demographic characteristics of individual interviewees**

Number of interviewees		66
<b>Sex</b>	Male	47
	Female	19
<b>Age</b>	<=20	7
	21-30	15
	31-40	18
	41-50	18
	51+	8
<b>Ethnicity</b>	White	32
	Visible minority	34
<b>Place of birth</b>	UK born	45
	Born outside UK	21
<b>Family status</b>	Married/civil partnership cohabiting	41
	Single/divorced/separated	25
<b>Dependants</b>	children	32
	No children	24
<b>Qualifications</b>	PhD	2
	Master's degree	27
	Bachelor's degree	10
	Below bachelor's degree	27
<b>Institutional affiliation</b>	Yes	32 (8 professionally registered)
	No	34

### 2.2.6 Data Analysis

The main aim of this study was to better understand the issues and challenges faced by BME people and those from SED backgrounds when considering engineering as a profession. Therefore the findings presented below are not intended to be generalised across a larger population, instead they are meant to provide interviewees' understanding and views of the issues and challenges faced by the subject population in making a career choice for engineering. To do this, we use the 'voices' of our participants in the data analysis, which allows for a deep and meaningful insight into challenges, barriers and opportunities faced by those from BME and SED backgrounds.

### 2.2.7 Dissemination

Another level of stakeholder involvement in this research was the presentation of the findings at the Royal Academy's dissemination and consultation event on 2nd May 2013 at which we elicited more recommendations and suggestions from attendees representing a variety of stakeholders. These suggestions and recommendations have also been incorporated into Chapter 5 of this report, together with our own recommendations and those of participants in the study.

## 2.3 Structure of the report

The first and second chapters of this report have introduced the research and outlined the methodology and methods that were employed in conducting the study. Chapter Three places the study in the context of existing studies in equality and diversity in engineering and seeks to position the study in the wider context of the debate on equality in organisations. In Chapter Four we set out the findings from the fieldwork and in Chapter Five we draw conclusions and make recommendations for increasing diversity in engineering more generally as well as specifically making the profession more attractive to people from SED and BME backgrounds. Finally, with permission, Chapter Six provides two case studies of good practice in two organisations. The case studies demonstrate what can be achieved in a large organisation and a small/medium enterprise.

**This section provides a brief overview of the literature relating to issues to be discussed within the report.**

### **3.1 People from Black and Minority Ethnic and Socio-Economically Disadvantaged Backgrounds in Engineering**

The engineering profession in the UK can be characterised, as being predominantly made up of white males, with over 90% of the workforce being male and, from the limited data available, it also appearing that over 90% of the workforce is white. The profession also has a relatively aging workforce, with a skewed age profile (Royal Academy of Engineering, 2013).

As such it is suggested that significant numbers of staff will be needed in the engineering and construction sectors to replace those who will leave due to retirement or other reasons. The Secretary of State for Business Innovation and Skills (Business Secretary), Vince Cable, has described the dearth of engineers as one of the biggest long-term challenges facing the UK economy (Cable, 2012), whilst Engineering UK have projected 2.74 million job openings in engineering companies between 2011 and 2020 (Engineering UK, 2013). A report for the Royal Academy of Engineering estimates that the British education system needs to double the annual number of university graduates in mathematics, engineering and sciences to meet expected demand (Harrison, 2012).

Against this backdrop, it is important to consider the literature that identifies the choice of career, and barriers to career choice, of individuals. In this report we are looking at this from the perspective of those from Black and Minority Ethnic (BME) and Socio-Economically Disadvantaged (SED) backgrounds.

Hall (1996, cited in Özbilgin and Malach-Pines, 2007) suggests that the choice of a career is a multi-faceted process that includes all spheres of a person's life. The careers of ethnic minority people are thus a function of several interrelated factors. For example, Syed (2008) puts forward a 'holistic perspective' on career choice that recognises the multi-faceted nature of the impacts on the career choices of highly skilled migrants. He identifies economic, sociological and psychological factors.

Other research demonstrates the multi-layered nature of factors that mould the career choices of ethnic minority people. Forson (2007) argues that confrontations and negotiations between the macro, meso and micro factors intertwine to shape ethnic minorities' choice of career.

At the macro level, BME peoples' careers and the careers of those in lower socio-economic groups may be mediated by ethnicity, class, gender and/or migrant status (Brown, 2004). Meso level factors include educational opportunities and experiences (Moore, 2006), careers guidance (Bennett et al, 2011) and family influences (Gottfredson, 2002). However, Whiston and Keller (2004) make a strong argument for the examination of the influence of family on career development to be considered in conjunction with socio-contextual factors such as socioeconomic status and ethnicity.

Much of this resonates with UK Government initiatives to increase the social mobility of individuals (Clegg, 2011). As the Business Secretary, Vince Cable, has identified, ‘an individual’s chances of reaching the top are heavily influenced by where they start off, going on to suggest that ‘[Men] and women with parents in professional and managerial occupations are twice as likely as those with parents in semi and unskilled occupations to end up in professional and managerial occupations themselves’ (Cable, 2012). The Secretary of State augments the ‘meso level’ factors debate by pointing out that although only seven per cent of people attend independent schools, these are the people who tend to reach the top of the professions (Cable, 2012).

The availability of inspiring role models is a key factor in ethnic minority pupils’ performance, enthusiasm and interest in Science, Engineering and Technology (SET) subjects, yet BME scientists are rarely featured in UK science readings or other materials (Frost et al, 2003). This has subsequent implications for micro level factors such as ‘science capital’, which includes strong interest and aptitude in science, technology, engineering, and mathematics (Moore, 2006; Archer et al, 2011). For those who do follow the route into the Science, Engineering, Technology and Mathematics (STEM) subjects and enter engineering, BME role models are still relatively thin on the ground (Royal Academy of Engineering, 2013).

### 3.2 The case for equality and diversity

The concept of diversity applied to an organisational setting refers to having a range of differences among people. If such differences are valued and celebrated within an organisation then a positive diversity belief can be identified, defined by the Chartered Institute of Personnel and Development (CIPD) as “Valuing everyone as individuals – as employees, customers and clients” (CIPD, 2012:1).

There are three main drivers for equality and diversity in organisations: the legal, ethical and business cases.

- The legal case is driven by legislative obligations such as those contained in the Equality Act 2010.
- The ethical case argues that a focus on diversity that sets out to achieve equality of outcomes can help all organisations to engage with their environment and provide them with the opportunity to meet and exceed their obligations to society.
- The business case focuses on organisational imperatives and highlights the contribution of good equality practices to the achievement of organisational goals. In addition to increasing the talent pool, increased diversity in organisations has also been associated with other benefits, including increased creativity and ideas-generation as well as improved decision-making (Watson et al, 1993).

### 3.3 Diversity in engineering

In terms of diversity research and initiatives within the engineering profession, the focus has been predominantly on gender although there have been some signs of moves to include other under-represented groups, such as people from BME and SED backgrounds. One of the challenges for researchers and policy-makers in this area has been the relative paucity of evidence in terms of data and trends. That which is available shows that BME as a group in general are under-represented in engineering, although there are variations within this. For example, a Royal Society report (2005) suggests that people from Indian and Chinese backgrounds were reasonably well-represented whilst those from Pakistani, Bangladeshi and Black Caribbean backgrounds were under-represented. In trying to focus on UK BME groups the picture is clouded by the fact that a proportion of those employed by engineering organisations will be non-UK nationals as the profession regularly recruits overseas talent (The Engineer, 2013). This is particularly true of engineering firms that have a global reach.

In relation to graduates, according to a recent report (McWhinnie and Peters, (forthcoming) there is evidence that BME graduates from engineering and technology courses are likely to fare less well than White graduates. The report suggests that even when degree class is taken into account, BME graduates are less likely to be in full-time paid work six months after completing their courses, with White graduates being more likely to be in engineering and technology, and graduate roles. In addition, McWhinnie and Peters (forthcoming) found that White respondents in their final year were more likely to have had some relevant work experience before undertaking their courses and were also more likely to have undertaken a work placement or internship. Of those BME respondents who did undertake a placement, they were less likely to have met a role model who inspired them.

Whilst exact data on SED or low income backgrounds is difficult to come by, what is available strongly suggests that they fare relatively less well, both in general and in engineering specifically and it is suggested that the professions still lag behind the social curve (Milburn, 2012).

Evidence points to a likely relationship between the early formation of science aspiration and subsequent careers in STEM (Dewitt et al, 2011). OECD (2007) research identified how UK students from migrant backgrounds were more likely to value science highly, to enjoy it and to want to pursue a career in it; however, groups that lack a history of excelling in certain areas are unlikely to aspire to study/work in those areas. The OECD report identifies how these effects are evident in different minority ethnic groups with lower teacher expectations of Black Caribbean children and higher expectations of Asian children. It goes on to suggest that apparent underachievement in science and technology by particular groups is strongly connected to the way society views members of these groups.

An Aspires Project conducted by Kings College reports that personal experiences and a range of emotional, identity-based and cultural factors shape what 'feels right' in terms of careers which means people's views can be resistant to change (Archer et al 2011). This could partly explain the lack of those from BME and SED backgrounds in engineering, as identified above, and highlights how career advice may be of particular relevance for children from ethnic minority and low income backgrounds because children from these backgrounds have limited 'science capital' (Archer et al 2011).



An annual survey carried out by Freshminds Research and commissioned by Engineering UK (2012) to measure the perception held by children of engineering, engineers and engineering careers found there was a low perception of engineering across various age groups. It was however found that improved knowledge would lead to improved perception of engineering. In addition, skills like creativity and communication, very relevant to engineering, were perceived as not particularly important. Despite the fact that engineering was seen as the profession that will contribute towards the country's growth, public awareness of engineers was lower than other professions.

For those from BME and SED backgrounds who do choose engineering as a profession, the meso-organisational factors are likely to have a direct role in determining and influencing their career trajectories (Syed, 2008). Such organisational factors range from organisational structures and culture, recruitment policies and industry working practises. For example, recruitment strategies, especially those of private organisations, can discriminate against BME graduates (Connor et al, 2004). This research found that over two-thirds of organisations had no specific actions to recruit and retain excluded individuals, such as those from BME groups. Where organisations use informal methods of recruitment the BME community is at a disadvantage as lack of existence of networks may mean that they are not aware of job opportunities (Booth et al, 2009). For people from SED backgrounds this may also be the case (Cable, 2012).

### 3.4 Conclusion

The projected shortfall in engineering professionals outlined above provides a clear business case for widening access to the profession to encompass previously under-represented groups. Nonetheless, there are barriers to entry faced by people from BME and SED backgrounds and these barriers are generated at all levels: macro, meso and micro. Some of these barriers may be perceived, however, there are some very real issues that need to be addressed by the engineering profession in order to tap into the potential pool of talent that these people can provide. As the empirical research in the following sections will identify, for people from BME and SED backgrounds macro, meso and micro factors frequently intersect to influence their career choices and progression within those careers.

**This section presents our findings with regard to the barriers to ethnic minorities and people from socio-economically disadvantaged backgrounds entering the engineering profession. The barriers are organised under the seven key themes that emerged from the analysis of the data drawn from the scoping, focus group and individual interviews. These are discussed under the following headings:**

1. Recurrent issues
2. Impact of SED and BME parents on career choice
3. Initiatives and priorities of schools
4. Policies and practices of engineering employers
5. The engineering qualification process
6. Tendency to see diversity primarily in terms of gender equality
7. Policies and practices of engineering institutions

In the discussion outlined under the listed themes, it is quite clear that although we have separated the themes for ease of analysis and discussion, each theme reflects macro (government; culture), meso (organisations; institutions) and micro (individual agency) level interactions and interrelationships. These intersect to differentially impact people at distinct intersections of various demographic and social variables. As such it needs to be borne in mind that solutions for many of the issues we raise will require a multi-level and multi-player effort to ensure success.

Further although our remit was to investigate ethnic minority issues and social class issues, we have found that the two frequently overlap and are conflated. As such both are marbled through our discussion below; however, where required we separate them for ease of analysis.

## 4.1 Recurrent issues

### 4.1.1 Negative perceptions of engineering

Participants generally spoke of four known negative perceptions of engineering (invisibility, dirty, poorly paid and hard). The importance of the perceptions of engineering in relation to people from ethnic minority and socio-economically disadvantaged backgrounds becomes clearer as we discuss influences on choice of engineering as a career.

#### ***Invisibility of the engineering profession***

The invisibility of the profession to the general public was cited by a large majority of participants as one of the reasons why people from all backgrounds were not entering the profession. This related primarily to the fact that although engineering and its products proliferate, there is a lack of knowledge amongst school children, young people and the general public about what engineering actually involves:

*I have been working on many high rise buildings in London and if you ask someone, "who is that building by?", they won't mention my company's name but they would say who the architect is. From that point of view, it's a really undervalued profession*

***(Interviewee 17 - BME Male Engineer)***

*I had never even heard of it before... how large the industry is, it's just in the background, like a building just pops up and you don't think of the people behind*

***(White Male Apprentice Engineer - Leeds)***

Interviewees almost always pitched the invisibility of engineering against the high visibility of law and medicine in particular.

Indeed some of the people we interviewed had never met an engineer until they started their apprenticeships or degrees and described how their desire to pursue engineering wavered because they did not really have someone in the profession to look up to in order to judge what the experience would be like.

Working class apprentices we interviewed in London told us that their communities were unaware of the profession. Participants generally argued that this invisibility of the profession to the general public means that unless an individual has other forms of contact with the discipline, they are unlikely to consider it as a profession.

*If you don't have someone in your family who knows or understands what engineering is, you are not going to do it, especially in the ethnic minority community - then that just continues and continues*  
**(Interviewee 58 – BME Engineer)**

*I think it [having a parent in engineering] would [make a person want to do engineering] because then they would actually know about it instead of like me having no clue and not knowing what it involves, they would be able to have a good idea of what they are getting into*  
**(White Apprentice Engineer – Leeds)**

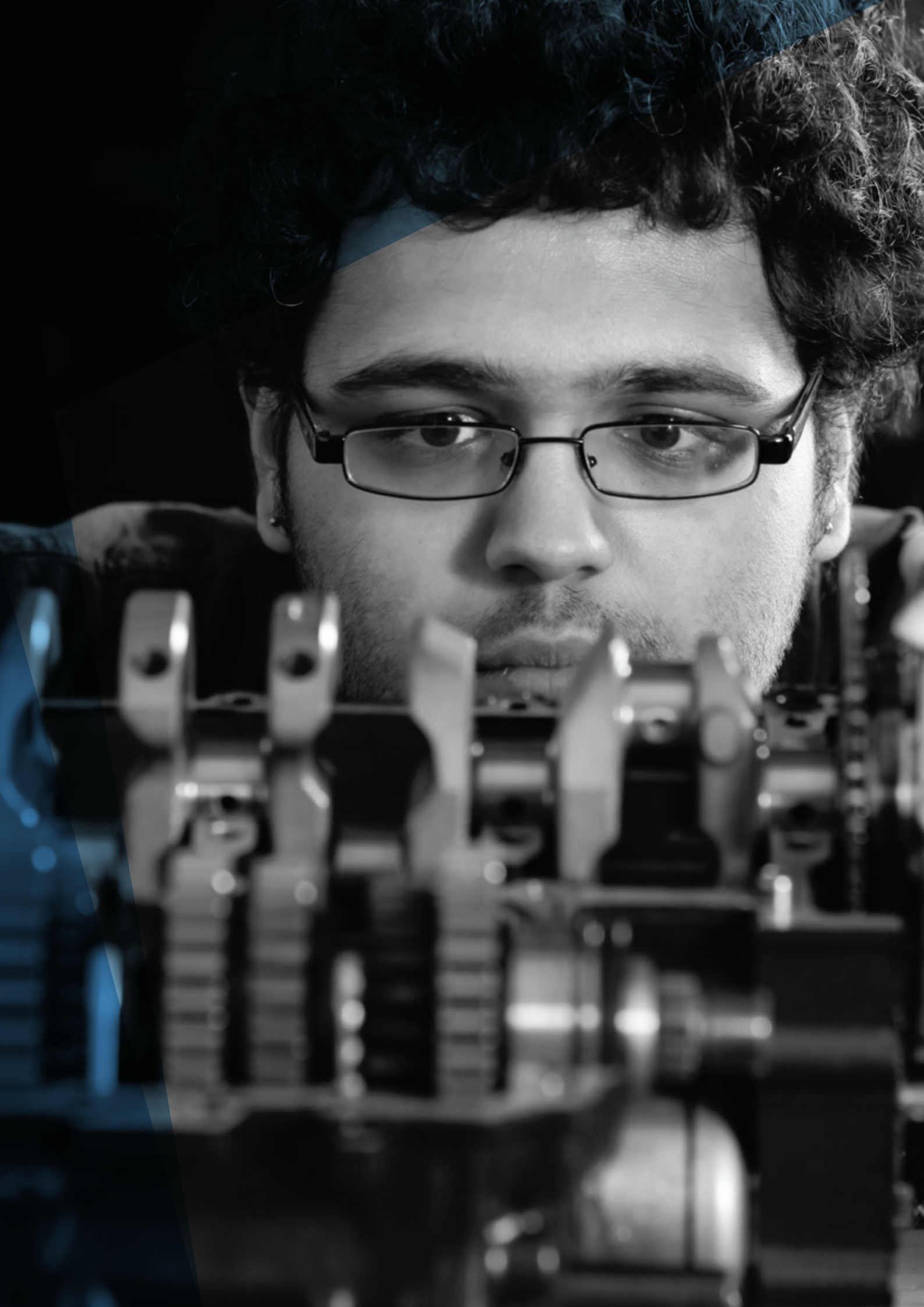
The above quotations seem to suggest that this invisibility has particular implications for BME and SED communities – we explore this further in the next section.

### Interviewee 35

Interviewee 35 is a forty-something year old White British man who left school at 16 with GCSE qualifications. He was always interested in “fixing things, practical stuff and building and anything like that” but “did not have a clue” about engineering and really just “fell” into it through a process of qualification and progression.

He wanted to be a builder and while he was at school his friend’s dad who owned his own building business and every school holiday he would go to work for him – “a fantastic experience” as he describes it. However, he was discouraged by his father from the building trade, so he did an apprenticeship in sheet metaling.

After working for several years, he was sponsored by his employer to study for an engineering degree on a part-time basis at a post-1992 university. He says the studying and working was hard with long hours and night school, however, the degree has given him more confidence and helps him with his research. He is looking to progress even further in engineering and may one day apply for chartered status.



### **Engineering as 'dirty' or 'manual' work**

Another recurrent issue that emerged whilst talking to participants was the perception of engineering as either 'dirty' and/or 'manual' or semi-skilled work. Many of the professional engineers we interviewed acknowledged that there was a general perception of engineering as boring work, which may impact the way people made decisions regarding its value as a career:

*Engineering is not seen as cool . . . most people see engineers as this guy coming to fix the boiler . . . I mean everything in your life every day is engineering and . . . I think it's a social problem in the UK; engineering is not seen as a very glamorous profession, in the UK, not [like] in other European countries*

**(Interviewee 16 - BME Male Engineer)**

However, in the apprenticeship interviews we found that where a family member or friend worked in engineering, the young person's perception of engineering tended to be more accurate. This theme interrelated with a number of others, including the qualification process, the engineering institutions and, in particular, definitions and classifications of engineering. Further, several participants suggested that among the BME community engineering was not seen to be a respected profession compared to medicine or law:

*I think that possibly - and this is just a theory - because they [ethnic minorities] don't feel engineering is anything special. So why bust my gut in a degree in a difficult subject and then pursue a professional career which is difficult as well and then it's not respected?*

**(Interviewee 14 - BME Male Engineer)**

*Another thing I will say being from an Asian background, I know my mum didn't care about this but a lot of families in Asian culture, being a doctor or a banker is the top thing and being an engineer if you work at NASA it's fine but if you want to work at a coal mine, that's not as big*

**(Interviewee 13 - BME Female Engineer)**

The invisibility of the profession coupled with the lack of respect it attracts within the BME community in particular underlines the significance of role models, which was cited as important in attracting people from particular ethnic groups.



### ***Pay disparity compared to other sectors***

Several participants argued that one of the reasons why ethnic minorities and people from working class backgrounds shun the engineering sector, even after qualification, is that the pay is unattractive compared to other sectors, particularly finance and banking. Compared to average graduate starting salaries in other professional sectors such as law (£37,000), investment banking (£38,000) and insurance (£26,000) participants referred to the fact that engineering is perceived to be poorly paid (c£24,000) (Engineering UK, 2013) for the investment that goes into initial qualification, training and CPD. It is no wonder then that finance and business are popular destinations for engineering graduates with an average of 28 per cent of them going into that sector (Ibid.).

#### **Interviewee 5**

**Interviewee 5 (Asian male), a mechanical engineer, always wanted to be an engineer but engineering was not really encouraged in his family. His dad, a test engineer who had experienced inadequate comparative pay, had concluded “engineers don’t get paid that well” and encouraged him to get a profession where he could earn more money, such as accounting. He admitted discovering that his father was right as his peers who have gone into management consulting for example, “get paid way more than we do and you just feel that everyone seems to get paid more.” He believes that “it all comes down to money, I can’t speak for all minority groups, but Asians are driven by being successful, your car, your house and how much money you have.”**

**He believes that one way in which engineering could become more attractive to ethnic minorities is for the sector to address the issue of pay disparity with other professions. In his words:**

**“Well they could make us earn more money, there are a lot of Asians out there who want to be engineers or they could be engineers; you are driven by the nice part of it but some are driven by just wanting security and wanting to have nice things. I have one friend, who is white, he did a degree and worked for a government agency and they could not start a family so they went to Australia and now he is earning twice as much, well I was earning more than him but now he is earning more than me in Australia as an engineer. He wanted to be an engineer but he also wanted to have enough to have a house and a family.”**

It was felt that ethnic minority students, like Interviewee 5 above, whose parents are migrants, are likely to be steered into what may be seen as more lucrative sectors. However, several of the engineers we interviewed, who had defied their parents, talked about pay being a secondary consideration for them compared to the love of what they do.

### **Engineering is ‘too hard’ or ‘too difficult’**

Hogrebe et al (2006, cited in The Royal Society, 2008) argued a negative relationship between low family income and students’ academic performance in mathematics and science, and The Royal Society (2008) have suggested that this may be because parents from less advantaged households are less likely to be involved in the help and supervision of their children’s work at school, rather than differences in education provision. Whatever the cause may be, participants argued that many children from SED backgrounds found the engineering feeder subjects such as mathematics, physics and chemistry difficult, or at least there was a perception that these subjects were more difficult than the more discursive ones. This is despite the fact that many of them, having entered the profession, had concluded that this perception was misleading.

#### **4.1.2 Non-existent, limited or poor careers advice**

Another recurrent theme was the perception that careers advice in schools was non-existent and where it existed, was generally inadequate. Participants who had experienced this first hand gave us examples:

*No I don’t think they pinpointed any careers really, I am twenty now so that was four years ago and all they would say is “if you don’t get your GCSEs you go to this college and do a more vocational course, but if you get these GCSEs you go to that college and then you go to university”. They did not do much with careers advice, it was just you get your grades, you get your GCSEs, you go to college and that’s it*

**(White Male Apprentice Engineer – London)**

*There was not really any encouragement. I remember doing one of these questionnaires, that identifies what career you want and it sort of goes into the computer and I remember doing that and it came back with some sort of engineering thing but I don’t really remember them, I don’t think I needed encouragement*

**(Interviewee 5 – BME Male Engineer)**

With groups that have limited exposure to role models in engineering, accurate, timely and relevant information via careers’ advice is crucial to raising awareness of engineering as an attractive alternative to other professions. Coupled with the negative perceptions of engineering, poor careers advice can create insurmountable barriers to engineering.

#### **4.1.3 Perceived lack of school expertise in feeder subjects**

Echoing some of the findings of the Royal Society report on the relationship between socioeconomic status and participation and attainment in science education (Royal Society, 2008) some interviewees highlighted government funding cuts and the impact of these on the availability of STEM subject expertise in schools, particularly in poorer inner-city schools attended by students from SED and BME backgrounds. A participant who has done some extensive work with schools to promote engineering argued that a lack of subject expertise meant that schools tended to dissuade students from taking higher level STEM subjects:

*Some subjects are difficult to find, the guys who are doing the academic things, they say “oh you are going to be over challenged” when we said we wanted to do Maths, Physics, Biology and Further Maths, it was “you can’t do all four, why not drop one?”*

**(Interviewee 1 – White Male Engineer)**

The participant above then went on to describe the state of STEM expertise in one of the schools he works with:

*Some of the physics teachers that have been through the school have been very desperate. Chemistry has got a spare [teacher] but they have to get back on track with these STEM subjects. The biology teacher...is not good enough... so how can you expect someone like that to teach and to control the classroom and get anything done?*

**(Interviewee 1 – White Male Engineer)**

Some of the younger participants seemed to confirm this view, at least in relation to their particular schools:

*I hated Maths and as soon as I left secondary school, I did well in Maths, college Maths, don't know why*

**(White Apprentice Engineer – London)**

*I like Maths, we have a good tutor, but in school I just hated it, they show one thing on the board and then move on, but now we are learning it*

**(BME Apprentice Engineer – London)**

### 4.2 Impact of SED and BME parents on career choice

The intersection of environment, culture, ethnicity, and class can be seen to influence the choice of engineering as a career. Several reports on career choice and ambitions of young people have demonstrated that young people from all ethnic backgrounds have high aspirations (EOC Moving On Up report, 2006; Healy, Bradley and Williams, 2006). Our research revealed that participants from both SED and BME backgrounds were ambitious, and when they were aware of engineering and understood its relevance to society, they were enthusiastic and interested in the subject. Many of them had an interest in engineering from a young age and explained it in terms of being “good with their hands” or “interested in breaking things and trying to put them back together” as well as:

*I went into engineering because I was good in science and Maths and wanted to do something that would make a difference*

**(Interviewee 57 – BME Male Engineer)**

*I think it was the electrical engineering from physics, from the science lessons that was fascinating and it was the problem solving, this is what you have to try and do and how you get the steps to solve that problem and that is where the interest was*

**(Interviewee 3 – White Female Engineer)**

However, awareness-raising was crucial to the choices that people made with regard to engineering. It was very clear from all the interviews that having a member of the family who was in some sort of technical, mechanical or ‘hands-on’ occupation was a significant factor in the choice of engineering as a profession. Several interviewees had been positively influenced by family members to go into engineering. These people tended to have parents who were from technical/engineering occupations. Some interviewees cited both parents and grandparents as influencing them. Indeed one participant suggested that “engineering is in the blood” (Interviewee 48 – White Male Engineer).

This theme also interrelated strongly with perceptions of engineering. However, while a number of participants stated that first generation immigrant parents saw education as highly valuable, cultural and family awareness and perception of the status of engineering as a profession impacted the direction in which participants were steered. As one example, Asian participants in particular tended to highlight the importance of parental influence in encouraging their children to pursue a 'proper' (i.e. traditional) career, such as in medicine, law or accountancy as described here:

*We organise work placements and it's so hard to get the families to agree to it because they see it as dirty and don't value it*

**(Interviewee 58 - BME Female Engineer)**

*Part of the problem is that people from ethnic minority backgrounds see engineering as dirty, they don't see it as a profession, they see it as mechanical, so if you talk to people, they say "no, I don't want to be an engineer"*

**(Interviewee 54 - BME Female Engineer)**

Participants who were discouraged by their parents from entering the engineering profession were also less likely to have a member of the family already employed in the profession. Parents also encouraged a number of interviewees to enter the professions in which they were able to work for themselves rather than relying on employers and engineering was not necessarily seen as one of those professions:

*In my family, we are very highly educated . . . a big part of the culture is how educated are you? Like education is a big part of your status and on top of that you have the family pressure. So within, like, my family and culture, everyone wants to know what everyone else's children are doing and my parents will be like "engineering"? It has to be law or medicine. You have to be smart and this is what they want you to do*

**(Interviewee 57 - BME Female Engineer)**

*If I had spoken to my dad, he would have said "do a profession which would enable you to practice on your own, don't be reliant on jobs that need the government or large organisations to employ you, do something that you can set up on your own" so that was what he was steering his children to do*

**(Interviewee 56 - BME Male Engineer)**

For those from 'working class' backgrounds we found there was often a lack of parental influence with regard to the academic route into engineering as their parents were unlikely, or unable, to provide guidance that included furthering education through a university. This coupled with negative perceptions of apprenticeships and the complexity of routes to professional qualification made engineering a more difficult career choice.

Linked to influences on career choice is the impact of role models. Typically BME participants and those who considered themselves 'working class' would point out that there were few people "like me" in engineering:

*I saw my [own] situation and also people you saw... well they did not come from the same background as me, council estate, they came from good backgrounds*

**(Interviewee 3 - White Female Engineer)**

*For me no, the perception is still the same, sometimes it's like why can't I see them? Why can't I be the leader? I want to become the person, the minority person or female that can lead people and say "actually you can do this", so they don't think engineer is not for that sort of people. But I have not been there yet, because I have not seen any minority people sitting at the board of directors. I don't know what I can do, I don't have the manual*

**(Interviewee 8 - BME Female Engineer)**

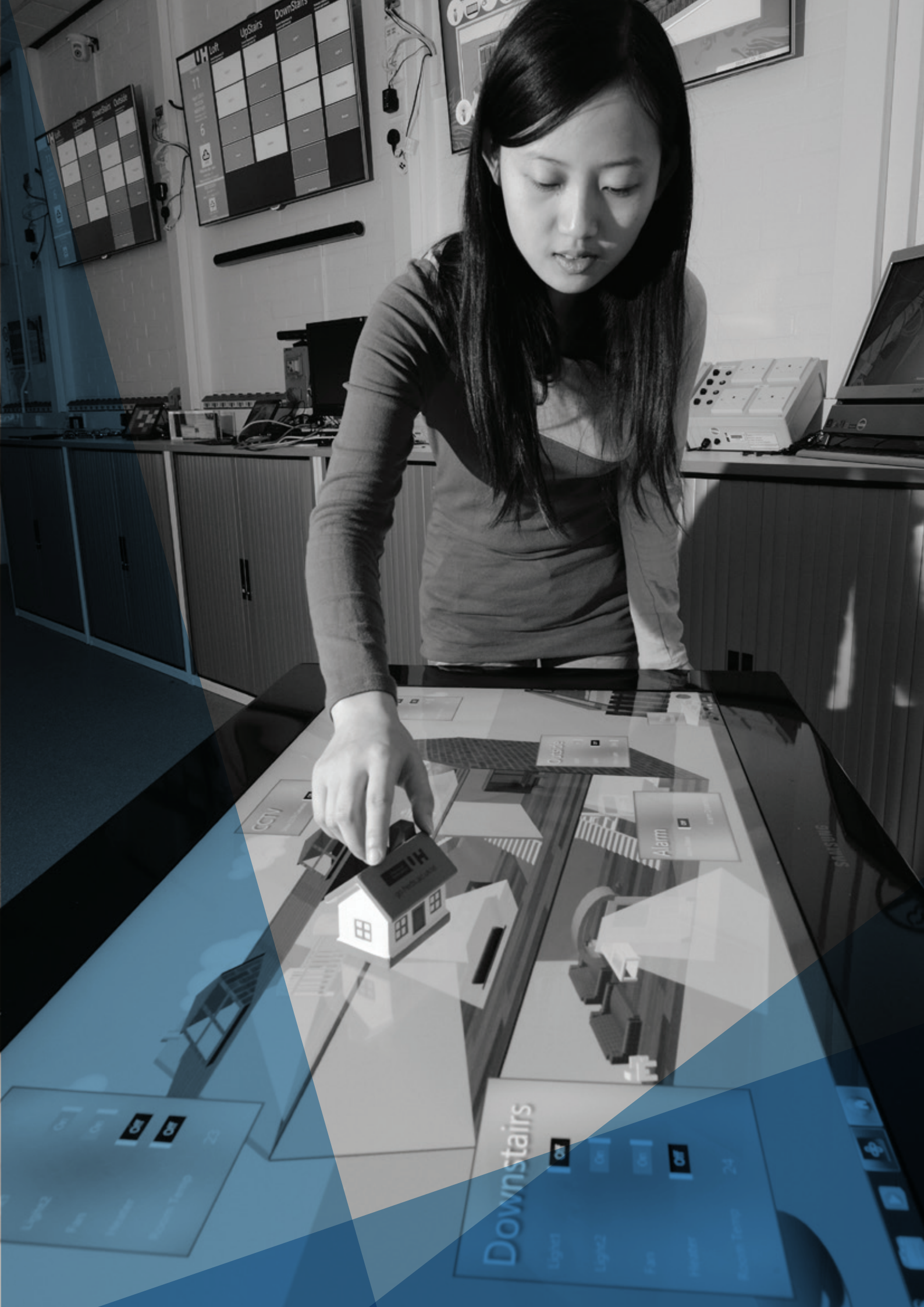
### Interviewee 66

'Interviewee 66' is a twenty-something year old Indian-British man who from a very young age knew he wanted to be an engineer because he was always "*interested in breaking things and trying to put them back together*". This interest was consolidated when his teacher, who was himself an engineer, encouraged him to get involved in the Young Engineer's Project and the Head Start course, a Royal Academy of Engineering sponsored project in which young people embark on a project with an engineer and at the end, present their project outcomes.

Interviewee 66 studied maths, physics, further maths, psychology and economics for 'A' Levels and studied engineering at a Russell Group university. He got a job with a large engineering organisation while he was in his final year at university and is currently working his way towards chartered membership of his engineering institution. Becoming an engineer, as a first generation migrant Indian was a difficult path for him as he was the only one out of 15-20 cousins who had not travelled down the traditional medicine/law/accountancy route. He believes that being an ethnic minority has both helped and hindered him. In his own words:

*"It hinders it [career] in a sense that it's an unconventional direction to head down; it generally does make the family question or wonder why you are heading down that [route], why not accounting or medicine type of thing. At the same time, I certainly do believe that a few of the schemes and places I managed to get on was because of the schemes that were being promoted, especially promoted among minorities - and that might have helped my cause."*





Upstairs	Downstairs	Outside
On	Off	Off
Off	On	On
On	Off	Off
Off	On	On

Loft	Upstairs	Downstairs
On	Off	Off
Off	On	On
On	Off	Off
Off	On	On

Upstairs	Downstairs
On	Off
Off	On
On	Off
Off	On

3D House Model

Upstairs

Downstairs

Loft

Outside

Alarm

Downstairs

Lamp1 [On]

Lamp2 [On]

Fan [On]

Power [On]

Alarm [On]



### 4.3 Initiatives and priorities of schools

Many participants felt that in many schools (most had attended state-sponsored schools) engineering was not promoted as a discipline, although those who had attended more specialist schools were less inclined to think so. There were several reasons for this.

#### Interviewee 3

Interviewee 3 (White female) grew up in a council flat in London and attended a local comprehensive school which had limited careers advice. However, having helped around her father's car servicing garage "taking things and taking them apart" she had already developed a love for engineering that way. She remembers NatWest and Halifax coming to: "*you know, a school of girls, well they are bound to go into banking, typing that kind of thing...so it was like you know what, these girls come from the local council estate; they are going to be working in shops and things like that*". However, there was one teacher who recognised her interest in electrical engineering "*but no one else really took a great interest*".

Pursuit of engineering in university was out of the question because "*coming from a working class background the thought of going on to more education and not actually earning any money to support the rest of my family . . . My mum was like "if you want to go to sixth form, we'll find a way" but ... that teacher helped me to look for an apprenticeship to go into electrical engineering. I had done quite well in my GCSE and he said "you have done quite well so an apprenticeship in electric engineering, a five year contract would suit [you]". So I could get a salary and still go to college, so I could still help my mum and there wasn't that burden. If I hadn't done that, I probably would have gone into sixth form, but not earning a salary would have been difficult and that would have impacted my studies*"

After her apprenticeship, she was recruited by a company that continued to give her day release to study for a degree in engineering, which she followed up with a Master's degree. She now works as a chartered engineer in a charitable organisation.

A number of participants said their school's perception of engineering was that it was manual/semi-skilled work and therefore discouraged the more academically able students from pursuing a career in engineering:

*It was in a state school [my brother] said the teacher there used to threaten them "if you don't do well in your exams, you are going to have to go work with [engineering company name]" and that was the threat she gave to the class that if they did not do well, they would end up in engineering*

**(Interviewee 23 – White Male Engineer)**

Even for others who had attended schools where engineering was valued as a profession, the focus on academic excellence and league tables which, when combined with perceptions amongst some careers advisors of STEM subjects as 'hard', led to the focus being on university entry (to the detriment of other routes such as apprenticeship schemes):

*When my brother said he would go into [apprenticeship], the school wrote to my parents like "it's a bit of a tragedy really; he's a very bright boy. What a shame that he just wants to go into industry" and that certainly was the attitude*

**(Interviewee 23 – White Male Engineer)**

*I think they are very clear because engineering itself is seen as a dirty job already so an apprenticeship sounds like "oh God, I don't want to be in that" but I think the message needs to be clear, that you can go into university but be as successful as anyone else even if you don't go to university. Some of the best engineers I know did not go to university*

**(Interviewee 58 – BME Female Engineer)**

Some participants expressed the view that traditional academic routes into engineering may be off-putting to many of those who would be interested in engineering, because they are technically and practically minded and also impatient to be doing things in practice rather than theory. However, there were some good examples of individual teachers taking the initiative to introduce students to engineering and alternative routes to it other than university:

*I did my GCSEs and really didn't want to go back to school, so I did an apprenticeship. One of my teachers at school told me to look into it... He spoke about engineering and told me about the different options*

**(White Apprentice Engineer – Liverpool)**

*I finished my A-levels and did pretty crap and one of the teachers at my school suggested apprenticeships and pushed me into engineering and it looked pretty good, practical and hands on*

**(BME Apprentice Engineer - Liverpool)**

However, on the whole, schools were generally viewed as obstructive to any route into engineering other than through university. The issue of apprenticeships will be further discussed in Section 4.5.2.

#### 4.4 Policies and practices of engineering employers

This was a large thematic category, which we have subdivided into sub categories for ease of reference. They cover eight separate issues that emerged from the data relating directly to the policies and practices of engineering employer organisations. Before we discuss the themes in this section it is important to highlight the fact that participants spoke of different perceptions of, and cultural disparities between, two types of engineering employers, with resultant implications for approaches and practices of diversity. Engineers with vast experience in the sector spoke of the differences between consulting and contracting firms. These differences were couched in terms of class. One interviewee explained how she was introduced to this at her first job interview:

*Even my interview at [company] I was basically asked the difference between consultants and contractors within the profession and apparently, all consultants are 'officers and gentlemen' and that was from a construction guy who was also middle class himself! Yet the perception is that construction takes everyone and consultants are middle class and clever and have all this wonderful education*

**(Interviewee 9 – BME Female Engineer)**

Some of the apprentices we spoke to alluded to class prejudice in the construction sector towards colleagues who were perceived to be from middle class backgrounds and vice versa:

*I find it the other way around as well; because I find that it is a lot harder coming from an affluent background into construction than it is the other way around because I know one who has a stigma on site like "oh here comes grammar school boy"*

**(White Male Apprentice Engineer – London)**

*I know there is a class issue...there are people from middle class backgrounds that people don't like at work, not because they don't do the right thing but because they are from those backgrounds*

**(Interviewee 54 – BME Female Engineer)**

### 4.4.1 Graduate recruitment practices

Most employer organisations we spoke to admitted to having a preference for conducting annual milk rounds at the Russell Group or traditional universities although a few claimed to have a mix of old and new universities in their annual recruitment rounds. A scoping interviewee we spoke to referred to employers not only recruiting from five to six particular universities but having target numbers for each. Research demonstrates that BME students and those from socio-economically disadvantaged backgrounds are more likely to go to Post-1992 universities (Chowdry et al, 2010) and are consequently less likely to be recruited in these milk rounds. We were told of an example of an engineer from a post-1992 university who went to an interview and was asked to remind the panel what university he went to. When he answered the question, the interview was stopped and he was told that the interview could not continue on the basis of the university he attended.

The employers we interviewed who were engaged in these elitist practices justified their practices by framing them in language revolving around meritocracy and the desire to employ the 'best' and generally felt that their recruitment processes were fair and transparent, and this view was not confined to white managers only:

*If you are good, if I have someone who is good, I don't care whether you are blue or black, whatever colour you are, if you are good and can deliver the goods, I will keep you, if you are not, then I am not keeping you... We are designing some critical stuff, you can't not know*

**(Interviewee 56 – BME Male Engineer)**

One scoping interviewee (employer) we spoke to explained the rationale for only engaging with the universities of Oxford, Cambridge, Warwick, Edinburgh, Durham and St Andrews:

*The standards, the criteria that we set for people to come into the organisation, are really high. We've always been acutely aware of that so typically someone coming to join us as a software engineer, we would be looking for: number one - a graduate; number two - a graduate who really has only straight 'A's throughout their academic background. So these are our main criteria*

**(Scoping Interviewee 11 – Employer)**

The problem is not that the engineering employers who engage in these practices expect high standards in their organisations, the issue is that they assume those high standards can only be found in candidates from certain Higher Education institutions, what the Millburn Report referred to as "a limited pool of talent having access to a limited set of opportunities" (Cabinet Office, 2009, p.7). The value placed on academic qualifications seemed to be dependent on whether the organisation was a contracting or consulting firm. Participants argued that consulting firms seemed to place more emphasis on academic qualifications:

*It's really strange, coming from contractors, because my side is contractors so there are a lot of working class people in that area. If I had gone into consultancy, it would be like "Where did you go to University?" In contracting, "oh Oxford" and it was like "my God, that is the only person I have met who's been to Oxford". I just think oh gosh. I work with people now who are, you know, they don't need to work, it's like "do you have properties in other countries" and it's like "no, just the one I've got" and they are lovely. I haven't really felt class in that environment. You can be yourself, but with consultancy, it's a bit more snobbish, more competitive*

**(Interviewee 3 – White Female Engineer)**

Nonetheless, as indicated in Section 4.52 there was plenty of evidence that some employers preferred experienced employees to those with high academic qualifications with little or no experience.

Furthermore, some scoping interviewees were also aware of the fact that their companies may inadvertently be susceptible to bias in selection processes. They referred to the possibility of selection panels engaging in a “wanting to select someone who looks like me” process without really being aware of it (Scoping Interviewee 11 – Employer). This phenomenon will be further discussed in Section 4.4.7. However, suffice to say here that in recognition of this fact some employers were taking steps to provide training to all recruiters and managers to limit the occurrence of unconscious bias in selection decisions.

### 4.4.2 School engagement practices

There was some evidence of very good practice in this area. Some of the employers were pro-active in engaging with local schools in an effort to raise an awareness of the profession. Depending on the location of the employer, such practice may reach out to those from less advantaged backgrounds. We also heard stories of individual engineers of different backgrounds who were involved in schemes to raise awareness of engineering in schools or had introduced school engagement into their organisations.

However, there was still very strong evidence of employers engaging with what they described as ‘the best’ schools – usually these were fee paying schools. Again this was justified on the basis that those were the schools where one could find the ‘best talent’. Some participants were keenly aware of this practice:

*Some companies select the schools they go to. There was a school that was literally five minutes away from the work place but it was not a work placement school and that is because they thought it was a rubbish school, that's the way it works and some of the young people there I know are capable but don't have the opportunity*

**(Interviewee 54 – BME Female Engineer)**

Indeed one engineering consulting firm we spoke to bypassed approximately 15 local authority maintained schools in their immediate area to raise awareness of engineering in two private schools; one 17 miles away and the other 40 miles away. This lack of engagement with inner city state schools undermines the need to raise awareness in BME and socio-economically disadvantaged groups about engineering. It also had implications for any approaches they took to providing internships and placements for young people from state schools.

### 4.4.3 The requirement for internships and work experience

The requirement of engineering employer institutions for prior work experience for entry jobs was also raised as a possible barrier to the entry into engineering for the groups under enquiry. Engineering firms require work experience prior to hiring graduates and the importance of work experience cannot be doubted.

Although we highlight the lack of visibility associated with engineering as a profession, one of the scoping interviewees also referred to the invisibility of people from BME groups and working class backgrounds to the profession. He argued that there was a need to make ethnic minorities and young people from SED backgrounds visible.

Several benefits were associated with work experience, internships and placements. Given the perceived obscurity of the routes through the profession and the highlighted issues with definitions and classifications of engineering, placements provide students from these backgrounds networking opportunities for them to find out more about the profession and routes into and through it:

*At first, I couldn't see the route, like 'what is an engineer'? When I finish will I be looked down on because I am female or will I be bullied in the class? When I had a summer placement with the environment agency and at that time people in the organization were chartered, although none of these are female but I could see that okay, I have the potential to go through this route or get my Masters so I can get chartered. By talking to the more senior people, they can tell you, "Okay, if you finish your degree it's better for you to do your Masters" so it's important to talk to the right people*  
**(Interviewee 8 – BME Female Engineer)**

*I did some shadowing of engineers and I found that I liked the engineering side of the industry and then Youth Works helped me to get the work experience and got me an apprenticeship, and I got in*  
**(White Apprentice Engineer – Southampton)**

However, it was very clear that participants felt that BME and working class people encountered difficulties in obtaining these placements. Such difficulties were associated firstly with a reluctance of engineering organisations to provide placements or unpaid internships to BME and socio-economically disadvantaged candidates. One senior engineer we interviewed spoke of the enormous difficulties getting employers to give young people work experience:

*I would love to bring more people in that way, I have been banging my head about this at the company for 18 years, saying I can bring in young guys, because you can get some brilliant young guys in who are not qualified but could be useful to the business. I would like to bring in the A-level students [but] I really struggle to get the company to agree*  
**(Interviewee 1 – White Male Engineer)**

The engineers and apprentices spoke of similar personal experiences and those of others:

*It was not easy. Organisations are not willing to take a student. It was very difficult, I spent days and nights. Even before the start of the summer, I started looking for organisations who can do paid employment and just summer, I didn't want to take a year and that is more beneficial for them. At that time, I did the placement program with the Environment Agency. I had experience with the agency and I had worked for them for two summers and I used that experience on my CV*  
**(Interviewee 8 – BME Female Engineer)**

*The young people I see coming in for work placements, for shadow opportunities, they are not from ethnic minority backgrounds*  
**(Interviewee 54 – BME Female Engineer)**

We were given examples of the practice of informal internships where people use their social capital and networks to provide and acquire experience in organisations. Graduates from the communities we are investigating are less likely to have these and similarly are less likely to be aware that these opportunities are available.

*Where I used to work, there was not an official internship scheme, but every summer you would see four or five 15 to 16 year olds coming to do a work experience and it was very informal where you would just speak to HR and say "my friend's son is coming in for two or three weeks", okay and first of all its exposure to the industry because it's not as well-known as other professions, so it gets a foot in the door*

**(Interviewee 55 – BME Male Engineer)**

*We have a contractor working for us and I see lots of trainees coming through, none of them are black and the only black trainee I have seen is an apprentice tradesman, not engineering, and he is from the local authority, so in terms of career engineering, I have not seen any but all these companies do it*

**(Interviewee 11 – BME Male Engineer)**

Indeed several of the apprentices (particularly those from middle class backgrounds) from the Liverpool focus group had benefitted from this practice:

*I got a job because of my mum and dad, the company they are in and it just kind of rolled over into that and into an apprenticeship. I went through the same route as everyone else, but my dad was a project manager for [the company] and my mum was the receptionist, so I just got it that way*

**(White Male Apprentice – Liverpool)**

*My dad is a mechanical engineer and he was one of the managers on the site, so he spoke to the people there and they needed help, so I started working with them and it was more mechanical that I was doing, but I got shown some of the civil stuff*

**(White Male Apprentice – Liverpool)**

*The opportunity came up because my dad plays for a football team and one of his mates worked at [the company] and my dad asked him to let him know him if any opportunities came up and one did and I didn't want to throw it away so I took it*

**(White Male Apprentice – Liverpool)**

#### 4.4.4 Global firms and the focus on international recruitment

The high level of international recruitment in the engineering sector obscures the invisibility of 'home' BME engineers. International recruitment means that global engineering organisations have relatively high numbers of 'ethnic minority' engineers in employment although many of these are not 'home' (UK) nationals.

Indeed we had several employers and engineers tell us that they had a very diverse workforce or team and it was only when we asked them to reflect on the nationalities and backgrounds of those employees or colleagues that they admitted that many of them were international recruits:

*Yes, I worked for [company] a number of years and in my team, I had French, Spanish, a German co worker and they were all the same, university based, middle class foreign engineers*

**(Interviewee 26 – White Male Engineer)**

It is therefore difficult for organisations to recognise that there is a lack of 'home grown' BME and SED engineers in the organisation. Hence there is little motivation to rectify an invisible problem.



### 4.4.5 Class diversity difficult to pin down and quantify

Identifying socio-economic disadvantage is usually difficult within an organisational context. As such capturing appropriate data in order to deal with any issues arising from it is a challenge for many engineering organisations. In particular, it has only been since the coming into force of the Equality Act 2010 that class has become a protected basis of inequality. This, it is argued, has hindered organisational willingness and ability to address class disadvantage. A scoping interviewee (Scoping Interviewee 6 – Education) suggested that although many older generation engineers have come from working class backgrounds they are reluctant to acknowledge their roots as this may be seen as a stigma with regards to career progression. Indeed one senior engineer told us how he felt that his promotion opportunities had stagnated as a result of his class, denoted by language and accent. Asked whether he felt his promotion opportunities had been impacted as a result of his socio-economic background, he responded:

*Yes, I have one at the moment, I have four equity partners, two of them come from high stakes background...I bang on the door for promotion and whether it be the language that I use or the manner, there is that little bit of a barrier there*

**(Interviewee 1 – White Male Engineer)**

Interestingly we were told of young people having an initial perception of engineering as more ‘working-class’ than other professions. Scoping Interviewee 2 (Social Enterprise) told us of a questionnaire that is given to potential work experience candidates from socio-economically disadvantaged backgrounds that his organisation places in companies. The questionnaire asks the extent to which the candidate thinks people in the particular profession will be like them. More than other professions, engineering comes up as the one in which most candidates believe they will meet people like themselves. However, this is before they are placed. After placement, though, engineering is the one profession that candidates say they mostly met people who were least like them. It is quite clear from the analysis of the data in this report that there are complex class issues in the sector but they can only be addressed if they are recognised and acknowledged.

### 4.4.6 Rationale for pursuing diversity

Interview data also points to a lack of understanding of the rationale for pursuing equality in this area. Some participants alluded to two contrasting types of employer organisations: old traditional and younger more modern, with recruitment policies and employment practices to match. To some extent this overlapped with a private versus public (or ex-public) sector divide, with the latter often seen to have more ‘go-ahead’ policies and practices in relation to diversity.

In a couple of organisations in particular there was a strong belief in the meritocratic illusion and it was suggested that the “market prevails” and therefore if people are “good enough” they would be employed:

*As a practice...it's primarily based on skills, the people with the right skills, whether they be black, white, Chinese, anyone on the planet, if they have the right academic credentials and can fit and they have the people skills to do the task*

**(Interviewee 1 – White Male Engineer)**

It was interesting that the same interviewee above was willing to acknowledge discrimination and disadvantage based on class in the previous section but not ethnicity. This interview was valuable in highlighting the relative nature of people’s perceptions. Often participants suggested that their recruitment and selection policies regarding ethnicity were sound and robust, however when probed further, it became clear that BME workers, for example, faced significant issues (see Section 4.4.7) and were more likely to be employed in the non-engineering jobs in the organisation.

Our first introduction to this was during the scoping interviews when, after explaining to a scoping interviewee what our research was about, he turned round and asked us why we wanted to speak to him in particular. He was the person in charge of diversity! Participant engineers also recognised the fact that some employing organisations were reluctant to acknowledge any problems:

*I don't think there is a will, they are aware but there isn't a will, not because they don't want to but it's easier not to*

**(Interviewee 58 – BME Female Engineer)**

*I don't believe that anyone believes there is an issue. I think they have to accept what they really are because at the moment, they don't believe that they are excluding people, because they don't say "I am excluding you", they think that they are not excluding people, but doing nothing doesn't generate anything. I think my perspective has always been "it's all very well that you say all the right things but you are not doing anything"*

**(Interviewee 9 – BME Female Engineer)**

Some companies we were told about actually refused to engage in certain business deals (for example government contracts) in order to avoid having to address any issues of diversity in the organisation:

*In [company's] case, they would exclude public projects and they wouldn't do government contracts so they wouldn't have to answer the questions and that worked to a point...and they basically set up a separate company to deal with that but that is quite common practice*

**(Interviewee 9 – BME Female Engineer)**

One of the questions we asked during the interviews was: "Think about the organisations you have worked for. Can you recall any policies or practices that you think enable black and minority ethnic and/or working class people to get in and stay in?" This question elicited three types of responses. Firstly a few participants interpreted the question in terms of positive discrimination and expressed their disagreement with the idea. Some gave examples of very good practice in their organisations, with specific examples including: links to schools and colleges, wide recruitment nets, the provision of mentoring and the existence of positive role models. We have cited in Section 6 examples of two companies whose diversity policies in this regard, were exemplary.

However, there was a general lack of awareness of equality and diversity initiatives. A majority could not think of anything at all that their organisations did to actively promote ethnic or class diversity, apart from a generally vague awareness of the existence of equal opportunities policies. We probed interviewees about their awareness of diversity champions and support networks for minority groups and most said they assumed there would be some initiative or other but they were not specifically aware of any. Clearly, and with particular reference to the larger global engineering firms, the message of valuing diversity, if any, is not filtering down effectively into the organisations.

### 4.4.7 Exclusionary and discriminatory organisational culture

The lack of BME people and people from SED backgrounds in engineering was also attributed to the overtly male, white, middle-class culture of the profession which resulted in certain practices which were disadvantageous and sometimes discriminatory. We highlight a few in this section.

#### **Recruitment and selection**

Approaches to recruitment and selection often have an impact on the diversity of organisations and progressive organisations will usually lay down principles and policies to limit bias in the selection process. However, many of the engineers we talked to, particularly those from ethnic minority backgrounds had had negative experiences of selection. Some had to change their names, or knew of people who had changed their names to more English-sounding names, in order to get jobs in the sector, while yet others had hidden their 'foreignness':

*I was talking to a recruiting agency that said your name, some people look at your name, oh [foreign sounding surname], oh he will not be able to communicate or socialise because engineering you have to be able to socialise as well. But I will say I occasionally applied for jobs using my middle name and I spoke with a careers counsellor at [university] and she said her husband is Chinese and there is nothing wrong with using your middle name and when I did that then I almost immediately got a job and my friend who works in the City she was also advised to change her name. I don't feel that anyone is going to be particularly racist like "oh she has an African name, she will not get the job", but I do feel like if they can't pronounce my name, they will think "oh I can't be bothered"*

**(Interviewee 20 – BME Female Engineer)**

*I was born in London but I was not British because we moved to Canada, so technically for a while I had two nationalities and I would put it on a CV and my dad said no, keep it British and I thought it was unusual but he was saying it from experience*

**(Interviewee 57 – BME Female Engineer)**

Black people with typically English names have experiences of selection which are all too common:

*I know an engineer and she has an English name and a German name and she gets to the interview and people are surprised that it's a black woman and she has had really awful experiences of phone interviews and then people reacting to her because she is black, so even an English name can be negative*

**(Interviewee 58 – BME Female Engineer)**

There are many ways in which interviewing practices can be seen as problematic for people who do not 'fit'. Engineers reported how they had experienced problems getting jobs that they felt they were qualified for and how the goal post would change every time they jumped over one hurdle:

*After graduating, I was really disappointed that when I applied to various jobs, I did not get in, each time they said I did not have enough practical experience. So I went somewhere to get my experience and after getting my experience, I came back and said "right, I want to work in this organisation because I think I have the experience" and it was still the same response and that pushed me to go back and get more experience. At the time thought it was not fair on me when I was asked to go and improve myself, when I had spent considerable time in the field*

**(Interviewee 53 – BME Female Engineer)**





Often these decisions are shaped by cultural prejudice (unacceptability) that is camouflaged in terms of meritocratic inadequacy (unsuitability) as they centre on personality and self-presentation:

*There was one example where my friend had long dreadlocks, and he worked on the factory floor and he wanted to move into an office-based job and he went to do a mechanical engineering degree. He wanted to move into an office-based job, he had a wife and two kids so he wanted more of a career for himself and at the interview, he had the dreadlocks. I think fourteen years and he had never cut them and before the interview he cut off his dreadlocks and he got the job and after that he asked the manager, would you have offered me the job if I had my dreadlocks and people knew he had the dreadlocks and the manager said he would not have gotten the job. He wanted people to look the part*  
**(Interviewee 11 – BME Male Engineer)**

### **Organisational culture**

Organisational culture theorists acknowledge the unifying as well as divisive nature of workplace culture and while “the way things are done around here” (Deal and Kennedy, 1982) can provide organisations with a source of shared core values, it can also prove to be exclusionary as well. Some ethnic minorities expressed a level of discomfort that their often lone presence elicited:

*At that time it was like everyone looked at me, “Oh engineer, black person” but if you go on the shop floor, there are black technicians*  
**(Interviewee 10 – BME Engineer)**

*You fight a two prong attack from the work force who think that you don't belong, and then from management. It's not direct but you see through it anyway and that can be much more unnerving*  
**(Interviewee 11 – BME Male Engineer)**

Culture of a profession can also define the image of the archetypal employee. Some of the definitions of particular professions can be quite narrow and a scoping interviewee stated that these definitions can be mixed up with cultural artefacts:

*It is about risk, it's about accent, it is about dress code, it's all these things, the idea that “you are or you are not what our clients expect and if you are not what our clients expect then I couldn't put you in front of our clients”*  
**(Scoping Interviewee 2 – Social Enterprise).**

As such, one interviewee had been uncomfortable as a Sikh in one organisation and therefore had to change the way he dressed. He had reverted to being more overt in his religious dressing, however, since moving organisations:

*I used to tie up my beard to try and look all professional...and it's not something I particularly wanted to do but I felt like if you don't do it, you would look a little bit out of place or you would not be accepted and while I was at this [new] organisation, I decided I would not tie up my beard and no one said anything, people accepted it so in this organisation that I am in now, I feel very comfortable but probably because it is a fairly academic environment and in some other organisations they might frown upon it*  
**(Interviewee 5 – BME Male Engineer)**

### **Racism**

Sadly, organisational culture also absorbs the values and assumptions of the broader society and research continues to suggest that racist attitudes and prejudices are deeply embedded in some sections of British society although overt racism is less frequent nowadays. As such racism and cultural insensitivity can shape organisational culture. We heard some horrendous stories of 'everyday' or 'banal' racism and cultural insensitivity, although thankfully these were not common.

#### **Interviewee 4**

Interviewee 4 went into the engineering profession as an apprentice electrician. His dad was an electrician who came from the Caribbean. Interviewee 4 left school at 17 and at that point he just wanted to play football and be in a rock and roll band but he went to be an apprentice at a company where his father worked. His story provides an interesting outline of his analysis of how the intersection of class and race impacted him:

*The industry was very openly racist, openly sectarian, and very separate. People got by, electricians, they were in the club but were not really given full membership and that is still the same today. The company, for an apprentice, was an excellent company. When I finished my apprenticeship, I became an electrician and I hated it . . . as a young black male in a very white environment, still being passed over for everything. I was twenty one, twenty two and my goal was to go out and become an engineer. I actually contracted and I was working at [company] for a year. I then kind of got myself together; it took me about five years to go back to college and qualify as an engineer.*

*I worked at [company] for a few years and that was one of the most racist environments I have ever stepped into. [Company] prided itself on being champions of equality [but] they count numbers, like the tea ladies, the cleaners, the majority are immigrants they are not indigenous and they say "we are good in diversity because we can count diversity across the board".*

*Luckily I had a great boss who was a fantastic guy, intellectual and really, really bright. He did his best and he put me on courses which helped my career, which no one else did. He was a white guy, he had no kind of reason but he just looked after. He was more working class, we had a lot in common in a funny sort of way, we were both musicians on the sly. We had conversations and enjoyed each other's company and he would tell me things that were not even obvious to me.*

*[Where] I started all the engineers were dressed in suits and ties. We had a call [for an engineer] and this woman said "leave the tray outside" and I said "I am not here to scrub the floors" and she reported me for being rude. John said she didn't mean it but I said "what didn't she mean? What is it about me that she thinks I should be bringing her tea and cookies?" [Company] have these titles associate directors, directors; I thought it was designed to show a career path, but it's not. I know a few black guys, engineers, who have never gone further than associate or director or whatever and they deserve it and that is one reason why I started my own practice. I left [Company] in 2000 and I don't know what it is like now but you go in and you might see a few black people, couple of women, not many.*

*Now I have my own practice, going four or five years, we do okay. I am not satisfied, but it's doing what I want to do which is run my own show, where no one can judge me, but still I have to go to meetings, construction sites and racism is still there.*



### 4.4.8 Externalisation of the problem of lack of ethnic/class diversity

Another issue that evolved from the data was the tendency of the employers and institutions to externalise the problem of ethnic and class homogeneity in the sector. Many of the interviewees highlighted the fact that there were limited numbers of ethnic minority children and those from socio-economically disadvantaged backgrounds in the educational pipeline that feeds the profession. Typical comments included:

*We need to create a more diverse pipeline*  
**(Scoping Interviewee 15 – Employer)**

Others referred to the belief that they had a “*narrow pool to choose from*” (Scoping Interviewee 10 – Employer) and the need for schools to influence and interest young people in STEM subjects and engineering (Scoping Interviewee 12 – PEI). As such there was an inclination to see the problem as external to the employer organisations and the institutions. Clearly this attitude is not helpful in engendering a desire to scrutinise internal processes and procedures to identify if there are any internal triggers, and externalisation hampers the willingness to find internal solutions to these issues.

### 4.5 The engineering qualification process

This theme links to the one above, as well as to others such as the engineering institutions. The tendency of schools to push the academic route in general, and of the engineering institutions to do so in relation to engineering specifically, has led to a number of outcomes including the downplaying of the apprenticeship route and perceptions of the traditional academic route into engineering (and subsequent chartered membership) as lengthy, complex and costly. This was perceived by a number of interviewees as a barrier for youngsters who needed to immediately earn a wage rather than follow a university route into work.

#### 4.5.1 Routes into engineering

In the UK there are three levels at which one can become professionally registered with an engineering institution as an engineer (See Figure 1 below). The first is at the level of Engineering Technician (EngTech), which requires an Advanced Apprenticeship (Level 3) qualification provided by Further Education Colleges and other independent providers. Secondly Incorporated Engineers (IEng) level are candidates who have completed a Bachelor's degree (Level 6 - usually BSc or BEng). Finally Chartered Engineers (CEng) registration requires a Level 6 qualification plus a Master's degree which takes the qualification up to Level 7. At all levels there are specific competencies and skills criteria that candidates must meet to qualify for registration.

Some of these competencies are acquired post qualification through work experience under the supervision of an experienced engineer. As new engineers gain knowledge and experience, they are assigned more difficult projects with greater independence to develop designs, solve problems, and make decisions in order to acquire the competencies required for the level at which they want to register. In order for an engineer to register with an institution they have to be a member of that institution. Membership fees for engineering institutions are usually free for student members and subsequently vary widely depending on the level of membership and the institution – In 2013 membership fees were as follows: ICE (£58-£347); IChemE (£75-£164); IMechE (£23-£258); CIHT (£38-£166). Registration fees range between £15.80 and £32.50.

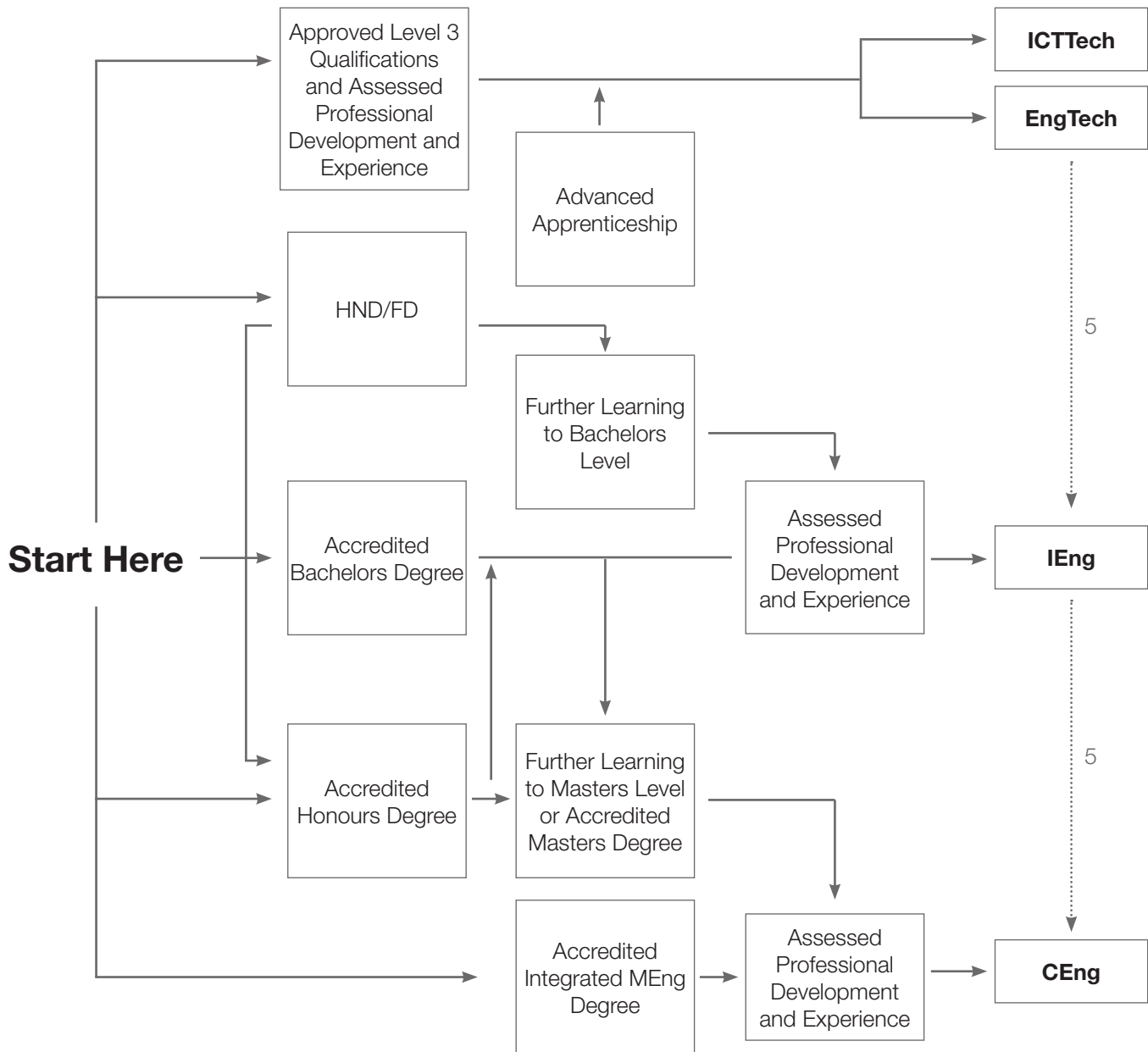
The scoping interviews suggested that many apprentices found it difficult to navigate the qualification process and sometimes were unsure of where the journey would lead them and what the next steps would be. Participants confirmed this, suggesting that the process of qualifying to be an engineer was quite complex and particularly for those who had no engineers in their networks to help navigate the process:

*Even the route, the [chartered membership] and all those sorts of things, it's a minefield . . . That's why I think apprenticeships are great, especially for a working class background, once you get mentored by people in those fields, they will say "have you considered this?" It can be far more applicable*  
**(Interviewee 3 – White Female Engineer)**

However, although this was true in some cases, some apprentices demonstrated good insight and awareness of where the process could lead them. One participant recognised it as “just a different career path and you can build up from the bottom of the ladder and I think you are actually better-rounded than someone who has been to Uni” (White Male Apprentice- Southampton). Others recognised that their current managers had also come in through the apprenticeship route and they were now the “top man”.

**Figure 1 – Standard Routes to Registration**

*Standard Routes to Registration as a professional Engineer or Technician*



**NOTES:**

1. This is a summary diagram; for full information see UK-SPEC <http://www.engc.org.uk/professional-qualifications/standards/uk-spec>
2. In all cases registration is dependent on demonstrating competence and commitment at a professional review.
3. If you do not have to the qualifications shown here there are other ways of demonstrating the necessary knowledge and understanding.
4. For details of qualification levels see <http://www.gcd.gov.uk> and <http://www.scgf.org.uk>
5. It is possible to progress from one registration category to another.
6. The different elements shown here are not necessarily sequential and some may be undertaken concurrently.

Source: Engineering Council – <http://www.engc.org.uk>

## 4.5.2 Apprenticeships

Another issue that emerged regarding the qualification process was the fact that the apprenticeship route tended to be viewed as second class – poorly perceived. Some interviewees talked about the existence of a hierarchy of qualifications. One participant argued that the Institutions made it more difficult to qualify for registration if a candidate did not have a degree – non-degree holders had to jump through more hoops for membership and that the process was too long:

*It is a barrier, because, they have a degree as the minimal qualification. It means anyone who does not have that minimum qualification, cannot progress and as for the other route, they say there is an alternative as well but you need 30 years of experience. I think there is too much emphasis on just getting a degree, you need some working knowledge otherwise it's all just theory*

**(Interviewee 21 – BME Male Engineer)**

Considering that for many people from socio-economically disadvantaged backgrounds university attendance, with its associated debt accumulation, can be a barrier to achieving a qualification in engineering, many saw the apprenticeship route as the only way to enter the profession:

*I couldn't afford to go to college because I needed to work and learn at the same time, so I could live a nice comfortable life. If I was at college, my mum would not be able to support me as a 19 year old, so I can't go to college and support myself at the same time*

**(White Male Apprentice – London)**

In spite of the above, several of the apprentices were acutely aware of the fact that apprenticeships were not accorded the same value as degrees. They suggested that this view was held by schools, parents and careers advisers:

*I came home and said to my dad "I want to do an apprenticeship in electrical engineering" and he said "you don't want to do an apprenticeship that is what people do when they fail their GCSEs". So even my dad had that perception*

**(White Male Apprentice – Leeds)**

*I think there is an outdated view of apprenticeships and when you say you want to do an apprenticeship, it's like "why do you want to do that?". They think you want to go and be a mechanic or something. If you are a high achiever in school, it's like well "why would you want to go and do that? You can do these GCSEs or whatever" and they don't realize there are other routes that can get you to the same place as Uni.*

**(White Male Apprentice Engineer – London)**

Apparently this view was also held by the engineering organisations that had employed them, although their employers tried to be strategic about the use of the term 'apprentice', engaging with it positively or negatively as the situation warranted:

*Even at my work, they don't like to call us an apprentice, they say "oh he is a trainee engineer" they don't say, "oh this is [supervising engineer's] apprentice", it's trainee engineer*

**(White Male Apprentice – Leeds)**

*If they want to sound like they are bringing young people in to train them up, they will call it an apprenticeship but if it's to someone in passing and they'll get their money, then they give it a job title*

**(White Female Apprentice - Leeds)**

Nevertheless almost all the apprentices spoke of their experiences of the scheme in positive terms.

### 4.6 Tendency to see diversity primarily in terms of gender equality

One strong factor that came out in the scoping interviews was the focus of diversity initiatives within the sector on gender equality. This focus came through in many of our interviews. Indeed discussions on engineering-related equality issues almost always seemed to revert to a discussion on gender equality. It was the rare employer interviewee who did not try to demonstrate a good track record in diversity using gender initiatives as justification and there were many examples of good practice, both in the Engineering Institutions and among employers. One interviewee suggested that this may be because it was an easier issue to address:

*I think there is awareness; it's slowly becoming an awareness; because lots of organisations are pushing the agenda forward but I think that the engineering industry has chosen to focus on gender because it's easier to solve the problem. People choose, I don't think that they don't notice, I think they choose the easier route. I can recruit 15 women and show I am diverse, now I have to go to Peckham and recruit one or two, at the end of the day they are not going to do that*

**(Interviewee 54 – BME Female Engineer)**

The research team is of the view that this focus on gender might result in several issues that negatively impact other strands of inequality. Firstly successful gender equality initiatives may lead to complacency around other forms of inequality. In recognition of this a scoping interviewee (Scoping Interviewee 8 – Engineering Institution) told us that her institution had made the decision to broaden their diversity focus into disability and the needs of their international members.

Secondly, a gender focus may treat women as a homogenous group resulting in a perception of gender as the only basis of inequality in *all* women's lives. As such the needs and experiences of women whose lives and work experiences are shaped by other strands of inequality such as ethnicity (ethnic minority women) or class (working class women) may be neglected. Further, we should add the proviso that translation into practice of gender equality has been slow and partial, i.e. even if the key issues have been identified, problems remain. To date less than ten per cent of engineers are women and with regard to pay, women engineers, on average, earn less than men in all the engineering sub-disciplines except chemical, process and energy engineering where women graduates earn a little over £1500 more than the average engineer graduate salary (Engineering UK, 2013). However there is evidence to demonstrate that across all sectors there are ethnic disparities in the gender pay gap (Longhi & Platt, 2008).

Finally, issues related to BME and class disadvantage may be eclipsed. We were told by one institution in the scoping interviews that although they collected data on their members with regard to gender, they did not do so with regard to ethnicity. This was justified on the basis that they needed to be responsive to the sensitivities of their international members in countries where ethnic conflict made divulging of ethnically sensitive information potentially disadvantageous, or possibly dangerous. However this practice makes it difficult to disaggregate data by different equality strands and has the potential to undermine the ability of organisations to identify, let alone address, ethnicity and class issues.

## 4.7 Policies and practices of engineering institutions

Two contrasting perceptions of the engineering institutions could be discerned: some saw their role as positive in terms of encouraging professional development and these participants valued membership for providing enhanced career development opportunities and for providing guidance and navigation through the qualification process:

*The first day we came here, there was a guy from the ICE and he said "I knew a girl who after five years of doing this, she was a chartered engineer" which is more than you can do out of university and most people want to become chartered ... if you show people that career path, it's not just being an apprentice, once you finish your apprenticeship, ... you can constantly progress in your career because you have the ICE and you can get more qualifications and you can have all those things on your CV and qualifications and get all those letters behind your name*

**(White Male Apprentice Engineer – London)**

Others questioned the relevance of the institutions or pointed to their multiplicity, with a resultant confusion as to their perceived benefits:

*In aerospace, there are so many disciplines between mechanical and electrical . . . but it doesn't really mean anything other than that you are part of a society where you follow a set of guidelines but it doesn't have as much weight as other sectors*

**(Interviewee 13 – BME Female Engineer)**

There was some evidence of the institutions being seen as 'exclusive' in that they are dominated by white men but also that they were reluctant to open their doors to those from the less traditional engineering routes and that they were partial to those with higher academic qualifications as opposed to experience:

*My other son, he is a proper engineer. When I look at his route, within such a short time, the engineering institute accepted his charter because he has a PhD and here I was with my HND, all this experience. Okay he is highly qualified but he is still green in my view, he is still green. This is where our own institutions don't help people and something has to be done.*

**(Interviewee 21 – BME Male Engineer)**

More than one participant had felt 'snubbed' by an institution who either refused to recognise their qualification route or, in one case, said the person was 'too young' to join. These were people who, as a result, decided they could function well without belonging to an institution. A civil engineer (MEng) who has been working for thirteen years said:

*I never got myself chartered. I would like to get myself chartered, I think there is a little bit of fear, they make it so difficult, they have so many hoops to jump through and doing that and having a small family, I wonder if all that effort is worth it. It makes me regret going back into engineering sometimes because of frustration with the way they make you jump through hoops*

**(Interviewee 14 – BME Male Engineer)**

Although all of the apprentices we interviewed were student members of their respective institutions, only approximately half of the 63 people we interviewed individually had engineering institution membership. Indeed one of the scoping interviewees argued that apprentices were usually not aware of the fact that they could register as EngTechs with the engineering institutions and suggested that perhaps this may be as a result of a 'deliberate' failure of the PEIs to communicate these messages to the candidates.

A final important issue raised with regard to institutions was that individual institutional diversity policies were not grounded within the greater context of increasing diversity throughout the profession, but seemed to be more focused on localised initiatives to increase membership. An institutional diversity committee member pointed out that the remit of the committee did not include engagement with employers or other institutions.



The scoping interview phase of this research sought engagement with stakeholders to identify the information that would be useful to them in increasing diversity. The phase generated four questions from the stakeholders. One of the findings from our interviews highlighted earlier was that ethnic minorities and people from socio-economic backgrounds have clear views about the problems in the sector. In this section, using data from conversations with participants, we outline answers to some of the questions stakeholders posed.

### 5.1 Perceptions of BME and SED communities and parents of engineering and engineering organisations.

The data in Section 4 has indicated that there are four main perceptions of the engineering profession and engineering organisations:

- Engineering is invisible
- The profession is viewed as poorly paid 'dirty work'
- Engineering and its feeder subjects are difficult
- Engineering organisations and institutions are elitist and ethnocentric in some of their policies and practices

Given the above perceptions of the groups who are the subject of this study there is a need for industry and the profession to proactively work with people from SED and BME communities to make engineering more appealing.

#### 5.1.1 Recommendations

##### *Engage with communities, including parents*

Clearly the perceptions of engineering and engineering organisations highlighted above are shaped by a number of factors including the individuals, families, schools and the industry itself. For potential engineers in the two underrepresented groups, the lack of role models in the 'professional' engineering category means their perceptions are being shaped primarily by schools, parents and families. Coupled with the strong influence that parents from certain ethnic minority groups have over their children, it is clear that engineering organisations need to engage proactively with schools and children but also with parents and the communities. As the following participant suggests:

*The communities themselves have a negative opinion of it so you have to do a lot of enlightening of the communities rather than just the students. The students are the future, they should be told about it in schools perhaps and the parents should be hearing about it too. [They] waste money advertising when [they] should be doing, and doing careers fairs... I think the parents need to be educated too*  
**(Interviewee 7 – BME Female Engineering Student)**

This means that any industry initiatives aimed at school engagement must involve parents as well.

### ***Provide placements, internships and work experience opportunities***

At the level of the individual students, we have also highlighted the issues raised by participants regarding the importance of placements, internships and work experience and the challenges encountered by young people from these groups in obtaining such opportunities.

Placements and internships can provide potential recruits with a true perspective of the profession in terms of its realities, and information on routes into and through engineering. Consequently candidates will be able to make informed decisions regarding careers in the industry. The participant below outlines how real experience in the industry can help with decision making about pursuing a career in it:

*I think like at school, we were specialist and we did the engineering course and four people went to do an apprenticeship in engineering, this place in Rotherham. I think because we did a course in it and we did it for two years, we could make an informed choice, but if you just did Maths and Science and say "I want to do engineering", it's like walking blind*

***(White Male Apprentice - Leeds)***

Another value of placements, internships and work experience is that they expose candidates to role models in the profession that they would not normally encounter in their everyday lives:

*One was my line manager; she was a woman like me. Although not chartered and she said, "It's important for you to study, don't just finish your degree" (and at that time, the rules had changed) "when you want to become a chartered civil engineer, you need a Master's degree". The requirement had become a bit stringent, so the law changed when I finished a bachelor's degree. She told me if I want to become chartered, I have to do a Masters. Prior to that a bachelor's degree could become chartered, so it was this route in front of me*

***(Interviewee 8 – BME Female Engineer)***

The little ethnic and class diversity in the profession that there is will provide role models for future generations, in the way envisaged by Interviewee 55 a Black African Electrical Engineer, who described the effect role models have on ethnic minorities in the profession:

*When you see a black person or BME person represented, you think "oh if they can do it, I can". The example of seeing someone of ethnic minority in leadership is powerful.*

Placement opportunities ensure that, in the context of the ageing profile of the profession highlighted in the literature review, organisations can proactively and positively influence talented individuals from these groups and shape them for the future. Indeed the participant below who has experience of placing students in professional organisations emphasises the brand loyalty that a good experience within an organisation can engender in the individual:

*a young person...that experience you have at age 16, 17 its usually...the brand loyalty of the students we work with is phenomenal...They complete their degree and they want to go and work for Shell because Shell took them for work experience and they've never done anything like this before and it stays with them*

***(Scoping Interviewee 2 – Social Enterprise)***

We are conscious of the negative publicity that unpaid internships have had because of their potentially exploitative and exclusionary nature (Randle, Forson and Calveley, 2015). However, used transparently and appropriately, they can provide benefits to both candidates and the organisations and it is important that young people are helped to understand the context in which internships operate.

It should be recognised that placements and/or internships provide an important advantage for young people of all backgrounds in gaining future employment. However, currently they are hidden and informal, which raises a particular barrier for people from the two groups in this study. As a first stage therefore, there is a need for engineering organisations and institutions to formalise the processes and procedures for setting up and implementing these employment experiences.

Secondly, reaching a broad base of people will require a robust and sustained engagement with the communities in which they live. This means organisations and institutions will have to be innovative about how they communicate the existence of these opportunities.

### 5.2 Employer and PEI policies and practices

We have discussed in Section 4 how interviewees, particularly those from BME backgrounds sometimes found the profession and its employers unwelcoming to people whose faces or social and cultural norms did not 'fit'. As such our recommendations in this sub-section will outline ways in which engineering organisations might change their environment to attract and accommodate people from diverse backgrounds.

#### 5.2.1 Recommendations

##### ***Taking stock: collect and analyse disaggregated statistical data on different strands of equality protected characteristics***

Hard data that provides evidence of how organisations are doing is important in the battle against homogeneous organisational cultures. It is therefore important for both PEIs and employers to regularly collect, monitor and analyse demographic data at all stages of the human resource management cycle and act upon any issues this raises, as appropriate. For example, are BME candidates and employees:

- Being shortlisted, interviewed and selected at the same rate as other candidates?
- Accessing sufficient and correct training and development opportunities?
- Progressing as expected through the organisation?

The data collected will require disaggregation in order to determine intersectional impacts of organisational policies and practices. This will also help to eliminate the inability to identify the absence of certain groups.

##### ***Identification and appointment of a diversity champion at the highest level in the organisation***

Research has demonstrated that diversity initiatives need support from the highest levels in the organisation. This should be active rather than passive support and should be communicated across the organisation. To do this diversity champions will need to be identified, appointed and supported in both employing organisations and PEIs.

### **Recruitment and retention**

We have already discussed the narrowness of recruitment procedures and made suggestions as to how these can be broadened with regard to placements and employee recruitment. Positive action is required in this regard. Organisations need to consider, for example, where and how they advertise. Traditional media may not always be sufficient or appropriate and there is a need to broaden recruitment channels as this participant below suggests:

*When you look at Metro, working class people may read that more, they are more graphic, a different audience, if you put more black or minority faces there, they can relate to it. They find out that this employer is quite supportive; I think that is one of the ways*  
**(Interviewee 8 – BME Female Engineer)**

Selection is important in ensuring the appointment of the right person for any position. As such many organisations set in place stringent procedures to standardise the process in order to ensure fair and equitable selection. However, we know that the formulation of these procedures can be inherently discriminatory. This is due to the fact that organisational processes may well be based upon ethnocentric norms (Noon, Healy and Forson, 2013). Further, procedures unfortunately do not always eliminate bias based on culturally determined stereotypes and ideas.

Many organisations still rely heavily on the selection interview which research has shown can be unreliable and sometimes lacks validity (Smith and Lister, 2008). It is therefore important to ensure that all selectors are properly trained, not just in the organisation's internal selection procedures, which may focus on penalty avoidance, but also in cultural awareness that enables selectors to overcome common prejudices.

### **Good Practice – Pre and post recruitment practice**

*Within the company they have different steps, they have a diversity team and their role is to work with HR and make sure the right strategies are in place to capture the diverse talent out there. I know they had training with the assessors, to make sure they have a diverse range of assessors. I have helped out with the assessment day and to help the image of [the company] to get potential candidates. There is training as well; we are trained about unconscious bias and that helps the mentality, so we have those strategies in place.*

*Once someone is in here, we have employee resource groups and I am part of one. They are sort of networks, I am part of a network and one thing we look at is helping [the company] maintain the diversity within the company, so asking members about their development, letting them know about courses that they are unaware of to help them progress in their career*  
**(Interviewee 30 – Mixed Race Male Engineer)**

Research has also demonstrated that people recruit in their own image and mixed recruitment panels are more likely to appoint a more diverse range of people. Alongside this, applicants from underrepresented and disadvantaged groups are more likely to feel comfortable and at ease in the presence of a mixed panel. We therefore suggest that the selection of recruiters should, as far as is practicable, reflect the candidate base.

PEIs' focus on numbers, we have argued, restricts their diversity initiatives to increasing membership. There is a need for PEIs to work in partnership with employers towards the realisation of the benefits of equity and fairness within the profession. PEIs have a significant role to play in promoting good practice in recruitment and selection processes in engineering organisations. For example, they could develop and disseminate codes of good practice in this area. Further marketing strategies should reflect the diversity of the UK population, ensuring that underrepresented groups have visibility.

### *Training*

Training can be a means of promoting equality and diversity in organisations by identifying and developing people from under-represented groups who have the potential for promotion, helping to ensure increased diversity in the higher echelons of the organisation. It can also be used as a tool for promoting integration and inclusiveness.

#### **English Language Support**

**Interviewee 9 (BME Female Engineer) told us about a rail company who, rather than reject candidates if their English writing skills were inadequate, have developed an English Language support initiative that is aimed at helping people from all backgrounds who are struggling with writing reports in English. It is aimed at training all staff, not just ethnic minorities. This practice has been very positively received by staff and as a result had generated loyalty by staff to the organisation**

We suggest that training is used as a vehicle to develop cultural intelligence and promote an awareness of unconscious bias. Cultural intelligence requires sensitivity to the beliefs, values and rituals of different social categories. However this needs to move beyond workplace based training sessions to engagement and immersion within the organisation and the wider community. The work being done by National Grid in this regard is commendable (see Section 6).

However, it is important to note that the tools and suggestions outlined in this section are of limited use in isolation; a holistic approach is required to make them effective. It is clear that change in organisations will be important in the bid to increase ethnic and class diversity in the engineering profession. This will involve levels of cultural change that have been slow to materialise in the past, but which can be engendered through a partnership between engineering employers, PEIs and the Academy.

### **5.3 Fragmentation of diversity initiatives**

Our research revealed a need for engineering stakeholders to partner in order to increase diversity within the profession. Although there were a number of good practice initiatives in the area of diversity promotion and support, which should be more widely adopted, we identified a piecemeal approach to this with pockets of good practice. In particular, organisations demonstrated good practice of partnership in the following areas:

- Schools, colleges, universities
- Social enterprises and charities
- Specialised recruitment agencies
- Engineering institutions and organisations

We suggest that a more co-ordinated industry-wide approach, led by the engineering institutions, is required in order to promote and apply these initiatives.

### 5.3.1 Recommendations

#### ***Engagement with schools, colleges and universities***

In order to encourage a new generation of talent, a number of employers spoke of engaging with schools. However, these schools were not always located in the areas in which the groups in this research would be living. Other organisations told of encouraging their own engineers to go into local schools in order to speak with children. One interviewee talked of the importance of this:

*I think 13 or 14 is a better age to start and I would really like to get to those people. I certainly want to get into the careers fair at the school. I also do get involved with the national physics thing called 'Protons for Breakfast' and it's more physics based but trying to connect the science with their everyday life and you talk and do prompting questions. The biggest problem I've got, with the exception of the Protons thing, which runs in the evening, is everything else is in the daytime and you go up and have to come back, but to me a couple hours in the evening, if it means we get a good evening in for engineering, it's been worth it*

***(Interviewee 1 – White Male Engineer)***

Clearly engineers themselves are aware of the need to go into schools and reach potential recruits early and employers can tap into the kind of enthusiasm that the interviewees above and below demonstrate:

*I spoke to someone about making it official and try to get in early and speak to 15 and 16 year olds and open up the schemes, that is the way to do it, when it comes to recruitment it's too late. They want to employ someone who has already been trained or had experience. When you come to university, it is probably too late because you are just studying*

***(Interviewee 55 – BME Male Engineer)***

Volunteers such as the one above, who works away from his local school area, is giving up his own time to do this. Organisations should arrange for employees to be provided with opportunities in order to undertake initiatives such as the above. Alongside this, organisations need to ensure that their engineer volunteers are properly trained (and rewarded) in order to promote the profession to the highest possible standard. In addition, resources should be budgeted to properly fund outreach projects. We are conscious of the fact that in the current economic climate this may be difficult for some smaller organisations; however, the case study in section 6.2 demonstrates that with innovative thinking organisations can find ways of reaching out to those from less privileged backgrounds. The National Grid Case Study (Section 6.1) also provides a prime example of engagement with a school from a socio-economically disadvantaged area.

Secondly, in the light of our discussion around the relative lack of knowledge and expertise of engineering as a practical application of the sciences amongst certain members of the teaching profession, schools outreach programmes need to also engage with teachers, head teachers and to some extent, governing bodies. School visits to engineering organisations and sites should be actively encouraged, promoted and adequately funded. This will help provide a level of understanding of engineering in practice which can then inform teaching and career support.

With regards to colleges, a number of employers cited the apprentice system as providing a good opportunity for engineering organisations to partner with colleges in order to develop talent. Some organisations mentioned how tutors came for site visits to meet the line managers of their students; this allowed the studies to be put into the workplace context.

Most employers mentioned careers fairs as being a strong link with universities. Likewise, placement students are seen as being important in developing talent. However, in order to reach the groups in this research, we suggest that it is important for engineering employers to widen the pool of universities with whom they have placement partnerships.



### ***Social enterprises and charities***

Our research has highlighted that there are a number of these organisations who have set in place structures which can help promote employment opportunities in the professions to the groups within this study.

As already indicated above, several of our interviewees volunteered their time through social enterprises and charities to raise awareness of engineering as a profession. This was a labour of love for them as they enjoyed encouraging people into engineering. Nonetheless, dependence upon such volunteers is a precarious practice as it relies upon the goodwill of volunteers and to stabilise this practice we suggest that organisations recognise, celebrate and promote this form of volunteering. Yet again, resources (time and expenses) should be set aside for such activities.

Two organisations, Social Mobility Foundation and STEMNET are important players in this field. Social Mobility Foundation:

*...support high-achieving young people from low-income backgrounds into the top universities and professions. We do this by providing a holistic programme of support encompassing internships, mentoring, university application support and skills development to students predicted to achieve ABB or above at A-Level who have been eligible for Free School Meals (<http://www.socialmobility.org.uk>),*

whilst STEMNET:

*...creates opportunities to inspire young people in Science, Technology, Engineering and Mathematics (STEM). This enables young people to develop their creativity, problem-solving and employability skills, widens their choices and supports the UK's future competitiveness. STEMNET helps encourage young people to be well informed about STEM, able to engage fully in debate, and make decisions about STEM related issues (<http://stemnet.org.uk/content/about-us>)*

The expertise of organisations such as those identified above, can be drawn upon by employers in order to develop dialogue with potential recruits from the communities these organisations serve.

### ***Specialised recruitment agencies***

Other forms of partnership that exemplified good practice was an engagement with recruitment agencies who specialised in the placement of workers from non-traditional (white, British) backgrounds.

Our previous research in this area (Healy et al, 2010) identified that larger organisations tend to outsource their recruitment activity to external recruitment agencies. This practice can lead to mis-alignment between the company's own diversity policy and the practices of the recruitment agency. Therefore, it is important that any engagement with recruitment agencies should ensure that:

- i)** only equal opportunities aware agencies are selected to represent them;
- ii)** there is an alignment between the employer's diversity policy and the agency's recruitment procedures;
- iii)** full communication of the employers equal opportunities and diversity priorities to the agency takes place.

### ***Engineering institutions and organisations***

It would appear that there is little communication of good practice in promoting diversity between the different institutions. This is despite the fact that in order to promote the different routes into engineering there needs to be a good partnership between the Engineering Council, the institutions who are licenced to certify engineers, and the employers. In this respect the Royal Academy of Engineering is very well placed to play a central role in providing information, research, analysis and policy support.

We recognise that in the current economic climate organisations may find it difficult to autonomously develop diversity initiatives which can sometimes prove to be quite costly. However, we identified that when employers are prepared to think innovatively and co-operatively about legitimate forms of co-operation (for example, joint funding of media promotions of the engineering profession), they are able to work together for mutual benefit. One such scheme already in operation is the Technician Consortium which has brought together several employer organisations to work together as discussed below.

#### **Partnering for success**

**The apprentices we spoke to were registered on Advanced Apprenticeship courses leading directly to a professional Engineering Technician qualification. The scheme is run by a consortium of key engineering consultancy practices. It has grown from 6 companies and 8 technician apprentices undertaking advanced technician apprenticeships in Civil Engineering at one college in London to over 30 companies and 140 apprentices on courses in Civil and Building Services engineering at 6 colleges across England and Wales, in two and a half years.**

**Although we came across several initiatives to raise awareness of engineering and also help people from disadvantaged backgrounds to enter and progress through the engineering professions, we also came across organisations that were proactively working with young people from these backgrounds.**

We present two examples of such good practice – one from a large organisation and another from a small organisation. We make no claim here to offer the full insight into the range of the work that engineering organisations are doing to increase the diversity of the profession, but we present some examples of work being done by the organisations we spoke to. In the small organisation, we interviewed the senior management team and in the large organisation we spoke to the Diversity & Inclusion Manager. We present the organisations firstly by providing their aims, drawn either from their websites or their own documentation. We then select insights from the interviews that we consider important in the context of this study.

## 6.1 National Grid

### *The company and its diversity policy*

National Grid is an international electricity and gas company, employing 26,000 people worldwide and around 9,800 in the UK. It is the UK's largest utility business, delivering gas and electricity to millions of people.

The company recognises the value of having a diverse workforce and, like many organisations, have actively encouraged the employment and career development of women. Around 21% of the National Grid UK workforce are women and these figures are reflected in most areas and at most levels of the organisation, including at board level. The company recognises that women are still underrepresented in some areas, such as field engineers, and remains committed to rectifying this situation. In 2012 around 9 per cent of National Grid employees were from black and minority ethnic backgrounds. The company aims to create: “A level playing field in the organisation” and promote equality of opportunity in the workplace by initiating “a programme of executive sponsorship and mentoring of high potential female and minority ethnic managers in order to ensure increased diversity throughout the leadership of the Company” (National Grid 2013).

The company states on their webpage that:

*We aim to develop and operate our business with an inclusive and diverse culture, ensuring equal opportunity in recruitment, career development, training and reward for all employees regardless of race, gender, nationality, age, disability, sexual orientation, gender identity, religion and background. Where existing employees become disabled, our policy is to provide continued employment and training wherever practical*  
**(National Grid 2013)**

Of course, it is good to have written policies and practices, but to what extent are they valuable in practice? Some of the workers at National Grid from very diverse backgrounds that we interviewed believed that they were:

*...the equal opportunity and diversity policy has really worked out well . . . To me, it's always been more about the person and what they can do and not their name or whatever and that is the policy that National Grid has*

**(Interviewee 65 – BME Male Engineer)**

*I was part of an intake where there was quite a good number from ethnic minority background . . . so yes in terms of diversity, they actively promote that and you can see in the diversity centre, they have taken pictures of people and especially women in engineering so no I don't feel uncomfortable at all, I feel welcome*

**(Interviewee 31 – BME Male Engineer)**

*...for Black History Month, we went into the schools and carried out science experiments and focused on black engineers and black scientists*

**(Interviewee 30 – BME Male Engineer)**

### **National Grid - 'Engineering our Future':**

Similar to other engineering companies in the UK, National Grid is facing a future shortage of engineers; they estimate that they will need around 1,000 new engineers by 2020 and rectifying this situation is described by Chief Executive Steve Holliday as 'one of the biggest challenges we face as a business' (National Grid 2013). Confronted with this worrying statistic the company commissioned a research project to explore the 'attitudes towards engineering among young people, parents and teachers across Britain' (National Grid 2013) the results of which were published in a report 'Engineering our Future'. The results of the research prompted National Grid to introduce initiatives in order to encourage young people into the engineering profession and two of these help promote engineering to those from disadvantaged backgrounds:

#### **1. Tackling Social Exclusion**

National Grid is currently, in conjunction with a school in the North West of England, piloting a programme which attempts to identify young people who, upon leaving school, are unlikely to go into further education and are likely to have difficulty in finding a job. The school is situated in an area of social disadvantage and has a large black and minority ethnic (BME) student population. The young people, who are selected from pupils across the school, join National Grid on a one-year paid work training programme. At the end of their year, successful students leave the organisation with an NVQ qualification and genuine work experience which helps them with future work opportunities. At the same time, those trainees who demonstrate potential may continue to be employed by National Grid. The programme is now in its second year of running.

#### **2. Work Experience**

National Grid believe that it is important for young people from all backgrounds to gain experience in engineering through a work placement and as a consequence they have put in place a number of different paid work experience programmes. Some of these are for a short duration of twelve weeks whilst others last a full twelve months. For one programme in particular, National Grid work with Rare Recruitment who specialise in working with organisations to recruit people with high potential from diverse backgrounds. In this instance they identify high-achieving engineering university students from BME backgrounds and give them the opportunity to undertake an intensive twelve week placement at the end of their first and / or second year of study. The aim of this programme is to allow budding engineers to gain experience in the workplace whilst again identifying possible recruits for the future.

A second work experience initiative revolves around National Grid's engagement with 'Transitions', a social enterprise organisation who try to match skilled refugee workers with organisations. Working with Transitions, National Grid offers placements to skilled engineers, usually with a first degree from their home country. In the first year of operating this scheme, National Grid provided placements for three individuals, one of which resulted in a permanent job.

At the school level, National Grid is working with The Smallpeice Trust, a small educational charity who promote STEM subjects to schoolchildren. For this project, Year 10 (14-15 year old) students from all backgrounds - who have the ability to study the STEM subjects at A Level - are eligible to apply for a place on a free residential five day training session at National Grid's in-house training centre in Nottinghamshire. These courses run twice a year and the students have the opportunity to learn from qualified National Grid engineers by engaging in various practical engineering exercises and activities. Clearly, the company is looking to generate an enthusiasm and interest in engineering in these young people who are hopefully the engineers of the future.

### **National Grid in the Community: The Young Offender Programme**

Apart from the initiatives outlined above, National Grid was a founder member of the Young Offenders Programme which is now supported by organisations across the UK. Since its incorporation around 2,000 people have been through the programme and statistics have shown that people who have been on the programme are far less likely to offend again. National Grid is the main administrator of the programme which provides work opportunities for young people leaving prison.

### **Conclusion**

National Grid is involved in a number of initiatives which promote engineering to groups from socially disadvantaged backgrounds and to those from black and minority ethnic backgrounds. They provide some excellent examples of good practice and demonstrate a strong business case for promoting diversity in the workplace while also recognising the importance of furthering social justice in the workplace. In order to achieve equality and diversity objectives, National Grid have a dedicated Human Resources team.

## **6.2 ADV Manufacturing Ltd**

ADV Manufacturing Limited is a small manufacturing firm situated in Coventry. The company, which was originally founded in 2010 and has been operating under its current name since 2012, manufactures specialised decorative trim for the prestigious end of the automotive industry. This process involves milling, cutting, sanding, bending and heating of aluminium and stainless steel, as well as the polishing, finishing and packaging of the product. ADV currently employ 165 permanent and contracted people who are employed as automotive engineers, office staff and shop floor workers. Headcount has increased by 60 per cent in the past eighteen months and the organisation is planning for future growth. In this respect, ADV are in the process of developing a number of their young employees, some of whom are in project engineering and they do this through their apprenticeship system. They have been engaged in the apprenticeship programme for two years and currently have eight apprentices in different areas with four more planned for September 2013.

As a small organisation, ADV senior management and Human Resource Department have a very close relationship with their workforce. They have limited funds to support staff development, however, their aim is to utilise on-the-job training combined with mentorship and day release at a local college. Interestingly, ADV do not actively seek out apprentices by advertising, rather they seek out potential within the workplace. If a line manager 'spots' a potential candidate on the shop floor, he/she puts the employee's name forward to the Human Resources Manager who, following discussion with the line manager and senior management team, activates the processes towards apprenticeship.

## The Apprenticeship

Apprentices attend a local college for one day a week. Whilst there, they are mentored either by their line manager or another engineering professional, who provides help and guidance with their coursework and projects. College tutors make site visits to hold progress meetings with the students and mentors. ADV take a keen interest in the development of their apprentices and the HR Manager uses one-to-one meetings with the apprentices to ensure that they are enjoying what they are doing and are 'on-track' with their studies. She also maintains close contact with the college.

ADV have set out a formal contract with their apprentices which both parties sign up to. The company pays the college fees and the students are allowed day release to attend the college though they have to make this time up. There is also a sliding-scale agreement for payback of fees: if the student leaves the company within one year of completion of his/her studies he/she has to repay 100 per cent of the fees. This drops to 50 per cent if the student leaves within two years. In this way, the organisation is able to develop a skill set that they need whilst ensuring that these skills are not 'poached' by other organisations.

## The Apprentices

Most of the staff are local people, some of whom have come through a work experience route via the job centre. Some have very little formal education but ADV have encouraged them to consider developing their careers from 'shop floor' factory jobs by moving into engineering via the apprenticeship route. One example is 'Joe' (a pseudonym), a young man who had no formal education and training and was working in the maintenance and cleaning team. When an issue arose with a newly installed 'robotic' system, Joe demonstrated that he had the ability to help out by making some suggestions. He was then given the opportunity to go on and study Electrical Electronics at college. The company's Automation Engineer is mentoring him and they are very pleased with Joe's progress.

When asked about the programme a young trainee mechanical engineer had this to say:

*'they have put me through college for mechanical, so I go on Tuesdays...if it wasn't for my manager, I probably wouldn't be here, he took a risk and chance with me, he went to the project directors and got me on the team'*

## Conclusion

ADV provides an example of how a small firm with limited funds can help the career development of potential engineers from non-traditional backgrounds in a time of austerity. By seeking candidates from the shop floor they are reaching out to socially disadvantaged youngsters, albeit with a sound business case in mind.



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