

MADE SMARTER

INNOVATION



Making Manufacturing Smarter

A guide for improving diversity and inclusion in UK manufacturing



Delivered by:
Manufacturing Team

Executive Summary

Imagine if there was one thing you could change that would increase the likelihood of better business outcomes eight times, your propensity for innovation and agility six times, high performance three times and double your chances of exceeding financial targets. You'd want to make sure you were in on the action. This one thing is a diverse and inclusive culture¹. The evidence for diversity in the workplace is overwhelming².

In terms of workforce diversity, manufacturing is perhaps almost passable at a surface level: 26% of the workforce are female and 13% of the workforce are from ethnic minority groups. Ethnicity varies across sectors with only three of the manufacturing sectors having better than the whole workforce average ethnic diversity. Digging a little deeper into 2020 Labour Force Survey data, it becomes apparent that representation across roles isn't equally spread.

The benefits of including diverse perspectives in decision making often are being missed. A largely homogeneous workforce often unwittingly excludes others, and a reinforcing cycle develops. To mitigate against the effects, intentional inclusive action is required.

This report has been written for Manufacturers, Technology developers who supply manufacturers and manufacturing and innovation policymakers. Recommendations are based on a series of interviews with recognised thought leaders about manufacturing innovation and/or inclusive innovation; a survey of 80 women in manufacturing; labour force survey data and existing white papers and literature on the topic.

Created in partnership with KTN Manufacturing Team



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¹<https://www2.deloitte.com/us/en/insights/deloitte-review/issue-22/diversity-and-inclusion-at-work-eight-powerful-truths.html>
²<https://www.mckinsey.com/featured-insights/diversity-and-inclusion/diversity-wins-how-inclusion-matters>



If diversity and inclusion aren't proactively addressed, there is a danger that well-intended efforts towards productivity, reshoring and innovation might lead to further inequality.



What Is In This Report?

This report highlights three key opportunities for Manufacturing in the UK.

01

There is an opportunity to **improve diversity in the manufacturing workforce** and to ensure that under-represented groups are included proportionally across roles and activities. Not only is this a moral obligation, but it is also integral to innovation and sustainable growth. Proactive and intentional measures need to be taken to ensure that the gaps in diversity are not exacerbated. Rather than assuming equality of opportunity, under-represented groups should be engaged, enabled, and empowered.

02

Technologies developed by and adopted in manufacturing should be inclusive. Technologies that exclude lead to a less diverse workforce and perpetuate the cycle. By including new perspectives, better innovation can be realised.

03

The unintended effects of technology on workforce diversity should be considered. Women and ethnic minority groups disproportionately occupy administrative and operator positions. If jobs are displaced, attention will be given to who occupies these jobs and the consequences for workforce diversity.

If diversity and inclusion aren't proactively addressed, there is a danger that well-intended efforts towards productivity, reshoring and innovation might lead to further inequality. Systemic bias may be embedded and amplified. This report supports the view that diversity and inclusion implications should be considered in all types of business decision making including technology selection and strategy, procurement, marketing sales and day-to-day operations (i.e., it shouldn't be constrained to Human Resource discussions).

What is Equality, Diversity, and Inclusion?

Equality, Diversity, and Inclusion are often used interchangeably. The three concepts are closely related yet distinctly different. Other terminology like 'protected characteristics' and 'intersectionality' can help us have constructive conversations around this topic.

Equity



Equality means everyone is given the same resources. Equity recognises that not everyone has different circumstances and requires different resources to reach an equal outcome. Leaders have a responsibility to make sure that those who could potentially be disadvantaged are given the tools they need to have fair access equivalent to their peers.

Diversity



Diversity is about celebrating difference and appreciating that a mix of viewpoints, backgrounds, mindsets, and experiences add value. Although measuring diversity is an essential starting point, inclusion is the end goal.

Inclusion



Inclusion means creating an environment where everyone feels valued, welcomed, and accepted for who they are. To create an inclusive environment, individuals need to be aware of their biases and be able to manage them. To see the benefits of a diverse workforce, the focus must be on inclusion as well as diversity³.



Protected characteristics

Protected characteristics are those legally protected under the Equality Act 2010⁴. These are:

- Age
- Disability
- Gender reassignment
- Marriage and civil partnerships
- Pregnancy and maternity
- Race
- Religion or Belief
- Sex
- Sexual Orientation.

Intersectionality

Intersectionality is the term used to describe instances where two or more protected characteristics intersect. Everyone has intersectional characteristics but the term is mostly used to refer to people who identify with two or more under-represented groups. For example, black women or disabled black women. Data shows that intersectionality can compound prejudices and bias⁵.

⁴<https://www.legislation.gov.uk/ukpga/2010/15/contents>

⁵<https://youtu.be/akOe5-UsQ2o>

Data on diversity in UK Manufacturing

Gender, Ethnicity and Disability are just three of the nine legally Protected Characteristics; listed in the Equalities Act 2010. We have selected to focus on three characteristics initially, primarily because there is a need to direct efforts where the most impact can be achieved. Conscious consideration of inclusion for these key areas will go some way towards improving diversity across all nine characteristics.

Data is critical if we are to understand the challenge, prioritise action and measure progress. Currently, data capture is fragmented with different approaches being taken by different groups. Diversity data capture and even diversity itself is not intrinsically the end goal. The *inclusion* of diverse ideas will deliver improved business performance but tracking and understanding diversity serves

as an indicator for inclusion and accessibility and is an important first step. Data can highlight where the action is required and can help us understand which actions are effective and where progress is being made.

A 2021 Make UK survey⁶ of Manufacturers in the UK found that only 67% of manufacturers have an ED&I strategy or are planning one, just 2% of the manufacturers have an average workforce age below 30 and Minority ethnic representation on boards is only 5%.

Figures showing analysis of the Labour Force Survey for 2020 are presented in Appendix 3. These illustrate the percentages of employment in specific sectors identified by two-digit Sector Identification Codes (SIC), and standard occupational classes.

67%

Of manufacturers have an ED&I strategy or are planning one

2%

Have an average workforce age below 30

5%

Minority ethnic representation

⁶<https://www.makeuk.org/insights/reports/manufacturing-our-recovery-through-inclusion>

Gender



Gender has been identified as a priority. It is singled out within the UN's Sustainable Development 7 goals. With women representing 51% of the population, change in this group has the most potential for impact. With just 26% female representation in manufacturing⁷, large discrepancies exist between genders at an aggregate level within Manufacturing and Tech, but true inequality is amplified when we consider the distribution across roles. This varies from sector to sector with discrete manufacturing being most affected (automotive, in particular). With more women in senior roles, continuous manufacturing (chemicals & pharmaceuticals) faces less of an issue. Gender, like disability, is impacted by technology that fails to be inclusive: in terms of its usability and in terms of the role that technology is likely to displace.

Ethnicity



Ethnicity is an area in which inequalities are significant. Although ethnic minority data has been aggregated in our presentation of 2020 Labour Force Survey ethnicity data, it is evident that there is starkly low ethnic minority representation on boards or at senior levels of management for several manufacturing SIC codes. Given the roles, minority groups are more likely to occupy (operator, shop floor) ethnic diversity is subject to the disproportionate impact of technology in terms of job replacement.

Disability



Disability data shows a mixed picture. While manufacturing does not have outstanding performance, it also includes occupations and sectors with higher-than-average employment of disabled people – this may be due to policies of individual firms. While it is hard to produce overall conclusions from this data, it shows that there is a need to be sensitive to disability issues and that Industrial Digital Technologies (IDTs) which affect specific sectors and occupational classes could well have a disproportionate effect on disabled employment – both positively and negatively. More information is required to fully understand the opportunities and challenges for people with diverse abilities in Manufacturing.

⁷<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes>



26% of the UK Manufacturing workforce are **female**

UK MANUFACTURING BY SOC 2020			
Caring leisure and other service	76%	24%	
Administrative and secretarial	69.5%	30.5%	
Sales and customer service	51%	49%	
Associate professional and technical	31.9%	68.1%	
Elementary occupations	28.7%	71.3%	
Process, plant and machine operatives	21.7%	78.3%	
Managers, directors and senior officials	23%	77%	
Professional occupations	19%	81%	
Skilled trade occupations	8.4%	91.6%	

What are the **main barriers** for women to get into manufacturing?



68.8%
Lack of awareness of the options available



63.7%
Lack of role models



22.5%
Articulating experience and strengths with confidence



58.8%
Unconscious bias

What do you think **would encourage more women and girls** into manufacturing?

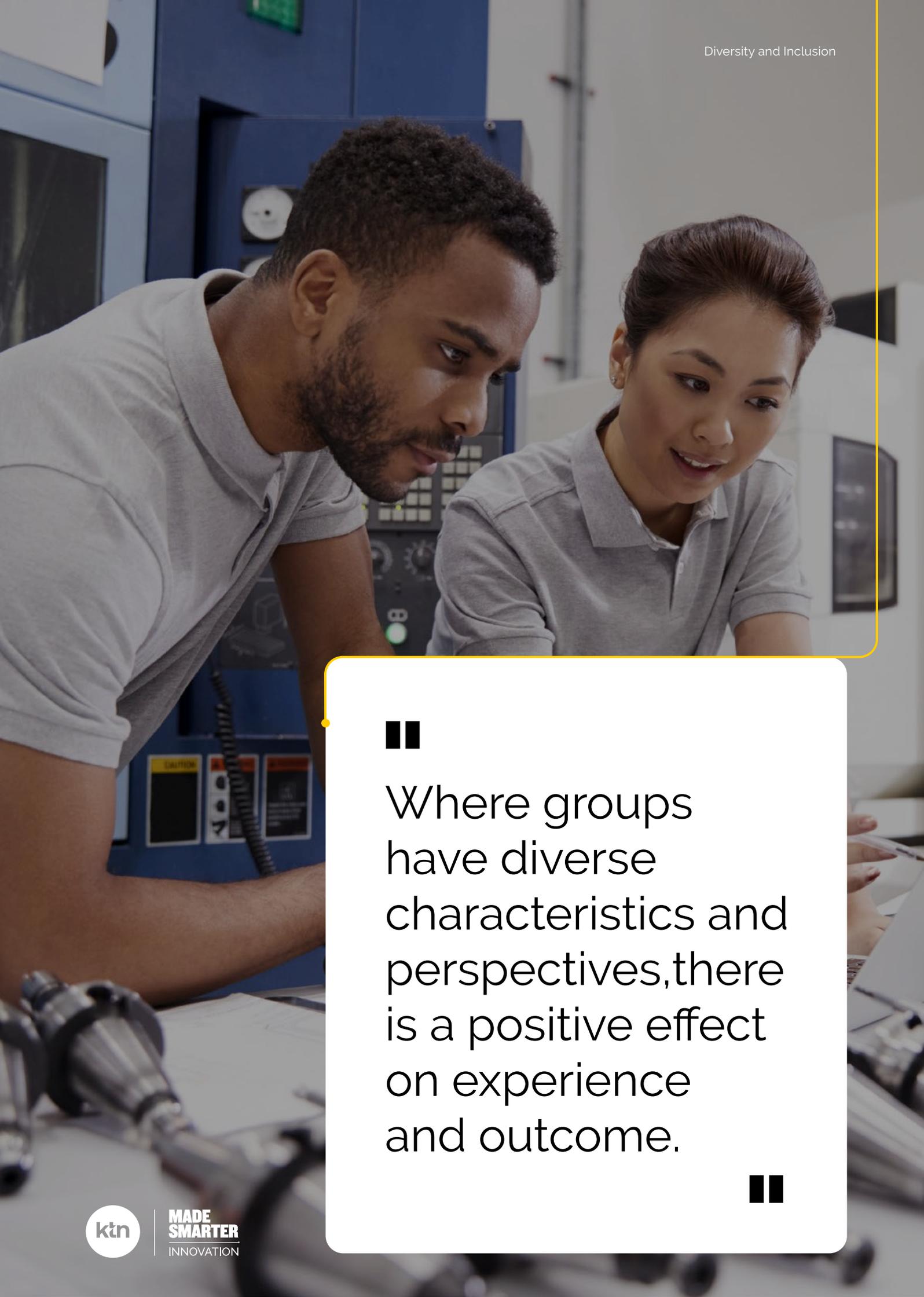


Ability to impact societal change **63.7%**

Clear diversity of people within the sector **57.5%**

Digitalisation and Technology **23.8%**

A focus on NetZero **20%**



||

Where groups have diverse characteristics and perspectives, there is a positive effect on experience and outcome.

||

Opportunity 1: Creating an inclusive and diverse workforce

Apart from the moral imperative for diversity and inclusion, an increasing body of work shows that where groups have diverse characteristics and perspectives, there is a positive effect on experience and outcome.

To achieve this effect efforts must be intentionally inclusive rather than tokenistic. Hearing the views and experiences of relatable people is important for creating a flow of diverse new talent and ideas. Conversely, putting the same people forward repeatedly (whether from under-represented groups or not), as well as restricting innovation, creates an impression of exclusivity. Although they are important and visible aspects, diversity is about more than race, gender, and disability.

Visibility of diversity of roles is important in encouraging interest in the sector. One of the key barriers identified in the KTN 2021 "Inspiring Women in Manufacturing" (IWIM) survey is the lack of visible role models. The manufacturing workforce requires more than engineers.

Leaders, managers, social scientists, policymakers, strategists, and analysts are needed. Stock images of manufacturing portray it as a career that involves machinery and wearing a 'hard hat' and heavy machinery – this is a narrow view of the type of work involved.

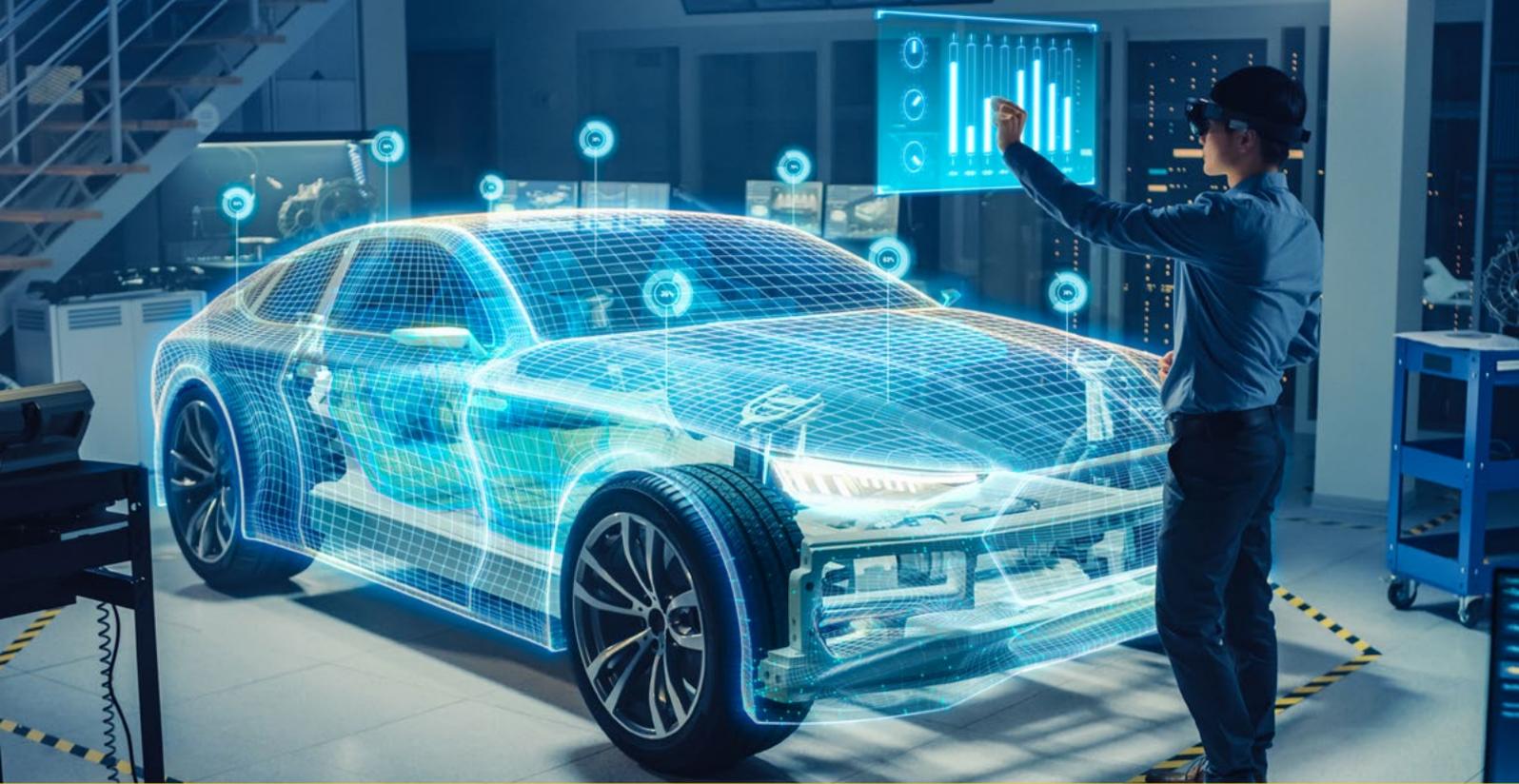
Visibility of a diverse community scored highly in the IWIM survey as a means of encouraging more women into manufacturing. Diversity encourages more diversity. Conversely, a lack of diversity is off-putting to minority groups.

Visibility of impact that reflects what is important (i.e., not what is assumed to be important) will help motivate minority groups to participate. Women, more so than men, are interested in the meaning at work and societal impact^{8,9}.

Waiting for inclusiveness and diversity to happen is unlikely to make a difference. A proactive and intentional strategy is required. Here are three practical steps that we as a community can take.

⁸<https://www8.gsb.columbia.edu/researcharchive/articles/26129>

⁹<https://pubsonline.informs.org/doi/abs/10.1287/mnsc.2020.3612>



01 **Monitor who is included and how they are included.** Although you might have a diverse workforce, pay attention to who is included in opportunities and whose input is considered. As a starting point, taking an informal note can be useful but in the longer term, and for larger groups, formal tracking helps establish a baseline. Tracking data can provide surprising insights that might otherwise go unnoticed. Who is included in events, meetings, decision making, proposal development, ideation? What role do they play? Looking at intersectionality is also important. Exploring combinations of priority characteristics like ethnicity and gender or gender and age can reveal gaps in insight and representation¹⁰.

02 **A common misconception is that Diversity and Inclusion can be resolved with recruitment into STEM subjects and recruitment to entry-level positions.** Whilst this is part of the challenge, Women are more likely than men to recognise that the more significant opportunity in creating a diverse workforce is around retention and progression of under-represented groups. Use data to track training, progression, and retention as well as overall proportions of protected characteristics workers in your organisation. The phenomenon of women becoming scarcer and scarcer through levels of seniority is often referred to as “the leaky pipeline”¹¹.

¹⁰ <https://hbr.org/2021/05/to-make-real-progress-on-di-move-past-vanity-metrics>

¹¹ <https://leakytechpipeline.com>

03 **Be aware that minority groups might not be comfortable speaking out. Make sure you provide a comfortable and inclusive culture.**

Extensive research shows that minority groups face specific challenges when speaking out. Challenges include confidence^{12,13}, social backlash^{14,15}, and being misrepresented or trivialised¹⁶. As well as providing an opportunity and a space, active steps need to be taken to provide support and encouragement for under-represented groups as they articulate their strengths and views.

04 **Find out what motivates, inspires, and discourages under-represented communities** you wish to work with and recruit, rather than assuming they have the same mindset as the current team.

05 **Encourage Allyship. It shouldn't just be under-represented voices championing diversity and inclusion.** This is an issue that impacts every aspect of business, including profitability, productivity, and innovation. If this is left to under-represented groups, a contradictory message is being given. Research shows that male allies are instrumental in realising an inclusive culture¹⁷.

06 **Join KTN's Diverse Speaker List¹⁸ and share it with others in your network.** KTN is keen to represent the inclusion aspect of D&I (Diversity & Inclusion) in raising the voices of the under-represented audience groups, whilst also proactively increasing the variety of perspectives in the manufacturing sector events, workshops and round discussion.

Our team working in D&I is interested in hearing from anyone who associates themselves with Manufacturing Innovation.

¹²Kay, Katty, and Claire Shipman. *The confidence code: the science and art of self-assurance--what women should know*. New York, NY Harper Collins, 2014. Print.

¹³<https://journals.sagepub.com/doi/abs/10.1177/0146167213486358>

¹⁴<https://link.springer.com/article/10.1023/A:1014782118902>

¹⁵<https://news.harvard.edu/gazette/story/2020/02/men-better-than-women-at-self-promotion-on-job-leading-to-inequities/>

¹⁶https://www.ted.com/talks/soraya_chemaly_the_power_of_women_s_anger?language=en

¹⁷<https://hbr.org/2020/11/be-a-better-ally>

¹⁸<https://info.ktn-uk.org/p/2VFU-94T/inspiring-diversity-in-manufacturing-speaker-list>



Opportunity 2: Inclusive Technology Development and Adoption

Diversity and Inclusion is often considered to be something Human Resource functions handle. This approach misses the opportunity for full integration of inclusion into the operational design and the fundamental importance of inclusive design in technology development. **D&I is a technical and operational concern.**

Technology has significant benefits for productivity improvements in manufacturing but it's worth considering the impact on inclusion as you develop or adopt new innovations.

Several examples of technology being exclusive can be found on the following page.

¹⁹<https://www.newscientist.com/article/2115648-posture-could-explain-why-women-get-more-vr-sickness-than-men/>

²⁰<https://www.newscientist.com/article/dn3628-women-need-widescreen-for-virtual-navigation/>

²¹<https://qz.com/192874/is-the-oculus-rift-designed-to-be-sexist/>

AR/VR Headsets



AR/VR Headsets tend to be oversized for women¹⁹ who are more likely than men to experience motion sickness when using VR²⁰. This is not just an ergonomics issue; the way depth perception occurs differs between men and women, but this has been ignored by tech developers. VR systems have been developed exclusively for men²¹.

AI/Data & Analytics



AI/Data and Analytics have the potential to displace low-skilled, administrative, and secretarial jobs which are occupied by a disproportionate percentage of the female and ethnic minority workers (see Labour Force Survey analysis, Appendix 3). Data on a diverse population is often missing as AI systems are constructed: what is assumed to be agnostic, often isn't – voice recognition is one example with disastrous consequences²², amongst others²³.

Robotics & Automation



Robotics and Automation have the potential to displace shop floor, low paid jobs which are occupied by a disproportionate percentage of female and ethnic minority workers. This is especially true in Automotive and Textiles and Clothing Manufacture.

Safety & Testing



Safety and Testing approaches - the way technologies are designed and tested for manufacturing and manufactured products need to be more inclusive. Whilst workplace accidents have been decreasing for men, they have been increasing for women²⁴ - perhaps being excluded from Personal Protective Equipment design considerations is a factor²⁵. Although men are more likely than women to be involved in a car crash, women are 47% more likely to be fatally injured in car crashes, 71% more likely to be moderately injured²⁶ and 17% more likely to die²⁷ - all due to them being excluded from design and test considerations²⁸.

²²<https://www.yumpu.com/xx/document/view/56095744/what-is-wrong-with-data-on-women-and-girls>

²³<https://www.newscientist.com/article/2115175-lazy-coders-are-training-artificial-intelligences-to-be-sexist/>

²⁴<https://www.equaltimes.org/the-invisible-workplace-accident?lang=en#YJuVjSgQoUE>

²⁵<https://www.wes.org.uk/sites/default/files/WES%20safety%20survey%20results%20March%202010.pdf>

²⁶https://www.washingtonpost.com/local/trafficandcommuting/female-dummy-makes-her-mark-on-male-dominated-crash-tests/2012/03/07/gIQANBLjaS_story.html

²⁷<https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811766>

²⁸<https://history.stanford.edu/publications/gendered-innovations-how-gender-analysis-contributes-research>

Technologies that are created with an inclusive mindset, often have much wider benefits and can enable everyone to perform better. For example, closed captions can help people working in noisy environments as well as those who have impaired hearing ability.

Here are four practical steps that can improve the inclusion of technology in manufacturing:

01

"Not about us without us" is a common phrase used by the disabled community. Make sure you involve a diverse range of users in your product development process. Having diverse teams or, at least teams who are proactively inclusive offers advantages. Understand and work to eliminate your own biases.

02

Build inclusion in from the start – explore what is possible. Don't leave inclusion until the end of the process or adopt a checklist approach.

03

Work collaboratively with under-represented groups. Immerse yourself in their environment or pay them to test your product as you iterate.

04

Seek out resources and support. Speak to the KTN Design team or check out the Design Guidelines^{29,30,31,32}.

²⁹<https://www.microsoft.com/design/inclusive/>

³⁰<https://developer.apple.com/design/human-interface-guidelines/accessibility/overview/introduction/>

³¹<https://www.w3.org/WAI/standards-guidelines/wcag/>

³²<https://hbr.org/2020/10/to-build-more-inclusive-technology-change-your-design-process>



Opportunity 3: Mitigating against unintended consequences

Although there is 26% female representation in manufacturing, it is worth considering how diversity is distributed across roles.

Ethnic minority groups are disproportionately represented in operator positions and rarely occupy board level and senior management positions across sectors within UK manufacturing.

Digital technologies improve productivity and although they are reported to create more jobs overall, are likely to displace operator and administrative jobs (those

disproportionately occupied by women and ethnic minorities). Jobs created tend to be professional-level jobs (those predominantly occupied by white men).

As we implement technologies and the profile of roles within manufacturing changes, efforts should be made to ensure that the manufacturing workforce doesn't become less diverse. To ensure we have a more diverse and inclusive future manufacturing workforce, upskilling displaced workers and being intentional about recruitment for professional level roles (rather than focusing on the workforce overall) is key.

Here are three practical steps to improve the diversity of the workforce and job roles change.

Planning

As you consider technology adoption, planning can help you consider the impact on workforce diversity. Who occupies the positions that are likely to be replaced? What will the diversity profile of your organisation look like before and after technology adoption?

Creating a pro-actively inclusive culture is critical

Seek out alternative voices. Whilst positive discrimination is illegal and does not make business sense, taking positive action to include people from under-represented groups who meet recruitment requirements is a valid and healthy approach to creating a diverse and inclusive team. Consider the overall profile of the team and the value diversity brings, as well as the fit for the individual post.

Skills development and training can help provide opportunities for people whose positions may be displaced by technology.

Numerous studies suggest that overall, technology creates more jobs than it replaces. The challenge is that the jobs replaced are disproportionately occupied by women and minority ethnic communities and the jobs created are currently disproportionately occupied by white males. Being cognisant of the potential to exacerbate diversity and inclusion challenges is a good first step towards better decision-making and creating targeted training for specific groups.

Summary of recommendations

Whilst this guide is not exhaustive and the aspiration is that it quickly becomes redundant, some practical steps that can be made to improve diversity and inclusion and ultimately productivity and innovation in UK Manufacturing.



Improve diversity in the manufacturing workforce

- Monitor who is included and how they are included.
- Use data to track training, progression, and retention as well as overall proportions of protected characteristics workers in your organisation.
- Be aware that minority groups might not be comfortable speaking out. Make sure you provide a comfortable and inclusive culture.
- Find out what motivates, inspires, and discourages under-represented communities.
- Encourage Allyship. It shouldn't just be under-represented voices championing diversity and inclusion.
- Join KTN's Diverse Speaker List and share it with others in your network.



Ensure technologies developed by and adopted in manufacturing are inclusive

- Make sure you involve a diverse range of users in your product development process. Having diverse teams or, at least teams who are proactively inclusive offers advantages. Understand and work to eliminate your own biases.
- Build inclusion in from the start – explore what is possible Don't leave inclusion until the end of the process or adopt a checklist approach.
- Work collaboratively with under-represented groups. Immerse yourself in their environment or pay them to test your product as you iterate.
- Seek out resources and support. Speak to the KTN Design team or check out Design Guidelines.



Consider the unintended effects of technology on workforce diversity

- As you consider technology adoption, make time to consider the impact on workforce diversity.
- Creating a pro-actively inclusive culture is critical. Seek out alternative voices.
- Use skills development and training to help provide opportunities for people whose positions may be displaced by technology.

Get in Touch

If you have questions and ideas about diversity and inclusion in manufacturing, please get in touch.



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This report was created by the Made Smarter Innovation Network.

The Made Smarter Innovation Network is a national programme for manufacturers looking to innovate and the developers of innovative digital technologies and solutions. It will deliver a vision of UK manufacturing that is more productive, competitive and sustainable through the development of a powerful ecosystem of innovative industrial digital technology (IDT) providers. Made Smarter Innovation Network is delivered by KTN, funded by UKRI through the £300m partnership between government and industry, and supporting the national Made Smarter movement.

Find out more about Made Smarter at www.madesmarter.uk



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