Human Capital

Why we need a new approach to tackle Britain's long tail of low skills

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ONWARD

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Data in this report

This work was produced using statistical data from the ONS. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

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Foreword

It is clear that more and more jobs are being disrupted and lost to technological change. Across the economy, entire categories of jobs are being destroyed while new occupations and industries are created, at an accelerating rate. Despite doomsayers' predictions, we cannot know how many jobs will be affected, or when they will be lost entirely.

We do know that some people and certain places will suffer more than others. Low-skilled workers in routine occupations are more likely to be affected: over a quarter of low-skilled workers are employed in an industry which is declining or reducing its workforce, work in an occupation that is slowly becoming defunct, or have a job with a high likelihood of automation. Workers with less than four GCSEs are more than 1.5 times more likely – 20 percentage points – to be in jobs at high risk of automation compared to people with degrees, and over twice as likely to work in an occupation that is declining over time.

This means that automation and industrial decline have huge geographic – and political – implications. Because higher risk jobs are distributed unevenly around the country, certain places are set to lose out much more than others, and invariably it is the places that have suffered most in previous decades that stand to lose out most in future years. In Richmond in London, 14% of residents are employed in a declining occupation and the average automation risk for a worker is 39%; in Richmondshire in Yorkshire, the figures are 32% and 45% respectively.

This is a product of innovation, but also a result of inaction. Employers have consistently reduced their investment in training and skills over the last decade, from an already low base, despite the growing risks of automation to low – and medium-skilled work. Since 2011 employer spending per trainee has fallen by 17% in real terms and adult learning participation in the UK is lower than it has been in two decades. At the same time, Government programmes to improve training and skills have fallen well short: individual learner accounts, introduced in 2000, ended in a series of police investigations over fraudulent activity, and the introduction of apprenticeships has experienced teething problems.

The risks are both economic and political. Left unaddressed, these trends will compound the regional imbalances of the past and widen the great divide between skilled and unskilled workers in the labour market. They also invite further political upsets: as we show in this report, a local area's Leave vote in 2016 is more highly correlated with local workers' propensity for automation than almost any other factor. If there was ever a modern equivalent of Disraeli's two nations, it is this.

To address this challenge will necessitate a profound and concerted shift in policy to retrain, upskill and prepare the 8.5 million low-skilled workers in Britain for the coming technological age. We propose four major reforms to achieve this – although given the scale of the challenge this must surely be just the start.

First, we need to make human capital investment as attractive to employers as investment in R&D. There is a growing evidence base that human capital investment delivers positive spillovers to the wider economy. We recommend that the Government introduces a Retraining Tax Credit at the Spending Review along similar lines to the R&D credit. For the low annual cost of around £0.9 billion, this would support 1.5 million workers to gain new formal qualifications, targeted towards SMEs and workers starting from a lower skills base.

Second, ministers should breathe new life into the National Retraining Scheme – a good idea badly handled since its announcement two years ago. The NRS should allow any individual whose job is particularly vulnerable to retrain into a different role, with lower automation risk, at their existing or future employer. It would be financed by a new Retraining Fund, taken partly from existing Apprenticeship Levy funds. Eligible workers would be matched to retraining options through a new UCAS-style portal, where they could apply to both accredited training courses and jobs that incorporate retraining into the on-boarding process.

This would dovetail closely with the proposed lifelong learning loan allowance proposed by Professor Alison Wolf and the Augur Review, which would give individuals the ability to access loan funding for vocational and technical education at any stage of their career for full and part-time students to self-fund training.

Third, we propose the Apprenticeship Levy is split in two, so that current levels of apprenticeships for under-25s are preserved but the remaining amount, just over £1 billion annually, is repurposed into a Retraining Fund from which employers can draw down funds to retrain workers at risk of automation. This separate fund would be considerably more flexible than the existing Levy, with employers able to pass funding down their supply chains, pool funds with other local employers or nationally as an industry, and to fund employee wages during training. This structure would also allow Government to "top-up" employer-led training spending for a specific local area, industry or employer, for example in response to labour market shocks, or if a large employer like British Steel went into administration.

Last, the Government should pump-prime places whose infrastructure and local economies have been underfunded for decades – in order to attract high growth, high skilled employers. The Shared Prosperity Fund, announced in the 2017 manifesto and due for consultation ahead of the Spending Review, should specifically be targeted towards at-risk regions. If repatriated in full from EU structural funds, it would represent a £2.4 billion annual fund to help attract large employers in high growth industries to areas in need of industrial renaissance.

In a focus group for this report, one participant – a low-skilled worker from a sugar factory – said, "the more advanced the economy gets, the more people like me get left behind". The point of this report is to help ensure that does not happen. For the last two decades, Britain has underinvested in its workforce. As a result, we have the highest concentration of low skilled workers in the developed world, a quarter of whom face a high risk of automation or industrial decline. If we are serious about healing the divisions at the heart of Britain's economy and politics, there is no better place to start than Britain's long tail of low skills.

Will Tanner, Director, Onward

Summary of recommendations

Recommendations

Problems	Solutions
Britain has underinvested in skills and training over many years. Employer spending on human capital is in decline, particularly among larger firms.	• Introduce a Retraining Tax Credit, targeted at low-skilled workers, to encourage firms to invest in human capital and boost productivity. This would cost an estimated £0.79–£0.87 billion per year and could train up to 1.5 million low-skilled workers over five years. • The proposed scheme would mirror R&D Tax Credit, introduced in 2000. Research estimates that UK business R&D spending would be 13% lower in the absence of R&D tax breaks.
Automation and the changing world of work are making these problems worse.	• The long-awaited National Retraining Scheme should be explicitly targeted at people whose jobs are at risk of automation and industrial decline. • Any worker whose job is at high risk of disruption should have a right to retrain into a different role with lower automation risk either at their existing or with a future employer, with training being fully funded and available during their normal working hours. This would dovetail with relief offered through the Retraining Tax Credit. • Employers would be able to draw down funding from a new £1 billion a year Retraining Fund, created by reforming the Apprenticeship Levy, which would be more flexible than existing apprenticeship funding. • HM Treasury should consider "topping up" retraining funding in specific places or in response to labour market shocks under this employer-led framework.
Certain places are particularly affected due to high concentrations of low skills and certain types of jobs.	• The Shared Prosperity Fund, due to be announced later this year, should be directed at local areas facing high levels of automation risk and industrial decline. • Local areas should be able to bid for funding for joint investment and tax flexibility to attract major employers, echoing the efforts made to attract Nissan to Sunderland in 1986 and Siemens to Hull in 2014.

The challenge

How automation and industrial change are reshaping the British economy

This section describes Britain's long tail of low skills, engrained over many decades, and the implications of these problems for UK productivity, automation and our politics. In particular, it considers how technological change and globalisation are fundamentally altering the UK labour market and will continue to do so in future decades, who stands to benefit, and who will lose out.

The next section goes on to explore a number of solutions to these problems, to ensure that as the economy changes and the nature of work adapts, everyone in Britain, regardless of gender, hometown or skill level, has the opportunity to thrive.

Britain's long tail of low skills

1. Britain's track record of underinvestment in human capital has left a long tail of low skilled workers

- Britain's share of low skill workers in the labour market is considerably higher than the OECD average.[1] According to the most recent statistics, 8.5 million economically active adults (aged 16–64) in England and Wales are qualified to Level 2 or below, equivalent to 30% of the working population.[2] Around half of these, 4.2 million people aged 16–64, hold qualifications below Level 2, equivalent to a D or lower at GCSE.[3]
- In total, a quarter of adults in England lack basic numeracy and literacy or both.[4] This is equivalent to the OECD average, but means that England lags the performance of countries such as Germany, Australia, New Zealand, Sweden, and the Netherlands.[5] The UK is unique in developed economies that the literacy levels of 16-24 year olds is worse than 55–64 year olds, meaning the population is becoming less equipped with the essential skills for lifelong learning.
- The UK's international standing on skills has fallen in recent years. In 2006, the UK was ranked 17th of OECD countries for low skills, 18th for intermediate skills and 12th for high skills. In 2012, the UK was ranked 20th for low skills, 25th for intermediate skills, and 11th for high skills. The UK is forecast to fall to 28th out of 33 OECD countries for intermediate skills by 2020 but rise to 7th for high skills, suggesting a workforce that is becoming increasingly polarised.[6]
- Low skill levels are particularly acute among younger workers – unusual among developed economies. At every qualification level, young people have lower literacy and numeracy in England than other developed nations. In 2016, nearly half of 16–34 year olds with Level 2 or below had low basic skills, compared to just under 30% of 16–34 year-olds in the OECD. In 2012, only Italy and the United States had higher levels of young people with low skill levels, and British 16–24 year olds fared no better than those aged 55–65.[7] This failure to ensure that future workers have higher skill levels than previous generations, despite the doubling of per-pupil school spending since 1997,[8] has considerable implications for the future of the British workforce.

Table 1: Share of 16–34 year-olds at different skill levels

	OECD	England	Difference
Below UK level 2	29.8%	48.0%	18.2%
UK level 2 and 3	15.0%	20.7%	5.7%
Post-secondary non university (UK level 4 and 5)	10.2%	21.4%	11.2%
University (UK level 6 and above and some level 5)	3.6%	6.9%	3.3%

Source: OECD (2016), Building Skills for All: Review of England.

- The UK's long tail of low skills has wide implications for economic activity and growth. In the most recent Employer Skills Survey, a total of 94% of the respondents who had skills shortages said it impacted their business. Nearly two thirds (63%) of total respondents expect to need new skills in the next 12 months, and firms find that having skills-shortage vacancies increased their operating costs and made them less competitive.[9]
- There are also severe implications for low-skilled individuals. Whilst the labour market continues to grow, the expansion of medium and high-skilled jobs has been accompanied by a contraction in low-skilled employment, and since 2006 low-skilled jobs have declined in nearly every quarter.[10] This can have severe consequences; the employment rate for those with no formal qualifications is less than 50%.[11]

2. This is exacerbated by employers' collective failure to invest in their workers

- The overall share of workers receiving job-related training has fallen from a high of nearly 16% in 2001 to just 13% in 2017.[12] That is equivalent to roughly 130,000 fewer workers compared to 16 years previously, despite all of the advances in education and the falling cost of training in that time.[13]
- If we consider training more broadly, at the firm level, the proportion of staff that receive training is slightly higher than 2011. But the average number of training days per trainee has declined steadily since 2011. When we look at firms of different sizes, another pattern emerges. The larger the business, the greater the proportion of their staff that receive training, but on average they provide fewer training days for their staff.
- This decline among larger businesses may reflect the tighter margins for many high-employment firms, for example in retail and hospitality, which have been squeezed by online competition, higher minimum wages, and rising business rates. Leading employers have told us that, because training is truly a discretionary cost, they find it harder to prove a return on investment and it is therefore more easily reduced.

Table 2: Number and proportion of staff trained over the last 12 months, 2011–2017, by firm size

	2011		2013		2015		2017	
	Training days per trainee	% of staff trained	Training days per trainee	% of staff trained	Training days per trainee	% of staff trained	Training days per trainee	% of staff trained
UK	7.78	55	6.74	62	6.77	63	6.39	62
Firm Size								
2 to 4	10.46	40	10.74	41	10.07	43	8.88	42
5 to 24	8.98	53	8.30	54	8.45	56	7.48	56
25 to 49	8.43	59	7.26	63	7.71	65	7.42	64
50 to 99	8.08	59	6.71	66	7.54	66	6.90	65
100 to 249	6.62	60	6.33	68	5.60	67	5.79	70
250+	6.35	54	4.95	71	4.80	70	4.74	67

Source: Department for Education, Employer Skills Survey 2017: Research Report.[14]

- Real-terms employer expenditure on training has remained stagnant since 2013; spending per trainee is around £500 lower than in 2011. Although not directly comparable, earlier surveys of employer training expenditure indicate that between 2005 and 2009 the amount spent per trained employee was not only higher in real terms than 2017, but that it was increasing.[15]

Table 3: Employer expenditure on training, 2011–2017

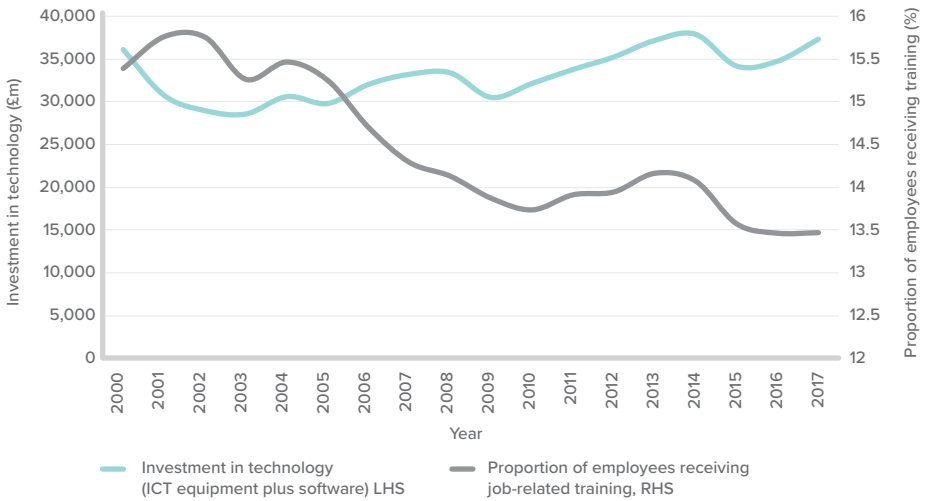
	2011	2013	2015	2017
Total employer training expenditure	£43.8 billion	£41.1 billion	£43.6 billion	£44.2 billion
Expenditure by trainee	£3,000	£2,400	£2,500	£2,500

Source: UKCES, Employer Skills Survey, values expressed in 2017 prices.

- This is heavily driven by several factors. First, since 2011, expenditure per trainee among larger employers (over 100 employees) has almost halved, whereas for firms with fewer than 100 employees, expenditure has remained mostly unchanged.[16] Even with the rise of e-learning providing training at a lower cost, this still represents a notable decline in investment into retraining. As a result, the overall difference between large and small firms' training investment is stark: the largest firms (over 100 employees) spend on average £4,000 less per trainee than the smallest firms (2–4 employees).[17]
- Second, smaller organisations have a well documented constraint on training, part of the inverse relationship between firm size and retraining.[18] They are less likely to allocate funding specifically to a training budget, even if their level of training expenditure is significantly higher. This is likely due, in part, to reduced economies of scale and partly due to being more attuned to the development needs of their employees.

- This may be due to growing technology investment. As set out in Figure 1 below, training expenditure has been falling consistently since 2001 as private investment in technology, measured by the investment in ICT equipment and software, has risen from £28 billion in 2002 to over £37 billion in 2017. This suggests that human capital investment by firms is being displaced by other forms of capital such as IT infrastructure and algorithms. Notably, these investments carry more generous tax treatment through capital allowances than training spending.

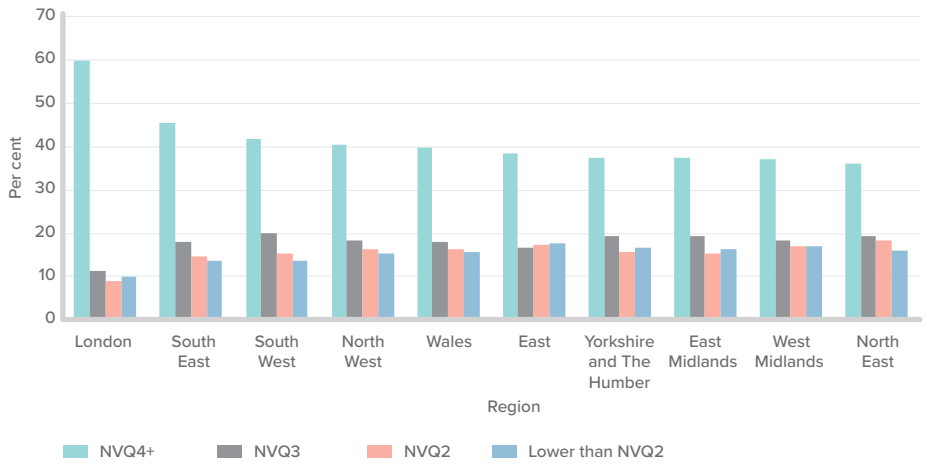
Figure 1: Proportion of employees receiving job-related training and investment in technology, 2000–2017



Source: ONS Business investment time series, Labour Force Survey, Onward analysis.[19]

- The decline in firm-level training seems also to have exacerbated the consequences of geographic brain drain, primarily driven by rising numbers of younger people going to university. A lack of alternative paths to highly-skilled employment has meant more graduates, who are highly mobile, eventually move to the places where there are the most opportunities; cities, and specifically, London.[20]
- Unsurprisingly, London has the highest share of high skilled workers (Level 4 and above) of any region, with 60% of people qualified to that level, and just 10% with lower than GCSE level. This contrasts with the North East and West Midlands, which have 36% and 37% at or above Level 4 respectively, and 16% and 17% with lower than GCSE.[21]

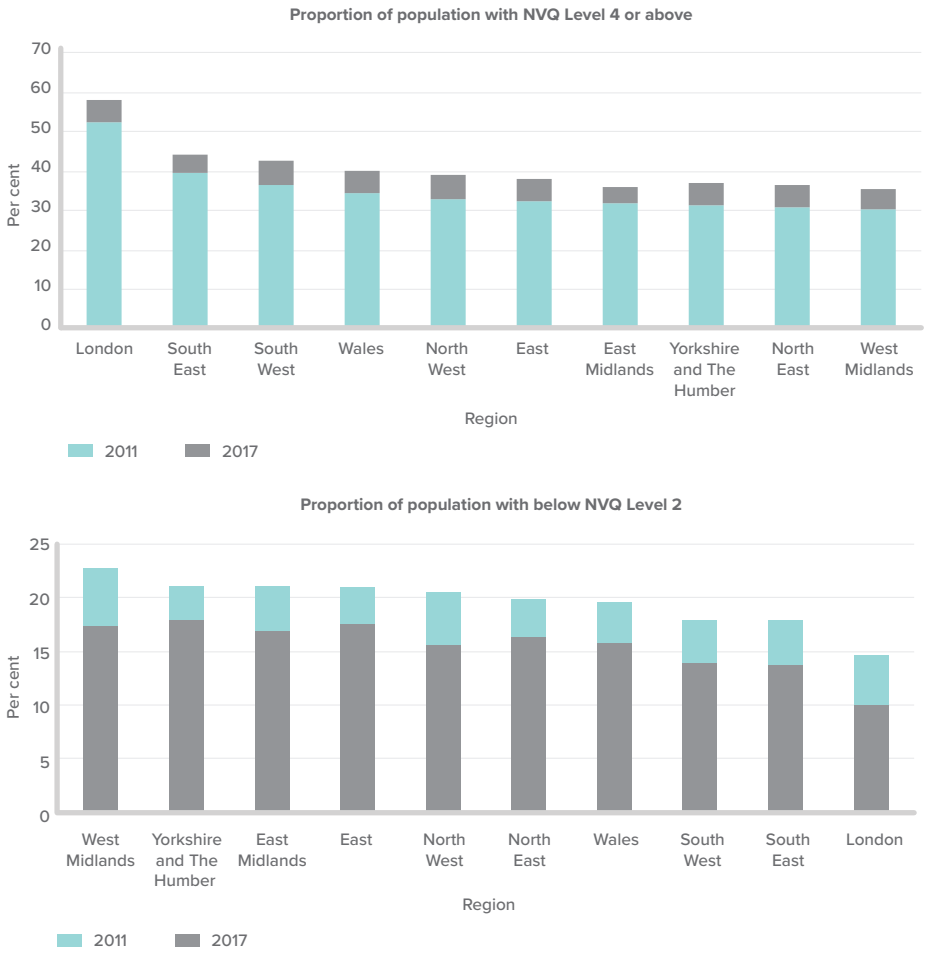
Figure 2: Highest Qualification held by economically active 16–64s by region



Source: Annual Population Survey (2018).

- In recent years, this regional education gap has persisted. As Figure 3 below shows, London has increased its share of highly qualified workers (holding at least a Level 4 qualification) by 5.6 percentage points between 2011 and 2017, to 58% of all workers. Meanwhile, the South East increased their share of highly qualified workers by 4.7 percentage points to 44.1%. Although this was not the highest increase in that period (the North East, North West and Yorskshire all saw greater increases), fewer than 40% of workers in these regions are highly qualified, meaning that the gap remains significant.
- The same is true for changes in workers with low qualifications (below GCSE-level). London has experienced a 4.6 percentage point decrease in the share of workers with low qualifications, surpassed only by the North West and West Midlands, which experienced falls of 5% and 5.3%, respectively.
- This partially reflects internal migration to meet the high demand for skilled workers in London.[22] Overall, the ratio of high skilled to low skilled workers in London has risen from 3.59 in 2011 to 5.8 in 2017. In regions such as Yorkshire, East Midlands and the West Midlands it has also risen but remains below 2.3.

Figure 3: Change in skill level 2011–2017, by region



Source: Annual Population Survey (2018).

3. There is a clear link between underinvestment in skills and Britain's weak productivity growth

- Analysis of industry training panel data between 1983–1996 by the Institute for Fiscal Studies has found that an increase of 1 percentage point in the proportion of employees trained is associated with a 0.6% increase in productivity and a 0.3% increase in wages. The impact of training on productivity is confirmed by a large number of robustness tests.[23]
- This suggests that the productivity of Britain's industries would be an estimated 1.28 percentage points greater if employers had sustained 2001 levels of job-related training (the highest proportion this century) or 0.33 percentage points greater if 2013 levels had been sustained (the highest proportion since the financial crisis). On the same estimates, wages would have risen by an additional 0.64 percentage points.[24]

- The OECD has recently suggested that investment in skills is a "key factor in fostering inclusive growth and in raising productivity in OECD economies,"[25] and that, in the UK context, increasing lifelong learning and promoting better use of skills would help improve UK growth and productivity.[26]
- Similarly, in its analysis of human capital estimates, the ONS noted its importance to delivering productivity,[27] and figures in late 2018 estimated that, whilst multi-factor productivity has declined overall, labour productivity has improved, with improvements in skill levels being one of the main causes.[28]

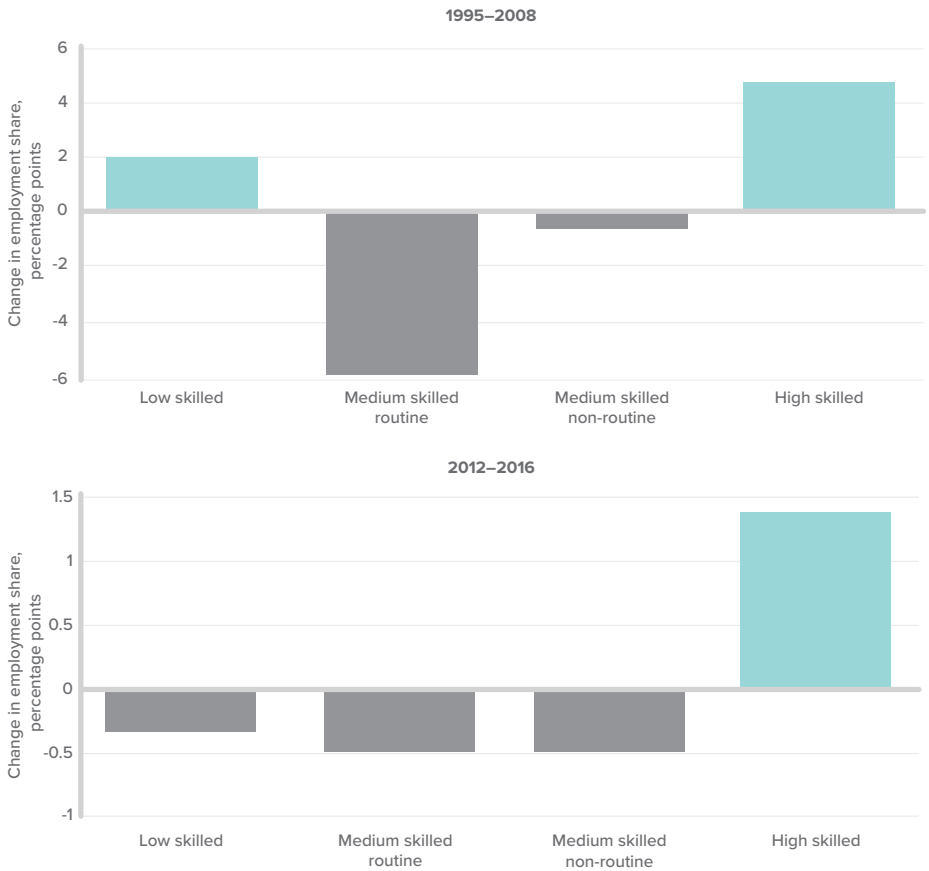
4. Rising employment has paradoxically made the labour market more precarious for low-skilled workers

- The jobs market is one of the great success stories of the last decade: more people are in work than ever before and vacancy rates are rising to heights not seen since the turn of the century. But Britain's labour market is simultaneously deteriorating for low-skilled workers, mid-level jobs are being hollowed out and individuals are showing high levels of anxiety about work security.[29] Fixing the gap between the headline employment statistics and the lived reality of the labour market is fundamental; it must be a priority if the centre right to restore a positive economic narrative.
- The proportion of UK workers who are "undereducated" for their current employment has increased in recent years, from 14.7% of 16–64 year-olds in 2012 to 15.2% in 2015. Despite the huge growth in university admissions, the rise has been most acute amongst younger workers between 16–34 years old.[30] If this trend continues, employers are likely to struggle with even greater skills shortages among their staff.
- Meanwhile, the proportion of workers who are overeducated has increased from a low of 14.9% to 16.1% in 2015. This is particularly acute among people who have been to university: 31% of graduates were overeducated in 2017. In other words, proportionally more graduates are working in roles for which they are over-qualified than non-graduates. Moreover, in 2017, 21.7% of those who graduated before 1992 were overeducated, whereas the corresponding figure for those who graduated in 2007 or later was 34.2%.[31] This indicates that the market for university-educated workers is saturated.
- This reflects a global trend. The UK experience compares with 22 other OECD countries, which have generally seen substantial falls in mid-level jobs alongside increases in both low skilled and high skilled work. Between 1995 and 2015, the share of jobs in middle skill occupations[32] declined by almost 10 percentage points in Western Europe and by 7.5 points generally among OECD members, with around three-quarters of this decrease in mid-skill jobs transferring to high skill occupations[33] and the rest to low skill[34] occupations.[35] The decline of routine occupations accounts for most of the fall in employment at middle-skill occupations.[36]
- While job opportunities for those in the middle have declined, work for those with a low level of skills has increased but is radically changed. The number of people employed on zero-hours contracts has increased five-fold in the last decade.[37] Young people (aged 16–24) account for a third of these contracts

and half of zero-hours contracts are in low-skilled sectors.[38,39] This indicates that they are often given to people with limited bargaining power. The rise of such atypical work and the gig economy has brought benefits in terms of greater flexibility, but also led to increased uncertainty and insecurity.

- The RSA have identified a different type of precariously employed people – those on typical contracts with few opportunities for progression and a strong concern about automation displacing them. They report low autonomy and excessive monitoring, which may worsen with the rise of algorithmic management,[40] and the lack of consistent hours or opportunities for progression can be one of the key drivers of in-work poverty. As a recent CEDEFOP study made clear, these changes in the labour market mean "low-educated workers are often employed in low-wage jobs and have a precarious employment relationship", working long hours that precludes learning and training and often in industries that are in decline.[41]

Figure 4: Job polarisation in the UK: Change in employment shares by occupation category, percentage points



Source: OECD.

5. Low skilled workers are particularly vulnerable to automation and ill-equipped to adapt to labour market change

- While estimates of the overall level of jobs likely to be lost to automation vary widely – and all should be taken with a hefty pinch of salt[42] – there is widespread academic agreement about who will lose out. In a 2013 study for Oxford Martin School, Frey and Osborne matched 702 detailed individual occupations in the United States to show that "computerisation [will be] principally confined to low-skill and low-wage occupations".[43]
- In a number of studies since 2003, David Autor has shown that routine task-intensive jobs in the United States have disappeared since 1980[44] and that as computerisation erodes wages for labour performing routine tasks, workers will reallocate their labour supply to relatively low-skill service occupations. Thus, automation hollows out routine low- and middle-income roles and increases competition for low-skilled workers in non-routine roles. While this analysis posits that it is the type of role, rather than the skill of the worker, that determines automation risk, the net maleficiary remains the same.
- Following studies from the OECD[45] and PwC,[46] the ONS recently produced new estimates of automation risk for each occupation in the United Kingdom. The findings suggest that, in 2017, around 7.4% of people (1.5 million) were employed in jobs at a high risk of automation, a slight decrease from 2011. Of these, 98.8% of people had qualifications of A-Level, GCSE or below, and 87% of the population deemed to be at low-risk had degree-level education.[47]
- To develop this further, new Onward analysis for this paper has supplemented the ONS automation study to combine its findings with additional insight on the groups that might be affected by industrial, or occupational decline, and to more fully capture the dynamics that might affect the future of the labour market.
- Our approach establishes new evidence about the distributional impact of automation in England and Wales. We have combined data from the census with industrial and occupational data to produce detailed estimates[48] of:
  - The proportion of the population working in industries that have seen their balanced GVA decline between 2011 and 2017;
  - The proportion of the population working in occupations that have seen their levels of employment decline between 2011 and 2017;
  - The proportion of the population working in industries that have seen declining employment between 2011 and 2017.
- In addition, using ONS calculated probabilities of automation which assess the likelihood that tasks within each occupation can be automated,[49] we matched occupational probabilities of automation to each census record, allowing analysis of which populations were most at risk of automation, and which factors increased and decreases the risk.
- Overall, we find that workers with low or no skills are in jobs that are more than 1.5 times as susceptible to automation, using the Office for National Statistics measure of automation risk, as workers with degrees. Similarly, we find low-skilled workers are over twice as likely to work in an occupation

that is declining over time. Only 4.1% of adults educated to GCSEs or below are working in roles with less than a 20% risk for automation. For degree educated adults, this figure is 47.8%.

- It is clear that achieving a degree-level qualification offers workers considerable protection from technological disruption. People with degree-level skills are around a third less likely (11.5 percentage points) to be in jobs at risk of computerisation and a half less likely (9.3 percentage points) to be in a declining occupation than the UK average. However, the relationship is not simple. Those with degree-level education are in fact more likely to be working in industries with declining GVA or employment. This suggests that, even if the industries they are likely to work in are being eroded, the job functions that higher skilled workers are currently performing are likely to persist.

Table 4: Qualification level and likelihood of automation and working in a declining occupation

Highest Qualification	Working in a declining industry by GVA	Working in a declining occupation by volume	Working in an industry with declining employment	Average propensity for computerisation
No qualifications or 1–4 GCSEs or lower, or equivalent	11.9%	27.5%	14.4%	55.1%
5+ GCSEs A*–C, or equivalent	15.5%	27.8%	16.5%	52.2%
2+ A-levels, or equivalent	15.3%	22.9%	15.7%	49.8%
Degree or higher	17.2%	11.6%	17.2%	35.9%
UK average	14.8%	20.9%	15.8%	47.1%

Source: Onward analysis of ONS data and 2011 Census.

In total, over a quarter of low-skilled workers suffer from one of these four risk factors – that is to say they are employed in an industry which is declining or reducing its workforce, work in an occupation that is slowly becoming defunct, or do a job with a high likelihood of automation. This is about 6 percentage points higher than the average for workers of all skill levels and around double the rate for those with degrees.

When we consider more than one risk factor, it is notable that those with the lowest levels of education are least likely to suffer two or three automation risk factors, supporting the idea that it is middle-educated jobs that are being hollowed out while lower-skilled but non-routine jobs, for example mechanics or bricklayers, are not yet being squeezed out of the labour market but are subject to a high degree of future risk. Table 5 below paints a more nuanced picture.

Table 5: Labour market risk by highest level of education

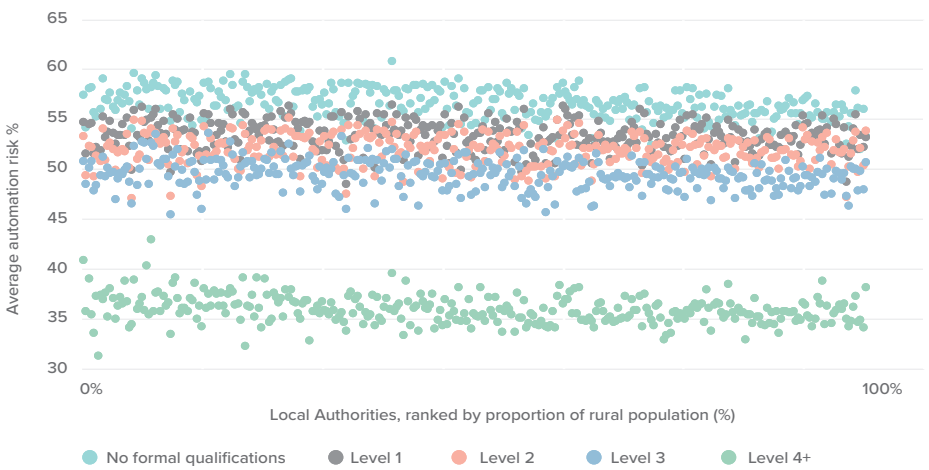
Highest Qualification	One risk factor (%)	Two risk factors (%)	Three risk factors (%)
1–4 GCSEs, or lower	27.8%	7.9%	3.6%
5+ GCSEs A*–C, or equivalent	27.3%	9.0%	5.3%
2+ A-levels, or equivalent	23.6%	8.8%	4.9%
Degree plus	12.9%	10.9%	3.9%
UK	21.7%	9.2%	4.1%

Source: Onward analysis of ONS data and 2011 Census.

Note: Risk factors are defined here as either working in an industry which is declining, working in an occupation that is declining, working in an occupation with a 70%+ probability of automation, or working in an industry which has seen decreases in employment.

- Workers with degree-level qualifications are less likely to be automated, but they are not any less likely to experience a combination of risk factors than those with lower qualifications. A total of 11% of people with degree-level qualifications experience two risk factors, meaning they are in a job or industry that is declining or which has declining employment – higher than the national average of 9%. Indeed, this group is more likely to experience a combination of risk factors than those with the lowest level of qualifications.
- This is also true when taken in the context of geography, as Figure 5 below demonstrates. By splitting local authorities into different skill cohorts, we see that low skilled workers have similar automation risk wherever they are located, while high skilled workers have similarly low levels of vulnerability irrespective of geography. In short, it does not matter whether in a thriving metropolis or a rural provincial village – the individual threat of technological change does not differ markedly.

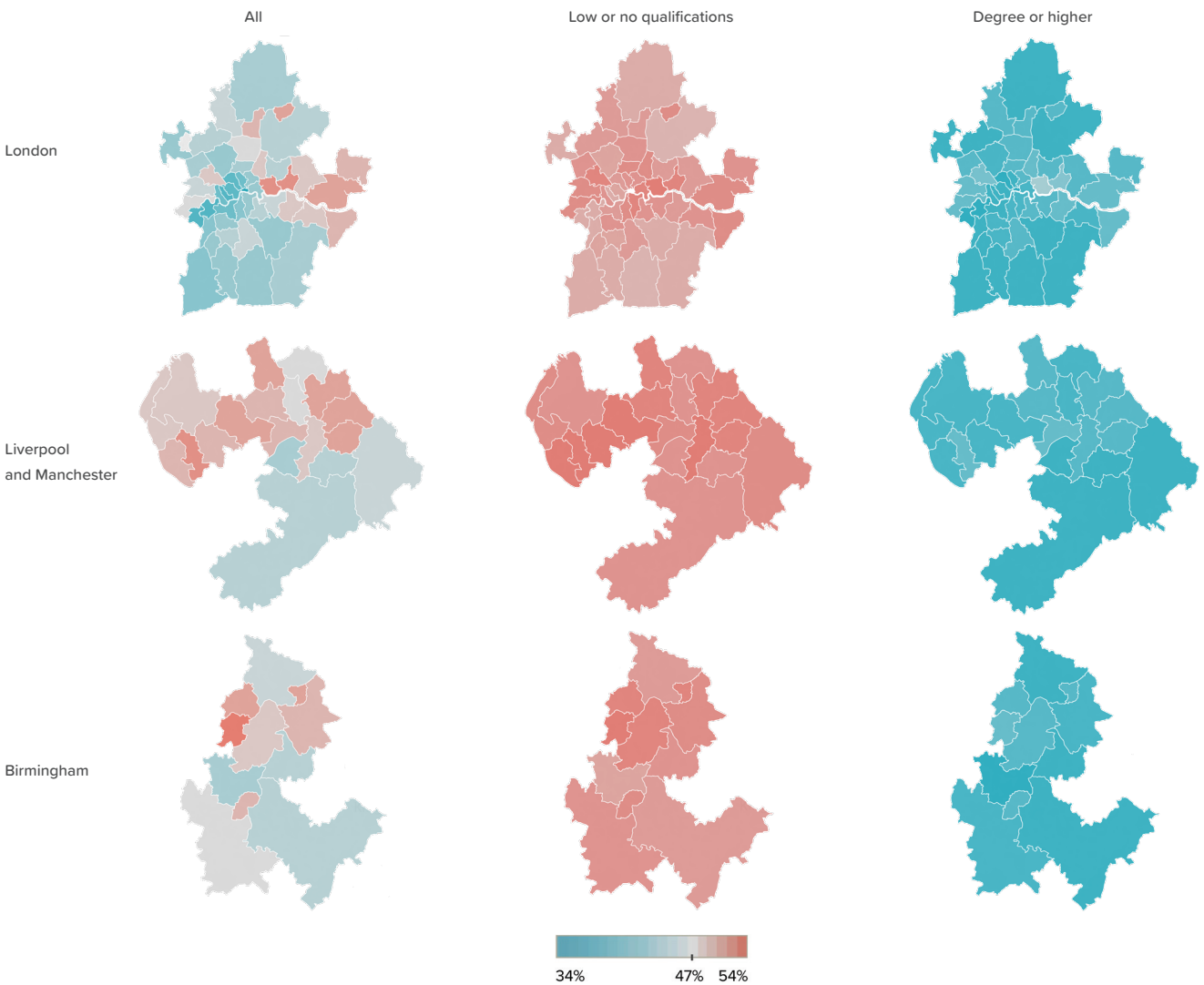
Figure 5: Propensity for automation by Local Authority and education level, England, ordered from most urban to most rural



Source: Onward analysis of ONS data and 2011 Census.

- This is shown clearly when local risk is mapped across borough councils within some of Britain's major cities. For example, there is a clear divide between West London and East London in terms of overall risk of automation, with the former relatively insulated and the latter relatively vulnerable. However, if the results are split by education level, we see that low skilled workers are vulnerable everywhere, especially in boroughs such as Tower Hamlets and Southwark, while high skilled workers are comparatively insulated from computerisation everywhere.
- The same is true of Liverpool, Manchester and Birmingham, where risk changes markedly when broken down by education. Whilst as AI becomes more advanced high skilled jobs may become more automatable, the immediate future suggests that low skilled workers will be hit the hardest.

Figure 6: Average worker propensity for automation by city travel to work areas



Source: Onward analysis of ONS data and 2011 Census.

6. The geographic distribution of low-skilled workers makes some places much more vulnerable than others

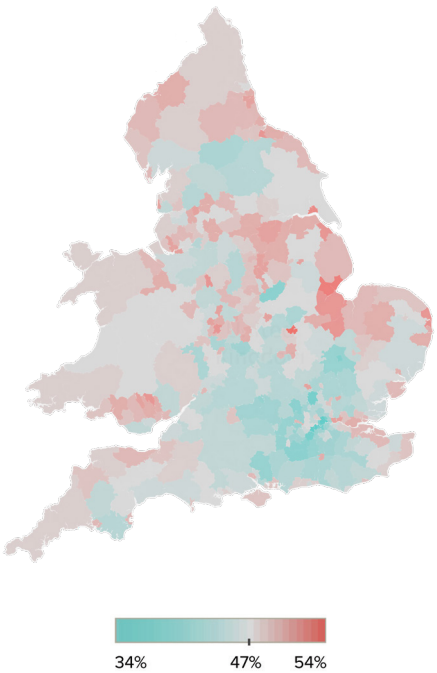
- The concentration of different skills in different places means some areas are affected by automation considerably more than others. When broken down by local authority, our analysis shows that the South East and London are relatively insulated from the adverse effects of technological change, while the North, Midlands, Wales and East Anglia are exposed. Thus, the losers from the next wave of industrial change could be the exact same places that lost out during deindustrialisation and globalisation in the last economic shift.
- This growing divide clearly reflects the concentration of high-skilled, technology driven industry around London, Cambridge and Oxford. Of the 25 local authorities with the lowest levels of automation risk, only one – Rushcliffe – is outside London and the South East and 8 of the top ten are in London. Outside London, affluent areas such as Cambridge, St Albans, Guildford and Oxford all exhibit low levels of automation risk, between 35%–43%.
- Residents in these areas have enjoyed considerable industrial and employment growth in recent years. Areas such as the City of London, Hammersmith and Fulham, Kensington and Chelsea, Camden, Islington, Elmbridge and St Albans all appear in the top 25 local authorities by share of residents working in growing industries, employed in growing occupations – as well as being in the bottom 25 local authorities by share of residents for risk of automation. Notably, some of these areas neighbour areas with higher levels of relative risk: Fenland, for example, neighbours Cambridge but workers there are 10 percentage points more likely to be automated.
- In contrast, the local authorities with the highest risk of automation tend to be in poorer parts of the country with a declining industrial and employment base. This includes towns in the North, Midlands and East Anglia such as Corby, Boston, Middlesborough and Stoke, all of which have an average risk of automation that is over 50%. These places face a perfect storm as the labour market changes and automation exacerbates the previous effects of globalisation and deindustrialisation. For example, 24% of workers in Kingston upon Hull are employed in occupations that are in a process of decline, and 13% of workers are in industries with falling economic activity – and yet the average likelihood of future automation is 52%.
- A number of the areas most at risk are rural, rather than urban. In Richmondshire in Yorkshire, 30% of workers are currently working in an industry that has declined in terms of GVA since 2011, 30% work in an industry that has seen employment decline over the same period and 32% work in an occupation that is in decline – and the risk of automation for residents of Richmondshire is 45%.
- Similarly, in Copeland in the Lake District, workers risk from automation is nearly 49% on average, with more than a quarter of workers employed in declining industries, occupations or industries with declining employment. Even in areas with a strong industrial history this risk level persists; for example the average risk of automation in Port Talbot is 50% and the

proportions of people employed in declining industries and occupations is well above the national average.

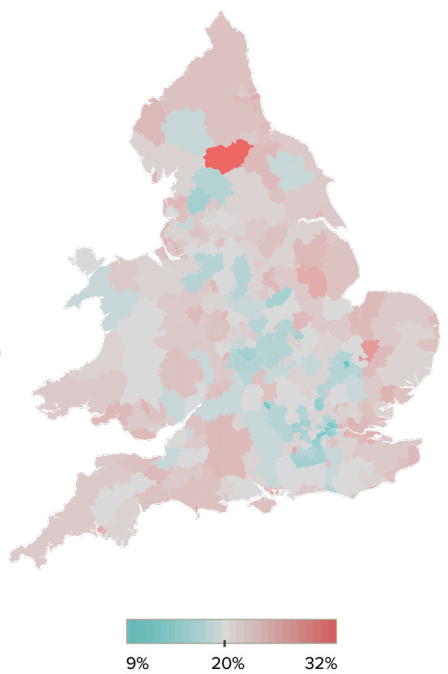
- For policymakers concerned about growing economic divides between low- and high-skilled workers and between more and less productive areas of the country, this should be of considerable concern. It suggests that the negative impact of automation will be felt by exactly the same people and places hardest hit by previous waves of industrial change – low-skilled people in places of weak and declining economic activity and employment. Irrespective of whether automation creates or takes away jobs from the economy as a whole, the distributional effect is clear: low-skilled workers in routine jobs are most at risk.

Figures 7: Geographic distribution of automation and occupation risk, by local authority

Average propensity for automation, by local authority



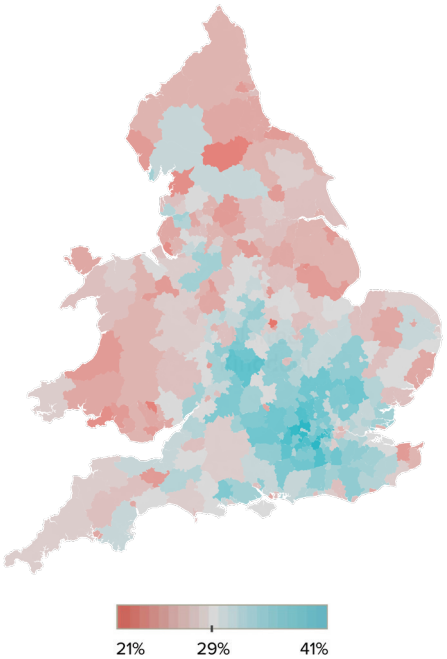
Proportion of the population working in a declining occupation



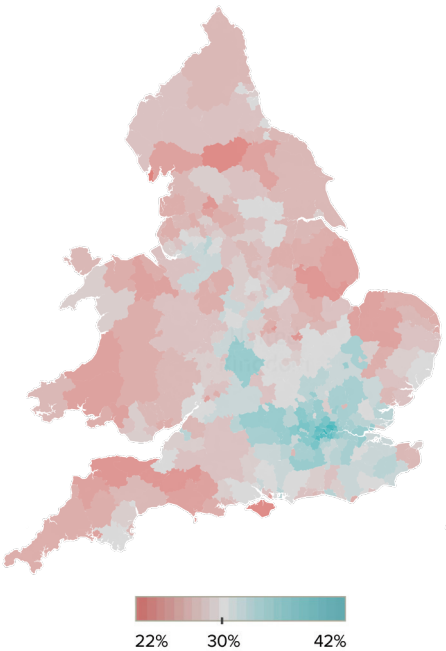
Source: Onward analysis of ONS data and 2011 Census.

Figure 8: Geographic distribution of growing industrial activity and employment, by local authority

Proportion of the population working in an industry with high GVA growth



Proportion of the population working in an industry with growing employment



Source: Onward analysis of ONS data and 2011 Census.

- There is also a strong correlation between the most productive local authorities and the areas least at risk of automation.[50] Ranked by productivity, the bottom 80 per cent of local authorities have automation risk scores at or above the national average – see Figure 9 below. The local authorities with the most productive economies (the top two deciles), when compared to areas lower down in the distribution, are far less vulnerable to automation.[51] This disparity is even greater when we look at the extreme ends of the distribution. The top ten most productive local authorities have an average GVA per job of £85,825 and 41.6% average probability of automation. This compares to GVA of £32,360 per job and 48.2% average probability of automation for the ten least productive local authorities.
- This pattern holds true in reverse. When looking at the areas least at risk of job displacement due to technological change, we see that they generate far more GVA per job than any other decile in the distribution. Again, there is not an obvious linear trend in this data. Little distinguishes the bottom 70–80 per cent of local authorities – ranked by automation risk or productivity – but the most prosperous areas far outperform the rest, providing further evidence of geographical inequality in England and Wales.

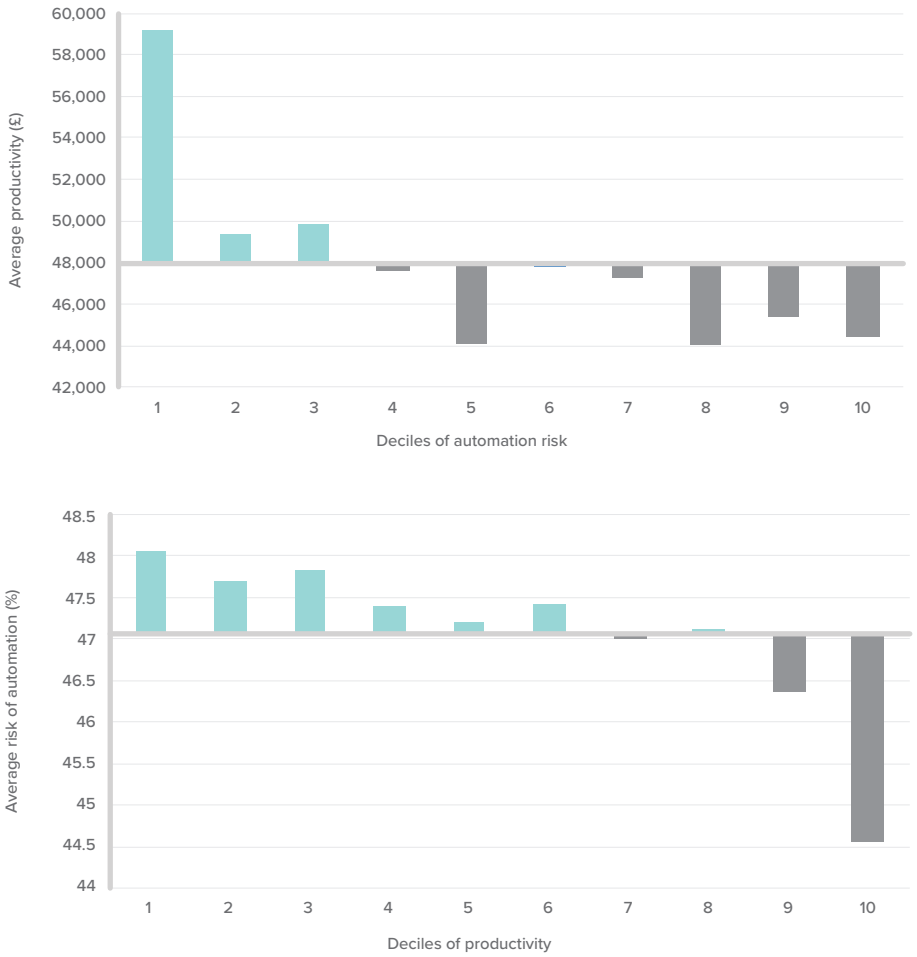
Table 6: Local authorities that are the most and least exposed to automation risk, by proportion of residents affected

	% working in growth industry	% working in declining industry	% working in growth occupation	% working in declining occupation	% working in industry with growing employment	% working in industry with declining employment	Share of employment at risk of computerisation
Least at risk							
City of London	39.8%	25.5%	39.7%	9.3%	42.4%	26.9%	35.0%
Richmond upon Thames	39.6%	16.2%	31.2%	14.4%	38.6%	15.4%	39.0%
Kensington and Chelsea	35.3%	23.4%	37.4%	15.3%	36.5%	22.9%	39.0%
Westminster	36.2%	22.1%	34.5%	16.6%	37.9%	21.7%	39.5%
Camden	35.1%	16.7%	32.1%	14.8%	39.8%	17.0%	39.6%
Wandsworth	37.2%	17.8%	29.1%	15.2%	38.0%	18.0%	40.4%
Islington	35.2%	16.8%	31.0%	14.8%	39.9%	17.3%	40.4%
Elmbridge	40.1%	15.7%	28.1%	16.1%	36.3%	15.7%	40.7%
Hammersmith and Fulham	38.2%	16.1%	31.3%	14.4%	40.2%	15.6%	40.8%
St Albans	35.4%	15.3%	26.3%	16.4%	34.4%	15.9%	40.8%
Cambridge	30.6%	8.7%	27.7%	14.1%	34.3%	9.9%	41.2%
Waverley	36.1%	14.0%	25.1%	17.3%	34.4%	14.3%	42.1%
Rushcliffe	30.1%	15.0%	21.1%	17.6%	30.3%	14.6%	42.3%
Chiltern	37.8%	12.5%	24.0%	17.8%	35.2%	13.1%	42.4%
Guildford	34.8%	14.4%	23.6%	18.4%	33.3%	15.0%	42.5%
Wokingham	37.8%	14.3%	25.6%	18.1%	34.4%	13.7%	42.5%
South Cambridgeshire	33.3%	12.8%	23.4%	17.8%	31.7%	14.3%	42.6%
Windsor and Maidenhead	39.5%	14.7%	26.7%	17.2%	35.4%	13.9%	42.6%
Oxford	26.2%	10.4%	23.3%	15.1%	30.9%	11.0%	42.7%
Hart	36.6%	17.9%	23.2%	20.7%	32.8%	17.5%	42.7%
Winchester	31.0%	16.0%	21.7%	19.3%	30.9%	15.9%	42.7%
Mole Valley	37.8%	14.5%	24.2%	17.1%	34.4%	15.5%	42.8%
South Bucks	40.7%	13.1%	23.6%	17.5%	36.1%	12.4%	42.8%
Kingston upon Thames	32.7%	15.0%	24.2%	18.8%	33.4%	15.6%	42.9%
Lambeth	33.7%	15.3%	27.9%	16.6%	37.8%	16.0%	43.0%

	% working in growth industry	% working in declining industry	% working in growth occupation	% working in declining occupation	% working in industry with growing employment	% working in industry with declining employment	Share of employment at risk of computerisation
Most at risk							
Corby	28.1%	13.1%	10.7%	17.7%	25.5%	16.9%	53.2%
Boston	25.1%	9.3%	10.9%	22.6%	24.8%	11.9%	52.6%
Kingston upon Hull	26.8%	12.9%	13.5%	23.7%	29.8%	13.4%	52.2%
Stoke-on-Trent	25.0%	12.5%	11.8%	23.7%	28.1%	17.2%	51.7%
Sandwell	28.1%	13.8%	13.2%	22.5%	30.1%	16.3%	51.6%
Blaenau Gwent	23.3%	15.9%	12.3%	20.1%	28.3%	18.4%	51.6%
North East Lincolnshire	24.9%	13.3%	13.1%	22.0%	27.4%	13.5%	51.5%
Great Yarmouth	29.3%	11.6%	14.0%	23.6%	26.7%	13.4%	51.2%
Fenland	30.4%	12.5%	13.0%	21.8%	30.5%	14.7%	51.1%
Middlesbrough	24.9%	13.5%	13.9%	23.0%	30.7%	13.8%	51.1%
South Holland	29.7%	8.9%	13.3%	20.1%	28.8%	11.2%	51.0%
Leicester	21.9%	15.9%	13.8%	20.2%	26.5%	17.0%	51.0%
Ashfield	29.5%	14.0%	12.3%	23.2%	30.0%	14.7%	50.9%
Blackpool	27.9%	14.4%	17.0%	23.4%	26.8%	15.5%	50.7%
Knowsley	27.3%	15.6%	13.3%	23.3%	30.0%	15.9%	50.7%
Bolsover	28.2%	12.2%	13.7%	20.6%	28.8%	14.7%	50.7%
Mansfield	27.8%	14.3%	12.4%	23.3%	28.9%	14.9%	50.6%
Doncaster	27.6%	13.9%	12.6%	22.8%	30.4%	15.3%	50.6%
Luton	31.5%	10.2%	14.4%	20.3%	34.4%	12.1%	50.5%
Merthyr Tydfil	25.9%	16.2%	12.7%	24.2%	27.6%	17.2%	50.5%
Wolverhampton	26.6%	14.0%	13.2%	22.6%	28.4%	16.5%	50.4%
Newham	27.1%	12.0%	17.7%	24.3%	34.4%	13.1%	50.4%
Halton	28.3%	16.9%	13.9%	22.3%	30.5%	16.5%	50.4%
Cannock Chase	31.8%	13.6%	12.4%	23.9%	31.6%	16.3%	50.4%
Lincoln	24.4%	13.2%	13.6%	24.0%	27.2%	15.5%	50.4%

Source: Onward analysis of ONS data and 2011 Census.

Figure 9: Productivity and automation risk, distance from the England and Wales average



Source: Onward analysis of ONS data and 2011 Census, ONS regional gross value added by local authority, ONS jobs density.

- Whilst this implies that, if at-risk workers are re-trained into occupations and industries that are resilient to automation, the local area could see a productivity boost as a result, it also illustrates a wider challenge: that the divide between successful and struggling parts of the country will grow over time. The shortage of highly-skilled workers in an area may be both a cause of increased levels of risk, and also a symptom of a weaker economy that offers high-skilled individuals fewer opportunities.

7. Women and ethnic minorities are at higher risk of automation and occupational decline

- Men are much more likely to work in growing industries and occupations. 38% of them worked in industries that grew in output between 2011 and 2017, compared with only 21% of women. Similarly, 39% of men are working in industries with growing employment compared to 21% of women.
- At an occupational level, men are also less likely to suffer from a changing labour market, albeit by a smaller margin. 19% of men are working in growth occupations, compared to 16% of women. Men are also marginally less likely to be working in declining occupations (19% to 23%).
- Accordingly, women, on average, work in roles with a higher probability of automation in future (48%) compared to men (46%). This is true across every age group apart from 25–34 year olds. Around one percentage point more women work in jobs with a 70%+ probability of automation than men, such as shelf-filling, waiting, or working as bar staff.

Figure 10: Gap between male and female average automation risk, mapped by local authority

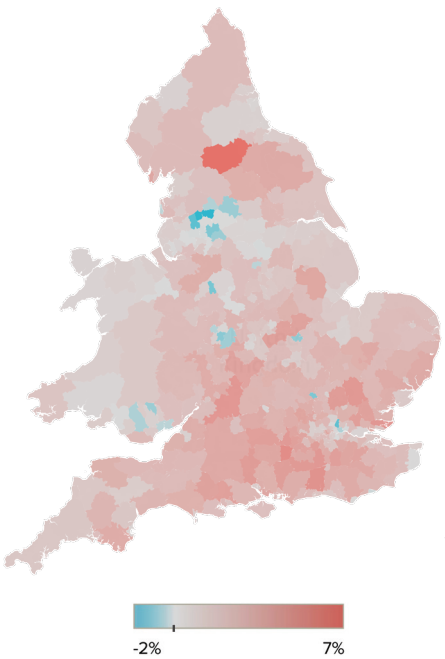
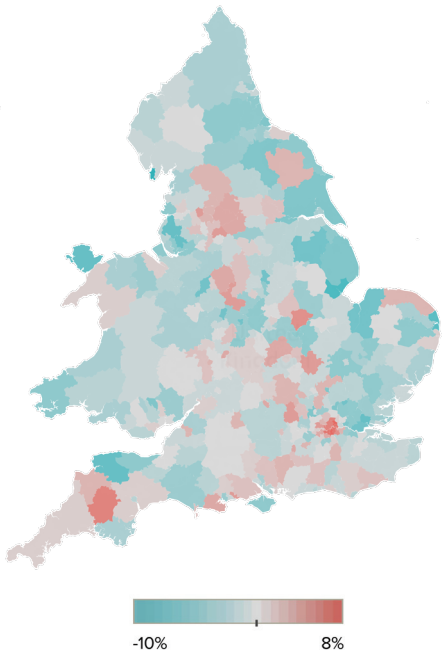


Figure 11: Gap between White and BAME average automation risk, mapped by local authority



Source: Onward analysis of ONS data and 2011 Census.

Note: A positive gap (coloured in red) indicates that women are more at risk than men, or that BAME people are more at risk than white people.

- Black workers (48%) are marginally more at risk of automation than other ethnic groups overall, compared to 47% for White and Asian workers. However, this masks wider differences between the characteristics of the industries and occupations in which different ethnic groups are employed.
- Of all ethnic groups, White workers are most likely to be employed in declining industries, declining occupations and sectors with declining employment. This offers further evidence of the declining prospects of the White working class in Britain, with between 15–20% of White people in Britain employed in industries that have seen output decline and jobs disappear over the last few decades.
- Asian (21%) and mixed/other ethnicity individuals (20%) are more likely to be employed in growth occupations than White people (18%) and considerably more likely than Black people (14%). The same ethnic groups have the most people working in industries with growing employment (32.5% for Asian and 33.1% for Mixed/Other individuals). For White people, the figure is 30.5%, and for Black workers it is 27.6% – a full 4.9 percentage points lower than their Asian counterparts.

Table 7: Changing employment and automation risk by ethnicity

	Growth industry (%)	Declining industry (%)	Growth occupation (%)	Declining occupation (%)	Industry with high jobs growth (%)	Industry losing jobs (%)	Automation probability
White	31%	15%	18%	21%	30%	16%	47%
Asian	25%	14%	20%	21%	32%	14%	47%
Black	23%	13%	14%	21%	28%	14%	48%
Mixed/Other	28%	13%	20%	20%	33%	14%	47%
Average	30%	15%	18%	21%	31%	16%	47%

Source: Onward analysis of ONS data and 2011 Census.

- Those that are most likely to benefit from technological change are highly educated individuals aged between 25–34. This follows a wider pattern of education being the best predictor of future employment risk: Asian men with a degree-level qualification (14%) are half as likely to work in an industry with declining employment than those with only secondary education (29%), and nearly twice as likely to be in an industry of high employment growth, by 28% to 15%. A similar pattern is visible for White and Black workers and across genders.

Table 8: Changing employment and automation risk by age

	Growth industry (%)	Declining industry (%)	Growth occupation (%)	Declining occupation (%)	Industry with high jobs growth (%)	Industry losing jobs (%)	Automation probability
18–24	27%	11%	14%	28%	31%	11%	55%
25–34	32%	16%	21%	18%	32%	17%	46%
35–44	31%	16%	20%	19%	31%	17%	45%
45–54	29%	16%	17%	20%	29%	17%	46%
55–64	29%	14%	16%	21%	30%	16%	47%
Average	30%	15%	18%	21%	31%	16%	47%

Source: Onward analysis of ONS data and 2011 Census.

- When broken down by age, 18–24 year olds are least likely to work in growth occupations or industries. Just 14% of this group are in jobs that are growing and 27% are employed in growth industries. 25–34 year olds are the most likely to be in growth occupations and industries, after which likelihood steadily declines with age. 18–24 year olds are also most likely to be in declining occupations – 27.8% compared to the England and Wales average of 20.9%. This is likely due to the stage of their career, with many employed in temporary or precarious employment at the start of their working life.
- Overall, the group most vulnerable to changing labour market is Black women. Irrespective of how educated they are, Black women are less likely than other groups of working in a growth industry. Black women with degrees have an 18% chance of working in a growth industry, compared to 29% among Black men with degrees, and 37% of White men with no or low skills. Nearly half (47%) of all Asian men with no or low qualifications work in industries with high employment growth, compared to 19% of degree-educated Black women.

8. Leave-voting areas are overwhelmingly more likely to be at a high risk of automation

- There is a strong correlation between how local areas voted in the EU referendum and their risk of automation, reflecting differences in the education and opportunities available. If we map the overall average probability of automation for local authorities against referendum vote share, we find that areas with high risk of automation are much more likely to have voted Leave in 2016. For example, the highest local authority for risk of automation is Corby, which voted to leave the EU by approximately 64% to 36%. At the other end of the spectrum is the City of London, which voted to remain in the EU by 75% to 25% and is the most resilient local authority to automation. This association is very strong, as the relationship between the two variables has an R-squared value of 0.60.

Figure 12: The relationship between risk of automation and Brexit

Source: Onward analysis of ONS data and 2011 Census, Electoral Commission.

- This also holds true when we consider the share of the population working in jobs with a low risk of automation. The more workers a local authority has in roles at low risk of automation and disruption, the higher the likelihood it voted Remain in 2016. Again, this relationship is extremely robust; with an R-squared value of 0.68.
- Polling for this report shows that most people do not think automation will affect their jobs personally, but the strength of association between automation risk and political behaviour illustrates a much deeper relationship between industrial decline, education levels, political views, and the future they think they can expect. This implies that the growing precariousness of the labour market for certain places was one of the greatest factors in the political upset in 2016 and that this political disruption may continue for as long as policymakers fail to address the training gap between low- and high-skilled workers.
- It echoes the previous argument that the core political divide in the West is not between classes or genders or ethnicities, but between the highly skilled and the low or unskilled. As academics such as Yascha Mounk and David Goodhart have written, the wider trend towards populism across the Western world is heavily correlated with education levels – with what *The Economist*'s Bagehot columnist calls "exam-passers" voting for more globalist, liberal causes and "exam-flunkers" voting for more populist leaders and against the elite.[52] This reflects a consistent failure to improve the opportunities available for those with low or no skills, and without a positive offer to do so the divides in our politics will continue to grow.

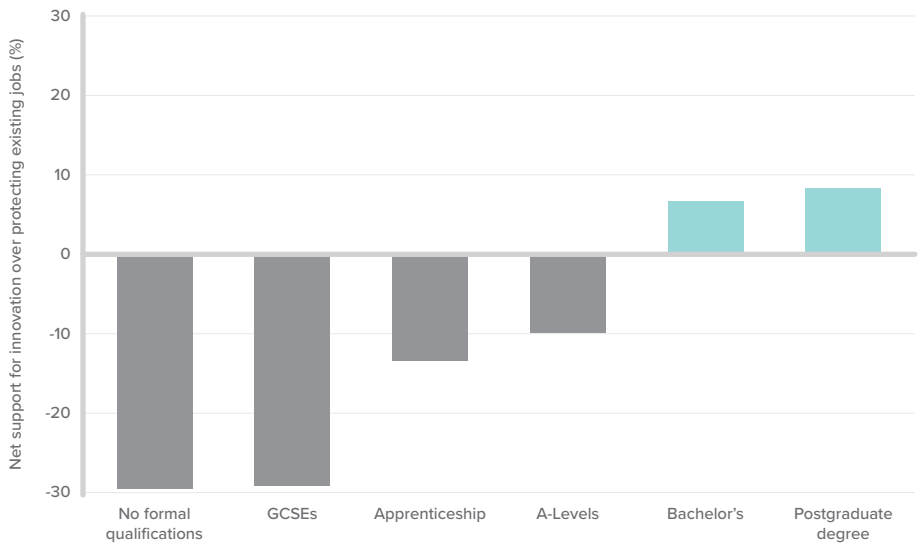
Attitudes towards automation and skills

What the public think should be done

The changing labour market and growth of automation has significant political implications, as set out above. Polls consistently show that workers are wary of automation and industrial change, and supportive of political remedies to protect existing jobs and mitigate the disruption of technology. In April, Onward's *Generation Why?* report revealed that:[53]

- When asked to choose, 55% of voters favour a government that "protects existing jobs and industries" compared to 45% who want one that "produces innovation and new technology". This scepticism about the benefits of new technology is strongest among younger voters. 57% of 18–24s and 63% of 25–34s favour a government that protects jobs over one that supports innovation. Only over 55s are favourable to innovation.
- Workers with lower qualifications are particularly nervous about the impact of new technology. Two thirds (65%) of people with no formal qualifications or GCSE level education want existing jobs to be protected instead of innovation pursued, with only one third in support. The only groups that favour innovation are graduates and postgraduates – the workers most likely to be the biggest beneficiaries.

Figure 13: Net support for innovation over protecting existing jobs, by education level



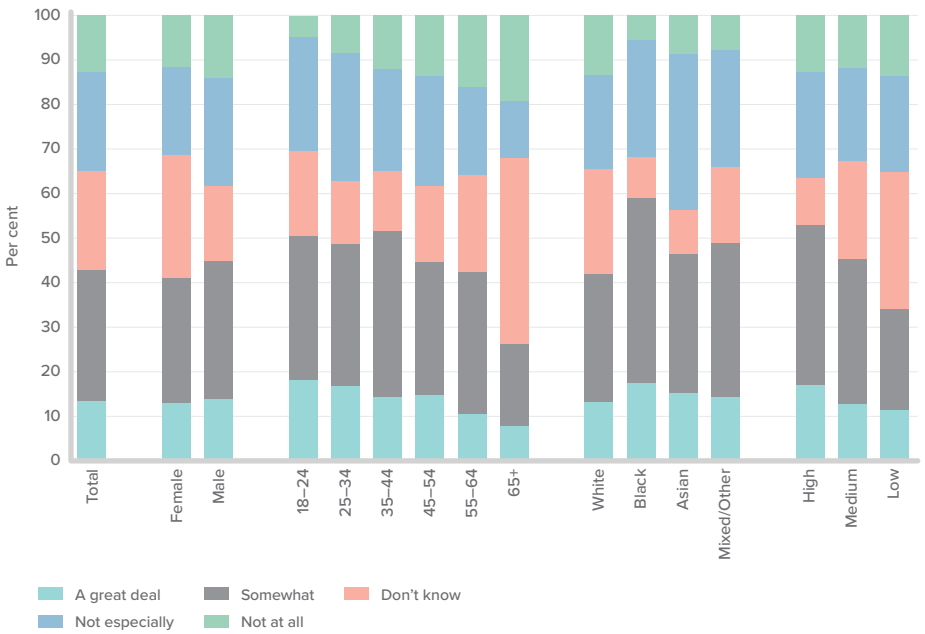
Source: Onward/Hanbury Strategy Poll, 10,031 sample, conducted 9–27 November 2018.

- This explains the popularity of certain education policies among the electorate. The second most popular education policy we tested in *Generation Why?* was "the introduction of a national retraining scheme for people to re-skill for new jobs throughout their lives", scoring more highly than reductions to student loans or making university funded by the taxpayer. Interestingly, a retraining scheme was the most popular education policy among over-55s and people over the age of 65 years old.

Additional polling for this report by Hanbury Strategy provides an even more in-depth picture of people's views of automation and changing labour market.

- On average, 64% of people believe that computers or robots will do much of the work done by humans. This varies across different demographics, with men (65%) marginally more sure than women (63%), 18–24 year olds (67%) more likely to believe it than over-65s (62%), and Mixed or Asian ethnicities (67%) more likely than White or Black voters (63%) to believe that automation is coming. The largest division is around education, where low skilled people are much less likely to worry about automation (61%) than high skilled people (68%).

Figure 14: How likely do you think it is that in the next 50 years computers and robots will do much of the work currently done by humans?

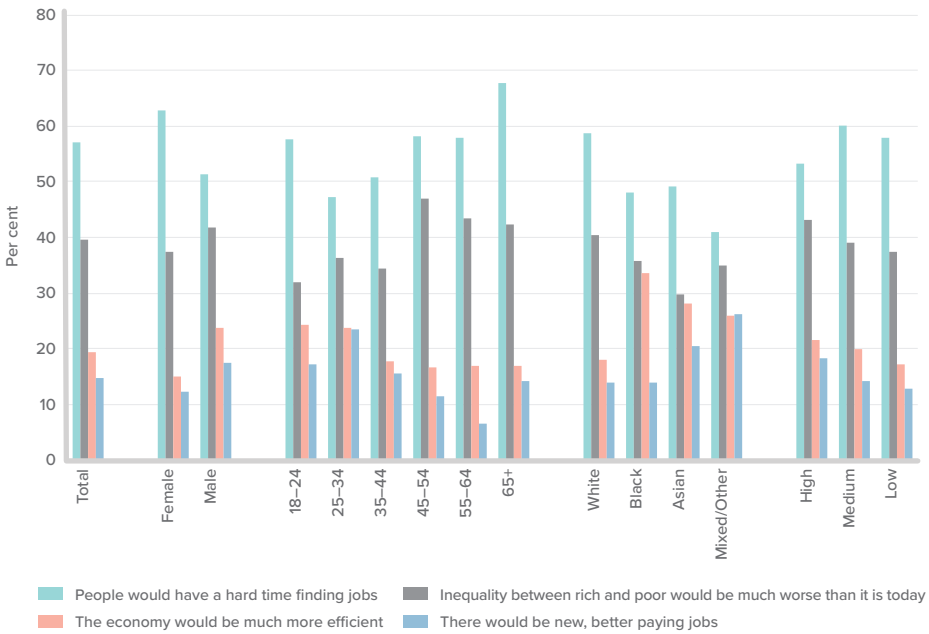


Source: Onward/Hanbury Strategy poll.

- This is not a prospect that most people welcome. When asked to consider what might happen if a large number of jobs were automated, people overwhelmingly choose negative options. On average, 57% think that people would struggle to find employment and a further 40% predict that inequality would rise. This compares to just 15% who predict new, better-paying jobs and 19% who believe the economy would be more efficient.
- Interestingly, there is considerable variation between different types of worker. Men are more optimistic about the implications of automation than women: 63% of the latter believing it would mean automation making it harder to find work, compared to 51% of the former. Young people are also considerably more optimistic: 24% of 25–34 year olds believe there will be new and better

paying jobs due to innovation, compared to just 7% of 55–64 year olds. The group most optimistic about the prospects for innovation are Mixed/Other ethnic groups, 26% of whom believe that automation will lead to better jobs, compared to 14% of White and Black workers.

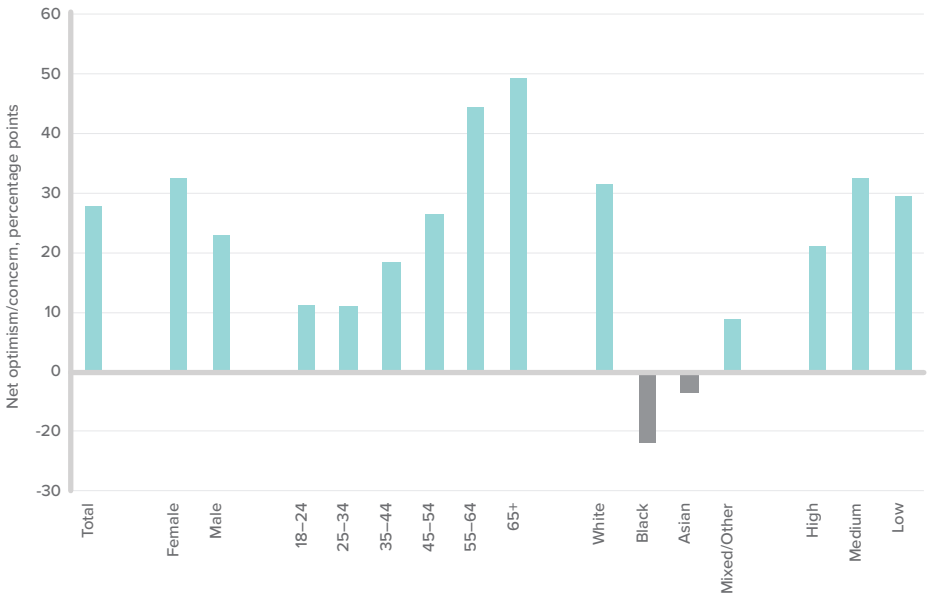
Figure 15: Which of the following, if any, do you think is likely to happen if computers and robots are able to do much of the work currently done by humans?



Source: Onward/Hanbury Strategy poll.

- Despite most people believing that automation will destroy a majority of jobs within the next few generations, few respondents believe they will be affected. 57% of all respondents did not feel their job was especially or at all threatened by technology, compared to just 30% who did, and only 9% who felt that it was threatened a great deal. Black and Asian workers were the only people who exhibited net concern about the threat from automation: 55% of Black workers believe their job is at risk, double the rate for White workers (27.5%). Worryingly, those most likely to be threatened by automation – people with low skills are less likely to feel threatened than high-skilled workers.

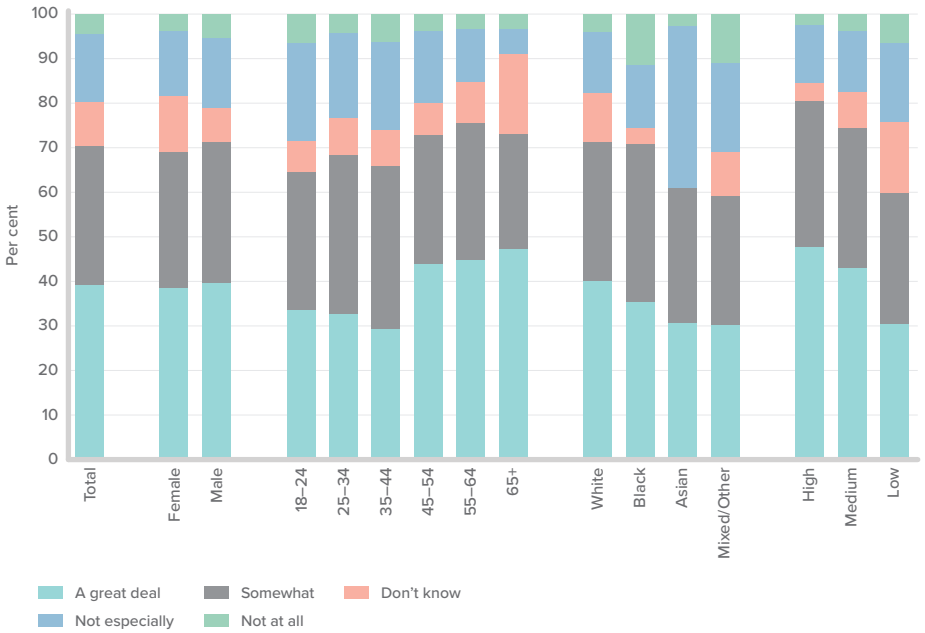
Figure 16: To what extent do you personally feel like your job is at risk of significant change from technology?



Source: Onward/Hanbury Strategy poll.

- When asked to what extent they feel like they have the skills and qualifications for their job, the majority of people (70%) are positive. However, certain groups are more equivocal: 60% of Asian workers feel they have the right skills, compared to 71% of White workers, and 11% of Black workers say they do not have the right skills at all for their job, nearly three times as many as for White workers. Nearly a quarter of low skilled workers (24%) are not confident they have the right skills, compared to just 16% of high skilled workers.

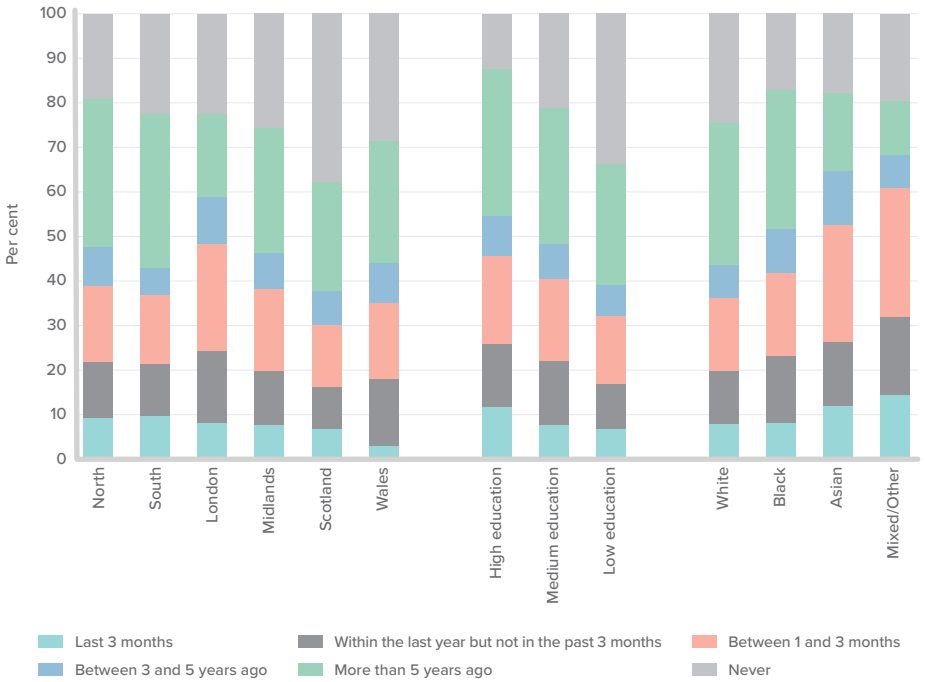
Figure 17: To what extent do you feel like you have the right skills and qualifications to do your job?



Source: Onward/Hanbury Strategy poll.

- The share of workers actively upskilling to gain a promotion or a new job is relatively low. On average, 21% of workers have gained a new skill in the last year, compared to 23% have never gained a new qualification to progress in work. High skilled workers (26%) are much more likely to have gained a qualification in the last year than low skilled workers (17%) and unsurprisingly around a third as likely to have never gained a qualification to progress in work, by 13% to 34%. There is also a considerable ethnic and geographic gap on this measure: workers in London are much more likely to have recently upskilled for work progression, and Asian and Mixed/other workers are more likely to have done so.

Figure 18: When was the last time, if ever, that you gained a new training qualification to help you get a promotion or a new job?



Source: Onward/Hanbury Strategy poll.

- When asked to consider whose responsibility it is to ensure workers have the right skills and education, the majority of people say the Government and individuals themselves (55.1%), with employers the least popular option (49.9%). This masks some variation between different groups. For example, older generations are much more in favour of self-reliance, with 63% of 55–64 year olds saying that it is individuals' responsibility, compared to 41% of 18–24 year olds.

Table 9: Which of the following, if any, have or has a lot of responsibility to make sure the workforce has the right skills and education to be successful in the future?

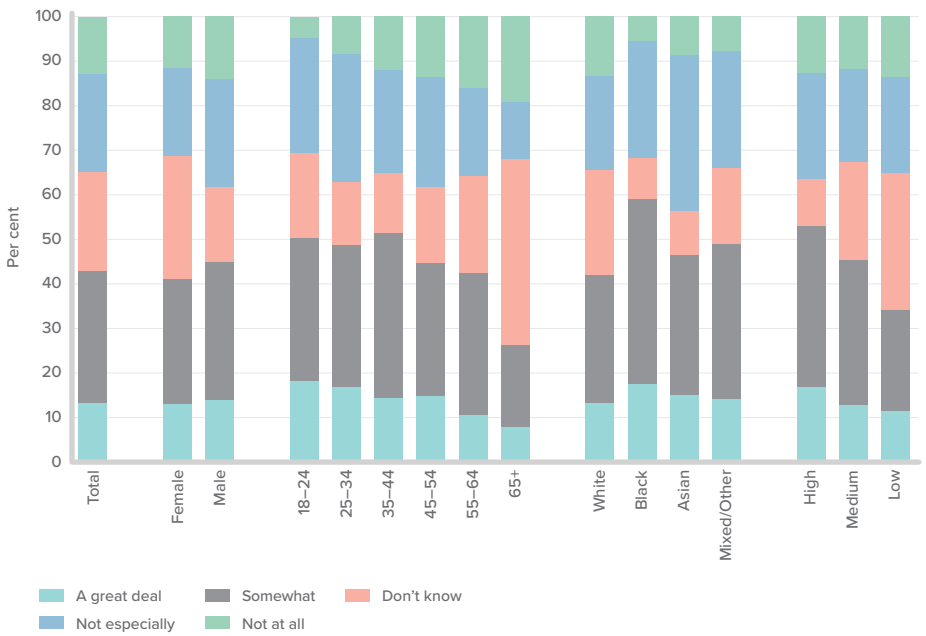
	The Government	Schools	Individuals themselves	Employers
Total	55%	53%	55%	50%
Female	54%	52%	57%	51%
Male	56%	54%	530%	49%
18 to 24	53%	51%	41%	40%
25 to 34	52%	49%	49%	51%

	The Government	Schools	Individuals themselves	Employers
35 to 44	48.30%	51.50%	51.70%	51.80%
45 to 54	58.50%	53.00%	62.40%	50.20%
55 to 64	59.60%	54.30%	63.00%	53.70%
65+	58.20%	58.20%	61.30%	51.40%

Source: Onward/Hanbury Strategy poll.

Similarly, there is wide variation when people are asked the extent to which their employer already helps them learn new skills. 53% of high-skilled workers say that their employer helps them learn new skills somewhat or a great deal, compared to just 34% of low skilled workers. Interestingly, Black workers are much more likely to say that their employer is supportive, with 59% saying so, compared to 42% for White workers. Men feel less supported than women.

Figure 19: To what extent does your employer take steps to help you and other employees to learn new skills on an ongoing basis?



Source: Onward/Hanbury Strategy poll.

Solutions

Creating the workforce of the future

Britain's low skills problem is deep, enduring and at risk of getting worse. The core of people and places most held back by low skills in the past are now threatened again by new technology, with considerable economic and political implications but little help from policymakers or employers.

Whilst technological advances will bring many benefits: improved productivity, innovation and safety, to name a few, they will also have a displacing effect. If the economy is to work for everyone, we need to find ways to retrain low-skilled workers to enable them to transition into new roles, earn more and be more productive, as well as providing them the opportunity to succeed across the country.

Our research has shown that workers with low- and medium-skill levels are the most likely to be affected by automation. Part of the answer is to prepare new labour market entrants for the changing nature of work, with an increased focus on aligning the education with skills systems being vital. However, for those already in the workforce, a more defined approach is required.

This paper argues for wholesale reform of the skills system to radically improve people's skills and retrain low-skilled workers for the changing world of work. Given the ways low-skilled workers are currently being failed, it should achieve three key objectives:

- It would include targeting at low- and medium-skilled workers in roles especially at risk of automation and industrial decline;
- It would reverse the decline in employer-funded training and encourage both SMEs and large businesses to retrain employees for new roles instead of replacing them;
- It would be targeted to help local areas that will otherwise suffer from high concentrations of low skills and economic decline.

In this chapter, we propose four solutions to achieve this: the introduction of a retraining tax credit along similar lines to the R&D tax credit; a more expansive National Retraining Scheme; reform to the Apprenticeship Levy into a Retraining Levy to fund; and using the Shared Prosperity Fund to attract inward investment from high skilled and high growth employers into local areas facing multiple risks.

Recommendation one: Introduce a Retraining Tax Credit to encourage companies to invest in their workers

As discussed in chapter 1, Britain has more low skilled workers proportionally than any other developed economy and employer spending on training per employee has fallen consistently for the last decade. As a result, undereducation is high and a large share of the workforce is at risk of automation and industrial decline.

One reason for this underinvestment is the relative disadvantage of human capital investment over other forms of capital spending. Under current tax rules, companies can claim up to 230% tax relief on research and development through the R&D Tax Credit and up to 100% on the costs of capital items such as equipment, machines, computers and office transport (up to £1 million p.a.) through the Annual Investment

Allowance. While employers can claim the costs of training an employee for courses related to their current job (for example, a nurse going on a first aid refresher), this does not extend to wider retraining and upskilling.

A brief summary of R&D tax credits

The R&D Tax Credit scheme was introduced in 2000–01 for SMEs and extended to large companies in 2002–03. Since then the tax credit has undergone a number of changes, including increases in the rate of enhanced reduction, and the introduction of the Research and Development Expenditure Credit (RDEC).

Following those changes, companies can claim up 230% tax relief on qualifying costs associated with research and development, depending on their size and the scope of the investment. The system combines both a tax credit – which reduced the company's liability for corporation tax by a percentage of their R&D expenditure, and an enhanced allowance component, which allows companies to deduct R&D expenditure from their taxable income.[54]

Between 2000–01 and 2016–17, over 240,000 claims have been made and £21.4 billion in tax relief claimed.[55] Between 2014–15 and 2015–16, the number of SME claims rose by 23% to 36,820, while the total number of claims for the large company and RDEC schemes increased by 17% to 6,215.[56]

In 2015, an evaluation of the schemes for HMRC found evidence that companies increase their R&D expenditure when the cost of R&D decreases. The study estimated the elasticity of R&D expenditure with respect to the user cost of R&D at – 1.96, implying that between £1.53 and £2.35 of R&D expenditure is stimulated by £1 of tax forgone.[57] Subsequent studies by academics at the LSE have estimated that a 10 per cent fall in the cost of R&D generates about a 26 per cent increase in the volume of R&D".[58] It is estimated that UK business R&D spending would be 13% lower in the absence of R&D tax breaks.[59]

Yet there are good arguments that human capital investment delivers positive spillovers – and should be treated similarly to other forms of investment. The link between human capital accumulation and long-run economic growth is well-founded in the literature. At a national level, Zvi Griliches (1997) estimated that rising human capital over the second half of the last century accounted for approximately one third of US productivity growth in that period.[60] Locally, Enrico Moretti (2002) has used matched firm-worker data to demonstrate that plants located in cities with a high level of human capital deliver a higher level of productivity than plants in cities with low human capital: a 1% increase in the share of college graduates working in corollary industries is associated with a 0.8% increase in productivity in the plant.[61]

Other studies find that raising the share of workers in an industry who receive training by one percentage point increases value added per worker by 0.6 to 0.8 per cent and that raising the number of training days per employee and number of hours training per head also boost productivity.[62] More recent studies have suggested that increasing training and boosting the UK's skills level would make an important contribution to improving productivity.[63]

A number of other countries have also recently introduced human capital tax credits. In Austria, companies can claim a full tax allowance for training expenses and a further 20% of actual expenses is deducted from taxable income. This implies a 120% tax allowance in real terms.[64] Firms that do not make enough profit to benefit from this tax allowance can instead claim a tax credit of 6% of the actual training expenses, and there is also a tax allowance for individual expenditure on training. Similarly, France provides a business credit for entrepreneurs equal to the number of training hours multiplied by the minimum wage.[65]

We propose that a Retraining Tax Credit in the UK would provide relief on any employer training or retraining costs of an employee studying towards a new qualification higher than their existing level. It should mirror the R&D tax credit in that it should provide relief for designated investment, and have separate rates for SMEs and Large companies. To specifically support low-skilled workers and avoid deadweight cost of training already highly educated workers, we propose differential rates for different levels of education, as per the box below.

Retraining Tax Credit: Proposed rates and worked examples

For large companies:

- 100% of spend training those with secondary qualifications or below;
- 50% of spend training those with post-secondary qualifications;
- 25% of spend training those with graduate or equivalent qualifications.

For SMEs:

- 230% of spend training those with secondary qualifications or below;
- 115% of spend training those with post-secondary qualifications;
- 57.5% of spend training those with graduate or equivalent qualifications.

Examples

An SME owner offers to pay for training for an employee with low/no qualifications at a cost of £2,000. They receive tax relief at 230% (£4,600) – reducing their taxable profits by that amount. Given a corporation tax rate of 19%, They pay £874 less tax, reducing the effective cost of the training to £1,126.

A large business owner expands training offered to their moderately qualified (post-secondary, non-graduate) staff. They spend £1,000 a year per member of staff on this. Tax relief at 50% means for each person they train they are liable to have £500 less of my profits taxed, reducing the effective cost of the training by around £95 per member of staff.

The Treasury will understandably be concerned with deadweight cost, but the design of the tax credit would safeguard against taxpayers' subsidising non-additional activity in two important ways. First, we recommend employers can only claim for recognised qualifications, for example those approved by

the Institute for Apprenticeships[66] or delivered by a college, university or Institute of Technology, to ensure that funding is targeted at recognised training rather than company training of limited wider value.[67] Second, the variable tariffs for different kinds of workers would ensure that employers have a larger incentive to train low-skilled workers due to the lower subsidy for workers with pre-existing advanced qualifications.

This would provide significant and targeted assistance for businesses to help their workers upskill, with more resources available to those our analysis suggests are most at risk of automation. The effects of retraining on workers' risk of automation is potentially considerable: the average C2 worker has a probability of automation of around 52.7%. A move into a supervisory role in the C1 grade reduces this likelihood down to 45.3%. For workers in DE professions the impact would be even more pronounced. A 50 year-old male DE worker has an average automation probability of around 60.4%; training to help them progress into an average C1 role would reduce this to 40.9%.

Our analysis estimates that the introduction of this type of Retraining Tax Credit would cost an estimated £0.87 billion per year if used over five years to retrain all of the 1.5 million workers the ONS currently defines as "at risk" from automation and technological change. This estimates that the average retraining cost per employee would be £1,400 at a large organisation and £3,700 per employee at an SME.

As the headline rate of corporation tax reduces to 17% by 2020–21, the relative value of the tax relief would diminish. This could mean that the rates would need to be adjusted to maintain parity of the incentives for employers. Similarly, if uptake were lower or higher than expected then the tax credit could be targeted and scaled up and down according to policy.

Recommendation two: Use the National Retraining Scheme to support at-risk workers to train into higher-value jobs

In 2017, the Conservative Party manifesto announced that the Government would help workers "to stay in secure jobs as the economy changes by introducing a national retraining scheme".[68] Since the election, the Treasury has announced £100 million of initial funding, mostly directed towards research, and partnered with the CBI and TUC to develop the scheme.[69]

However, two years on there is little detail about how the scheme will work in practice and no pilots have yet been rolled out.[70] The gradual introduction attempts to avoid the mistakes of the past – previous lifelong learning reforms, such as individual learning accounts and adult learner loans, have ended in failure, with low rates of take up and high rates of fraud.[71] But over two years the problems have got worse and the Government now desperately needs to set out further detail.

The problem with individual learning accounts

Individual Learning Accounts (ILAs) were introduced by the Labour Government in 2000 and subsidised the cost of certain courses with the goal of expanding access to training and skills development. Initially seen as a success, with one million account holders achieved six months earlier than expected, the scheme was withdrawn in 2001 on the recommendation of the police due to questions about courses being fraudulently promoted and sold. In 2002, the National Audit Office published an excoriating report that found serious failures over design, roll-out and monitoring. For example, the Department was unaware that 13 providers had registered over 10,000 accounts and 20 had received payments in excess of £1.5million.[72]

The experience in other countries is more promising. Singapore's SkillsFuture Credit is a prominent example of a successful scheme,[73] although there have been issues with fraud in the programme.[74] More recently, the Canadian government committed to a similar policy that would allow workers to subsidise their retraining costs and there have been suggestions that the National Retraining Scheme should follow their lead and be built around a new generation of personal learner accounts.[75]

Wide scale fraud notwithstanding, there are a number of other problems with personal learner accounts that make them ill-suited for targeted retraining. In particular, individual accounts favour workers with personal initiative and the wherewithal to find and fund training. The people at most risk of automation and industrial decline in the coming years are less likely to be in this category, predominantly because our polling shows that they believe they will be unaffected, and because training is mostly undertaken by those who are already well qualified. Indeed, previous ILA surveys found that around 40% of participants had high qualifications, 25% with degrees, and nearly 90% of respondents were White.[76]

A similar conclusion when the Government recently consulted on tax relief for self-funded work-related training. The proposal was discontinued when the consultation found that the barriers to learning were take-up, upfront cost and a lack of time, none of which would be solved through a purely financial mechanism like a learner account.[77]

The key challenge for the NRS is how to target training effectively – both in terms of participants and the jobs to train them towards. There is an inverse relationship between those who currently retrain and their level of need: 52% of people with a degree say that it is 'very likely' that they will undertake job-related retraining in the next two or three years, whereas only 12% of those with no qualifications say the same.[78] Similarly, there is a risk of training workers in skills that are themselves likely be automated in future: a previous Department for Work and Pensions initiative to train unemployed workers to drive HGVs was abandoned after it became clear autonomous vehicles would likely make the jobs at least partially obsolete within ten years.

We therefore recommend that the National Retraining Scheme is tightly targeted around current and future labour market risk, extrapolating recent ONS work to model which occupations are likely to decline in the future and which are most resilient to industrial change.[79] The scheme should allow any individual whose

job is at high risk of disruption to apply to retrain into a different role with lower automation risk (either at their existing or future employer), and any employer of a high-risk worker to fund their retraining through a reformed apprenticeship levy (see next recommendation).

Different job matching models have been explored by a number of recent studies for the World Economic Forum (WEF). In 2018, a study by BCG for the WEF compared 958 specific job types against a database of information scraped from online jobs boards to match jobs with transferable knowledge and skills. It identified a large number of job transitions for workers at risk of automation in the US. For example, assembly line workers are a 'good fit' for construction labourers; electrical equipment assemblers for electricians, and executive assistants for HR specialists.[80] The NRS should aim to support people to make these transitions, either with their existing employer or joining another firm.

Using the Office for National Statistics' predictions of automation risk by job role, the Department for Education and HM Treasury could develop an adaptive model to match workers in England and Wales to different kinds of training. The potential gains in terms of resilience to automation are considerable. Using only the ONS' published occupational risk scores, a florist could halve their automation risk if they trained as a groundskeeper or gardener; a retail cashier or check-out operator would cut their risk by a third if they trained to become a customer service supervisor, and waiting staff could fall from 73% automation risk to 52% if they trained as a security guard.

Obviously these figures are illustrative of current demand for different job roles, and a matching programme would have to factor in expected future demand after retraining. Nonetheless, the central point remains; even existing data already shows the potential of matching at-risk workers to similar jobs that have a markedly lower threat of automation.

Table 10: Top five low and high risk jobs, by SOC code

	High risk jobs	Probability of automation	Low risk jobs	Probability of automation
Administrative and secretarial occupations	Stock control clerks and assistants	59.57%	Office managers	47.06%
	Credit controllers	59.75%	Finance officers	48.17%
	Sales administrators	60.86%	Office supervisors	48.74%
	Legal secretaries	61.57%	National government administrative occupations	50.97%
	Receptionists	61.83%	Local government administrative occupations	51.02%

	High risk jobs	Probability of automation	Low risk jobs	Probability of automation
Skilled trades occupations	Weavers and knitters	57.59%	Gardeners and landscape gardeners	31.73%
	Butchers	58.48%	Groundsmen and greenkeepers	32.67%
	Bakers and flour confectioners	58.51%	Agricultural and fishing trades n.e.c.	34.60%
	Fishmongers and poultry dressers	60.26%	Farmers	36.86%
	Florists	63.61%	Horticultural trades	38.41%
Caring, leisure, and other service occupations	Childminders and related occupations	55.77%	Senior care workers	41.57%
	Care escorts	56.23%	Houseparents and residential wardens	45.20%
	Housekeepers and related occupations	58.07%	Ambulance staff (excluding paramedics)	45.70%
	Beauticians and related occupations	58.76%	Rail travel assistants	45.80%
	Hairdressers and barbers	58.79%	Caretakers	46.42%
Sales and customer service occupations	Vehicle and parts salespersons and advisers	56.84%	Customer service managers and supervisors	41.43%
	Telephone salespersons	57.59%	Communication operators	46.64%
	Pharmacy and other dispensing assistants	60.64%	Sales supervisors	47.90%
	Sales and retail assistants	63.78%	Market research interviewers	50.41%
	Retail cashiers and check-out operators	65.47%	Sales related occupations n.e.c.	51.91%

	High risk jobs	Probability of automation	Low risk jobs	Probability of automation
Process, plant and machine operatives	Van drivers	65.52%	Driving instructors	51.95%
	Agricultural machinery drivers	65.76%	Rail transport operatives	54.12%
	Weighers, graders and sorters	67.16%	Marine and waterways transport operatives	55.75%
	Tyre, exhaust and windscreen fitters	68.07%	Water and sewerage plant operatives	55.82%
	Sewing machinists	68.64%	Energy plant operatives	55.85%
Elementary occupations	Kitchen and catering assistants	69.20%	Hospital porters	55.77%
	Bar staff	70.66%	Parking and civil enforcement occupations	57.18%
	Elementary sales occupations n.e.c.	70.69%	Security guards and related occupations	57.33%
	Shelf fillers	71.70%	Forestry workers	58.35%
	Waiters and waitresses	72.81%	Elementary security occupations n.e.c.	58.58%

Source: Office for National Statistics.

The job-matching process could be delivered using a new digital platform through which workers could apply for retraining in their local area or online. Eligibility could be set flexibly, with workers able to access fully-funded retraining if their automation risk fell and skill level increased by retraining into the role. Given one of the greatest barriers to retraining is finding time around jobs, employers could also advertise job offers with retraining incorporated on the platform, or those promoted through trusted intermediaries.

The growing effectiveness of immersive, digitally assisted training across a range of domains (see Box below) suggests that, over time, the NRS could offer online training on job preparedness and for some specific roles digitally.[81] For courses that are not appropriate for digital delivery, the platform could link workers with courses run by FE colleges, training academies and institutes for technology, in a similar way that UCAS matches potential students to different options for post-school study.

Case study: Lambda School

Lambda School is a two-year old startup that provides higher education for no upfront cost to thousands of people around the world through guided online learning. Students only pay back the costs of tuition once they earn $50,000 per annum, at a rate of 17% of their salary for two years or up to a maximum of $30,000 total. The average Lambda graduate increases his or her income by $47,000 a year.[82]

Originally limited to machine learning and data science, Lambda has recently expanded into other digital courses, including user experience design (UX) and development for Android and iOS mobile apps. However, the founders see the model as applicable across a range of occupations and skill sets: in January the business announced a $30 million fundraise to expand into medical courses, such as nursing, and cybersecurity.

The model combines live video classes online, taught to a rigid curriculum, from 8 am to 5 pm every weekday over nine-months, with instant, one-on-one help from instructors and teaching assistants via Slack, the instant messaging app.

Whilst the Lambda school might have a number of differences to the NRS offering, it illustrates that a targeted, outcomes driven form of education can be delivered through digital means. If the NRS were to use such tools it could expand both the breadth of retraining options available, and also their reach.

Recommendation three: Reform the Apprenticeship Levy to create a separate employer Retraining Fund to support retraining

Since 2017, employers with a wage bill of over £3 million have paid an annual Apprenticeship Levy on their wage bill. This is levied at 3% minus a £15,000 apprenticeship allowance, which they are able to draw down to pay for the costs of apprenticeships within 24 months. The Levy is expected to raise £2.6 billion for apprenticeships in 2018/19, rising to £2.8 billion in 2021.[83]

In 2017/18, 375,800 people started apprenticeships and 814,800 participated on an apprenticeship. However, the Levy has experienced teething problems and attracted widespread criticism from employers. In 2017/18, the number of apprenticeship starts fell by 133,600,[84] only 9% of the available funds have been accessed by employers,[85] a rising number of firms have underpaid their levy obligation,[86] and freedom of information requests reveal that there was around £400m underspent in the system's first year.[87] The risk is that employers increasingly treat the Apprenticeship Levy like another tax they have to pay rather than a transformative incentive to invest in training.

There is also an argument that the beneficiaries of the Levy are not those the scheme originally set out to support or who most require training. In 2017/18, 44% of apprenticeships were at advanced level, equivalent to two A Level passes,

and 13% started at higher level, equivalent to a foundation degree, up from 40% and 7% respectively. The proportion of apprenticeship starts at intermediate level, equivalent to 5 GCSEs, fell from 53% in 2016/17 to 43% in 2017/18 – and the number of starts at degree level or above more than quintupled from 2,000 to 11,000.[88]

The recent Augar Review also documented that at Level 2 the lion's share of apprenticeships are being taken in lower value sectors, such as Business, Administration and Law, and Retail and Commercial Enterprise, with only 28 per cent of all starts at Levels 2 and 3 in ICT, Construction and Engineering (including Transport) – and in shortage industries like construction starts are very low indeed.

While degree level apprenticeships are to be welcomed, it is worrying that limited levy funds are increasingly being used to train already-qualified workers in advanced courses, rather than supporting low-skilled workers to progress and retrain.

We propose a series of reforms to the Apprenticeship Levy to accelerate employer drawdown and better target resources on workers that need training.

First, the Apprenticeship Levy should be split in two, with 60% of funding restricted to apprenticeships for younger workers entering their chosen profession. This funding would be restricted towards apprentices aged between 16 and 25 years old of any pre-existing skill level. This would preserve the current level of 59% of funding being spent on participants under the age of 25 years old over time, leading to no fewer young apprenticeships than currently, but redirect the remaining funds on low-skilled workers in need of training.

The remaining 40% of employers' Apprenticeship Levy funds should be repurposed into a Retraining Fund to help fund low-skilled workers at risk of automation and industrial decline to retrain through the NRS. This would collectively amount to £1.04 billion a year on current receipts.

While it would be restricted to funding workers with low-levels of existing education under the NRS framework, in other ways employers should have significantly more flexibility in how this money can be spent. For example, we believe that employers should be able to pass funding down their supply chains to SMEs, pool their funding with other employers locally, and spend it on employee wages during training.

This would address many employers' concerns with the levy while simultaneously targeting support at those that most need it.

These proposals would dovetail with other ways for individuals to self-fund lifelong learning, such as the Augar Review's welcome proposal for a transferable lifelong learning loan to be available for not only student loans but higher level technical and vocational qualifications too. This would ensure that individuals can undertake retraining even if their employer or future employer is unwilling to fund it through the NRS.

This dual framework would have wider benefits too. First, it would enable Government to "top up" funding for apprenticeships or low-skilled workers through an employer-led route, rather than through government programmes that in the past have proved wasteful and poorly targeted. The Government has implied that further training investment will be available in the future, describing the £100 million

dedicated to the NRS at the 2018 Budget as an "initial investment". The TUC, who together with the CBI are partnering with Government around the design of the NRS, have argued that this should be followed by "billions" of further investment.[89]

Second, it would allow Government to respond to labour market changes quickly or to target support to specific people in distressed regions. There would be no reason, for example, why the Chancellor could not reinvest the £400 million of unspent 2016/17 levy funds into low-skilled retraining into a region of the economy, effectively match-funding employer contributions and doubling skills spending in those regions. Further, if an area faced a potential shock like the threatened closure of the British Steel plant in Scunthorpe in May, which threatened 5,000 jobs, the Government could offer increased retraining funding for workers in that specific local area in certain industries, flexing the scheme provisions to the circumstances at hand.

Recommendation four: Use the Shared Prosperity Fund to specifically support inward investment in areas at risk of decline and automation

The threat of automation or industrial decline is not uniform: these risks affect different places more than others. Industrial and occupational growth is concentrated in urban cores and some of the surrounding prosperous suburbs, many of the risk factors we identify above are prevalent in local areas that are already struggling; rust belt and isolated parts of the country where manufacturing, mining, and other mainstay industries are either declining or automating.

Retraining solves one dimension of this problem, but ensuring that there are good jobs for people to do is also essential. There is little point developing skills if there is nowhere to apply them, and requiring people to move en-masse from their homes and communities is not a desirable or a realistic objective. Regenerating the prospects of these communities will require attracting more employers who provide good and high quality jobs.

Work from Enrico Moretti in the United States shows that the key to revitalising a place is attracting high-quality jobs which then generate spillover growth in the surrounding communities.[90] A repeat of this analysis in the UK found that, whilst effects on pay were negative, high-quality jobs could be relied upon to in turn generate significant new employment options in an area. This illustrates the importance not just of attracting good jobs, but also of preparing and connecting low-skilled people to them so that growth benefits the wider population. Similarly, the foreign direct investment literature suggests that successful investment that generates long-term benefits comes from participation in higher-value activities and participation in global value chains.[91,92] Crucially, efforts are also more effective when they include a focus on building links with local companies, and when they come from a local level.[93]

The overall direction we should be travelling in is clear: we need to be attracting money and companies in high-growth industries into distressed areas, as well as new businesses and startups. However, so far policies to get there have proved

wanting. The recent revival of Enterprise Zones, popularised in the Docklands and elsewhere in the 1980s, was an attempt to target investment, with the recognition that they were aimed at assisting parts of the country that had "missed out on the last ten years".[94] Since 2016, there has also been an increased interest in 'free zones', especially Free Ports, to help different areas benefit from improved connectivity with foreign markets as Britain leaves the EU.[95] The history of enterprise zones is not straightforwardly positive, however – the Centre for Cities has shown that in the 1980s they were expensive and did not create large numbers of additional jobs in some places, and urban and accessible zones were far more successful.

We believe there is a case for renewed focus on enterprise zones, with emphasis on attracting regional inward investment and foreign-owned firms. Targeted foreign direct investment can be transformative for distressed local areas and can help build a high-skills base that can sustain wider industry. As recent Onward research demonstrates, foreign firms account for around 16% of total UK employment but contribute 30% of total productivity growth.[96]

This is what Margaret Thatcher recognised when she brought Nissan to Sunderland in 1986, a plant that currently employs 7,000 people directly, 40,000 in its supply chain and produces hundreds of thousands of cars a year. More recently, it is what European Structural and Investment Funding achieved in Hull, when £52 million of funding was used to encourage Siemens to locate its wind turbine production and installation facilities in Yorkshire in 2014. In the US, Opportunity Zones have similarly proved successful at using targeted tax and joint investment support to attract high-skilled jobs to distressed neighbourhoods, kickstarting economic revival.

The Government's industrial strategy, coupled with the Shared Prosperity Fund, offers a route to turbocharge this agenda. The Government has been clear that it intends Local Industrial Strategies to be a successor to the national strategy. Announced in December 2018, they will be led by combined mayoral authorities and local authorities with a remit to "capture the strengths and opportunities of an area and provide the long-term plan for how we ensure we seize those opportunities".[97] The next stage is to give these place-based plans a clear funding base to bid for and to focus investment on employer-led growth in areas in need of revitalisation.

The Shared Prosperity Fund (SPF), which will replace EU structural funds after Britain has left the EU, is the logical funding mechanism for this kind of economic investment. If EU structural funds are replicated in full by the Treasury, this would amount to £2.4 billion in economic funding to distressed regions every year.[98]

Table 11: ERDF and ESF funding, by priority axis, 2014–July 2018

	£ millions	% fund
European Regional Development Fund		
Research and innovation	342.0	24%
Enhancing access to, and use and quality of, ICT	56.9	4%
Enhancing the competitiveness of SMEs	655.0	47%
Supporting the shift towards a low carbon economy in all sectors	197.5	14%
Promoting climate change adaptation, risk prevention and management	14.1	1%
Preserving and protecting the environment and promoting resource efficiency	26.6	2%
Sustainable transport in Cornwall and the Isles of Scilly	25.3	2%
Promoting social inclusion and combating poverty and any discrimination	28.0	2%
Technical Assistance	52.4	4%
European Social Fund		
Inclusive Labour Markets	928.3	72%
Skills for Growth	333.4	26%
Technical Assistance	21.5	2%

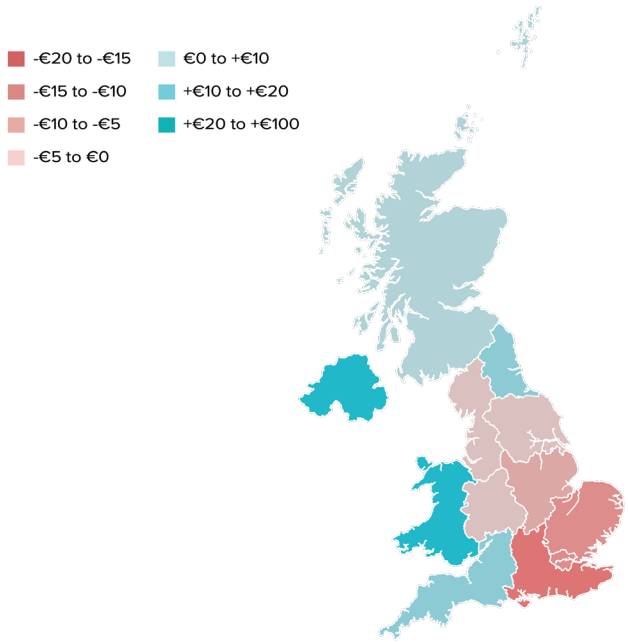
Source: House of Commons Library, Briefing Paper Number 08527.

The Government has said that the SPF will "strengthen the foundations of productivity", "reduce inequalities between communities", and "ensure that investments are targeted effectively to align with the challenges faced by places", and has pledged to consult widely on its design and purpose ahead of the Spending Review later this year.[99]

We recommend that the Shared Prosperity Fund is specifically targeted at responding to the challenges experiencing labour market risks through automation and industrial decline, both directly, and through a wider programme of skills and investment. This could also include targeted help for those who are already out of work, or marginally attached to work, who are also likely to lose out from automation.

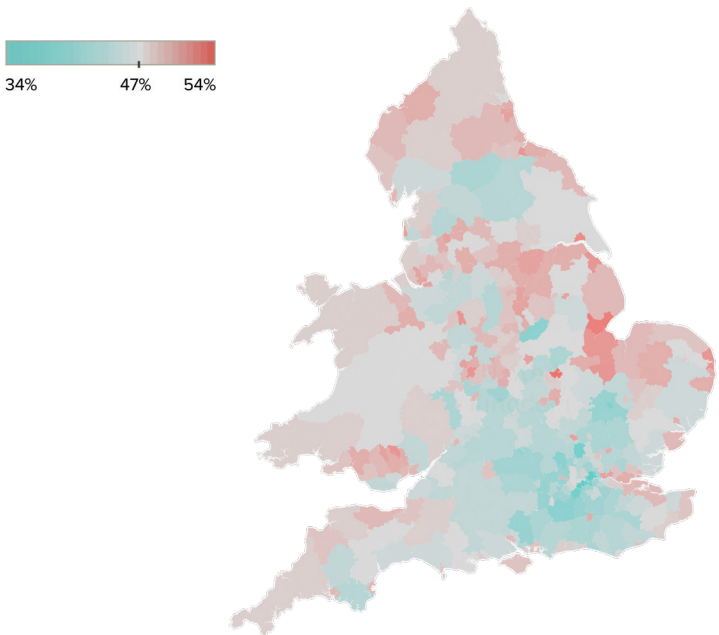
This will necessarily entail a new funding formula that better takes account of need: as Figures 21 and 22 demonstrate below, the current system for allocating funding is weighted heavily towards "Less Developed" regions, which make up 63% of the population of Wales (in West Wales and the Valleys) but only 1% of the population of England (Cornwall and the Isles of Scilly). This means that many areas at high risk of automation and industrial decline, including much of the Midlands and North West, receive comparatively little funding.[100]

Figure 21: ERDF/ESF funding by region per year, relative to UK average (£m)



Source: House of Commons Library.

Figure 22: Average propensity for automation, by local authority (34%–54%)



Source: Onward analysis of ONS data and 2011 Census.

Changing this does not mean regenerating dying industries or "backing losers". It means working with local areas to identify potential growth industries and supporting major new employers to the area with matched funding, tax flexibility and local support. This could happen directly, or through working with, and funding, devolved bodies such as combined authorities.

We should be helping smaller cities and towns realise their ambitions to become hubs for new industries, just as places like Great Yarmouth and Hull are being revitalised through wind energy production[101] and areas such as Thanet are using creative industries to drive economic growth and employment.[102]

Crucially, if high-skilled jobs are brought to at-risk areas and the correct steps are taken to prepare people for and connect them to those jobs, it will not just be those who are well paid who will benefit. The spillover effects are likely to be high, both in terms of direct multiplier effects, and in terms of making the area more conducive as a place for others to invest through a thicker labour market and agglomeration effects.

Annex

Methodology

Data sources and limitations

The primary objective of this report was to evaluate the geographic dimensions of the risk posed by automation and industrial changes that will occur in the coming decades. To provide a sufficient sample size to break down results by sub-populations at the local authority level, the census was chosen as the main data source.

The most recent wave of the census was in 2011 which means that the majority of the analysis in the report assumes that the current composition of the population in each area is (broadly) similar to the composition in 2011. However, this disadvantage is offset by the increased granularity of results – with the sample size permitting us to examine impacts in different areas by factors such as the education and skill level of each individual, their implied social grade, their age, and their ethnicity.

A significant amount of the information tied to individual risk was derived from the occupation status in either current or past employment. Due to this limitation, and because we were seeking to understand the impacts on the current labour market, the analysis was restricted to those who were economically active, defined as either in employment, or actively looking for work.

Risk indicators

After using the census to identify the population, four indicators were matched in to flag whether each individual was 'at risk' under each dimension. The following criteria and processes were used for each element:

Automation risk

Automation risk scores were drawn from the recent ONS estimates on the probability of automation in England by occupation. These figures refined the approach that had been previously taken by the OECD and Frey and Osborne, and use the characteristics of each job to estimate the probability that it could be automated.

Using the estimates for each occupation from the ONS release, the automation risks were matched in for each individual using their Standard Occupational Classification (SOC) code at the four digit level, which provides a high level of detail on the role an individual carries out at work. This provided an automation estimate for each individual which could then be used for analysis.

Industry growth and decline

To determine which industries could be viewed as 'declining' or 'growing', data on the balanced GVA of each industry was used. This was intended to provide a picture of the overall prospects of the industry in the short-to-medium term, in order to identify those individuals working in industries that either had significant growth prospects, or which were likely to decline in the near future.

The data used from the ONS provides per-industry estimates of gross value added per industry, accounting for both the income and production measurements. To ensure that we were accounting for more recent trends, rather than the impacts of the financial crisis, our indicator tracked the movement of balanced GVA from

2011–17. We also carried out additional analysis to see which industries had suffered from longer-term decline in the period 2001–07, and which had not.

In order to avoid our estimates of the level of growth or decline being skewed by extreme values, and to account for the pattern of growth, a linear regression was used on the data to calculate the predicted values of GVA for each year. If, using these values, an industry's GVA has increased by more than 20% over the period of analysis (2011–17) then they were classified as an industry that was growing. If they had declined over the same period then they were classed as declining.

Occupational growth and decline

To determine if occupations were in growth or decline annual Labour Force Survey data from the ONS was used, classified by 3-digit SOC code. For the years 2001–10, SOC2000 coding was used which differs to the SOC2010 coding used for the years 2011–17. In these cases, guidance from the ONS was used to translate the occupational codes into SOC2010 equivalents. Full details on this process are available on request.

Once occupational classifications have been harmonised, we then evaluate growth or decline over the 2011–2017 period, using the same approach highlighted for growing and declining industries; namely identifying the underlying trend as a way of filtering out the impact of extreme values at the start or the end of the measurement period.

If employment has increased by more than 20% over the period then the occupation is declined as growing, and if it has declined at all then it is viewed as a declining occupation. As with the industry approach, we also tested this for an earlier period (2001–2007) to identify which occupations only declined post-recession, and which ones were undergoing a more sustained decline.

Employment by occupation

The last indicator used was employment by industry – capturing cases where the industry was thriving, but primarily due to a large amount of investment in technology or equivalents, therefore meaning that workers were at risk. This was calculated using ONS data on aggregate employment by industry.

Using these figures, the intercept and slope was calculated using the data points for the measurement period in question (2011–2017). As with the occupational and industry data, this was intended to reduce the impact of outliers at the beginning or end of the measurement period that were much higher or lower than the rest of the trend period.

Once the estimated percentage increase has been calculated, the industries were defined into growing and declining industries by employment. Industries that had, on average, seen a decline in employment were classified as such, whilst industries that had seen their employment grow by more than 20% were classified as growing.

Analysis and limitations

Having allocated indicators to each individual, we then used their demographic characteristics to calculate the average level of risk for different groups, either by their overall average level of risk (automation), or the proportion of the population with that risk indicator (industry, occupation, employment by industry). These were used to report results for local areas, and at a national level. Where the sample size was too small (fewer than 10 observations) these results were excluded from both local and national calculations, in line with ONS disclosure rules.

The limitation of this analysis is that the combination of data source and the rules used to generate risk indicators mean that to some extent the results tell us where the at-risk population was, rather than providing a projection of the future challenges. Our judgement was that this detail provided by the census justified this approach, and that previous performance of occupations and industries was a reasonable guide of the current challenges that automation poses. If, however, the risks from automation and industrial change alter dramatically in the future, then the people and places impacted may differ from those outlined in this report.

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