

Transport for the North

Connectivity and Labour Markets in the Northern Powerhouse



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Executive Summary

The NPIER set out an ambitious vision, in part implying stronger population growth...

The Northern Powerhouse Independent Economic Review (NPIER) set out a deliberately ambitious vision for transformation of the North’s economic performance. In that vision, productivity, GVA, and employment all grow more rapidly than in the past, rebalancing the gap in performance relative to southern England seen in previous decades. Structural changes in the economy continue, and in some cases accelerate, as the North specialises more in its ‘Prime Capabilities’.

There is only limited scope to meet increased demand for workers from business-as-usual (BAU) population growth, as economic activity rates are already reasonably high, and unemployment rates are already reasonably low. The projected aging population will curb activity rates. The turnaround in employment trends projected as part of the NPIER Transformational scenario will necessarily involve a similar turnaround in population trends. Compared with BAU, NPIER assumed that the North’s working-age population would be 792,000 higher in 2050, while the number of jobs in 2050 would be 855,000 higher. Consistent with this, the total population would be 1,464,000 higher.

...but Brexit may constrain this...

This stronger rate of population growth than in the past implies a higher rate of in-migration. If Brexit means a lower rate of international in-migration into the UK, the availability of a suitably skilled workforce could constrain achievement of the vision, in terms of the number of jobs and the size of the boost to GVA.

...and automation may substitute for scarce labour...

This constraint could be relieved in part by a prospective acceleration in the rate of automation of tasks. This would raise the rate of productivity growth, allowing a higher GVA to be delivered by fewer workers, but with a significant shift in the profile of skills required.

...however this would also result in a shift in labour demand towards higher skill levels

In this report we have attempted to quantify this shift by taking the jobs projections from the NPIER Transformational scenario and developing detailed projections for the implied numbers of workers at different skill levels, and hence derive the scale of impact of the shift towards higher-skill jobs. Both BAU and the Transformational scenario have a strong shift in the proportion of workers who are in high-skilled jobs, with a decline in the number of medium- and low-skilled workers, but the shift is more pronounced in the Transformational scenario. This is shown in Table 0.1.

Table 0.1: Projected changes in each of the 9 major occupational groups under the two IER scenarios

Occupational Group	Jobs in 2015 (000s)	Additional Jobs in 2050 BAU scenario (000s)	Additional Jobs in 2050 Transformational scenario (000s)
Managers, directors and senior officials	673	258	363
Professional occupations	1,377	567	762
Associate professional and technical occupations	925	327	464

Administrative and secretarial occupations	896	-277	-207
Skilled trades occupations	855	-284	-367
Caring, leisure and other service occupations	798	402	519
Sales and customer service occupations	665	2	128
Process, plant and machine operatives	580	-229	-157
Elementary occupations	861	-60	56
Total	7,630	706	1,561

...which would require careful policy provision

Policies will be needed to ensure that this vision is realised in a socially beneficial and inclusive manner, so that the benefits of stronger productivity growth are spread widely. These relate particularly to the widening of access to lifelong skills provision and re-training. Targeted high-skilled inward migration would help to meet the growing demand for high-skilled workers, but this would not address the more fundamental problem of helping existing residents with low or medium skill levels who will experience challenges in finding work.

Commuting is also affected by skill shifts and the location of work

At the same time, we have interpreted the impact of these effects on the scale of commuting flows into and within the Northern Powerhouse region, which are affected by:

- the shift towards higher-skill jobs, because medium- and high-skilled (and hence better-paid) workers tend to commute further (and, more generally, travel more)
- the spatial pattern of clustering of jobs (concentrated in city centres or distributed around cities)
- the extent to which work is performed in physically proximate workplaces or remotely through digital communications

We have combined this with assumptions for the spatial clustering of workplaces, drawing on the ‘compact’ (city centre-focused) versus ‘dispersed’ (with a wider geographical spread in and around cities) scenarios presented in *Future Transport Demand in the North*, and assumptions for the way in which work is performed, drawing on the ‘travel friendly’ (faster, easier commuting journeys) versus ‘digital’ (more remote working) scenarios in the same report.

Table 0.2 shows commuting patterns in the North for workers of different skill levels under each scenario.

In 2015, 61% of workers in the North were resident workers who live and work in the same LAD, another 36% were workers who live in the North but work outside of their local authority, and only 3% were those living outside of the North. There was a marginally greater tendency for people to be resident workers at lower skill levels. This is not expected to change by 2050 in the BAU scenario.

Commuting is boosted by a larger number of high-skilled workers...

In the four Transformational scenarios, by 2050, smaller proportions of workers are expected to work in the same local authority area where they live or commute from outside of the North. Instead, the results suggest an increased propensity for people who live in the North to commute to work outside of the local authority of their residence. This is driven by the strong growth projected for high-skilled workers in the Transformational scenario and the assumption that high-skilled workers are much more likely to commute and travel longer distances than workers with lower skills levels.

...and when work is concentrated in city centres with good transport infrastructure

In addition, compact city centres and travel friendly transport infrastructure are expected to cause a greater shift towards commuting between northern LADs than job dispersion and digital working. Therefore, commuting patterns in the Compact & travel friendly scenario appear the most different from those in the BAU scenario.

Table 0.2: Commuting patterns in the North in 2015 and in 2050 under five scenarios

	2015	BAU scenario	Compact & digital scenario	Compact & travel friendly scenario	Dispersed & digital scenario	Dispersed & travel friendly scenario
	% of all workers in the North at each skill level					
Low-skilled workers						
Living and working in the same LAD	61.7	61.3	55.5	41.6	56.1	42.2
Commuting from within the North	35.6	35.9	43.6	57.2	43.0	56.6
Commuting from outside the North	2.8	2.8	0.9	1.2	0.9	1.2
Medium-skilled workers						
Living and working in the same LAD	61.2	61.2	56.0	42.5	56.6	43.2
Commuting from within the North	35.7	35.8	43.2	56.5	42.7	55.8
Commuting from outside the North	3.0	2.9	0.8	1.0	0.8	1.0
High-skilled workers						
Living and working in the same LAD	60.7	60.7	40.1	27.3	40.5	27.8
Commuting from within the North	36.2	36.3	58.5	71.0	58.0	70.6
Commuting from outside the North	3.1	3.1	1.4	1.7	1.4	1.7

Note: Residence and workplace areas are defined in terms of LADs.
Source: Cambridge Econometrics.

Figure 0.1 shows the same commuting patterns in terms of *flows* of workers. It shows that the numbers of workers commuting within the North on journeys that are long enough to cross LAD boundaries is higher in all the Transformational scenarios than in BAU, especially among high-skilled workers and in the travel friendly variants. The *Skills only* scenario takes our occupational projections and estimates the impact of these on commuting patterns based on the differing propensity to commute longer distances between different occupations. These are then compared to the four scenarios

taken from the Future Transport Demand study that make key assumptions about the impact of technology on patterns of travel, which we have disaggregated by skill level for comparison purposes.

Figure 0.1: Commuting flows in the North in 2015 and in 2050 under five scenarios



Notes: The vertical axes represent the number of workers in the North in a given year. Each cluster of three bars shows the numbers commuting (1) within the same LAD, (2) between LADs in the North, and (3) from outside of the North, for a particular skill group and scenario.

Residence and workplace areas are defined in terms of LADs.

Source: Cambridge Econometrics.

More commuting across LAD boundaries in the North

Even in the digital scenarios, the number of workers commuting across LAD boundaries in the North is some 70% higher than in 2015, while the number of workers is only some 20% higher; in the travel friendly scenarios it is more than double the number in 2015. The share of workers commuting between LADs is noticeably higher than the share of resident-workers in the travel-friendly scenarios, unlike the digital scenarios in which the split is similar. This

is because the stronger tendency to commute is visible in the results for workers at all skill levels under the travel-friendly scenarios, not only for high-skilled workers as in the digital scenarios.

Occupational shifts point to more commuting over longer distances ...

... while technological changes could either moderate or amplify commuting

The following conclusions can be drawn from the analysis:

- a strong shift is projected in the proportion of workers in higher-level occupations over coming decades, and that shift is expected to be strengthened by the restructuring envisaged in the NPIER 'Transformational' scenario
- workers in higher-level occupations typically travel more, including in their commuting journeys to work
- commuting levels and modes will be strongly influenced by
 - the geographical pattern of the location of jobs (higher concentrations in city centres favours rail)
 - the impact of technological change on the scope for remote working (likely to be higher for higher-level occupations) and on the ease and cost of travel (autonomous vehicles and digitised transport systems)

Further research is required to understand the implications of these trends for the labour supply and skills development in the North.

1 Introduction

This section provides the context for the study, discusses TfN, the Northern Powerhouse initiative, the findings of the IER, and events since the IER (Brexit, and an increased focus on “automation”) that need to be taken into account, and thus outlines the reasons why this study is both relevant and necessary.

Chapter 2 summarises key historical trends for the North. These are the trends that the Northern Powerhouse initiative is seeking to turn around so as to bring about an improved economic future for the North.

Chapter 3 discusses two key labour market trends for which the future for the UK, and the North, is likely to be different from the past: the impact of technology and the aging of the population. It then presents the vision set out in the Northern Powerhouse Independent Economic Review (NPIER) as it relates to the growth of jobs and the growth in the working-age population required to support that vision.

Chapter 4 takes the NPIER jobs projections and estimates the expected profile of those jobs broken down by occupation, drawing on wider evidence on trends and policy influences on future demand for occupations and the supply of skilled workers. It also provides a geographical breakdown of the location of jobs.

2 Key features of historical trends in the North’s economic and labour market performance

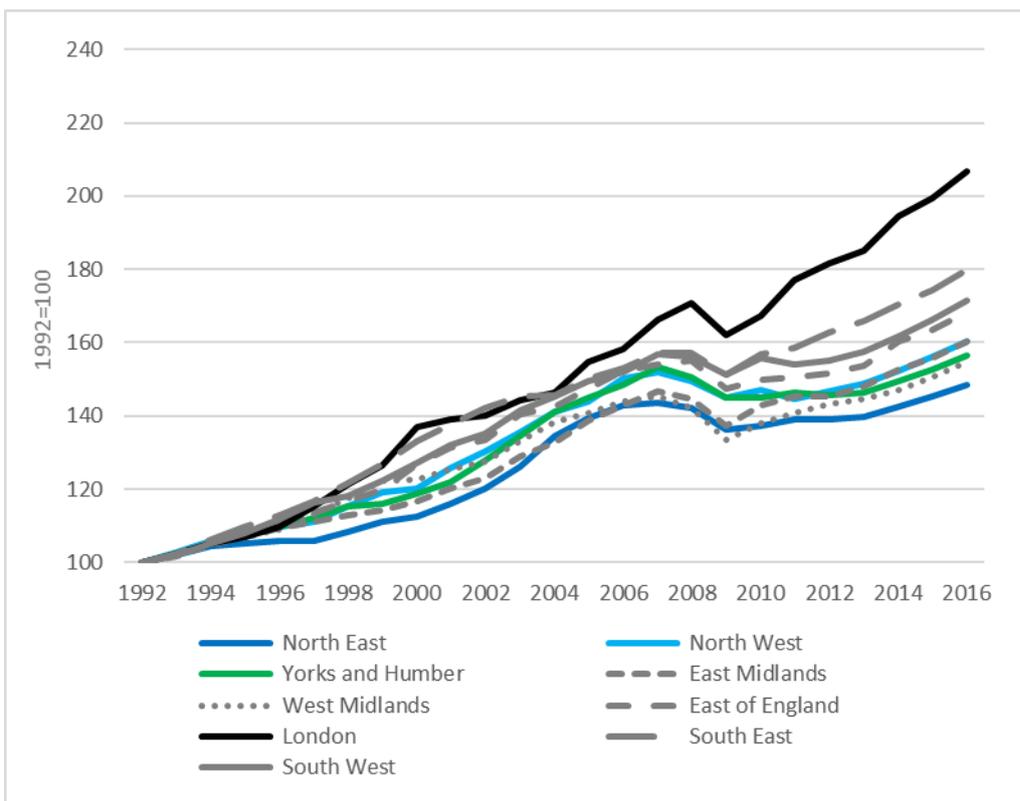
This chapter summarises key historical trends to which the Northern Powerhouse initiative is seeking to respond so as to bring about an improved economic future for the North.

2.1 Macroeconomic underperformance

Slower growth in GVA and jobs...

Figure 2.1 shows the relative growth rates of GVA in each of the 9 regions of England, over the period 1992 to 2016. Whilst all nine regions have seen overall GVA growth over the period in question, some regions, notably London, have grown significantly faster than others. The three northern regions, North West, North East, and Yorkshire and Humber, represent three of the bottom four regions in terms of GVA growth.

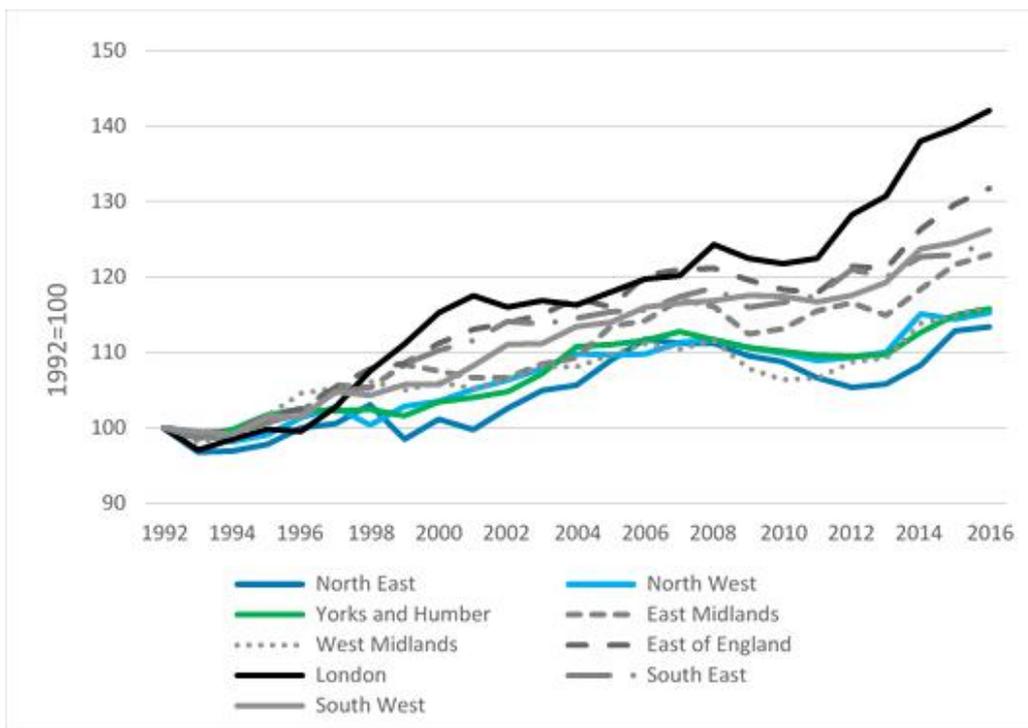
Figure 2.1: GVA by region



Source: Cambridge Econometrics, ONS.

According to Figure 2.1 employment between 1992-2016 increased in all 9 regions with overall growth strongest in London. However, the three regions of the North as well as the West Midlands have had the least employment growth, forming a cluster of the regions that has persistently lagged behind other regions. Following the post-2008 economic crisis, three clusters formed, with London pulling away from other regions while employment in the Northern regions cluster increased the least over 2008-2016.

Figure 2.2: Employment by region

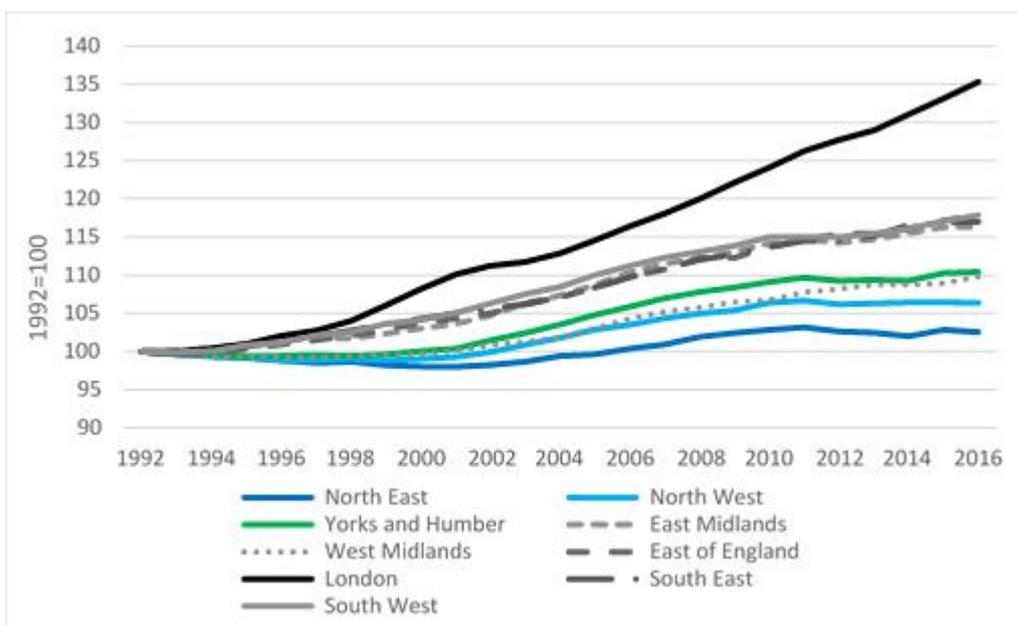


Source: Cambridge Econometrics, ONS.

...and in working-age population

The North's slower economic growth has been associated with slower growth in the working-age population. The exceptional growth in London, which had seen long-term decline in population over the 50 years to 1990, is clear. The next fastest-growing group of regions is made up of the East of England, the East Midlands, the South East and the South West. The regions of the North, together with the West Midlands, saw an upturn in the growth of working-age

Figure 2.3: Working-age population by region



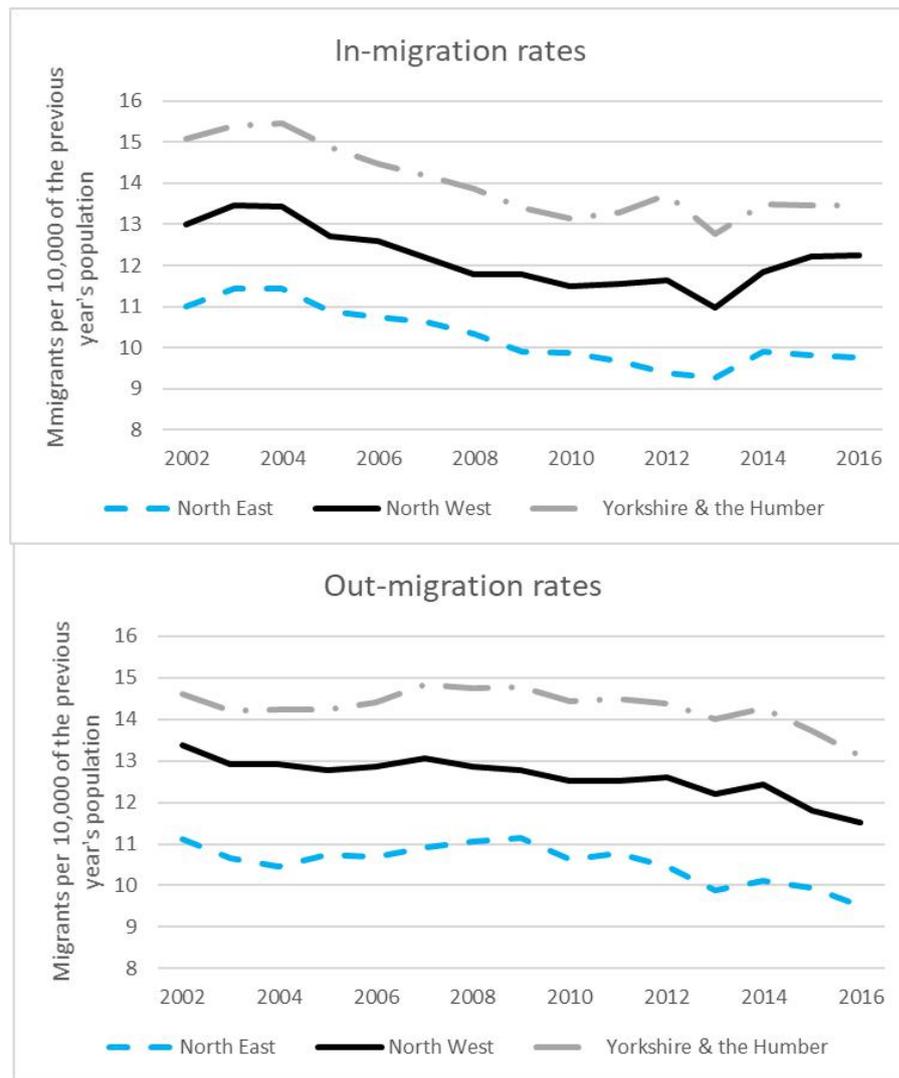
Source: Cambridge Econometrics, ONS.

population from the late 1990s, but the rate of increase was still slower than elsewhere.

Figure 2.4 shows the inward and outward migration rates for the three regions that comprise the North of England. As a result of its size, internal migration into local authorities in the North is largely comprised of movements from another Northern local authority. According to the ONS¹, there were about 425,000 movements in both directions between local authorities in the North in 2016, compared to 342,000 movements between local authorities in the North and the rest of the UK. This resulted in total in-migration of 175,700 and total out-migration of 166,000, equivalent to net in-migration of 9,700. In 2016, the North gained just six additional residents for every 10,000 of the population. However, this represents a small but significant turnaround, as recently as 2012, the North was experiencing a net out-migration of 12,000 residents per year. This shift was the result of both an increase in in-migration and a reduction in out-migration, even though the total number of moves in both directions between the North and the rest of the UK was similar in the two years.

¹ Internal migration - Matrices of moves between Local Authorities and Regions (ONS)

Figure 2.4: In-migration and out-migration rates in regions of the North



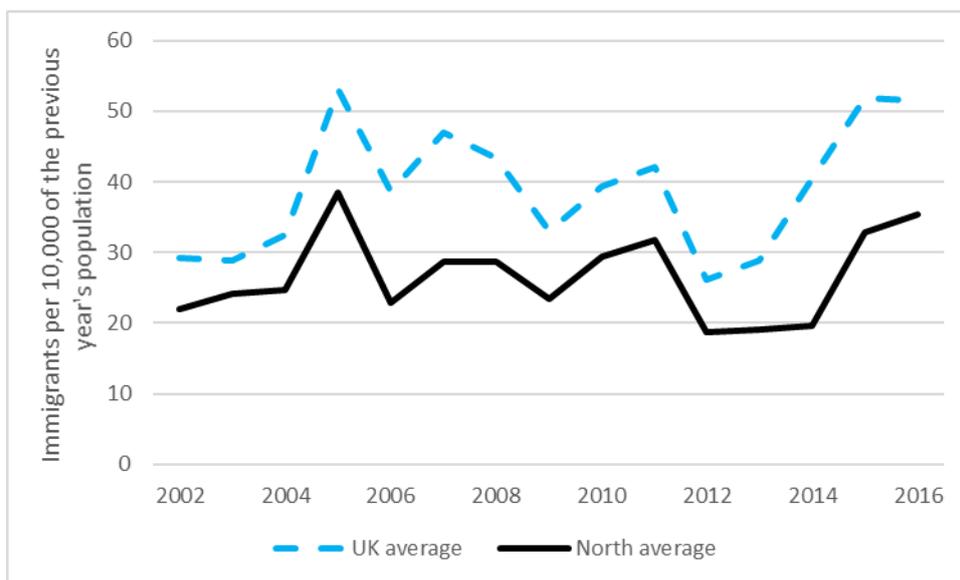
Source: ONS Mid-Year Population Estimates.

There were variations in the rates of in- and out-migration between the three regions of the North historically, with Yorkshire & the Humber having the highest churn. All regions experienced low levels of net out-migration during and immediately after the recession, but migration flows have become more balanced in recent years, with in-migration rates rising while out-migration rates continue to decline.

...and a higher level of international net in-migration...

Like elsewhere in the UK, net migration into the North has been driven more by international migration than domestic migration. In 2016, there were over 55,000 people moving to the North from outside of the UK², equivalent to 35 immigrants for every 10,000 of the population in 2015, in comparison with an average of 52 immigrants for every 10,000 of the population for the UK as a whole. The net international migration rate in the North has been lower than the UK average (see Figure 2.5). There were signs of divergence from the UK average in the period leading to the recession, but the North's strong recovery in the last few years at above its pre-recession rates has closed a small proportion of this gap.

Figure 2.5: Net international migration rate in the UK and the North



Source: ONS Mid-Year Population Estimates.

...which is likely to fall back after Brexit

Currently EU nationals make up 8% of the UK workforce³. Whilst the final details of the UK's migration system after Brexit are as yet undetermined, reports indicate a decrease in net migration by EU citizens into the UK by 51,000 in financial year 2016/17. Surveys also indicate that a significant number of EU citizens in the UK are either planning to leave or are considering leaving (8% and 35% respectively)⁴.

A productivity and wage gap

According to the Northern Powerhouse Independent Economic Review (NPIER 2016), the North's economic performance gap (measured in GVA per capita terms) has persisted over the last thirty years, averaging about 25% below the rest of England (10% – 15% when London is excluded). The productivity gap is reflected also in a gap in average earnings: 2015 mean earnings for full-time workers were about 16% lower in the North than in the rest of England (5% lower when London is excluded).

² Mid-Year Population Estimates (ONS)

³ <https://assets.kpmg.com/content/dam/kpmg/uk/pdf/2017/08/the-brexit-effect-on-eu-nationals.pdf>

⁴ UK Life Sciences Industrial Strategy: Initial Findings, Mckinsey 2018

*The North shares
in the UK's
productivity
problem*

UK productivity and real wages have stagnated since the recession in 2008⁵ and subsequent period of fiscal austerity. Although this phenomenon has been experienced in a number of developed economies, the UK has been particularly affected (experiencing weaker productivity growth over this period than, for example, the US, Germany, France and Italy)⁶.

This problem has often been exacerbated by the implementation of fiscally contractionary policies, nowhere more so than in the UK. The UK has a range of high-quality knowledge assets, high levels of capital liquidity, and a relatively well-educated labour market that should normally lead to a high-skill, high productivity, high wage economic model, but the current combination of tight fiscal and loose monetary policy, combined with more long-term problems related to poor infrastructure and skill-gaps in key mid-level occupations, has incentivised many sectors to follow an “asset sweating” low-skill, low-wage strategy over the past decade. This tendency has had the effect of reducing overall national productivity and damaging international competitiveness. Although unemployment has fallen since the recession, a significant portion of the growth has been in low-wage, low-productivity roles. Whilst the UK contains some very productive firms, a ‘long tail’ of under-productive firms has held back growth and wages⁷ and exacerbated existing problems with a regionally unbalanced economy⁸. Over the next decade, this problem is likely to be brought into sharp relief by the outcomes of the UK leaving the European Union.

2.2 Industrial restructuring

Like the UK as a whole, the North has undergone significant industrial restructuring over the past 30 years (and beyond). This has been as a result of a number of factors, including the UK's trading relationships with the rest of the world, with an increased specialisation in services, whilst importing goods in higher quantities; the process of globalisation, in which the UK has retained an important role in a number of global supply chains, but with a significant proportion of physical manufacturing taking place elsewhere; and finally, the impact of continuous technological innovations on increased efficiency in manufacturing, leading to fewer workers being required to produce the same level of output. The UK as a whole has seen industrial restructuring away from manufacturing employment and towards employment in knowledge intensive business services (KIBS) and private consumer services⁹.

⁵ Office of National Statistics

<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/articles/supplementaryanalysisofaverageweeklyearnings/latest>

⁶ Office of National Statistics

<https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/datasets/internationalcomparisonsofproductivityfirstestimates>

⁷ HM Government Industrial Strategy

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

⁸ Christian Ketels of Harvard

⁹ Between 2000 and 2016, Great Britain employment share in the Manufacturing sector fell from 14.8% to around 9%, whereas employment in KIBS rose from 11.6% to 13.7% over the same period. The proportion of jobs in overall Services (a broader measure than KIBS) increased from 77.8% to 83.8% during this period. KIBS sectors and their UK Standard Industrial Classification (SIC, 2007) codes include: media (58-60); IT services (61-63); financial services (64-66); legal and accounting services (69); head office and management consulting (70); architecture and engineering services (71); and other professional services (72-75).

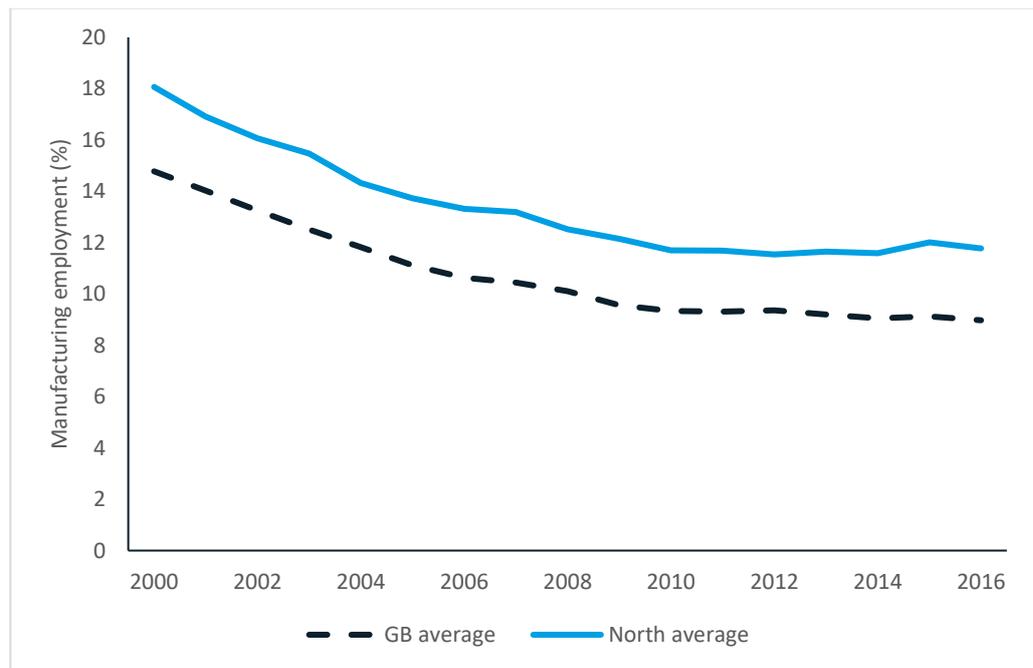
The North was more exposed to job losses in manufacturing...

... and gained fewer jobs in knowledge-intensive business services

Figure 2.6 shows that manufacturing has consistently played a bigger role in employment in the North than for the whole of Great Britain¹⁰. The long-term decline in the share of manufacturing in all jobs both nationally and in the North continued in the first decade of the 2000s but has levelled off since 2010.

Some 29% of the national manufacturing jobs lost between 1980 and 2000 were lost in the North of England, but the new (high-productivity) KIBS and service sector jobs that effectively replaced them were instead strongly clustered around London and the South East: only 17% of new KIBS jobs were located in the North. Those new service sector jobs that did arise in the North tended to cluster in the larger Northern cities, leading to the patterns of spatial growth we have seen over the past 20 years. Figure 2.7 shows a marked contrast with Figure 2.6: the North has a smaller share of KIBS in all jobs than Great Britain as a whole, and this sector's share in all jobs has been increasing. The North has lost high productivity jobs in manufacturing as a result of (national) industrial restructuring but has gained less from the growth of high productivity jobs in KIBS.

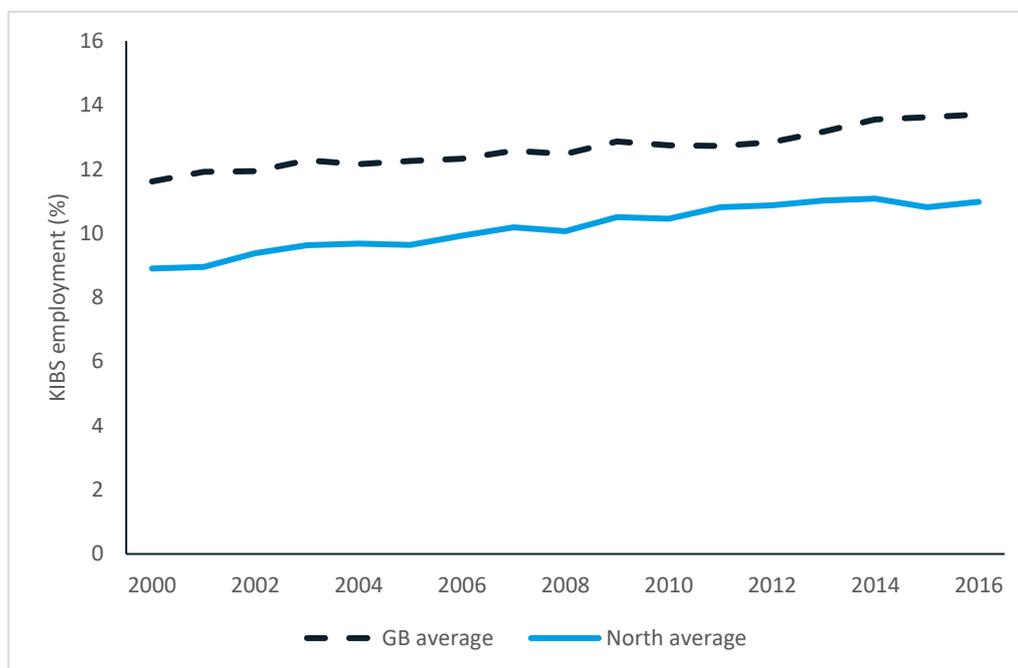
Figure 2.6: Share of manufacturing in all jobs



Source: Cambridge Econometrics, ONS.

¹⁰ We compare the North of England to Great Britain when data for Northern Ireland is unavailable to allow comparison with the United Kingdom.

Figure 2.7: Share of KIBS in all jobs



Source: Cambridge Econometrics, ONS.

Note: KIBS: Knowledge-intensive business services.

2.3 Restructuring of occupations and skills needs

A hollowing out of mid-level occupations

Like other developed economies, the UK has experienced marked changes in occupational structure and skills demand, partly as a result of industrial restructuring, and partly as a longer-term trend in which routine tasks are increasingly being carried out by technological systems. This has not only affected low-skill, low-wage positions: a “hollowing out” effect has been observed, with an expansion in the shares of total employment for high-income and low-income jobs relative to middle-income jobs. This is seen in the increase in higher level occupations that, for new entrants at least, typically require a university degree, but also in the low-pay service sector, of which the most recent manifestation has been rapid growth in the gig economy.

A review by McIntosh (2013) of the literature on the future of the labour market and “hollowing out” – also known as job polarisation – finds that hollowing out was caused by task-biased technological change where the falling cost of computing power led to technology replacing jobs that could be routinised. Often, such jobs were in the middle of the job distribution when ranked by initial wages, with the result being that the employment share of these jobs fell while the employment shares for high-income and low-income jobs rose. This suggests that going forward, as new disruptive technologies in AI, big data and robotics proliferate, there will likely be changes in the future composition and distribution of jobs in the North and the broader UK economy and this will affect how people work.

More limited opportunities for graduates in the North

Professional occupations in the North form a lower proportion of overall employment than in the rest of the UK and this partly explains why fewer graduates take jobs in the area. The North also loses a substantial number of graduates from its universities to areas in the rest of the UK and further afield. Data for 2015/2016 shows that 55.6% of graduates who were domiciled (but not necessarily attended university) in the North East or Yorkshire and the Humber gained employment in these regions¹¹. As an example, the SIA on medical technologies in the Leeds City Region found that only 40% of graduates take jobs in area, with the graduate outflow leading to a shortage of multidisciplinary graduate engineers needed for the local medical technology sector. There is an element of circularity here, with skilled labour moving out of the North in order to access high-wage, high-value positions in London and the South East, and high-value firms showing a lower propensity to base themselves in the North, partly due to the perceived difficulty in attracting skilled workers. The ability to drive this cycle in reverse, possibly on a sector-by-sector basis, is a crucial task for the Northern authorities.

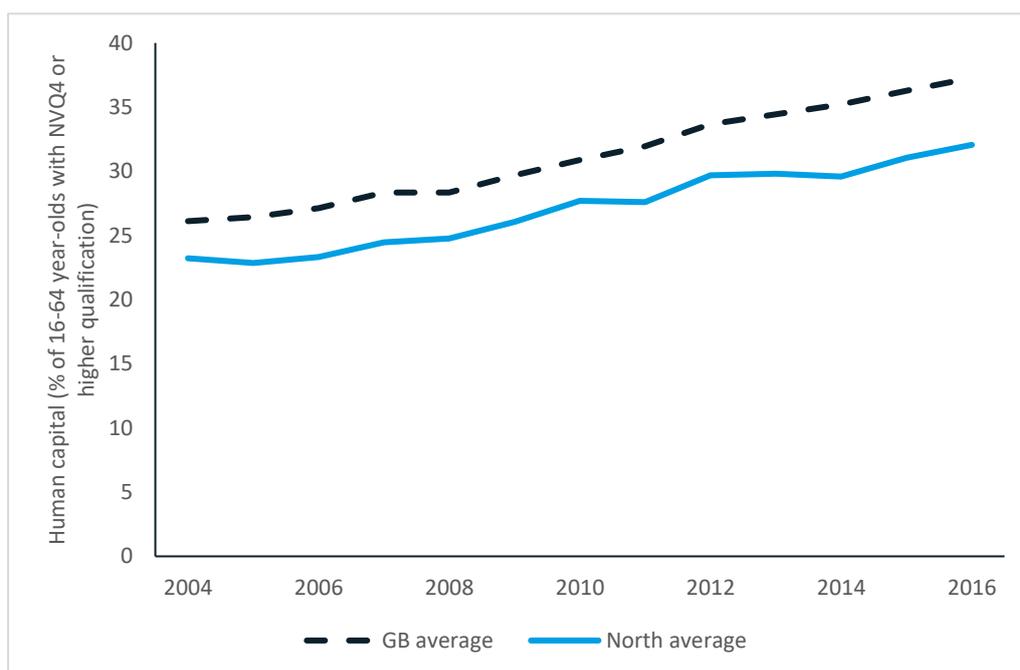
A gap in the educational attainment and skills of the North's labour force

The North's attainment and retention of higher level skills and qualification consistently lags behind the national average. Based on the percentage of the working age population (16 - 64-year-olds) with NVQ level 4 or above, human capital in the North steadily increased over the last decades but with the North consistently lagging behind Great Britain¹² (see Figure 2.8). This pattern is also present at the lower schooling level, with secondary school attainment in the North lagging behind the South. According to the Northern Powerhouse Education and Skills Report (NPESR 2018), pupils in the North make one-third of a grade less progress at sixteen on average compared to London pupils. 25% of these pupils are at secondary schools in the North judged by Ofsted as inadequate or in need of improvement. As well as their direct impact on the educational attainment of local residents, the quality of local schools is an important consideration when skilled workers decide whether or not to move to an area, and could partly explain the difficulty of firms in the North in attracting skilled labour.

¹¹ Higher Education Statistics Agency (HESA) Destination of Leavers from Higher Education: <https://www.hesa.ac.uk/news/29-06-2017/sfr245-destinations-of-leavers> .

¹² Data on employment destinations of graduates are not available for Northern Ireland"

Figure 2.8: Proportion of the working-age population with NQV 4 or above



Source: Nomis.

Older workers in more senior roles and mid-level occupations

Figure 2.9 shows the age breakdown of workers in the North by occupation in 2011. Within high-skill¹³ positions, it is unsurprising that *managers, directors and senior officials* have an older age profile than *professionals* or *associate professionals*, as this is an occupational group that workers tend to be promoted into after several years working in the sector.

The two occupations with the lowest average age were *sales and customer services*, and *elementary occupations*, reflecting the often temporary, transient nature of these occupations.

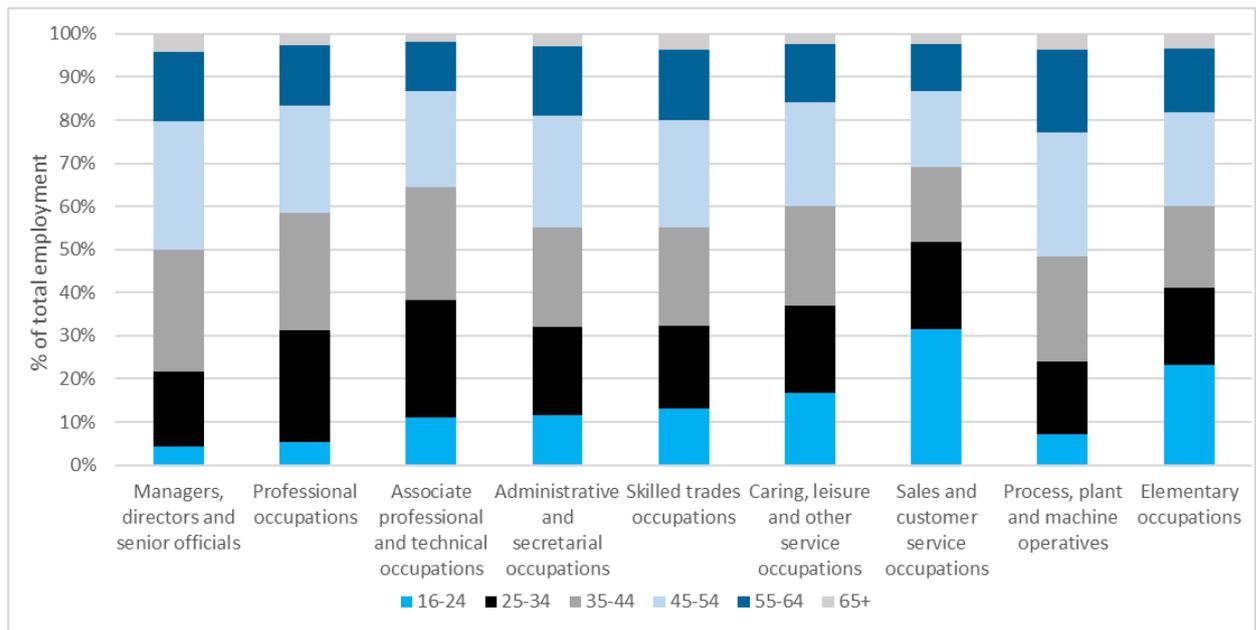
Occupations most at risk of obsolescence, also had older age profiles

Of the remaining occupational groups, those with the oldest age-profiles tended to also to be the groups most at risk from future obsolescence. These were *administrative and secretarial*, *skilled trades*, and *process and plant operatives*, which had the oldest average age profile of all groups, with over half of current workers aged 45 or above. This suggests that some of the reduction in jobs in these occupations can be met through the normal process of retirement.

The average worker at each skill level in England and Wales as a whole is marginally younger than in the North, but the overall profile is very similar.

¹³ 'High-skilled' includes major groups 1 to 3, 'medium-skilled' includes groups 4 to 7 and 'low-skilled' includes groups 8 and 9, according to the ONS 2010 Standard Occupational Classification (SOC2010): <https://www.ons.gov.uk/methodology/classificationsandstandards/standardoccupationalclassificationsoc/soc2010>

Figure 2.9: Age distribution of workers in the North by occupation



Source: Census 2011.

2.4 Lessons from history drawn by the Northern Powerhouse Independent Economic Review

In summary, the NPIER argued¹⁴ that the North’s weaker performance is due to gaps in skills, innovation, and levels of investment. Poor connectivity and transport, lack of agglomeration and low enterprise rates are also identified as having a bearing, but these were of second order in importance.

The NPIER identified¹⁵ the North’s distinctive offer of four ‘Prime’ capabilities (Advanced Manufacturing, Energy, Health Innovation, and Digital), that it argued should represent the North’s ‘shop window’ for future international investors, drawing on evidence of existing specialisation and expertise in more than one location in the North. It also identified three key ‘Enabling’ capabilities (Financial and Professional Services, Logistics, and Higher Education) that would need to develop in order to support the growth of the Prime Capabilities.

In the following chapter, we explore the implications of this conceptualisation and its associated projections for future growth paths on the North’s labour market more widely.

¹⁴ SQW and Cambridge Econometrics (2016) *The Northern Powerhouse Independent Economic Review Workstream 1: Analysis of the pan-Northern Performance Gap – Final Report*.

¹⁵ SQW and Cambridge Econometrics (2016) *The Northern Powerhouse Independent Economic Review Workstream 4 Scenarios for Future Growth in the North – Final Report*.

3 Future trends and what a transformed future for the North might look like

This chapter considers two key labour market trends for which the future, for the UK and the North, is likely to be different from the past: the impact of technology and the aging of the population. It then presents the vision set out in the Northern Powerhouse Independent Economic Review as it relates to the growth of jobs in different ‘capabilities’ and the growth in the working-age population required to support that vision.

3.1 Technology trends and the impact on labour markets

Technological change will have radical impacts on the labour market

Much has been made of the potential for rapid technological change in manufacturing processes and products and in the application of artificial intelligence (AI) to automate a wide range of tasks including in professional and business services. *Industry 4.0* is a catch-all term for a wide variety of these technological improvements, some of which are already under way and others of which are likely to become widespread during the next few decades. These include the increased use of both automative technology, advanced sensors and robotics to replace routine and semi-routine physical work. Artificial intelligence includes advanced data-processing and machine learning techniques to augment and replace systematised cognitive tasks.

There have been a number of studies published on this subject in recent years, and whilst all speculative by their nature, the conclusions are relatively consistent. The overall demand for labour is unlikely to decrease, but there are likely to be profound changes in demand patterns. The relative demands for high-skilled labour and certain types of non-routine medium-skill labour will increase, whilst the demand for routine work, some of which is currently categorised as medium skill as well as low skill, is likely to decrease significantly. The probability for high levels of skill mismatch and unemployment is significant and requires policy action now in order to counteract potential negative impacts. The central policy need is for expanded and carefully tailored skills provision, including retraining options for those directly affected, in order to reduce the proportion of the working-age population with only low-level qualifications, and to ensure that the qualifications received are relevant and specifically tailored for the needs of future industry.

Estimates of the scale of impact vary

Working Futures¹⁶ suggests notable reductions in Manufacturing, Clerical and Secretarial employment as a result of AI and expert systems. Increases are projected in Managerial, Professional, Technical Skilled, and Service Industry professions, where creativity, decision-making and intuition are valued.

McKinsey Global Institute report that 60% of occupations have at least 30% of constituent work activities that could be automated, but the shift towards new ways of working, and the redistribution of capital and labour, will also create

¹⁶ Working Futures 2014-2024

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/513801/Working_Futures_financial_evidence_report.pdf

new occupations¹⁷. The sectors affected align with those in the Working Futures report.

Due to technological advancements, by 2030, between 75m and 375m workers (3% to 14% of the global workforce) will need to switch occupational categories¹⁷. The growth areas globally are in Health-Care; Engineering, Science/Technology, IT, and Managers and Executives. The major shift will be away from Manufacturing and other occupations that can be automated including Agriculture, Transport, Accommodation, and Administrative Support Services¹⁸.

Greater flexibility in the timing and location of work, but also in security of employment

Advances in remote access technology is enabling more flexible working patterns and increasingly allowing those members of the workforce that are unable to be in the office for eight hours a day to participate in work. According to the Government-commissioned Taylor Review of Modern Working Practices (2017), this “*shift towards greater variation in working patterns is likely to continue as the economy moves towards full employment and people look for work that suits their individual lifestyles and preferences*”. However, the Taylor Review also found that the greater variation in working patterns is also being associated with negative outcomes from lack of job security that comes with arrangements such as the zero contract hours associated with the gig economy.

The following particular impacts on the location of work are likely:

- Broadband, cloud computing, and a market for online collaboration tools, mean that more jobs that once required in-person interactions can be performed anywhere. A report in the US estimated that regular work-at-home among the non-self-employed population more than doubled between 2005 and 2015¹⁹.
- As the demand for highly skilled workers increases, this trend could continue to develop as firms will look to delegate tasks from their most skilled employees to others to allow them to focus on the most value-creating activities^{Error! Bookmark not defined.}. Lower value-generating tasks, including HR and finance can be completed remotely, with (for example) up to 50% of the US workforce holding a job that is compatible with at least partial telework¹⁹.

Policy responses to the challenge

The key questions now are the extent to which these trends will continue in the face of new global challenges and opportunities, and the extent to which public authorities have the ability to identify and support opportunities for sectoral growth. Two questions stand out in particular, firstly, the extent to which the North can leverage its existing strengths in parts of high value advanced manufacturing to capture the productivity benefits of Industry 4.0, and, secondly, its ability to attract and retain a larger share of high-value KIBS sector firms that will develop at a national level over the decades to come.

¹⁷ Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation
<https://www.mckinsey.com/~media/McKinsey/Global%20Themes/Future%20of%20Organizations/What%20the%20future%20of%20work%20will%20mean%20for%20jobs%20skills%20and%20wages/MGI-Jobs-Lost-Jobs-Gained-Executive-summary-December-6-2017.ashx>

¹⁸ UK Power up Report, Deloitte, 2018

¹⁹ Telecommuting statistics: <http://globalworkplaceanalytics.com/telecommuting-statistics>

Several UK Government-sponsored science and innovation audits (SIAs) have been undertaken focussing on specific sectors and local areas in the North. These SIAs, which were undertaken by broad consortia of local authorities, LEAs, business leader and some of the N8²⁰ universities, identify and evidence new areas where research excellence and emerging innovation strengths offer potential competitive advantage, with a view to underpinning future investment decisions to maximise related opportunities and boost economic growth and productivity.

SIAs and Industrial Strategy

The UK Industrial Strategy and wider government policy is encouraging places and their functional geographies within the UK to identify their key strengths in emerging technology-driven sectors and to specialise in becoming world leading in these fields. The Government commissioned Science and Innovation Audits (SIAs) are enabling regions to understand their strengths and position in the global supply chain to develop strategies to maximise their growth and pulling power for trade and investment.

The 2017 SIA on the bio-economy²¹ in the North of England finds that the North has the facilities as well as specialised research and innovation assets to become a world-class bio-economy based on agri-tech, agri-science, and industrial biotechnology. The area is currently strong in translating research into innovation. However, weaknesses remain in how the coordination of innovation support for companies which need to commercialise it. Looking to the future, the SIA suggests that by 2030 economic activity and innovation in the sector should be driven through bio-clusters as focal points where early-stage insurgent companies access support to bring their innovations to market. This scenario of the future of the North's economy, coupled with deeper integration of agri-food, chemical and bioenergy supply chains, is in line with the trend seen in KIBS sectors and is consistent with the Government's Industrial Strategy. Indeed, all SIAs point to KIBS sectors playing an increasing role, and thus accounting for higher employment, in the North's future economy. These SIAs forecast growth in sectors in which the North is active such as medical technology, materials chemistry, high performance computing, high-value manufacturing²² and offshore renewable energy production.

The SIA for Sheffield and Lancaster focusses on driving productivity growth through innovation and high-value manufacturing. The SIA argues for identifying and action on those components needed to equip the UK to deliver the vision of Industry 4.0. Given the North's quest to be a world-class region for high value manufacturing, investment in skills and the science and innovation infrastructure will be critical in anticipation of Industry 4.0 and future manufacturing. The advent of Industry 4.0 will bring about significant changes to working practices as digitisation and robotization increase in the work place.

The Liverpool City Region (LCR) SIA set out the Region's commitment to develop its innovation ecosystem to maximise its contribution to economic growth. It is argued that recent devolution of budgets to local authorities will

²⁰ The N8 Research Partnership is a group of eight research-intensive Northern universities including Durham, Lancaster, Leeds, Liverpool, York, Manchester, Newcastle and Sheffield.

²¹ The bio-economy integrates food production with the manufacture of materials, chemicals and fuel through the bio-refining of bio-renewable raw materials from agriculture, aquaculture and forestry.

²² High-value manufacturing generally requires advanced technical competence and specialist knowledge, often resulting in high value addition products.

allow the LCR to more freedom to shape and better target funds for innovation. The Audit examined and set overarching ambitions and programmes for three themes where the Liverpool City Region has potential to be a world class leader and generate significant economic impact. These themes include infection, materials chemistry, and high performance computing (HPC) and cognitive computing. Synergies between these themes were also examined, with partners developing cross-theme projects to exploit latent synergies as well as the ambition “for the LCR to be a national exemplar of place-based and innovation-driven economic growth that supports the UK Industrial Strategy”. The audit also identified prevailing and developing challenges to the Region’s future, such as increased automation in line with the fourth Industrial Revolution, and concerns with increasing anti-microbial resistance.

The SIA for Greater Manchester and Chester focussed on identifying the Region’s capabilities, challenges and opportunities for future economic growth. Within the context of increasing devolution of health budgets to regions and the imperative to grow the Northern Powerhouse economy, the SIA identified ‘core strengths’ in health innovation and advanced materials in which the Region excels internationally. The Audit also found that there are fast-growth opportunities linked to the future of digital, energy, and industrial biotechnology that the Region can combine with its ‘core strengths’ to release new synergies of innovation and productivity growth. The presence of a critical mass cutting-edge assets and capabilities in science and innovation is identified as one of the Region’s strengths. However, strategic investment to capitalise on opportunities, exploit synergies and strengthen the area’s innovation ecosystem through increased collaboration between science output and businesses is needed to improve the Region’s productivity which lags the England average.

As highlighted in the *UK Industrial Strategy* published in 2017, the emergence of new technology and the requirement to increase Clean Growth, Mobility, and adjust to an Ageing Society is presenting new opportunities and challenges that are shaping the direction of business in the UK²³.

Focused investment in research and innovation in these high-value sectors would be in line with the Government’s Industrial Strategy to raise innovation in the UK, to improve productivity, and strengthen UK supply chains

As a result of current demographic and environmental challenges faced and a shift in global supply chains, the UK government is investing in steering the economy towards opportunities presented by the emerging markets in health, AI/data, clean energy, and transportation.

Targeted industries for potential re-shoring of manufacture in the UK concentrate around the ability of Industry 4.0 to open up high value markets in advanced products and processes. In particular, key opportunities for the UK exist in clean energy, advanced manufacturing, digital, and health.

Some of these insights are captured implicitly in the IER and in the research underpinning the Working Futures study; however, some are not, and reflect

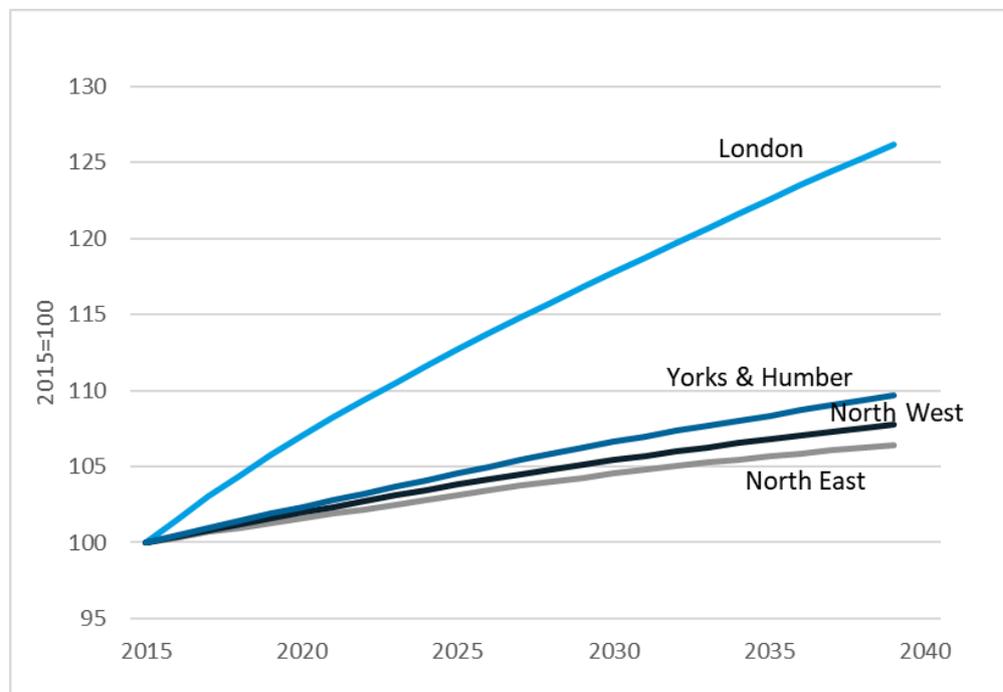
²³ HM Government Industrial Strategy
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

more recent trends. Hence there remains a likelihood that the projections shown in the quantitative element of this study could underestimate the disruptive impact of future trends; they should therefore be understood within the context of the qualitative appraisal above.

3.2 Demography

Figure 3.1 shows the current 'principal' ONS population projections by region to 2039. The projections shown in the figure are 2014-based and have not yet been updated to be consistent with the 2016-based national projections. In the latter, the ONS made somewhat lower assumptions for international migration into the UK than previously, but still quite high (165,000 net in-migration per year from 2022, compared with 185,000 in the 2014-based projections). In due course, therefore, when the regional projections are updated, they will be revised downwards.

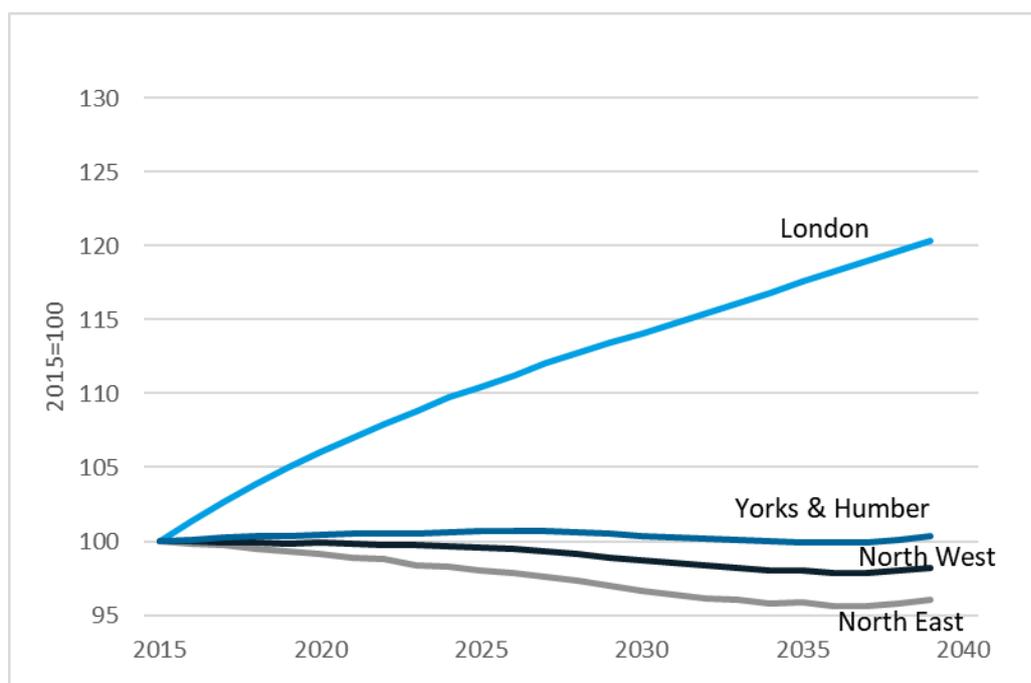
Figure 3.1: ONS projections for population by region



Source: ONS 2014-based subnational population projections.

The working-age population is expected to grow more slowly than the total population, reflecting the aging of the population. In the three regions of the North, the effect is that the working-age population is projected to be flat or falling. While improved health and the higher state pension age will increase the numbers in the labour force who are aged 65+, this effect will not make a substantial difference to the broad trends shown in Figure 3.2.

Figure 3.2: ONS projections for the population aged 16-64 by region



Source: ONS 2014-based subnational population projections.

Some argue that there is a risk of 'brain drain' following Brexit, with younger, higher income, and higher skilled EU citizens more likely to consider leaving. IT, business/law, and engineering/construction are the sectors most likely to lose high-skilled workers²⁴. If the 'brain drain' materialises, it can be expected to have an adverse impact on sectors which particularly rely on workers from the EU, such as IT, business/law, and engineering/construction. For example, Deloitte (2018)²⁵ reported that 10.3% of the workforce in the engineering sector comes from the EU.

According to research by Deloitte²⁵, Northern Powerhouse-based EU citizens are less likely to consider leaving than those in London (21% compared to 59%), indicating the requirement for a localised approach to dealing with labour market trends and skills shortages to be taken.

In the low-skill segment of the market, there is an opportunity to counteract the loss of EU workers by focussing on automation in the industries that will be affected (namely agriculture, hospitality, administrative)²⁴, although the burden of investment costs should not be underestimated. EU workers make up over 14% of the UK's workforce in the accommodation and food services sector.

3.3 The vision set out in the Northern Powerhouse Independent Economic Review

The 2016 NPIER undertook an analysis of the North's historical economic underperformance, its key capabilities and opportunities, to develop a vision for what a realistic but stretching vision for the North would look like.

In broad economy-wide terms, the NPIER's Transformational scenario proposed a future in which, by 2050, the North's GVA would be £97bn larger

²⁴ <https://assets.kpmg.com/content/dam/kpmg/uk/pdf/2017/08/the-brexit-effect-on-eu-nationals.pdf>

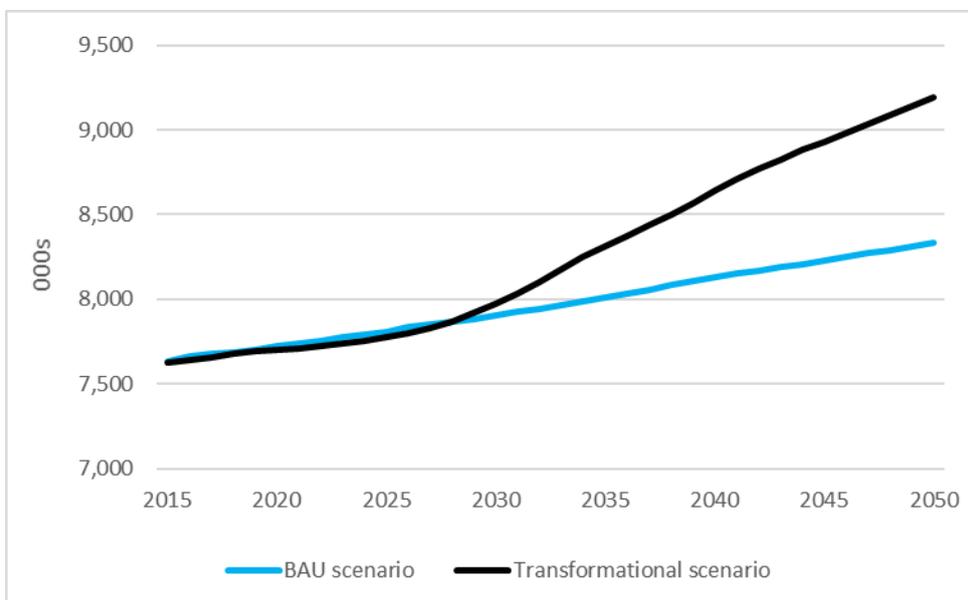
²⁵ UK Power up Report, Deloitte, 2018

(in 2015 prices) with 850,000 more jobs than would occur under a ‘business as usual’ scenario.

The faster growth in the NPIER’s Transformational scenario was led by a transformed performance in four prime and three enabling capabilities. In the supporting analysis, outcomes for the rest of the economy, aggregated to a further five sector groups, were also developed, to give an economy-wide perspective.

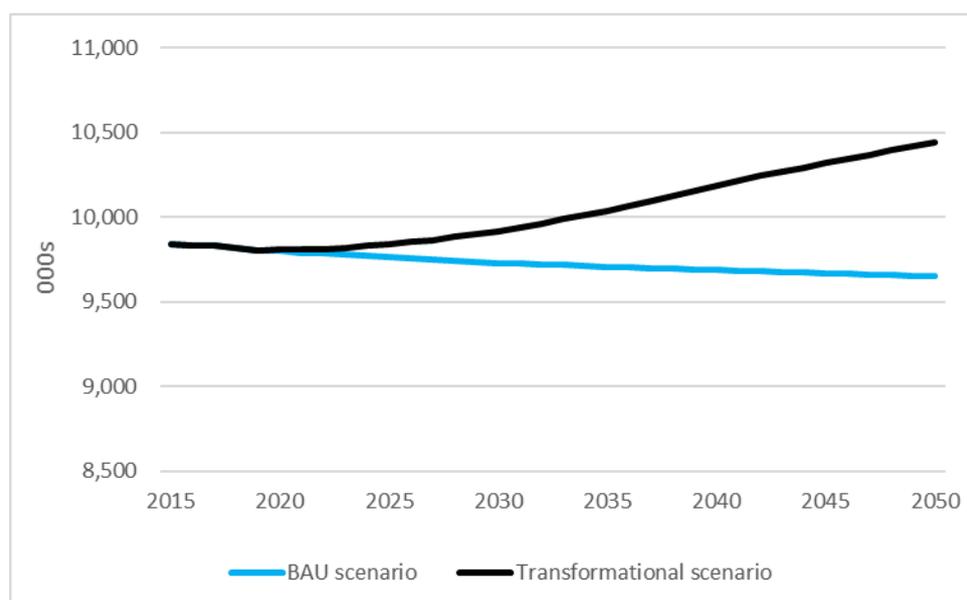
The stronger economic performance in the Transformational scenario compared to BAU is reflected initially in stronger *productivity* growth. The total number of jobs in the North is expected to grow at a similar pace in the two scenarios up to 2030, after which there is an acceleration under the Transformational scenario, as shown in Figure 3.3.

Figure 3.3: IER projections for jobs in the North under the BAU and Transformational scenarios



Source: Cambridge Econometrics, Northern Powerhouse Independent Economic Review

Figure 3.4: IER projections for working-age population in the North under the BAU and Transformational scenarios



Source: Cambridge Econometrics, Northern Powerhouse Independent Economic Review

There is only limited scope to meet increased demand for workers from BAU population growth, as economic activity rates are already reasonably high, and unemployment rates are already reasonably low. The projected aging population will curb activity rates. While the increased number of jobs is larger than the number of workers required, because of double-jobbing, the turnaround in employment trends projected as part of the NPIER Transformational scenario would necessarily involve a turnaround in population trends. Compared with BAU, the NPIER's Transformational scenario assumed that the North's working-age population would be 792,000 higher in 2050, as Figure 3.4 shows, while the number of jobs in 2050 would be 855,000 higher. Consistent with this, the total population would be 1,464,000 higher²⁶.

Jobs by capability / sector group

Table 3.1 shows the jobs projections for each of the seven capabilities and the five sector groups under both the business as usual and Transformational scenarios.

Table 3.1: IER projections for jobs in the North by capability and scenario

	2015		BAU scenario			Transformational scenario		
			2015-50		2050	2015-50		2050
	(000s)	(% of total)	(000s pa)	(% pa)	(% of total)	(000s pa)	(% pa)	(% of total)
Prime Capabilities								

²⁶ The emphasis in the NPIER was on closing the *productivity* gap. The Transformational scenario set out a way in which this might be achieved while at the same time closing the gap in the growth rates of *GVA and employment*, with the resulting implication for *population* growth, but higher *productivity* does not necessarily mean (or require) a larger economy.

Advanced manufacturing	580.8	8	-9.2	-2.3	3	-7.3	-1.6	4
Energy technologies	116.0	2	-1.0	-1.0	1	-0.7	-0.7	1
Health innovation	567.5	7	1.7	0.3	8	2.1	0.3	7
Digital	131.5	2	1.2	0.8	2	2.5	1.5	2
Enabling Capabilities								
Financial and professional services	373.1	5	3.9	0.9	6	8.8	1.7	7
Logistics	404.0	5	1.3	0.3	5	5.0	1.0	6
Higher and further education	112.0	1	0.3	0.2	1	1.0	0.7	2
Other sector groups								
Agriculture and food	211.0	3	-2.4	-1.4	2	-2.3	-1.3	1
Other production industries	644.1	8	-5.5	-1.0	5	-6.4	-1.2	5
Other business services	1,060.4	14	14.1	1.1	19	11.6	0.9	16
Other public services	1,406.0	18	9.3	0.6	21	10.9	0.7	20
Consumer services	2,024.2	27	6.5	0.3	27	19.6	0.8	29
Total	7,630.4	100	20.2	0.3	100	44.6	0.5	100

Source: Cambridge Econometrics, Northern Powerhouse Independent Economic Review.
Notes: The 'Other sector groups' noted in the table come from the supporting analysis for the NPIER; they were not included in the Review's published outputs.

The difference between the two scenarios is distributed unevenly across capabilities, representing differences in impact according to the industrial composition of the North's economy. The productivity impacts of the Transformational scenario are strong in tradeable activities, and jobs are expected to continue to be shed in production industries (such as agriculture, mining and manufacturing), while strong growth in jobs is expected in business services. However, there is also a rise of population-driven industries (public services, distribution, logistics, and hospitality) in the Transformational scenario, to cater for a growing population, which reflects aspirations for the North to be a more attractive place to live and work.

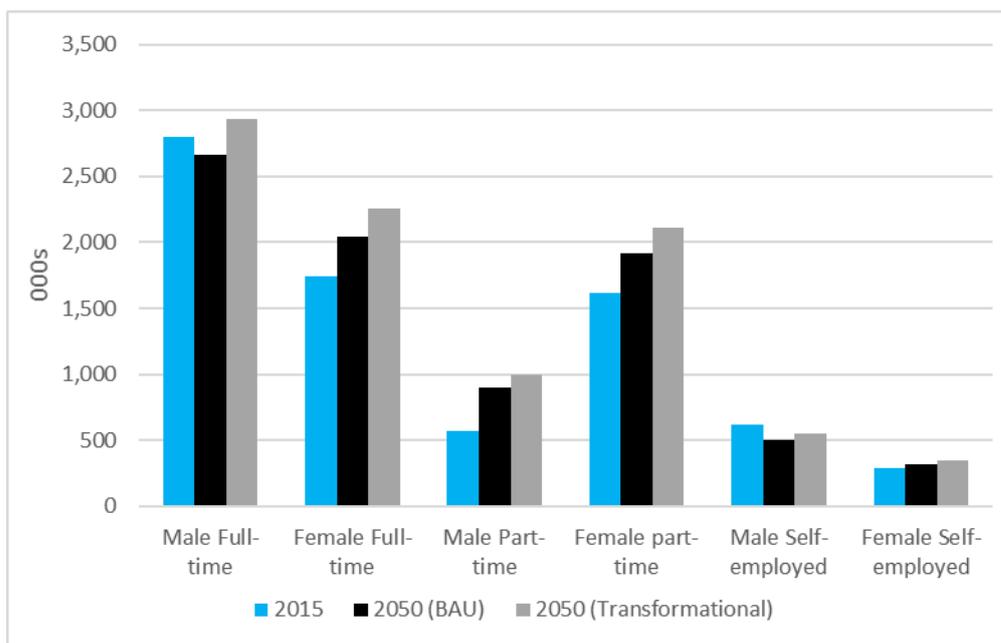
In both scenarios, the trends of the region's largest employers (Health services, Other production industries, Other business services and Other public services which together made up almost 50% of employment in 2015) were assumed to be similar.

Some of the greatest differences in the average annual job increase between the two scenarios are in Financial & professional services and Consumer services, which were assumed to benefit most from the clustering of economic activity. There are also substantial differences in Digital, Logistics and Higher and further education. Taken together, these five groups account for 40% of total jobs in the North in 2015, and they are expected to contribute to two-thirds of total job increase over 2015-50 under the BAU scenario and even more (80%) under the Transformational scenario.

Jobs by gender and type of work

Figure 3.5 shows the breakdown of jobs in the North by type of employment, in 2015 and in 2050 under the two scenarios. Employment is projected to grow in all female categories compared to 2015, the absolute increase in both part-time and full-time work the Transformational scenario by 2050 being almost twice as large as in the BAU scenario. Jobs held by females are expected to contribute the most to total job growth in the North over 2015-50. As a result, by 2050, there would be more jobs held by females than males in the North under both scenarios, in contrast with the 2015 profile.

Figure 3.5: Jobs in the North by gender and type under the BAU and Transformational scenarios



Source: Cambridge Econometrics.

The number of male full-time jobs, accounting for over a third of all employment in 2015, is expected to fall slightly under the BAU scenario, reflecting the loss of jobs in sectors that traditionally employ more males. In the Transformational scenario a small increase is expected. Male part-time employment is expected to grow more rapidly, reflecting the growth of leisure services and the rise of the gig economy.

4 Assessing the implications of the Transformational scenario for occupations, skills and particular labour markets

The NPIER did not calculate the expected profile of jobs broken down by occupation. Nor did it provide a geographical breakdown of the location of jobs. Both of these are of key interest when considering the possible implications for travel demand: travel characteristics vary by occupational group (higher paid and more specialised workers generally travel further), and the relative attractiveness of rail and road transport depend on whether jobs are clustered in city centres or more widely distributed. This chapter reviews wider evidence on trends and policy influences on future demand for occupations and the supply of skilled workers, and then presents projections that disaggregate the NPIER Transformational scenario by occupation and by local authority.

4.1 The UK-wide context and policies to address the North's skills deficit

UK-wide trends that will also apply in the North

The occupational profile of the UK is not expected to remain static over the next 10 to 30 years. Changes in trade patterns and supply chains, shifts in product demand and the impact of automation and AI are all expected to have profound effects on the industries people will work in and the specific tasks they will be required to carry out.

Jobs in science, research, engineering and technology are expected to rise at double the rate of other occupations between now and 2023²⁷, whilst the majority of jobs on the Home Office's Shortage Occupation List are in either STEM-related roles or industries²⁸.

The UK is rated as having the 5th most efficient labour market in the World Economic Forum's Global Competitiveness Report 2016-17. But, job security is low due to light regulation of temporary work²⁹. Employment in the gig economy increased by 50% over 2008-16 and looks set to continue³⁰. The rapid growth of the gig economy is partly because it started from a relatively small base but also a relatively larger increase in self-employment (compared to employees) which itself resulted from slowdown in traditional full-time employment following economic slowdown in the late 2000s. Employment growth in the gig economy was also facilitated by the rapid spread of the IT platform technologies on which it is based. On the other hand, the proportion of employment classed as traditional full-time employment reduced from 65%

²⁷ HM Government Industrial Strategy

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

²⁸ HM Government Home Office – Immigration Rules

<https://www.gov.uk/guidance/immigration-rules/immigration-rules-appendix-k-shortage-occupation-list>

²⁹ Good Work – The Taylor Review of Modern Working Practices

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/627671/good-work-taylor-review-modern-working-practices-rg.pdf

³⁰ Good Gigs – A Fairer Future for the UK's Gig Economy

https://www.thersa.org/globalassets/pdfs/reports/rsa_good-gigs-fairer-gig-economy-report.pdf

to 63% between 2008 and 2010 and has remained around that level since²⁹. This suggests that, despite concerns, the trend towards more part-time and temporary work has not been as great as initially thought.

Middle-income occupations are reducing due to market changes in advanced economies, which could lead to further income polarisation. Increased investment in productivity growth from automation could create growth, but to *maintain* employment, new employment opportunities need to be provided quickly for those affected by the proliferation of automation.

The Taylor Review of Modern Working Practices for the UK government suggests that the hollowing-out effect of middle-income occupations is not currently impacting on wages in the UK, with the number of people receiving wages within 25% of the median remaining fairly constant at just over one-third over 2001-16. However, as automation increases with time, it will be important to acquire new skills not affected by automation, for example, non-cognitive skills such as negotiation and empathy²⁹.

Policies to address the North's skills deficit

The North currently has a skills generation and retention problem, both in terms of a deficit of high-skilled workers, and a surplus of residents with low skills³¹.

Universities UK has recently made a number of recommendations to improve UK-wide graduate retention³²:

- improved partnerships between business and universities
- more granular data on skills shortages
- improved university measures to encourage retention – currently universities in the North of England will receive lower scores on the new Teaching Excellence Framework if they retain graduates due to the lower wages in these areas

There is a strong influence of large cities on graduate retention rates, with London, Manchester, Belfast and Birmingham all above or around 50% graduate retention. The average retention rate for large cities is 38% compared to 26% and 23% for medium and small counterparts respectively³³.

Availability of jobs appears to be the biggest factor influencing new graduate mobility patterns, with career progression opportunities appearing to be more important than wage levels³³. Identifying measures that would make the North more attractive to existing high-value firms looking to expand or relocate, and improving the start-up, 5-year survival and scale-up rates of businesses within the area are two policies which could support career progression in the North.

Graduate work experience opportunities are unevenly distributed across the country – 62% of businesses in London had employed an intern compared to 33% of businesses in the North²⁹, whilst London had an 19% share of UK

³¹ These issues are developed further in Education the North: driving ambition across the Powerhouse <http://www.northernpowerhousepartnership.co.uk/media/1208/npp-educating-the-north.pdf>

³² Graduate Retention – Meeting Local Skills Needs <http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2017/graduate-retention-meeting-local-skills-needs.pdf>

³³ The Great British Brain Drain – Where Graduates Move and Why <http://www.centreforcities.org/wp-content/uploads/2016/11/16-11-18-The-Great-British-Brain-Drain.pdf>

graduate jobs in 2015, compared to 4% in the second placed city, Manchester³³.

4.2 Modelling the location and occupational profile of jobs in the NPIER scenarios

The analysis builds on the pan-Northern IER work and aims to portray the occupational profiles of different labour market areas in the North in the future. The labour market area projections are also used to highlight implications for the resident population to inform migration patterns into and out of the region, for example, to calculate the additional levels of workers at different educational qualification levels that would be required to fill the target occupational roles, and the levels of FE and HE graduation and retention rates that this would correspond to.

Table 4.1 presents the data inputs into the modelling and analysis.

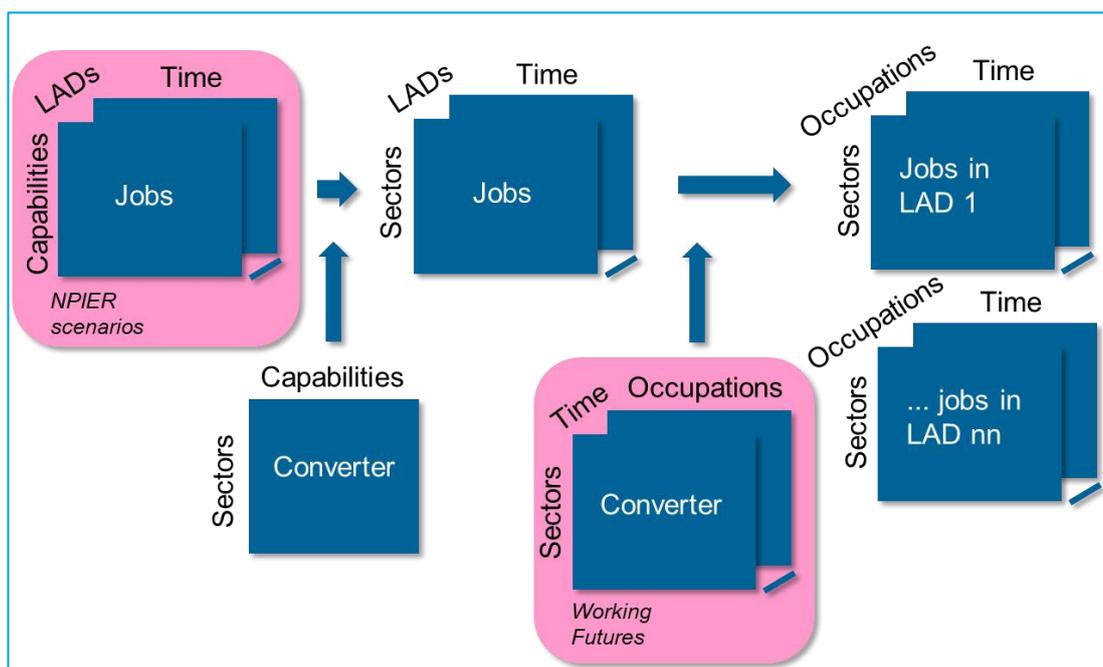
Table 4.1: Data sources for Stage 1 modelling

Variable	Source	Breakdown
Jobs in the North	Northern Powerhouse IER	By scenario and capability
Capability-sector converter	Cambridge Econometrics, based on data from Business Register and Employment Survey	By capability and sector
Jobs in the UK regions	Working Futures 2014-24 ³⁴	By sector and occupation

A summary of the modelling steps is presented in Figure 4.1.

³⁴ HM Government – UK Labour Market Projections: 2014 to 2024
<https://www.gov.uk/government/publications/uk-labour-market-projections-2014-to-2024>

Figure 4.1: Methodology to model occupational profiles by local authority (LAD)



Source: Cambridge Econometrics.

The starting point was the Northern Powerhouse IER projections of jobs by capability for the North. These pan-Northern projections were disaggregated to local authorities and districts, based on Cambridge Econometrics' existing local employment projections, with additional uplifts for agglomeration effects³⁵ applied in large city authorities in the Transformational scenario.

In the first stage, the local authority-level projections of jobs by capability were converted to 45 sectors defined in terms of the 2007 Standard Industrial Classifications. This was done using the proportion of each capability that can be attributed to a particular sector, based on data from the Business Register and Employment Survey.

The second stage involved splitting the projections for each sector in each local authority into 25 occupations (as defined by the 2010 Standard Occupational Classifications). Trends in the sector-specific distribution of occupations in the corresponding region (North East, North West, Yorkshire & the Humber or East Midlands) from Working Futures up to 2024 and extrapolations of these trends to 2050 were used to derive these estimates.

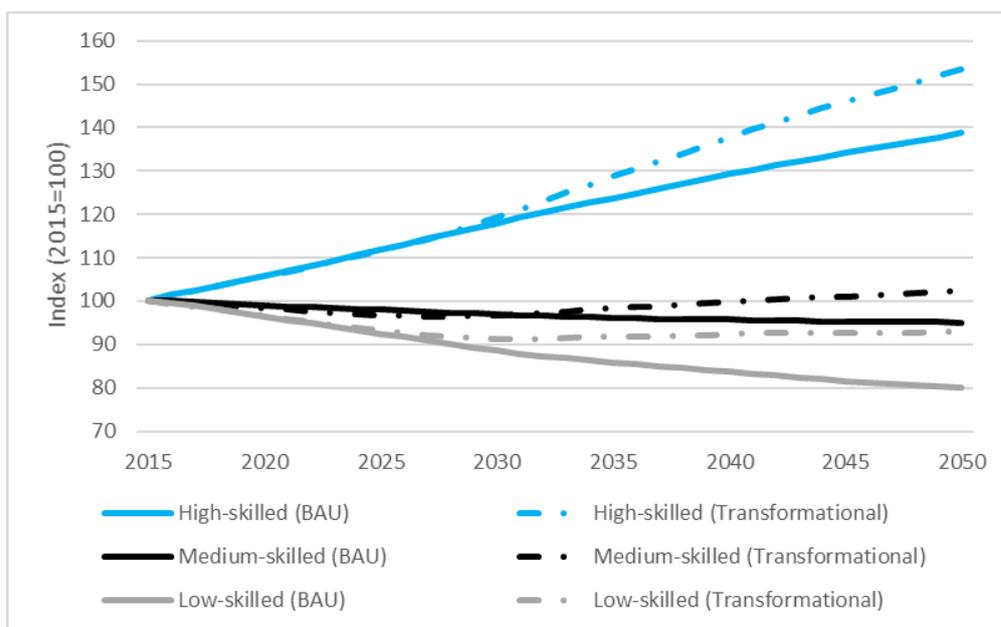
Finally, summing across the sector dimension gave the occupational composition in each local authority.

Results

³⁵ The idea that firms located close to each other, particularly common in urban areas, benefit from lower costs of production, attract more customers and have more opportunities to exchange ideas and knowledge, which can foster competition and innovation.

Figure 4.2 illustrates trends in three occupation groupings in the North; high-skilled, medium-skilled and low-skilled³⁶. Under the Transformational scenario, growth is expected in high and medium-skilled occupations (an increase of 35,300 and 1,600 jobs per annum over 2015-50, respectively), while jobs in low-skilled occupations are expected to stabilise from 2030 after a decline since 2015. On the other hand, the number of medium and low-skilled occupation jobs is projected to decline consistently throughout the whole period (by 3,500 and 6,400 jobs each year, respectively) under the BAU scenario.

Figure 4.2: Projected growth in jobs in the North by skill level and scenario



Source: Cambridge Econometrics.

Table 4.2 shows that *Managers, Directors and Senior Officials, Professional* occupations and *Associate professional* and technical (which together make up the ‘high-skilled occupations’ group in Figure 4.2) grow by similar rates, and some 0.3 percentage points per annum faster in the Transformational scenario than BAU. Growth in medium-skilled occupations under the Transformational scenario is expected to be driven by *Caring, Leisure and other Service* occupations and *Sales and customer service* occupations, most of which are related to the consumer services capability which were assumed to grow rapidly because of population growth and agglomeration effects.

Table 4.2: Projected jobs in the North by major occupation and scenario

	Jobs in 2015	BAU scenario (2015-50)	Transformational scenario (2015-50)	Total absolute difference between Transformational and BAU scenarios

³⁶ High-skilled: SOC 1-3, Medium-skilled: SOC 4-7, Low skilled: SOC 8-9.

	(000s)	(000s)	(000s pa)	(% pa)	(000s)	(000s pa)	(% pa)	(000s)
Managers, directors and senior officials	673.3	258	7.4	0.9	363	10.4	1.2	105
Professional occupations	1,377	567	16.2	1.0	762	21.8	1.3	195
Associate professional and technical occupations	925.2	327	9.3	0.9	464	13.3	1.2	137
Administrative and secretarial occupations	895.9	-277	-7.9	-1.1	-207	-5.9	-0.7	70
Skilled trades occupations	854.8	-284	-8.1	-1.1	-367	-10.5	-1.6	-83
Caring, leisure and other service occupations	797.9	402	11.5	1.2	519	14.8	1.4	117
Sales and customer service occupations	665.3	2	0.0	0.0	128	3.7	0.5	126
Process, plant and machine operatives	580.4	-229	-6.5	-1.4	-157	-4.5	-0.9	72
Elementary occupations	860.6	-60	-1.7	-0.2	56	1.6	0.2	116
Total	7,630.4	706	20.2	0.3	1,561	44.6	0.5	855

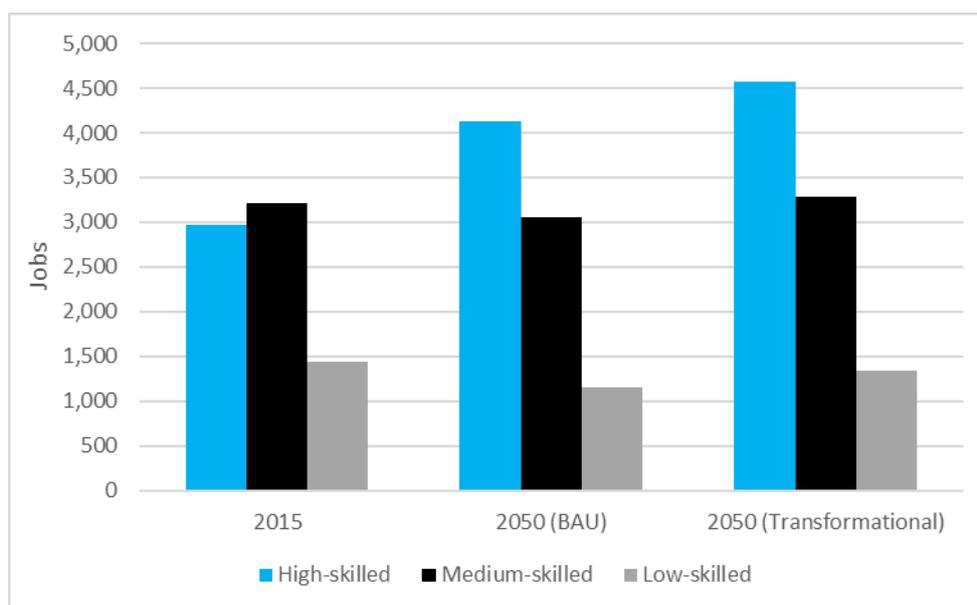
Source: Cambridge Econometrics.

There are projected to be steep declines in employment demand in *Administrative and secretarial* occupations, *Skilled trades* occupations and *Process, plant and machine operatives*. In practice, these reductions may be realised as a slow decline, with the workforce progressing towards retirement, rather than a radical structural change, because workers in these occupations are older on average, with almost half of all workers in these sectors due to retire within the next 20 years as a matter of course.

The projected growth in employment in high-skilled jobs is expected to be distributed proportionally across the three component occupations, albeit the route by which workers enter the *professional* and *associate professional* occupations is more direct than entrance in the *managers, directors and senior officials* group, and the age-differential between the three high-skilled groups is expected to continue, even as the overall age profile dips, as is commonly seen in expanding industries.

There is a shift towards higher-level occupations in both scenarios, compared to 2015. Between scenarios, there is little difference in the *proportions* of jobs in the North across occupations by 2050: the proportions of high-skilled and low-skilled jobs are marginally higher under the Transformational scenario than under the BAU scenario. But the *number* of jobs is higher in the Transformational scenario (see Figure 4.3).

Figure 4.3: Projected number of jobs by occupation in the North in the two scenarios

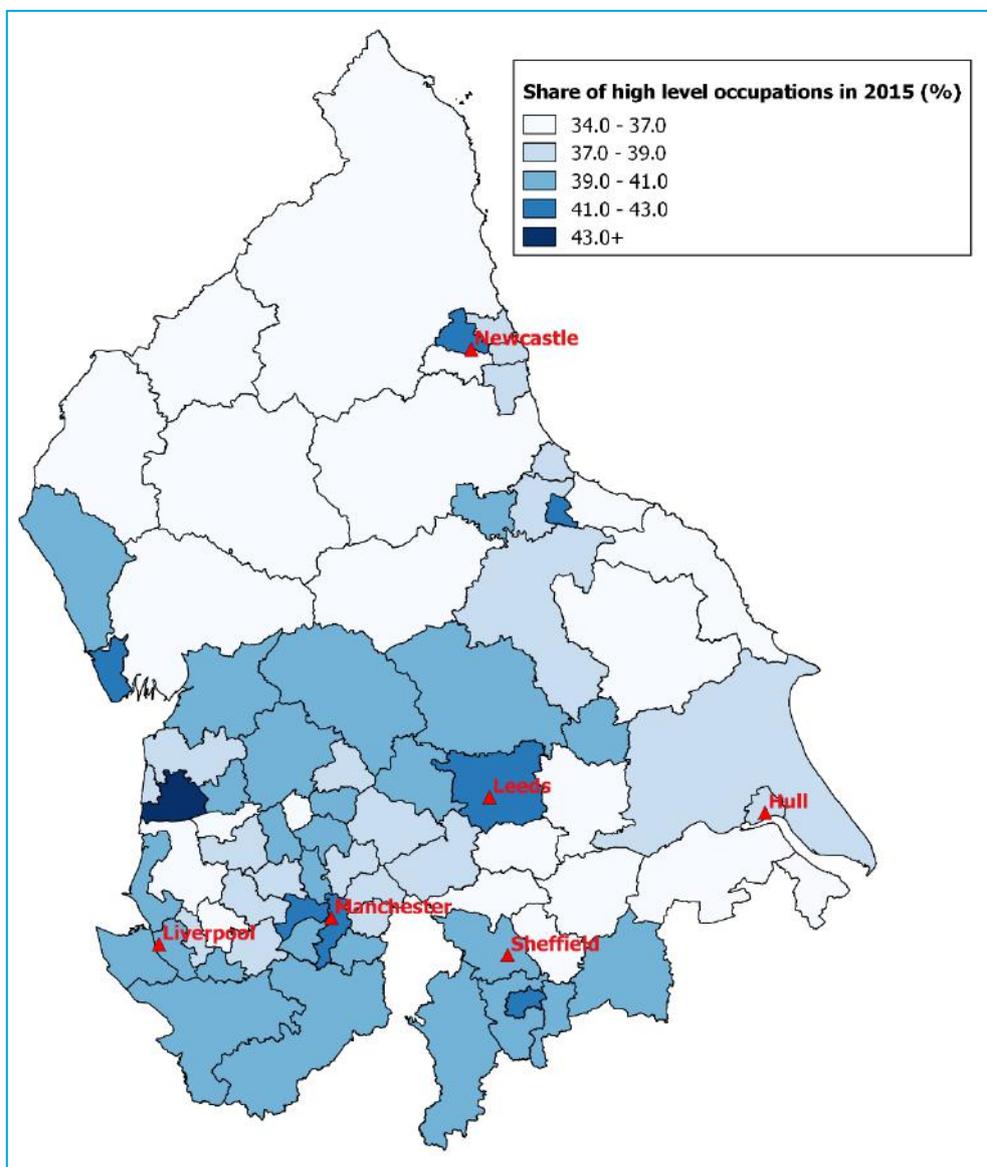


Source: Cambridge Econometrics.

The similarity in outcomes reflects the method: in any given year, the same shares of occupations in each sector are applied in the two scenarios, and the shift in jobs between sectors in the Transformational scenario does not result in much change in the distribution of occupations. In other words, the Transformational scenario is treated as increasing the number of jobs overall (including in higher-level occupations) and raising productivity within occupations, rather than accelerating further the shift towards higher-level occupations. The Transformational scenario results imply that the shift away from production industries would be accompanied by an increase in jobs in business and public services (which are high-value and high-skilled) but also in logistics and consumer services (which generate less value and require less skill). Also, the increasing share of employment in population-dependent sectors in the Transformational scenario, particularly health and residential care, and hospitality, boosts jobs for low-skilled workers. If these trends continue past the projection period, there may be a shrinking proportion of middle-level occupations in the region. This redistribution of jobs is likely to cause knock-on effects in the supply chain of the most impacted sectors and occupations, which were not explicitly modelled and therefore not fully captured in these results.

The local authority-level projections reflect the shift towards high-skilled occupations as for the North as a whole, as well as highlighting trends that are characterised by the unique features of each area. Figure 4.4 shows variations in the share of high-level occupations as a proportion of all jobs in 2015 across local authorities. As expected, the share is generally higher in major city or urban authorities. Examples of these include Greater Manchester and the areas surrounding Liverpool, Leeds and Newcastle, which are all in close proximity to areas with a much lower average skill level. However, even within urban areas, high-level occupations still show a tendency for sub-city-level clustering, with many cities or city regions containing particular areas with particularly high proportions of high-skilled jobs.

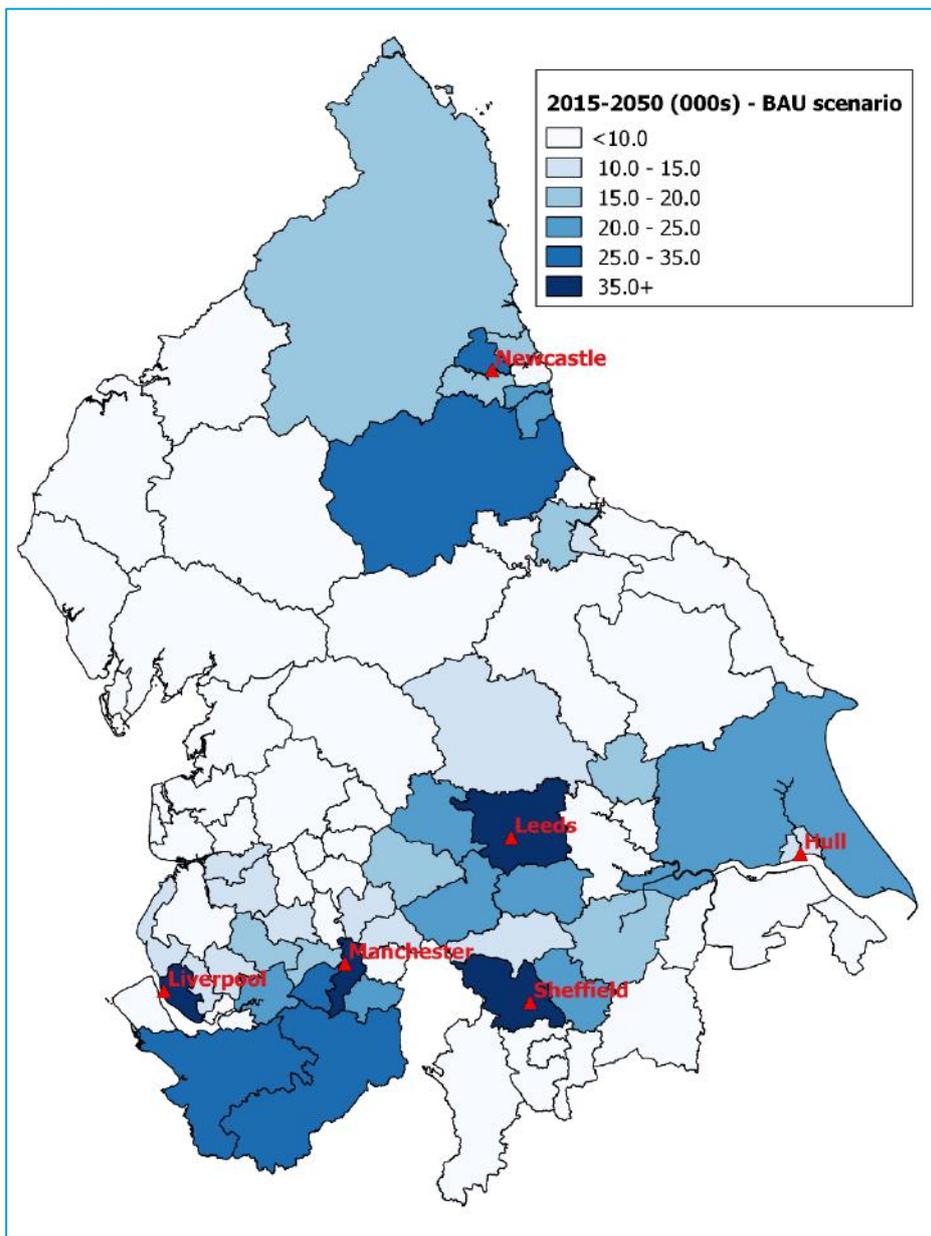
Figure 4.4: Share of high-level occupations as a proportion of all jobs in the North by Local Authority in 2015



Source: Cambridge Econometrics. NPIER

Figure 4.5 and Figure 4.6 illustrate the absolute changes in the number of high-skilled occupation jobs across the North over 2015-50 under the BAU and Transformational scenarios respectively. In both cases, the increase in high-skilled occupation jobs is expected to be largest in the city authorities that are assumed to benefit directly from agglomeration (Newcastle, Manchester, Liverpool, Leeds and Sheffield). These cities have some of the largest workforces in the region because of a large population base as well as substantial commuting inflows. In addition, sub-urban local authorities are projected to see more of an increase in the number of high-skilled jobs than predominantly rural areas.

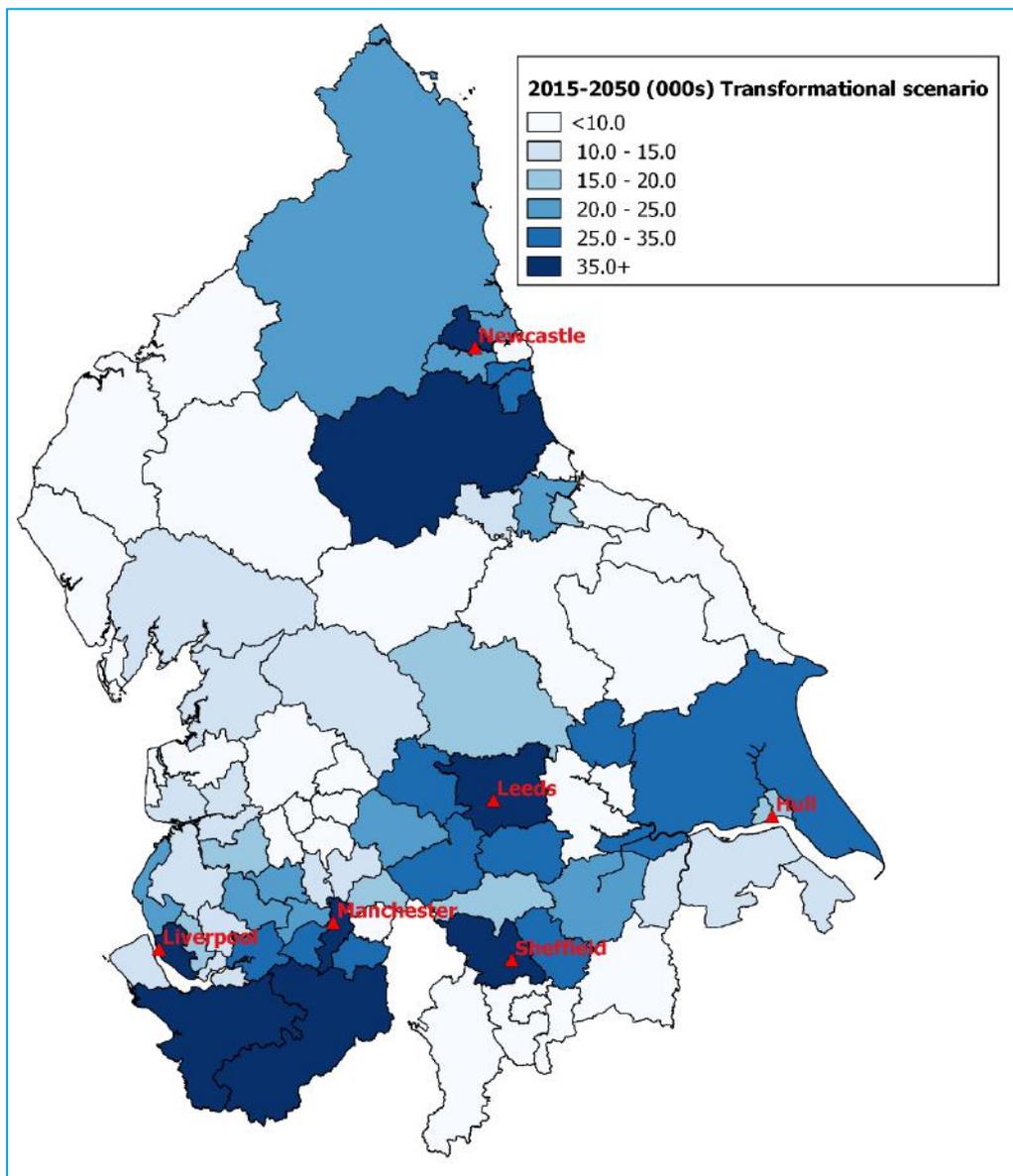
Figure 4.5: Projected increase in high-level occupation jobs in the BAU scenario in LADS across the North



Source: Cambridge Econometrics, NPIER

Comparing the two scenarios, growth in high-skilled jobs is projected to be stronger under the Transformational scenario in most local authorities. Cities and urban areas are expected to have a greater share of this difference, because of the size of the labour force in these areas and because the clustering of high-value economic activity that attracts high-skilled workers is more likely to take place closer to city centres.

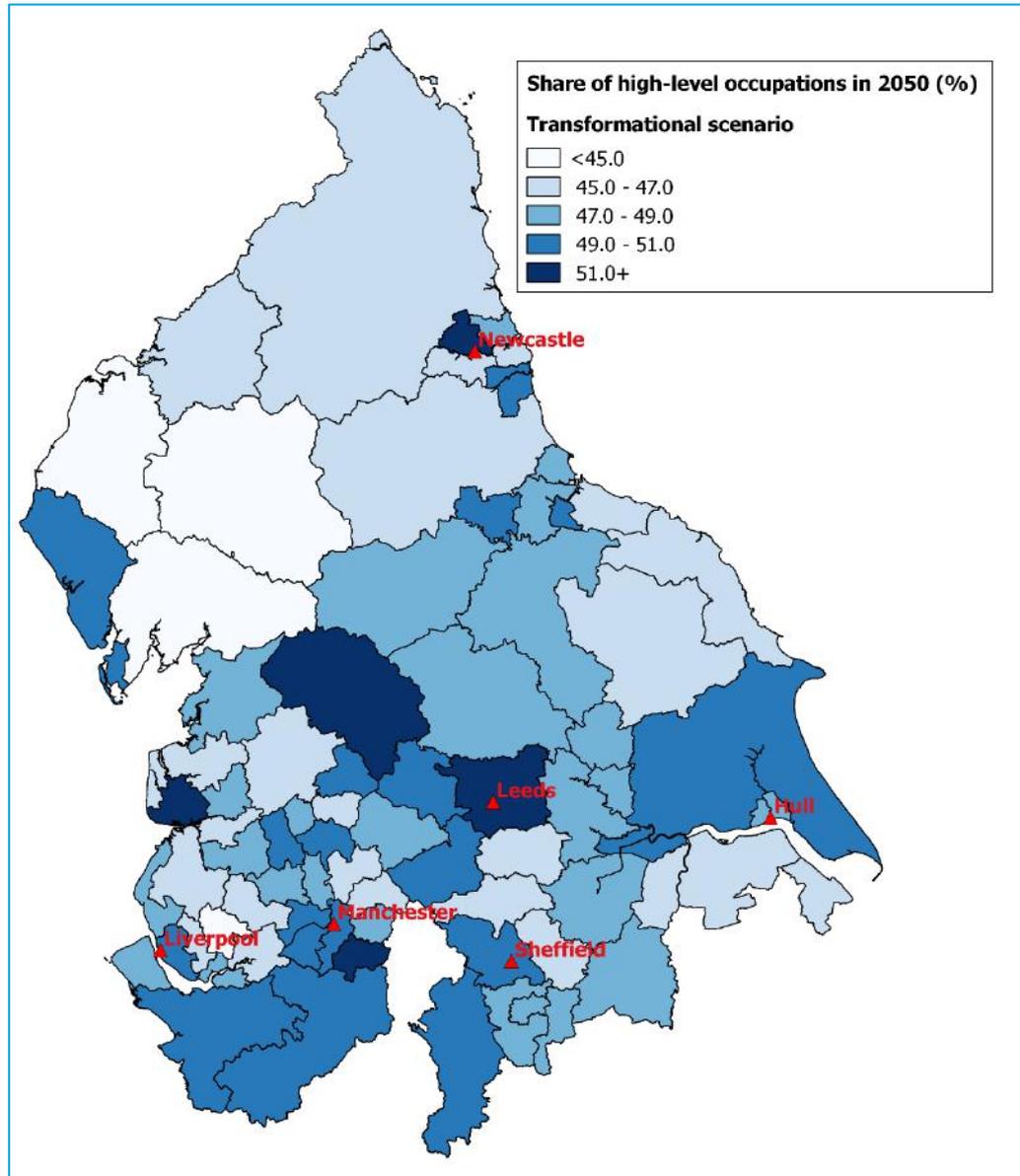
Figure 4.6: Projected increase in high-level occupation jobs in the Transformational scenario in LADS across the North



Source: Cambridge Econometrics, NPIER

The large number of net additional high-skilled jobs created is expected to contribute to a higher share of these jobs in cities and urban areas by 2050 in both scenarios. However, the increase in skill intensity is likely to be most drastic further outside of city centres (see Figure 4.7). This indicates that even though the number of additional high-skilled jobs may be relatively small, they can make a significant contribution to overall employment growth in these areas.

Figure 4.7: Share of high-level occupations as a proportion of all jobs in the North by Local Authority in 2050 under the Transformational scenario



Source: Cambridge Econometrics. NPIER

Implications

The shift away from routine low- and medium-skill occupations to both flexible, non-routine low- and medium skill occupations³⁷, but high-skilled occupations in particular, represents both a continuation of recent historical trends, and a reflection of the anticipated effects of Industry 4.0. Our view is that the level of impacts seen in these figures is more likely to be an underestimate than an overestimate, and the actual level of occupational redistribution away from the “routine” occupations could be considerable.

³⁷ McKinsey Global Institute identify seven categories of activity: four non-routine activities: application of expertise, stakeholder interaction, management & personal development, and unpredictable physical activities (eg sports coaching) are projected to experience an increase in demand; the three “routine” activities data collection, data processing, and predictable physical activity (eg assembly line work) are projected to experience a fall in demand.

The impact of these effects should be partly mitigated by the current age profiles of these occupational groups, as a significant proportion of existing workers may be approaching retirement age by the point in time by where their job becomes directly impacted by automation.

The increase in the number of high-pay, high-skilled jobs represents an opportunity for job market entrants with the requisite education and skills to take advantage of them; however, for low-skill workers, the potential number of job opportunities looks set to shrink, and the phenomenon already in evidence, in which low- and medium-skill workers are forced to rely indefinitely on jobs within the “gig” economy, which would more typically be fulfilled by temporary or transient staff, could well be exacerbated.

Table 4.3: Labour requirements by skill level under the BAU and Transformational scenarios

	2015		2050 (BAU)		2050 (Transformational)	
	Total ('000 jobs)	Replacement rate ('000 workers per year)	Total ('000 jobs)	Replacement rate (000s of workers per year)	Total ('000 jobs)	Replacement rate ('000 workers per year)
Total jobs	7,500	187.5	8,400	213.2	9,200	236.1
High-skill	3,000	75.0	4,100	106.4	4,600	120.7
Medium-skill	3,200	80.0	3,100	77.1	3,200	80.0
Low-skill	1,300	32.5	1,200	29.6	1,400	35.4

Source: Cambridge Econometrics.

Table 4.3 shows that both scenarios see the total number of new entrants into the labour market (the replacement rate) increase from around 190,000 workers per year to over 200,000, with the entirety of the growth coming in high-skilled occupations (from 75,000 in 2015 to 106,400 in the BAU scenario and to 120,700 in the Transformational scenario in 2050). The number of medium and low-skill jobs would still grow, but the replacement rates for these skill levels (respectively 80,000 and 32,500 in 2015) are expected to remain little-changed. The projected increase in high skill replacement rate represents a significant challenge to the education and skills system in the North of England.

Table 4.4: Movement of HE graduates into and out of the North in 2015/16

Annual graduates who grew up in the North of England	Annual graduates from northern universities	Annual graduates entering the northern labour market
60,000	70,000	60,000

Source: HESA, 2017.

Table 4.4 shows how the North of England is a net exporter of higher education graduates to the rest of the UK. Most relevant here is the final figure of approximately 60,000 new graduates into the labour market in 2015/16,

which contributed to the 75,000 new high-skilled workers entering the labour market in the same year (Table 4.3).

Not all graduates are in high-skilled jobs, and not all high-skilled jobs are taken by graduates: some 66% of graduates and 78% of postgraduates within the labour force are in high-skilled employment, and 22% of non-graduates are also employed in high-skilled occupations³⁸.

By 2050, we can expect the annual demand for high-skilled occupations to rise significantly, with an additional 45,000 high-skilled workers required each year to meet the aspirations of the transformational scenario. Addressing this issue is not a matter of improved graduate retention alone; the current total annual graduates from Northern Universities is ~ 70,000 – this is somewhat short of the required 120,000 of high skill workers needed, but will require a multi-faceted approach, including expansion of HE provision in a number of targeted high-demand occupations, but also providing comprehensive FE, retraining, upskilling and apprenticeship schemes in order to take young people who might typically go into *secretarial and administrative, skilled trades or production, plant and machine operative* occupations and equip them with the skills needed to work as *Associate Professionals* instead.

High levels of inward migration may alleviate a shortage of high-skilled workers – but it does not address the equally fundamental problem of a surplus of low-skilled workers, in a time when demand for routine physical, computational and administrative skills are likely to shrink rapidly. A further discussion on immigration and demographic change follows in the next section.

³⁸ Graduate Labour Market Statistics 2016, DfE.

5 Connectivity in the North

This chapter considers the implications for commuting of the occupational profile and location of jobs developed in Chapter 4. It begins with a review of the changing nature of commuting in the UK and in the North, mapping the geography of commuting to key cities. It then considers alternative patterns of the spatial clustering of jobs (concentrated in city centres or distributed around cities) and alternative outcomes for the way that work is generally carried out (in the workplace or remotely), following the the ‘compact’ versus ‘dispersed’ and ‘travel friendly’ versus ‘digital’ scenarios presented in *Future Transport Demand in the North*³⁹.

5.1 Trends in commuting

*Historical trends
in national
patterns of
commuting...*

In November 2017, DfT published research⁴⁰ commissioned from Imperial College and NatCen Social Research on commuting trends in England between 1988 and 2015.

Nationally, however measured, (trips per person, trips per worker or absolute number of trips) the number of commuting trips is in decline. This is despite a growth in population and record numbers in employment. A number of reasons are put forward for this decline:

- Workers are commuting fewer days per week and working from home is growing
- There has been a growth in “trip-chaining” (e.g. dropping children off at school and then going on to work). In part this is a definitional issue in that in the National Travel Survey – the principal data source on commuting trends - a commuting trip starts at home and goes directly to the usual place of work. Over time, trip making patterns have become more complicated.
- More workers do not have a usual place of work – they are employed but do not make a regular journey (technically, more than two trips a week for four consecutive weeks)
- Part-time and self-employment is growing and people with this employment status travel commute less on average than other employees.

The decline in trips is not just associated with commuting trips. Over a 25-year period, the total number of trips made per person for all purposes has declined by around 15%. However, there has not been an equivalent drop in the amount of time spent travelling or distance travelled.

Indeed, on average commuters are now travelling further and for longer than they did 25 years ago, reflecting higher incomes and decisions made about the trade-off between commuting time and housing costs.

³⁹ Future Transport Demand in the North

<https://transportforthenorth.com/wp-content/uploads/TfN-Future-Transport-Demand-Statement.pdf>

⁴⁰ Le Vine S., Polak J. and Humphrey A. (2017) *Commuting Trends in England 1988-2015*, DfT

Car dominates commuting – nationally 66% of commuting trips are made as a car driver or car passenger.

The average rail commute is over 20 miles. This compares with 10 miles as a car driver or 5 miles on a bus.

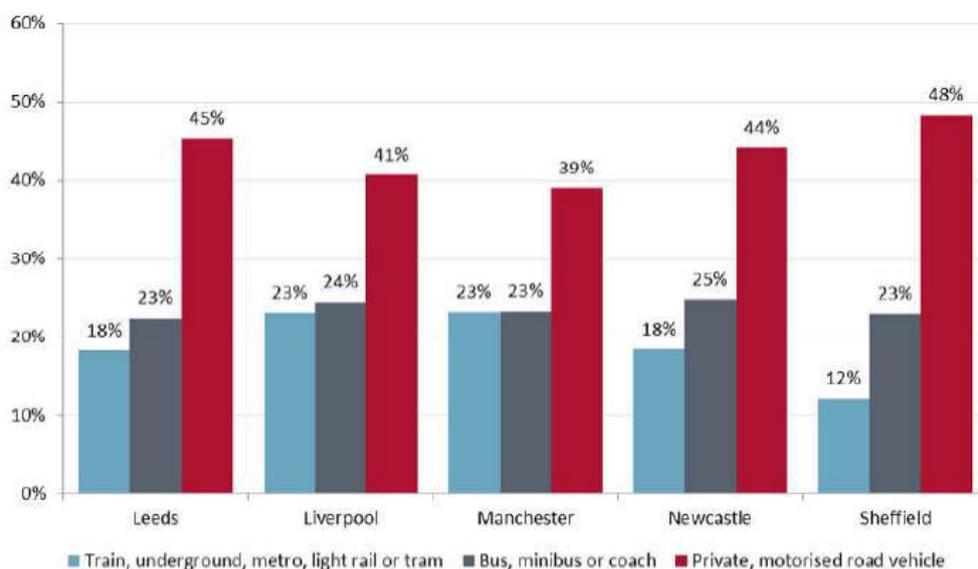
Rail’s share of the commuting market is growing, but it is a minority mode. These are national figures and are strongly dominated by the London market. Nonetheless, city centre stations in the North have experienced strong growth in throughput over the last two decades and in part this is attributed to higher growth in rail commuting.

Outside London, commuting by bus in in decline, as is walking to work.

...and in the North

Work⁴¹ by Steer Davies Gleave in 2014 for HS2 Ltd looked more at travel and commuting patterns in the North. This showed that in conurbations outside London, car/van dominates the personal travel market, accounting for 84% of all trip making. Bus accounted for 11% and rail/metro/tram account for 6%. This data is for all trip purposes (not just commuting) and excludes walking or cycling. However, if we look at journey to work trip making to city centres, we see a different picture and public transport is much more significant:

Figure 5.1: Commuter modes of transport by Northern City



Data source: 2011 Census Travel to Work Data, Steer Davies Gleave analysis. Note Census data is for main mode of travel to work. Feeder modes are not identified in the data

In major conurbations outside London, trips by train/metro/tram average 15 miles, while those by car/van are around 7 miles while the average for bus is 4 miles.

⁴¹ Steer Davies Gleave (2014) *Transport Constraints and Opportunities in the North of England*, HS2 Ltd

The changing nature of jobs, and the trade-offs made between moving house or commuting further

The nature of employment has changed – more self-employment and more part-time working - and this has contributed to a reduction in the volume of commuting. Should this trend continue a further reduction should be expected.

Countervailing this is the number of people in employment. The NPIER Transformational scenario has more jobs and, other things being equal, this could mean more commuting.

Also, people are travelling for longer and further. In part this is because of opportunity, but in part it is because of necessity in that it is now much easier to move job than it is to move house (for home owners, at least) and for those that want to move, limited housing supply and affordability considerations are extending house-buyers acceptable area of search, which also has an impact on commuting distances.

Also, life-styles are now more complicated – multiple working adults in a household, reflecting the impact of housing costs on the trend for grown-up children to live at home for longer and on the trend for adults to share rented accommodation – and this creates complex and variable travel patterns.

The location of future job growth is clearly a key factor determining future commuting trends. Knowledge-intensive jobs have a high propensity to locate in city centres, with a secondary tendency emerging for clusters of specialised activity based around specially designated city-fringe sites, such as science innovation and research parks. Further growth in such city centre jobs will also support growth in other sectors (leisure, retail, culture etc.). Commuting to city centres is typified by longer journeys and a greater propensity to use public transport and rail in particular. There is, however, an element of policy choice here – such growth won't happen by itself, and facilitating policies and programmes need to be in place.

One area of uncertainty is the trip-making patterns of young adults – they drive less, they have lower car ownership and lower driving licence holding than the same cohort did two decades ago. Chatterjee et al (2018)⁴² say “the evidence indicates that the causes of the changes in young people’s travel behaviour lie largely outside transport” (e.g. socio-economic factors, and also the influence of technology). The question is whether these effects are leading to a “delayed adulthood” after which they return to trend, or whether they will survive as this cohort ages. The jury is out and this is an uncertainty to note.

There is a wider question on the effect of broadband/the internet and ability this creates to work more effectively from home/non-traditional locations and whether this will change in the future. Clearly there are a substantial number of jobs where this has no and will never have an impact, but it is important for knowledge-based sectors and also the self-employed who market themselves directly to their customers. Our view is that in conjunction with other wider societal trends, technological change has and will continue to drive changes in commuting patterns, but it is very difficult to isolate its impact. This is separate to questions around what will (for example) be the impact of e-retail on traditional shop-based employment.

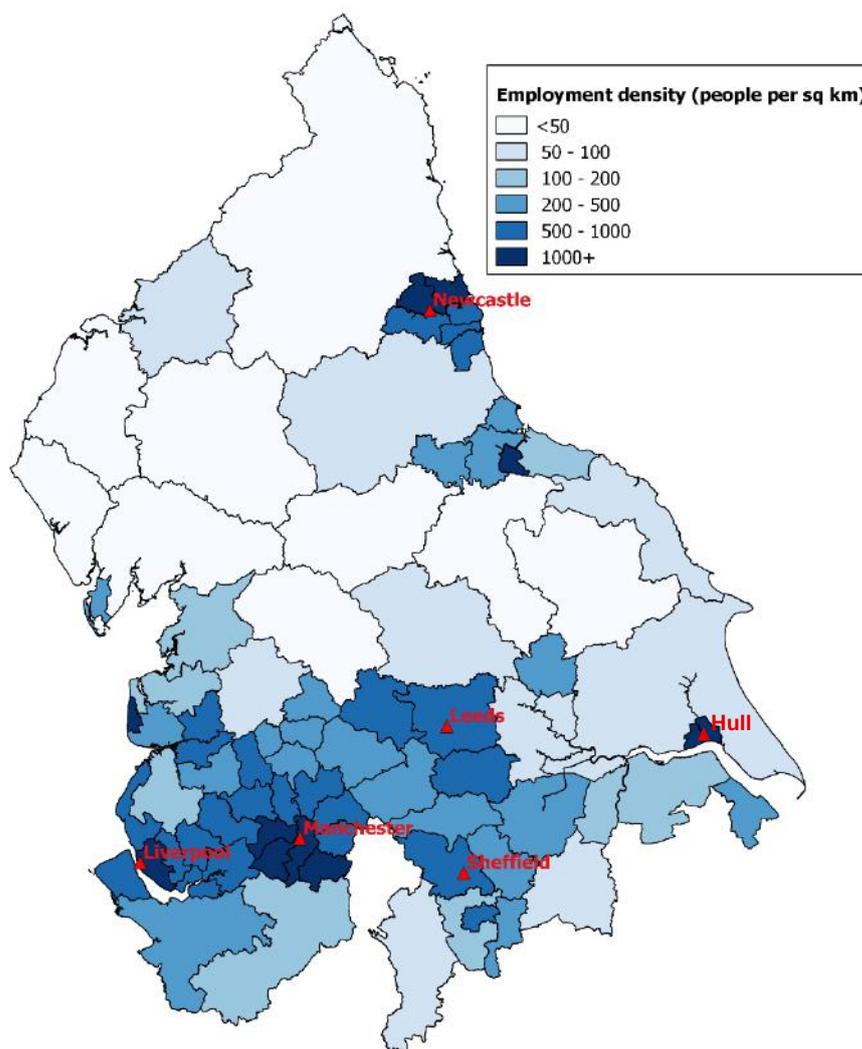
⁴² Chatterjee, K., Goodwin, P., Schwanen, T., Clark, B., Jain, J., Melia, S., Middleton, J., Plyushteva, A., Ricci, M., Santos, G. and Stokes, G. (2018). *Young People’s Travel – What’s Changed and Why? Review and Analysis*. Report to Department for Transport. UWE Bristol, UK

A further uncertainty is the impact of Mobility as a Service (MaaS), Uber, autonomous vehicles, organised ride sharing, bike-share schemes, etc. and whether this will induce more trip making or have a significant impact on trip patterns. The likelihood is that car transport will become considerably cheaper, but road congestion at peak times could increase. Improved technologies to support remote working would work in the opposite direction.

5.2 Spatial distribution of employment and population

This section reviews how commuting patterns and “labour market catchment areas” have changed over recent history and discusses how these patterns are likely to change in the future.

Figure 5.2: Employment density in the North, 2016



Source: Cambridge Econometrics, BRES

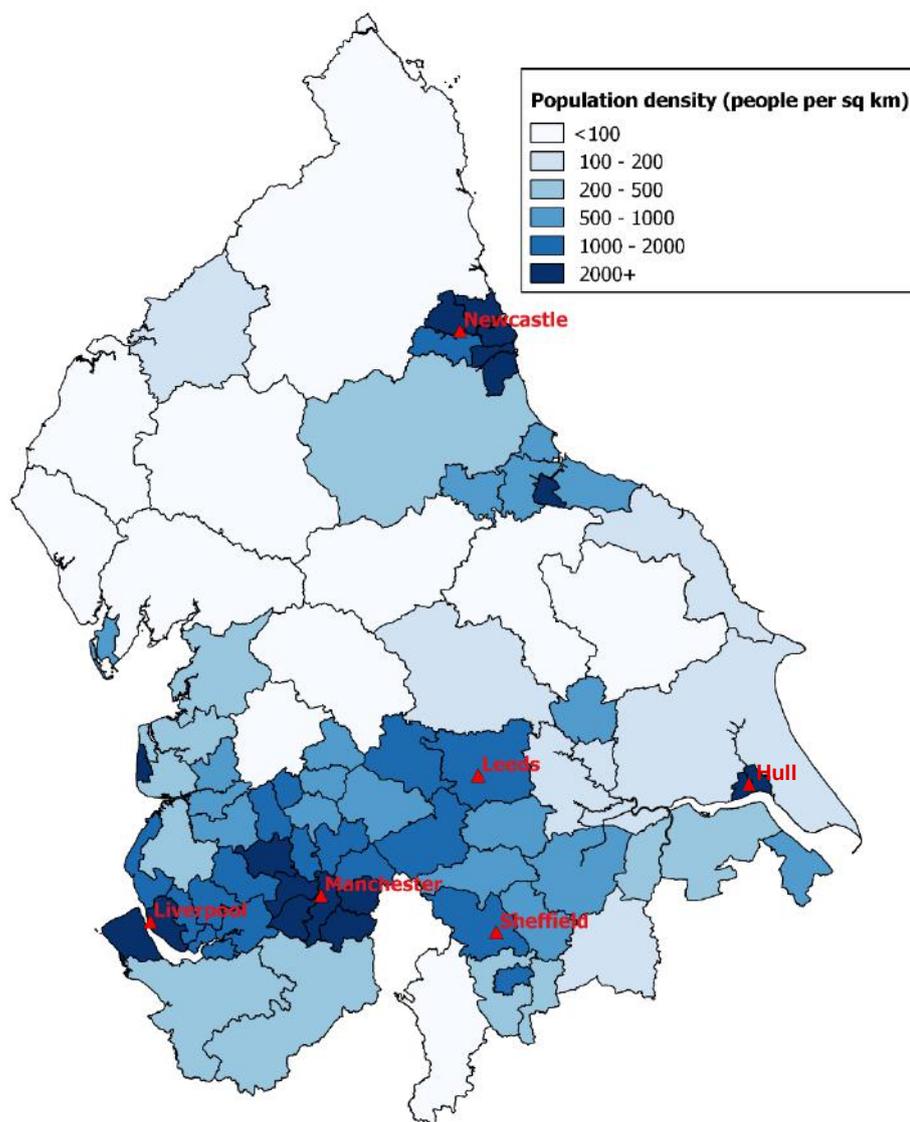
Figure 5.2 shows that the spatial distribution of employment across the North was far from homogeneous in 2016. The visible concentration in the south-west corner of the North contains over 50%⁴³ of all employment across the three regions, with the most densely active belt from Liverpool to Manchester. Other, relatively more spatially-isolated employment centres are visible along

⁴³ The counties of West Yorkshire, South Yorkshire, Lancashire, Greater Manchester and Merseyside between them contain 65% of all employment in the North, in only 23% of the total area.

the East coast, in Tyneside, Teesside and Humberside. The majority of the counties of Cumbria, North Yorkshire and Northumberland have low levels of employment density.

Unsurprisingly, the overall spatial distribution of total resident population mirrors the distribution of employment, albeit with a few minor changes – also note the change in scale of the colour cohorts as total population numbers are roughly twice that of employment in 2016 (Figure 5.3). The range of population density is also narrower: the ratio of the most employment-dense and least employment-dense LAD in the North (Manchester and Eden) is a factor of 238, whereas the ratio of population densities between the same two LADs (also the most and least populous) is only 194.

Figure 5.3: Spatial distribution of resident population in the North, 2016



Source: Cambridge Econometrics, APS

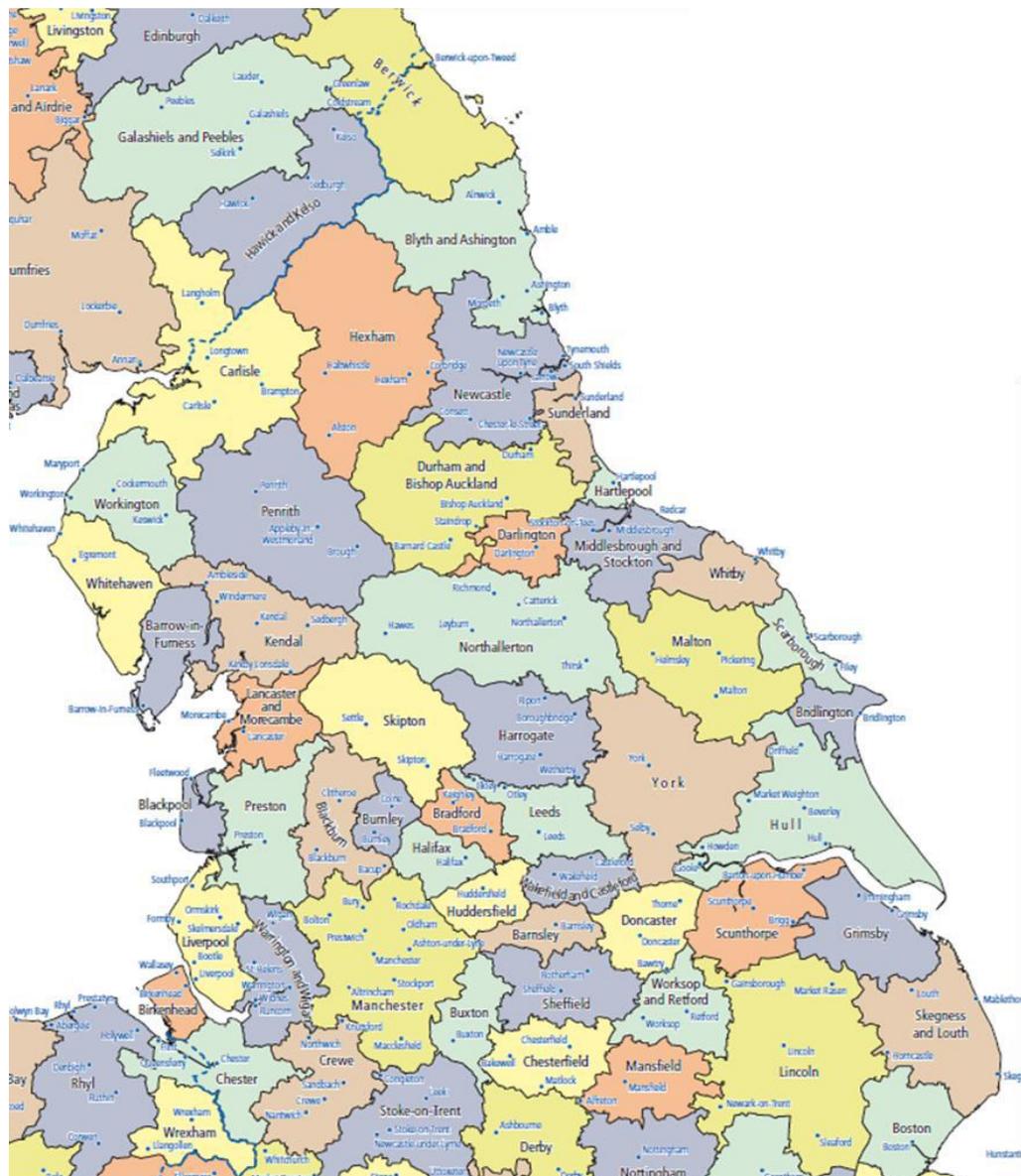
Although bilateral commuting data is only available from the 2011 census, district-level net commuting can be calculated by taking the difference of the workplace employment figures from BRES and the resident employment figures from Annual Population Survey. There are two LADs within the North

that experienced net daily in-commuting of over 50,000 people – these are Manchester (144,000) and Leeds (67,000).

Travel to Work Areas

The ONS has an established definition of a Travel-To-Work Area (TTWA): “The current criteria for defining TTWAs are that at least 75% of the area's resident workforce work in the area and at least 75% of the people who work in the area also live in the area⁴⁴.”

Figure 5.4: The 2011 TTWAs for the North and surrounding areas



Source: ONS.

Using this definition, the Manchester TTWA has a resident population of 2.7 million and Newcastle and Liverpool each have a population of 1 million. Assuming that the trend on longer commuting journeys continues and accepting the ONS definition, what this suggests is that over time there will be

⁴⁴ ONS (2016) *Travel to work area analysis in Great Britain: 2016*

fewer, larger TTWAs in the North, with the largest TTWAs focussed on the larger northern cities.

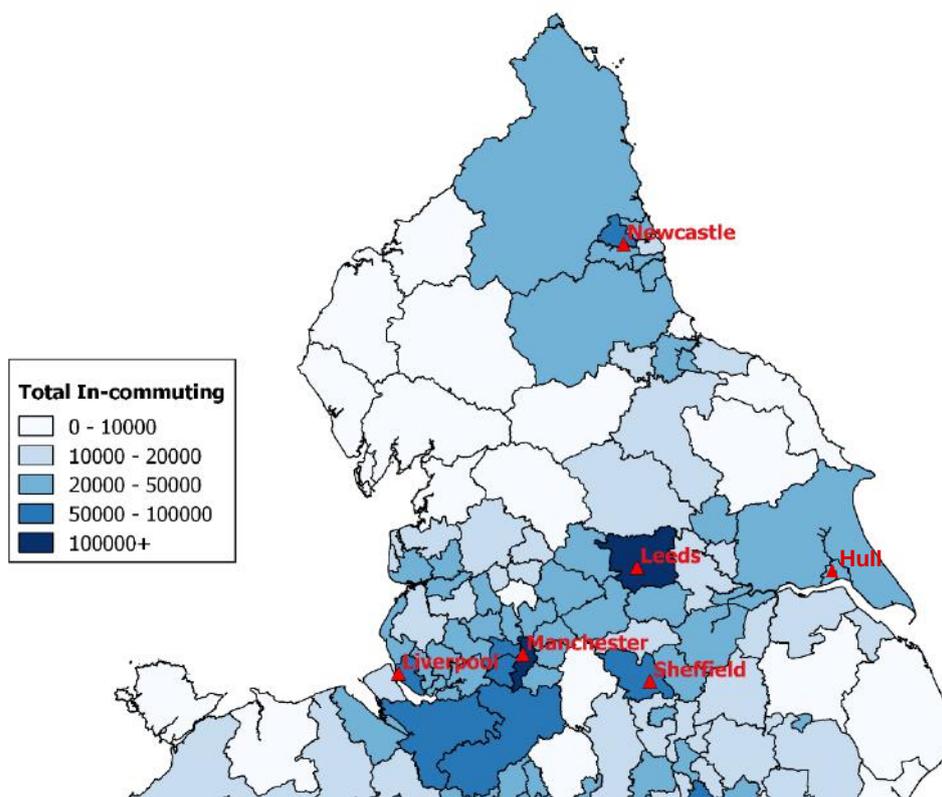
The TTWA methodology creates a series of contiguous, non-overlapping spatial areas of varying sizes, which are typically assigned names correspondingly to the largest settlement or settlements contained within. This method can provide a number of insights, for example a series of smaller TTWAs signifies a more fragmented labour market and a lower overall rate of commuting between places, whereas a few, larger TTWAs signifies a more integrated labour market with widespread commuting within each TTWA. The methodology can be misleading however, and many people misinterpret a TTWA as being analogous to a Labour Catchment Area, or a Functional Economic Area, which they are generally not good spatial representations of.

It is particularly worth noting that the Liverpool TTWA, for example, is not necessarily the spatial area that comprises 75% of the workforce of the Liverpool LAD, City Region, or FEA.

Origins and destinations of commuters

The 2011 census contains both gross commuting values, as well as bidirectional commuting patterns between specific LADs. From this, it is possible to estimate bi-lateral commuting movements for 2016 by taking 2011 bilateral commuting values and updating these using a RAS process, which applies a growth rate that is the product of resident population at origin, and workplace employment at destination, and then rescaling these so that net commuting values remain consistent with actual 2016 data.

Figure 5.5: Total In-commuting by LAD, 2011



Source: Cambridge Econometrics, based on Census 2011 data.

It is not possible to display bi-lateral commuting movements on a single map. The spatial pattern of total in-commuting reveals a familiar pattern, with inward commuting of over 100,000 people each day into both Manchester and Leeds, with other significant commuting into Liverpool, Trafford and Salford, Sheffield, Newcastle and both East and West Cheshire.

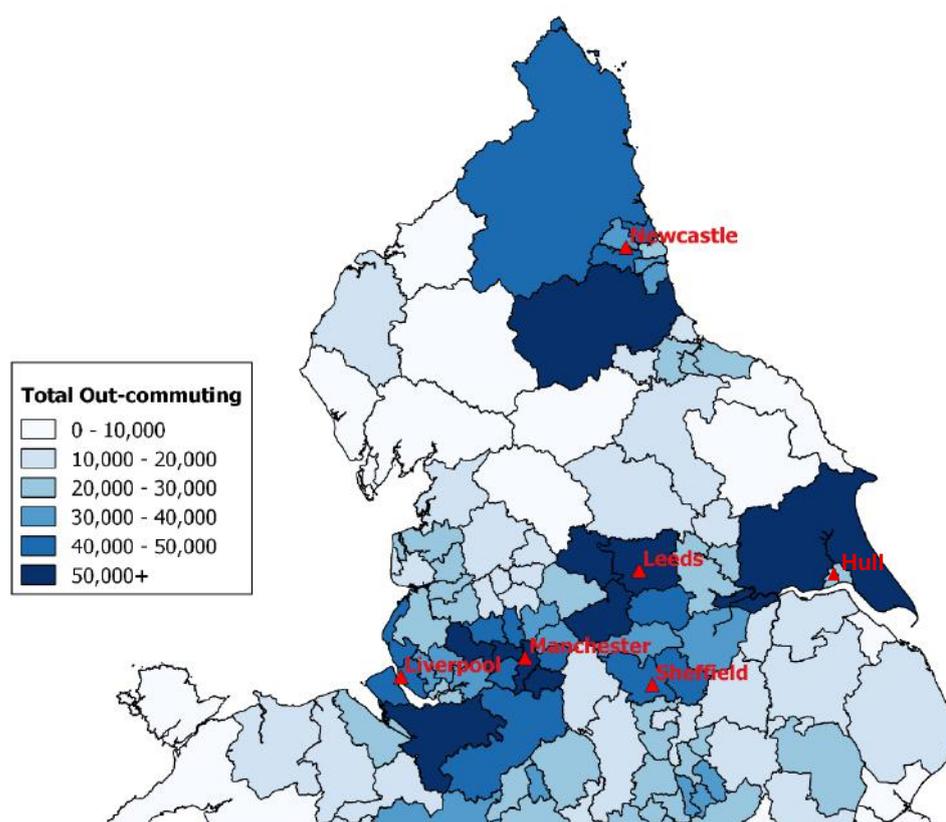
The pattern of out-commuting is revealing, with the highest levels of out-commuting seen in the LADs surrounding high-employment-density urban centres, for example around Newcastle and Hull.

Several of the LADs in the Liverpool-Leeds corridor, for example East and West Cheshire, see high levels of both in-commuting and out-commuting, suggesting an active and integrated labour market is already in operation along this corridor.

The LADs of Cumbria and North Yorkshire are also distinctive, in that their low overall population and employment numbers mean that they have low levels of both in-commuting and out-commuting in absolute terms.

2016 commuting data

Figure 5.6: Out-commuting by LAD, 2011



Source: Cambridge Econometrics, based on Census 2011 data.

The majority of labour markets in the North are local in nature, with 60% of workers living and working in the same LAD, compared to a UK average of 54% according to Census 2011 data. This goes up to ~80% for rural areas, and down to <50% for urban areas.

In order to construct cartographical representations of the multitude of labour market areas within the North, we specifically identified LADs that had significant labour inflows, and passed a size and density threshold of 100,000 total employment and 500 workers/square km. There were 15 LADs out of 77

that passed this threshold. The 15 LADs were grouped into 8 clusters based on the extent to which they functioned as a single unit. We defined this to be any group of spatially contiguous LADs, for which their bi-directional commuting relationships with each other were stronger than with the rest of the surrounding region. For example, within Greater Manchester, we found that Manchester, Stockport, Salford and Trafford effectively functioned as a single labour market area, with high levels of commuting between all four LADs in both directions, whereas other LADs within Greater Manchester had either more of a one-directional relationship with these central four LADs, or functioned as a slightly separate labour market of their own, for example the cluster of businesses within Wigan and Bolton.

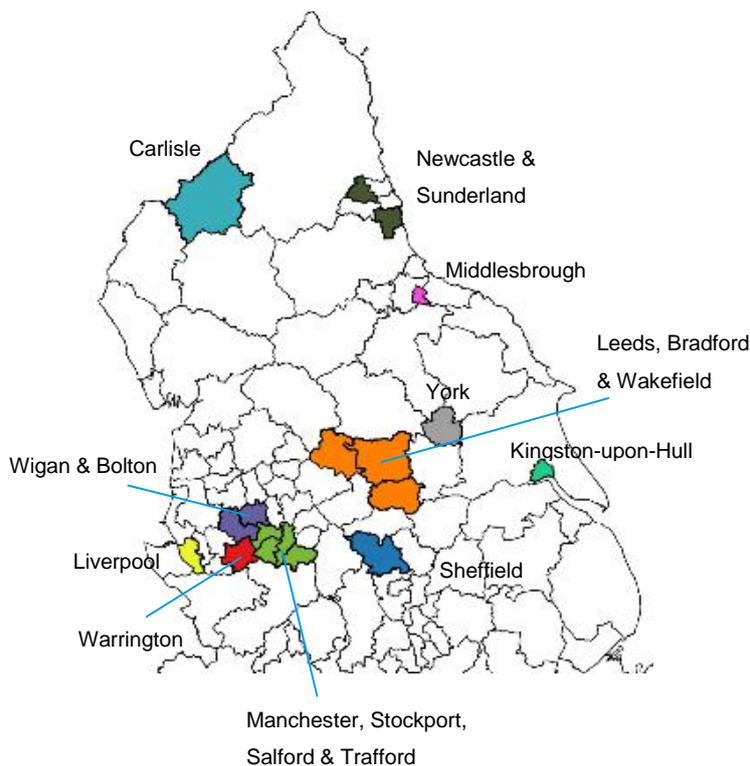
- Manchester, Stockport, Salford and Trafford
- Leeds, Bradford and Wakefield
- Liverpool
- Sheffield
- Newcastle and Sunderland
- Kingston-upon-Hull
- Wigan and Bolton
- Warrington

For the purposes of geographical comprehensiveness, we have also included three other labour markets in our analysis that fell below this threshold, these were:

- Carlisle
- Middlesbrough
- York

The extent of the hinterlands of these 11 key labour markets as of 2016 are shown in Appendix A.

Figure 5.7: Key labour market areas in the North



Source: Cambridge Econometrics.

5.3 Alternative scenarios for the origin and destination of workers

Having understood potential changes in the scale and type of labour market areas in the North, we consider how these outcomes may vary depending on the ‘compact’ versus ‘dispersed’ scenarios presented in *Future Transport Demand in the North*⁴⁵. We then consider the implications of the jobs growth for commuting flows taking account of the existing pattern of commuting and how this may vary depending on the ‘travel friendly’ versus ‘digital’ scenarios in the same publication.

Modelling methodology

The main data sources used in the modelling and analysis are summarised in Table 5.1.

Table 5.1: Data sources for stage 2 modelling

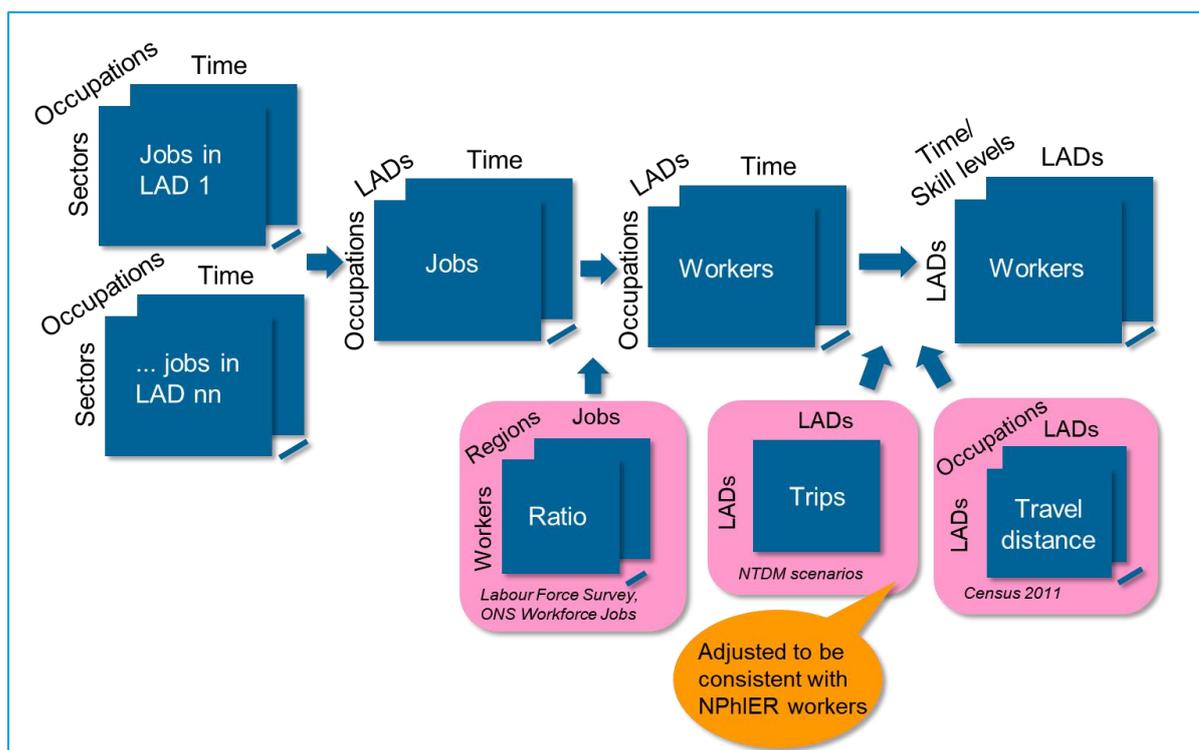
Variable	Source	Breakdown
Jobs in the North	Stage 1 modelling	By scenario, local authority and occupation
Workforce jobs	ONS Workforce Jobs	By region

⁴⁵ See <https://transportforthenorth.com/wp-content/uploads/TfN-Future-Transport-Demand-Statement.pdf>.

Employed people	Labour Force Survey	By region
Origin-destination matrices	Census 2011	By local authority

Figure 5.8 illustrates the next stages of modelling commuting patterns between local authorities in the North.

Figure 5.8: Methodology to model commuting flows between local authorities



Source: Cambridge Econometrics.

Converting from jobs to workers

Employment in the local authorities derived from the previous modelling stage, in terms of *jobs*, were converted to *workers* to be consistent with travel data, because for example, one person may work multiple jobs but only require one seat on a commuter train. For each local authority, this was done using the double jobbing ratio in the corresponding region (North East, North West, Yorkshire & the Humber or East Midlands). The ratio was calculated as the number of jobs per worker (both workplace-based) for the latest year of published data and extrapolated to 2050, taking into account historical trends. At the same time, output from *Future Transport Demand in the North* which reallocated some workers geographically to workplaces either in city-centre LADs ('compact') or to edge-of-city LADs was used. The results presented here simply reflect the underlying assumptions and methods undertaken.

Projecting commuting propensity

The next step is to estimate from where and in what proportions people may commute into a labour market area to work, particularly those working in high-level occupations. The origin-destination matrix from Census 2011 provides a

baseline indication of commuting patterns between local authorities. The published tables do not include a breakdown of this origin-destination matrix by occupation (which was available in the 2001 Census), although there is separate information about residence and workplace employment by occupation. These matrices, adjusted to reflect assumptions based on *Future Transport Demand in the North* for the impact of digital working or of 'travel friendly' transport improvements, were then applied to the workers-by-workplace projections to generate projections of commuting flows between local authorities.

Projecting the spatial distribution of employment sites

The spatial distribution of employment sites was projected as two distinct scenarios that replicate the "Compact" and "Dispersed" Scenarios from *Future Transport Demand in the North* in which a significant proportion of new employment space is located either in the major city centres, or in city-fringe sites. For the purposes of this study, it was assumed that the Compact scenario would see higher levels of employment growth in the LADs of Liverpool, Manchester, Sheffield, Leeds, Hull, and Newcastle. In the dispersed scenario, this growth was instead transferred to surrounding LADs. The employment growth rates of relatively isolated, rural areas were assumed to remain constant.

Projecting the spatial distribution of resident population by occupation

A greater challenge was creating robust projections for the future resident population by LAD, disaggregated by occupation. The 2011 census provides a detailed breakdown of the occupational distribution of resident population at the LAD level (and below). In order to project the occupational distribution of each LAD to 2050, it was assumed that the occupational distribution would change at the same rate as the occupational distribution of employment within that LAD, based on data from Census 2011.

A set of five scenarios emerged from different combinations of the assumptions described above:

- BAU
- Compact & digital
- Compact & travel friendly
- Dispersed & digital
- Dispersed & travel friendly

The BAU scenario assumes a continuation of recent historical trends and was based on projections of jobs for the BAU scenario. The rest of the scenarios were based on projections for the Transformational scenario. 'Compact' scenarios assume brownfield development takes place in the cores of urban areas, in contrast with a mix of greenfield and brownfield development in the suburbs and urban fringes assumed in the 'dispersed' scenario. In addition, the 'digital' scenarios include assumptions for an increasing preference for digital connectivity and high travel costs, versus improved physical connectivity and low travel costs assumed under the 'travel friendly' scenarios⁴⁶.

⁴⁶ Transport for the North (2017), *Future Transport Demand in the North of England*: <https://transportforthenorth.com/wp-content/uploads/TfN-Future-Transport-Demand-Statement.pdf>

Commuting matrices for the four *Future Transport Demand* scenarios, originally developed by SDG for car and rail commuting, were extracted for relevant LADs and scaled to the projected number of workers in the North. In doing this, it was assumed that each commuting trip corresponded to one worker. Census 2011 data on commuting distances by occupation for each LAD and data on distances between LADs were then used to disaggregate total flows by skill level. This was done through an iterative scaling process which ensures that the number of workers in each LAD is consistent with what the job projections imply at all skill levels.

Findings Table 5.2 shows commuting patterns in the North for workers of different skill levels under each scenario.

In 2015, 61% of workers in the North were resident workers who live and work in the same LAD, another 36% were workers who live in the North but work outside of their local authority, and only 3% were those living outside of the North. There was a marginally greater tendency for people to be resident workers at lower skill levels. This is not expected to change by 2050 in the BAU scenario.

Commuting is boosted by a larger number of high-skilled workers...

In the four Transformational scenarios generated by SDG, by 2050, smaller proportions of workers are expected to work in the same local authority area where they live and commute from outside of the North. Instead, the results suggested an increased propensity for people who live in the North to commute to work outside of the local authority of their residence. This is driven by the strong growth projected for high-skilled workers in the Transformational scenario and the assumption that high-skilled/high-paid workers are much more likely to commute and travel longer distances than lower-paid workers.

...and when work is concentrated in city centres with good transport infrastructure

In addition, the scenarios suggest that compact city centres and travel-friendly transport infrastructure could cause a greater shift towards commuting between northern LADs, than job dispersion and digital working. Therefore, commuting patterns in the Compact & travel friendly scenario appear the most different from those in the BAU scenario.

Varying the assumptions between ‘digital’ and ‘travel friendly’ leads to a significant shift in shares. In contrast, varying the assumptions between ‘compact’ and ‘dispersed’ makes little difference: although ‘compact’ favours rail commuting (which usually means crossing LAD boundaries) and ‘dispersed’ favours car commuting (which also includes within-LAD commuting), this effect is outweighed by the fact that the number of car commuting trips is far larger.

Table 5.2: Commuting patterns in the North in 2015 and in 2050 under five scenarios

	2015	BAU scenario	Compact & digital scenario	Compact & travel friendly scenario	Dispersed & digital scenario	Dispersed & travel friendly scenario
	% of all workers in the North at each skill level					
Low-skilled workers						
Living and working in the same LAD	61.7	61.3	55.5	41.6	56.1	42.2
Commuting from within the North	35.6	35.9	43.6	57.2	43.0	56.6

Commuting from outside the North	2.8	2.8	0.9	1.2	0.9	1.2
Medium-skilled workers						
Living and working in the same LAD	61.2	61.2	56.0	42.5	56.6	43.2
Commuting from within the North	35.7	35.8	43.2	56.5	42.7	55.8
Commuting from outside the North	3.0	2.9	0.8	1.0	0.8	1.0
High-skilled workers						
Living and working in the same LAD	60.7	60.7	40.1	27.3	40.5	27.8
Commuting from within the North	36.2	36.3	58.5	71.0	58.0	70.6
Commuting from outside the North	3.1	3.1	1.4	1.7	1.4	1.7

Note: Residence and workplace areas are defined in terms of LADs.
Source: Cambridge Econometrics.

Figure 5.9 shows the same commuting patterns in terms of *flows* of workers. It shows that the numbers of workers commuting within the North on journeys that are long enough to cross LAD boundaries is higher in all the Transformational scenarios than in BAU, especially among high-skilled workers and in the travel friendly variants.

Figure 5.9: Commuting flows in the North in 2015 and in 2050 under five scenarios



Notes: The vertical axes represent the number of workers in the North in a given year. Each cluster of three bars shows the numbers commuting (1) within the same LAD, (2) between LADs in the North, and (3) from outside of the North, for a particular skill group and scenario. Residence and workplace areas are defined in terms of LADs.

Source: Cambridge Econometrics.

A summary of commuting patterns in selected areas in 2050 is presented below.

Under Business as Usual, more workers tend to live locally

In the BAU scenario, the commuting results only reflect changes in the location of jobs and occupations and not other factors that may affect travel patterns such as technological change. Therefore, the majority of the workforce in 2050 is expected to be made up of resident workers in most areas, with the exceptions of Warrington and Middlesbrough where around half of the workforce are likely to be in-commuters. Carlisle, Sheffield, Wigan & Bolton and Leeds, Bradford & Wakefield are likely to be the most self-sufficient with around 70-80% of the workforce coming from within the respective areas across all skill levels.

In general, higher-skilled workers are more likely to commute into work, demonstrated by the smaller difference between the shares of those from within the area and those coming from the rest of the North at higher skill levels. In addition, the percentage of workers who commute from outside of the North, though relatively small, is positively associated with the skill level, implying that workers with higher skills are likely to not only commute but also travel longer distances.

In the two Compact scenarios, jobs are more concentrated in urban areas, which means fewer job opportunities are available close to home for people living outside of city centres, making them more likely to commute. As a result, the percentage of resident workers in total employment at each skill level is also expected to be lower than in the BAU scenario. This reduction is accompanied by an offsetting increase in the share of people commuting from within the North and a small reduction in the share of people commuting from outside of the North. Further assumptions were made for digital working or shorter, more comfortable commutes. The former counteracts while the latter reinforces the impact of compact city centres on propensity to commute.

Under the Compact & digital scenario, in most areas, fewer people are expected to work where they live or commute to work from outside of the North, but more are expected to commute from within the North. This shift is particularly strong for high-skilled workers but not too dissimilar between low and medium-skilled workers. Manchester Combined, Leeds, Bradford & Wakefield and Carlisle are some exceptions where the 'digital' impact outweighs the 'compact' impact, resulting in an increase in the share of resident workers out of total employment at the low and medium skill levels. In these cases, fewer people would commute and if they do, they would travel shorter distances.

...especially in the 'travel friendly' variant...

In the Compact & travel friendly scenario, there is a clear shift to cross-LAD commuting in all areas at all skill levels, because people living outside of cities live further from the location of most jobs but have to spend less time travelling. Again, differences from the BAU scenario are the greatest for high-skilled workers and in areas with tighter boundaries. The assumption for 'digital' versus 'travel friendly' does not have a significant impact on the shares of commuters from outside of the North as the differences between the two scenarios are mostly marginal given the relatively small number of such commuters.

...whereas in the 'Dispersed' scenarios commuting is generally less important

Contrasting with the Compact scenarios, the Dispersed scenarios assume jobs are more spread out around city boundaries, meaning people living in sub-urban and rural areas can access jobs with shorter trips or without commuting at all. This assumption is expected to result in a subtle redistribution of shares from Northern commuters to resident workers, with almost no effect on commuters from outside of the North. This impact is only noticeable in Wigan & Bolton, Liverpool and Sheffield and there is little variation between skill levels.

Manchester and bordering local authorities stands out as the only area presented where the trend is towards more rather than less commuting in the Dispersed scenarios compared to the Compact scenarios. As economic activity spreads to neighbouring districts, there may be a sufficiently large incentive for those who previously considered the distance too far to commute to this area. Another reason may be that the belt around Greater Manchester is already densely populated, so some may decide to move further out to benefit from better local services despite a longer commute. In this case, there would be not only a change in propensity to travel but also a change in demographics.

Table 5.3 shows the commuting patterns by skill level in each of the 11 labour markets under the scenario that produces the largest increase in commuting compared with BAU: the Compact and Travel Friendly Scenario. Maps showing changes to the hinterlands to these areas under this scenario are provided in Appendix B and maps showing changes by skill level under all scenarios are provided in Appendix C.

Table 5.3: Commuting flows to selected areas in the North under the Compact & travel friendly scenario, 2050

	Low-skilled workers			Medium-skilled workers			High-skilled workers		
	Resident workers	Rest of the North	Outside of the North	Resident workers	Rest of the North	Outside of the North	Resident workers	Rest of the North	Outside of the North
	% of low-skilled workers in the area			% of medium-skilled workers in the area			% of high-skilled workers in the area		
Liverpool	36	63	1	36	64	1	21	77	1
Sheffield	49	50	0	53	47	0	43	56	1
Warrington	22	77	2	24	75	1	12	86	2
Kingston upon Hull	53	47	0	48	52	0	28	72	0
Manchester Combined	58	40	2	58	40	2	46	51	3
Leeds, Bradford & Wakefield	75	25	0	75	25	0	59	41	0
Newcastle & Sunderland	42	58	0	39	61	0	29	71	0
Wigan & Bolton	38	61	0	36	63	0	20	80	0

Carlisle	79	21	0	79	21	0	63	37	0
York	46	54	0	51	49	0	32	68	0
Middlesbrough	33	67	0	29	71	0	17	83	0

Source: Cambridge Econometrics.

6 Conclusions

The NPIER set out an ambitious vision, implying stronger population growth...

The Northern Powerhouse Independent Economic Review set out a deliberately ambitious vision for transformation of the North’s economic performance. In that vision, GVA, employment and productivity all grow more rapidly than in the past, rebalancing the gap in performance relative to southern England seen in previous decades. Structural changes in the economy continue, and in some cases accelerate, as the North specialises more in its ‘Prime Capabilities’.

There is only limited scope to meet increased demand for workers from BAU population growth, as economic activity rates are already reasonably high, and unemployment rates are already reasonably low. The projected aging population will curb activity rates. The turnaround in employment trends projected as part of the NPIER Transformational scenario would necessarily involve a similar turnaround in population trends. Compared with BAU, NPIER assumed that the North’s working-age population would be 792,000 higher in 2050, while the number of jobs in 2050 would be 855,000 higher. Consistent with this, the total population would be 1,464,000 higher.

...but Brexit may constrain this...

This stronger rate of population growth than in the past implies a higher rate of in-migration. If Brexit means a lower rate of international in-migration into the UK, the availability of a suitably skilled workforce could constrain achievement of the vision, in terms of the number of jobs and the size of the boost to GVA.

...and automation may substitute for scarce labour...

This constraint could be relieved in part by a prospective acceleration in the rate of automation of tasks. This would raise the rate of productivity growth, allowing a higher GVA to be delivered by fewer workers. The overall impact on employment demand would grow, but with a significant shift in the profile of skills required.

...however, this would also result in a shift in labour demand towards higher skill levels

In this report we have attempted to quantify this shift by taking the jobs projections from the NPIER Transformational scenario and developed detailed projections for the implied numbers of workers at different skill levels, and hence derived the scale of impact of the shift towards higher-skill jobs. Both BAU and the Transformational scenario have a strong shift in the proportion of workers who are in high-skilled jobs, with a decline in the number of low-skilled workers, but the shift is larger in the Transformational scenario. This is shown in Table 6.1.

Table 6.1: Projected changes in each of the 9 major occupational groups under the two IER scenarios

Occupational Group	Jobs in 2015 (000s)	Additional Jobs in 2050 BAU scenario (000s)	Additional Jobs in 2050 Transformational scenario (000s)
Managers, directors and senior officials	673	258	363
Professional occupations	1,377	567	762

Associate professional and technical occupations	925	327	464
Administrative and secretarial occupations	896	-277	-207
Skilled trades occupations	855	-284	-367
Caring, leisure and other service occupations	798	402	519
Sales and customer service occupations	665	2	128
Process, plant and machine operatives	580	-229	-157
Elementary occupations	861	-60	56
Total	7,630	706	1,561

...which would require careful policy provision

Policies would need to be put in place to ensure that this vision is realised in a socially beneficial and inclusive manner, particularly related to the widening of access to lifelong skills provision and re-training. Targeted high-skilled inward migration would help to meet the growing demand for high-skilled workers, however this would not address the more fundamental problem of helping existing residents with low or medium skill levels experiencing increasing challenges in finding work.

Commuting is also affected by skill shifts and the location of work

At the same time, we have interpreted the impact of these effects on the scale of commuting flows into and within the Northern Powerhouse region, which are affected by:

- the shift towards higher-skill jobs, because medium- and high-skilled workers tend to commute further
- the spatial pattern of clustering of jobs (concentrated in city centres or distributed around cities)
- the extent to which work is performed in physically proximate workplaces or remotely through digital communications

Consequently, the number of commuting journeys that take place over a longer distance (crossing LAD boundaries) increases by more in that scenario than the number of workers.

We have combined this with assumptions for the spatial clustering of workplaces, drawing on the 'compact' versus 'dispersed' scenarios presented in *Future Transport Demand in the North*, and assumptions for the way in which work is performed, drawing on the 'travel friendly' versus 'digital' scenarios in the same report.

Table 6.2 shows commuting patterns in the North for workers of different skill levels under each scenario.

In 2015, 62% of workers in the North were resident workers who live and work in the same LAD, another 36% were workers who live in the North but work outside of their local authority, and only 3% were those living outside of the North. There was a marginally greater tendency for people to be resident workers at lower skill levels. This is not expected to change by 2050 in the BAU scenario.

Commuting is boosted by a larger number of high-skilled workers...

In the four Transformational scenarios, by 2050, smaller proportions of workers are expected to work in the same local authority area where they live and commute from outside of the North. Instead, the results suggested an increased propensity for people who live in the North to commute to work outside of the local authority of their residence. This is driven by the strong growth projected for high-skilled workers in the Transformational scenario and the assumption that high-skilled workers would be much more likely to commute and travel longer distances than workers with less skill.

...and when work is concentrated in city centres with good transport infrastructure

In addition, in the case with compact city centres and travel friendly transport infrastructure would cause a greater shift towards short-distance commuting than job dispersion and digital working. Therefore, commuting patterns in the Compact & travel friendly scenario appear the most different from those in the BAU scenario.

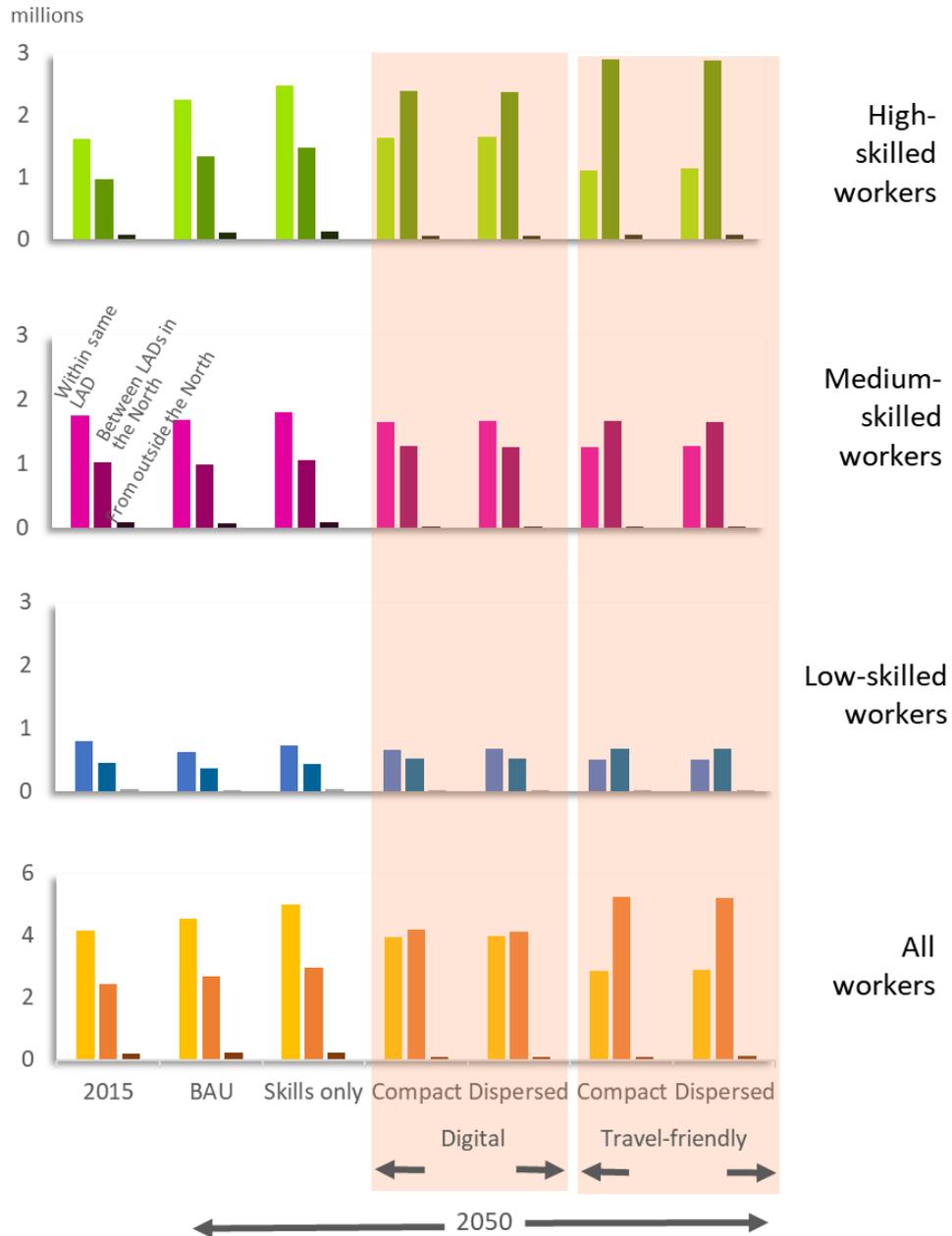
Table 6.2: Commuting patterns in the North in 2015 and in 2050 under five scenarios

	2015	BAU scenario	Compact & digital scenario	Compact & travel friendly scenario	Dispersed & digital scenario	Dispersed & travel friendly scenario
	% of all workers in the North at each skill level					
Low-skilled workers						
Living and working in the same LAD	61.7	61.3	55.5	41.6	56.1	42.2
Commuting from within the North	35.6	35.9	43.6	57.2	43.0	56.6
Commuting from outside the North	2.8	2.8	0.9	1.2	0.9	1.2
Medium-skilled workers						
Living and working in the same LAD	61.2	61.2	56.0	42.5	56.6	43.2
Commuting from within the North	35.7	35.8	43.2	56.5	42.7	55.8
Commuting from outside the North	3.0	2.9	0.8	1.0	0.8	1.0
High-skilled workers						
Living and working in the same LAD	60.7	60.7	40.1	27.3	40.5	27.8
Commuting from within the North	36.2	36.3	58.5	71.0	58.0	70.6
Commuting from outside the North	3.1	3.1	1.4	1.7	1.4	1.7

Note: Residence and workplace areas are defined in terms of LADs.
Source: Cambridge Econometrics.

Figure 6.1 shows the same commuting patterns in terms of *flows* of workers. It shows that the numbers of workers commuting within the North on journeys that are long enough to cross LAD boundaries is higher in all the Transformational scenarios than in BAU, especially among high-skilled workers and in the travel friendly variants.

Figure 6.1: Commuting flows in the North in 2015 and in 2050 under five scenarios



Notes: The vertical axes represent the number of workers in the North in a given year. Each cluster of three bars shows the numbers commuting (1) within the same LAD, (2) between LADs in the North, and (3) from outside the North, for a particular skill group and scenario.

Residence and workplace areas are defined in terms of LADs.

Source: Cambridge Econometrics.

More commuting across LAD boundaries in the North

Even in the digital scenarios, the number of workers commuting across LAD boundaries in the North is some 70% higher than in 2015, while the number of workers is only some 20% higher; in the travel friendly scenarios it is more than double the number in 2015.

The analysis therefore shows that;

Occupational shifts will lead to longer commuting journeys...

- the impact of occupational shifts is expected to increase the propensity for more workers to commute over longer distances
- the impact on the overall scale of commuting of alternative types of shift in the location of work ('compact' versus 'dispersed') is not large (although it affects the relative attractiveness of public versus private transport)

but the potential impact of technological changes is ambiguous

- the impact of alternative technological trends on the scope for remote working and on the cost and ease of travel is large, but it is very uncertain which trend will predominate