Industrial Strategy and Key Cities: An evidence review focusing on selected industrial sectors

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Preface and Acknowledgements

The 2017 Industrial Strategy Green Paper highlighted the importance of sector specific and local analysis in devising a strategy for inclusive growth. Accordingly, this report looks at 6 industrial sectors that are important to UK growth and closely connected to a range of local authorities that are part of the 'Key Cities Group' (comprising 26 of the UK's cities). The aim is to analyse the net socioeconomic benefits of the existing and future connections within and across the specified industrial sectors and relevant Key City local authorities, contributing to the evidence base underpinning UK industrial strategy.

The report was authored by researchers at University of Leeds, collaborators in the University of Cambridge, and in the iBUILD (EPSRC-ESRC) research centre. The report was commissioned by Key Cities. We gratefully acknowledge funding and support from Key Cities, funding from an ESRC IAA Brexit/ISCF award, and, in the case of the University of Cambridge authors, funding by the ESRC (ES/N006135/1) project into Structural Transformation Adaptability and City Economic Evolutions, as part of its Structural Transformations Programme.

Executive Summary

Key cities have commissioned the University of Leeds to produce an evidence review of the impact and relevance of identified sectors for the UK Key cities. This preliminary report presents the research by the University of Leeds as well as drawing on the work of Cambridge University, the Manchester Chamber of Commerce and the iBuild local infrastructure project. Research took the form of interviews with representatives of Key Cities, data analysis, and review of existing literature (academic and policy). Further research will build on this base.

In the interview section below we argue that:

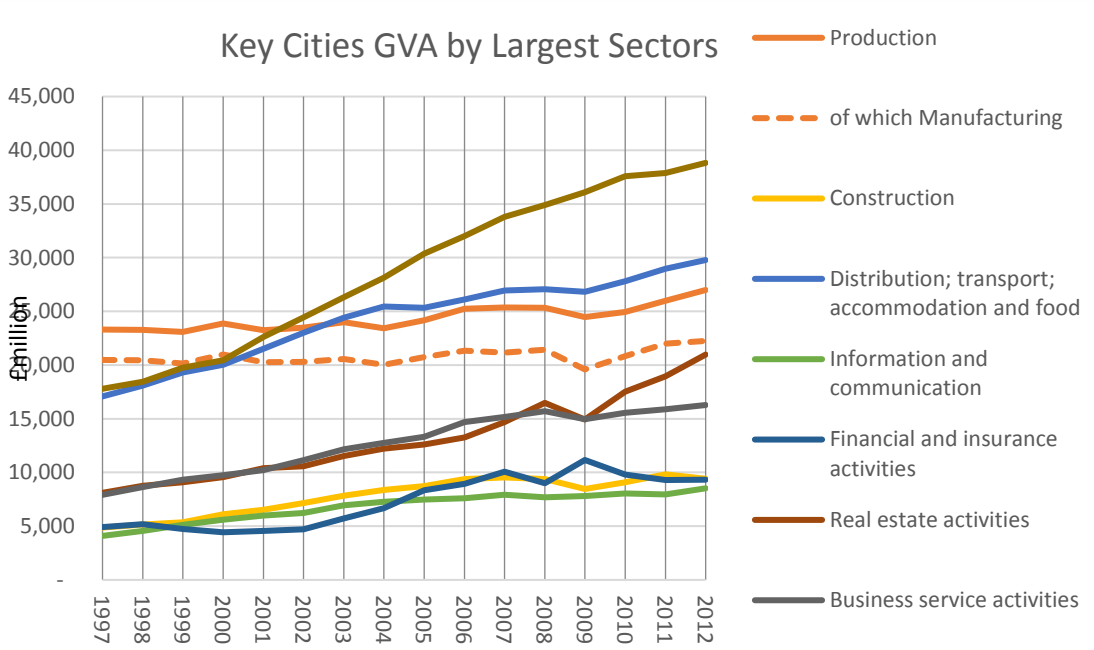
- Key cities often have targeted and sophisticated support strategies for the development of business and key sectors.
- Key cities often have excellent, 'on the ground' knowledge of their geography and identified key sector.
- Key cities often make excellent use of their local resources, particularly the University sector, to develop partnership and support for their key sector.
- Key cities often have a wider view of the sector than simply their own geography noting the supply chains (national and international) and interrelating sectors and regions.
- Key cities often utilise a wide and targeted range of funding sources, both public and private finance.
- Key cities support their identified sectors without losing sight of the wider social and environmental issues.
- The University and Key City relationship was very strong in the participating key city regions and acted as an engine for regional growth.

Historically many Key Cities have suffered from low cost competition in global value chains combined with an over-dependence on a single sector. Key Cities are aware that developing clusters of interrelated sectors can act as a defence against such threats, reducing the threat of competition on cost alone by embedding production in a higher quality and sophisticated mix of sectors and reducing Key Cities' dependence on single sector. Collaboration between cities (e.g. between Key Cities and between Key Cities and Core cities) can strengthen such clusters by allowing greater scale.

Our preliminary analysis in the "Sector overview" section below reveals the potential for such clusters amongst the chosen sectors (Healthcare, Education, Energy, Marine & Maritime, Digital, & Advanced Manufacturing):

- Further and Higher education are very often key elements in a cluster offering research capacity and skilled future employees tailored to chosen sectors, as well fertile research terrain to Universities.
- The South Coast Marine Cluster featuring three Key Cities shows the potential for agglomerations of cities to work together but also how clusters must be tailored to the specificities of location.
- Sectors such as Marine & Maritime, Energy and the digital sector are important sectors in their own right and critical inputs into the rest of the economy: it is difficult to think of a sector that is *not* dependent on digital technology, on energy or on imports/exports. The necessary transition to sustainable energy offers Key Cities the potential to develop local generation and supply with benefits to energy security and efficiency.
- The aerospace and automotive industries and the life sciences sector offer the possibility to build on the UK's existing strengths and fit well with clusters involving universities, digital economy, and renewable energy.

In the first section of the report we present an overview of the Key Cities' economy, looking largely at employment and business births and deaths. The chart below shows their combined economies by sector. Health and Education feature strongly and point to the importance of further and higher education as well as the size of the NHS as a customer. Production ('of which manufacturing' is also shown) maintains a strong showing although the data does not currently allow us to see the detailed role of advanced manufacturing, life services, marine and so on. Information and communication similarly shows good growth and an important presence, suggesting an important role for the digital sector.



* Workplace based GVA1,2 NUTS3 by industry at current basic prices. Source: ONS. 'Agriculture, forestry and fishing' and 'Other services and household activities' not

Contents

Methodology

In compiling this report we took the central problem to be how the specified sectors can be of benefit to the Key Cities, individually and as a group, and thereby to the UK as a whole. We considered social, environmental and economic benefits and what Key Cities should think about in developing an environment for growth.

We examined the actual circumstances of the Key Cities in 2017, the six specified sectors and the incidence of those sectors in the Key Cities. To do so we conducted interviews, surveyed academic and policy literature, examined official statistics, and worked with academic experts to interrogate other data sources. In the time available this material allowed us to build up a preliminary analytical picture of the situation – one that could be augmented with further research material e.g. interviews, and further analysis. Moving to the analysis, examination of the literature on social provisioning in general, summarised briefly in this section, provided key concepts concerning the successful implementation of a sector based industrial strategy and these concepts then informed analysis of the Key cities, the sectors and the implementation of the sectors in Key Cities presented in the rest of this report.

The system in place to meet each of the needs of society, for instance housing, food and services, could be considered as a separate system of provision. Analysis of each system of provision should consider the totality of that system, including the materiality of the good being provided as well as the economics of the supply chain, the cultural importance and so on. In reality, such systems of provision are all interwoven in a complex whole which can be thought of as a system of systems. Provisioning for everyday household needs makes up a substantial part of this system of systems (by share of the economy and because all households, rich and poor, have such needs) and has been labelled the foundational economy[1]. This critically important part of the economy includes appropriate housing, heat, food, health & education but also quality jobs, childcare, internet connections and so on.

In the UK in 2017 a given system of provision cannot be classified as either wholly public or private: on the one hand 'the contract state' (Bowman et al, 2013) employing extensive outsourcing means private firms are hugely implicated in sectors sometimes considered state sectors (e.g. health and education); and on the other 'markets are themselves created and organised by the state' and 'even totally private provision cannot exist in a totally disembodied market'2 (e.g. via property & company

[1] Bowman et al, 2013
[2] Bayliss, Fine, Robertson, 2016

law, regulation, planning permission3 etc.). Local authorities scope for action therefore extends across all aspects of society.

Industrial policy that champions certain sectors must therefore consider how they fit with these broader goals and possibilities. Industrial policy must consider more than simply competing on price and must find ways to embed championed industries into the local economy and society. Moreover, as we have seen this imperative complements the role of local authorities to manage boarder social provisioning (ie including economic, social and environmental considerations). Successful implementation of an industrial policy that targets certain sectors cannot be built on zero-sum competition which aims simply at displacing economic activity from A to B and then attempting to keep it there. Instead, it must build synergies with the local area and with the rest of the UK, synergies which reduce the impact of competition from elsewhere.

For these reasons we asked two critical questions when analysing the six specified sectors: i) what are the links with other systems of provision, including the intentional construction of economic clusters, and in particular with social provisioning for households and; ii) what the connections with other geographical areas, e.g. between Key cities and their surrounding area, between Key Cities themselves, and between Key Cities and the rest of the UK.

As indicated above the rest of this report presents the analysis of the Key Cities, the sectors, and the specific incidence of those sectors in key Cities with these considerations in mind. It briefly outlines an indication of the economic impact of investing in the selected sectors for the Key Cities. It presents the results of interviews with representatives of the Key Cities showing that they have a strong understanding of their cities (a major advantage of the smaller, manageable size of Key Cities) and their links to the rest of the UK. It presents brief overviews of the chosen sectors before examining their incidence in the Key Cities, for the last it attempts to address each of the following areas: where is the sector prevalent, it's value to that place, it's potential, how Key Cities are working with the sectors and with clusters of sectors, how they are connecting to other places, and any barriers to growth.

[3] (Bowman et al, 2013)

Overview of the Key Cities

This section provides an analysis and overview of the Key Cities detailing their importance to the national economy. This overview is vital to inform the analyses presented in the report and crucially reflects a key interview finding of the interconnectivity of Key Cities in supporting and developing identified sectors.

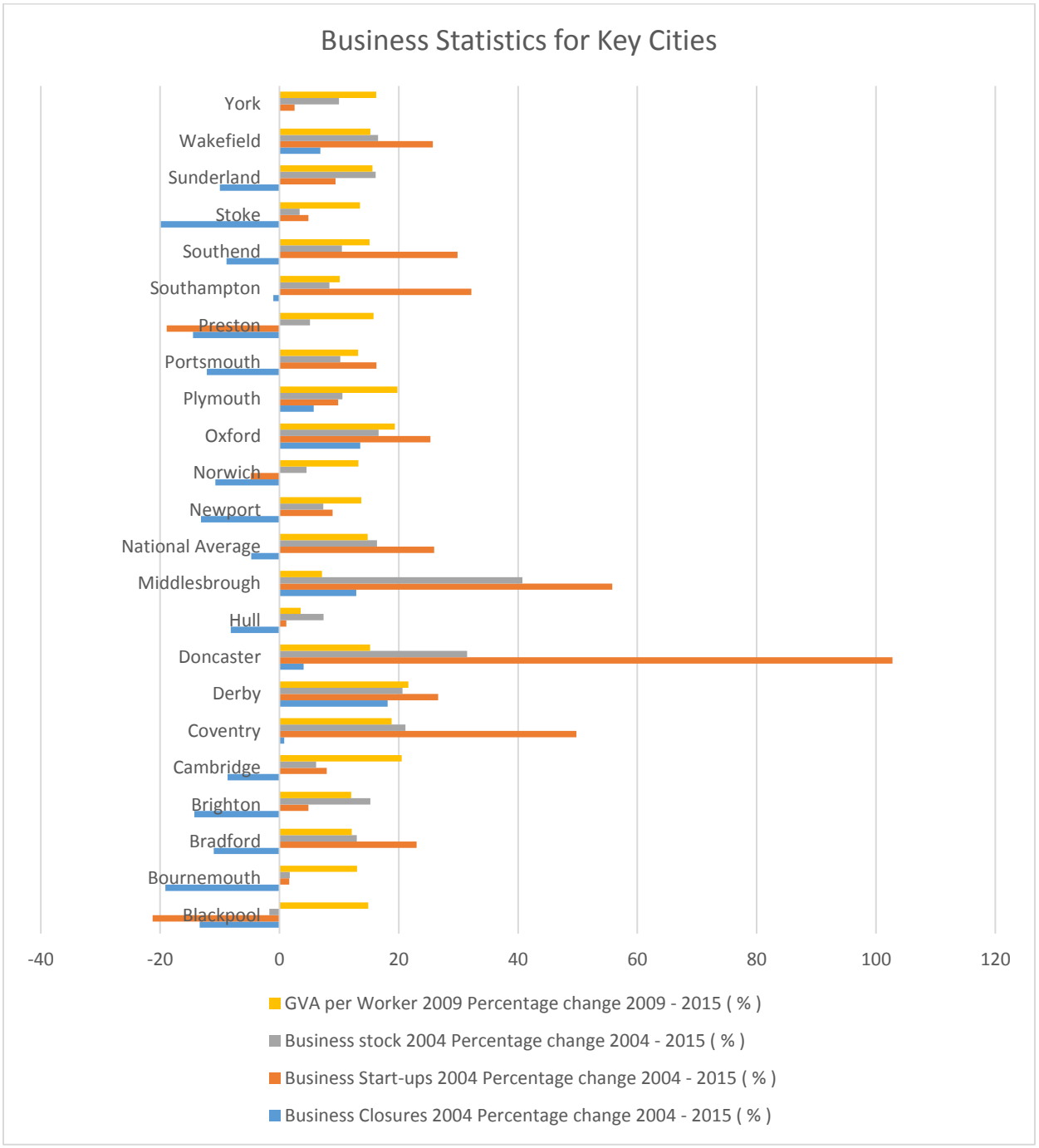
The Key Cities located within England and Wales demonstrate considerable growth and significance to the national picture. The companies located with the Key Cities areas provide around 13% of the total employment in England and Wales for the six key sectors contained within this report. The share of each varies significantly, from 8% of digital industries employment through to 30% of marine industries employment.

Overall, this section highlights the diversity of these sectors across the Key Cities (see further detail presented in the appendix), with highly varied rates of corporate births and employment changes, with some cities generating lots of new companies with relatively little effect on employment, whereas others are generating new employees out of mostly existing corporate stock.

Historic growth rates and relative importance to each economy is also highly varied. There are areas where sectors are expanding rapidly but still make-up only a tiny fraction of the workforce, and conversely many of the largest employing sectors are seeing only slow growth rates. The clear outcome here is that, over time, the important sectors of today will not necessarily be the dominant employers of tomorrow.

Business Growth in the Key Cities

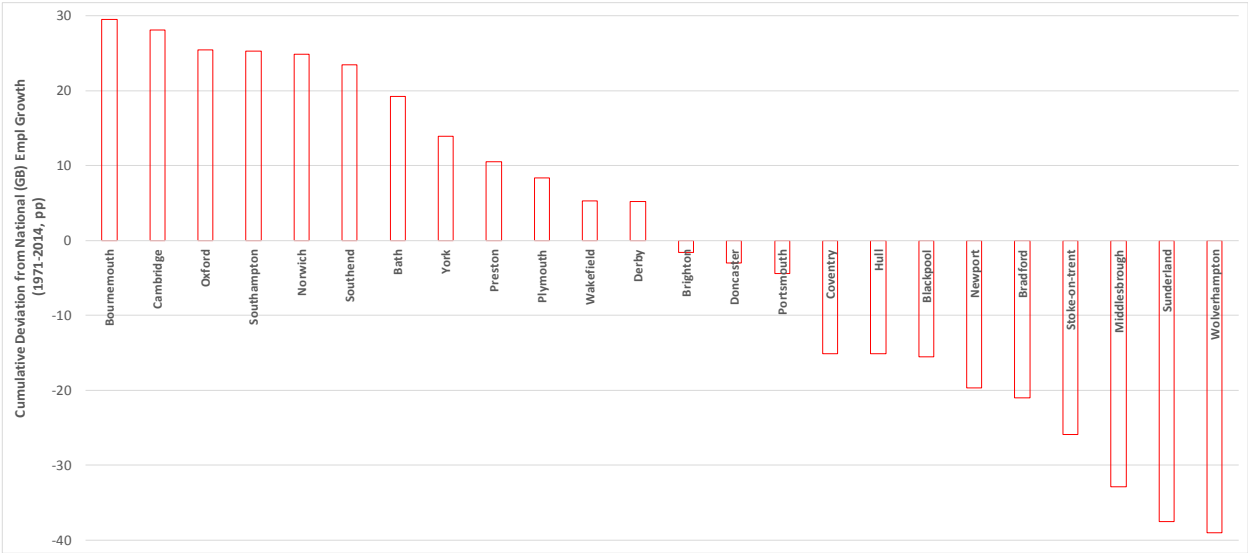
The following chart gives an overview of business creation and GVA in the Key Cities[4] with a comparison to the national average:



[4] Data obtained from Centre for Cities (Bath and Wolverhampton data wasn't available for this analysis). Notably, this report draws from multiple data sources and care should therefore be taken when making comparisons as geographies and methods may differ.

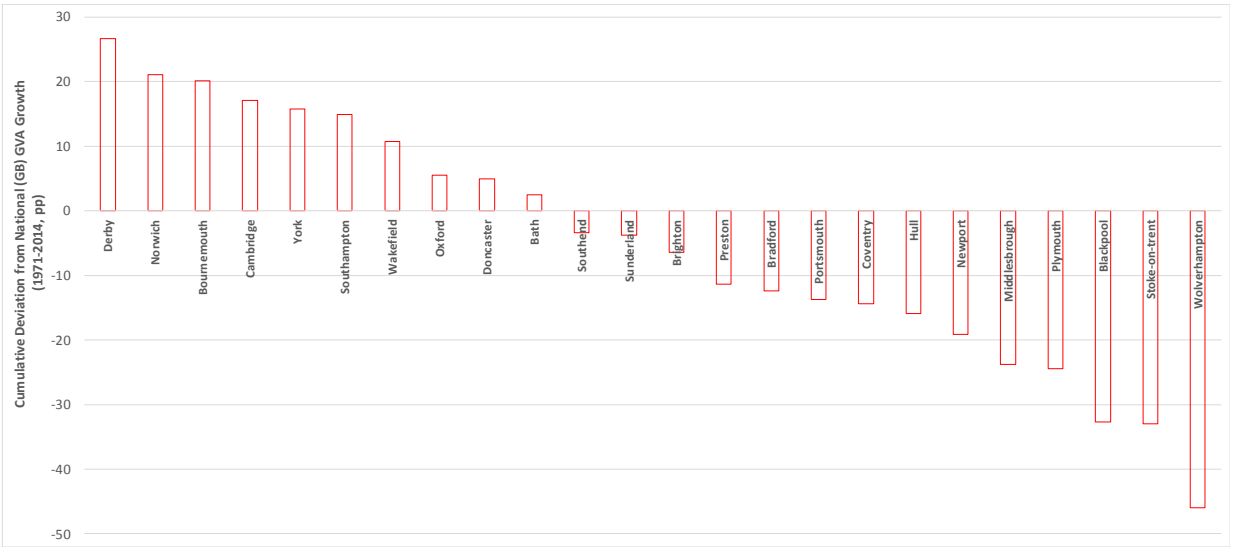
A useful way of depicting and comparing the growth rates of cities is to examine each city's *cumulative differential growth rate* over a specified period[5]. This is derived by, starting in the base year, taking a city's growth rate for that year and subtracting the corresponding national growth rate. This is then done for the subsequent year, and the figure added to that of the previous year, and so on, so that by the end of the period being analysed we obtain the cumulative percentage point difference in growth between the city and the nation. The value of this approach is that it gives a direct estimate of the *cumulative growth gap* among cities. The following charts show the results of this approach for the Key Cities, for both cumulative differential employment growth and cumulative differential output (real GVA) growth. What is immediately clear in both cases is that some substantial growth gaps have opened up across the Key Cities over the 1971-2014 period. For example, for employment there is a growth gap of some 50-60 percentage points between the leading cities of Bournemouth, Cambridge, and Oxford, and the lagging cities of Wolverhampton, Sunderland and Middlesbrough. In the case of output, a somewhat similar gap is evident between the fastest growing cities of Derby, Norwich and Bournemouth, and the slowest growing cities of Wolverhampton, Stoke and Blackpool.

Cumulative Differential Growth of Employment across the Key Cities, 1971-2014



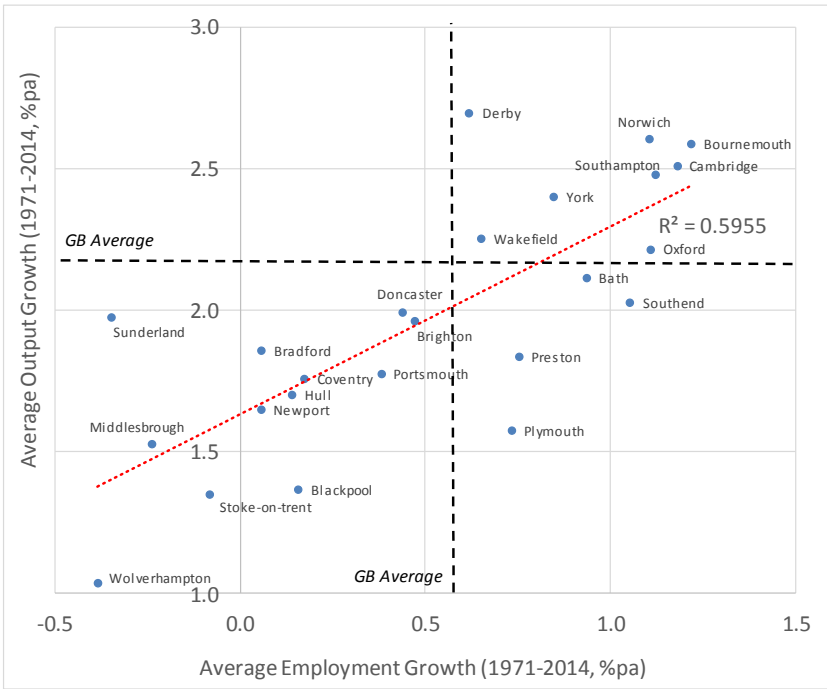
[5] The following brief commentary of initial results uses the time series on employment, gross value and productivity (for 82 sectors) that we have constructed for some 85 British cities for 1971-2014 as part of an ESRC project (see www.cityevolutions.org). From these data we are able to provide analyses for all of the Key Cities, except Salford (which is part of our Manchester area, and therefore can't be identified separately) Kirklees (which in our data set is split between Leeds and Huddersfield), and Tees Valley.

Cumulative Differential Growth of Output (Real GVA) across the Key Cities, 1971-2014



Dividing the whole period into two main subperiods, 1971-1991 and 1991-2014, reveals some interesting trends (See Appendix). This division is shown elsewhere to mark a definite shift and change in the geographies of growth across Britain[6].

The relationship between Employment Growth and Output Growth across the Key Cities, 1971-2014

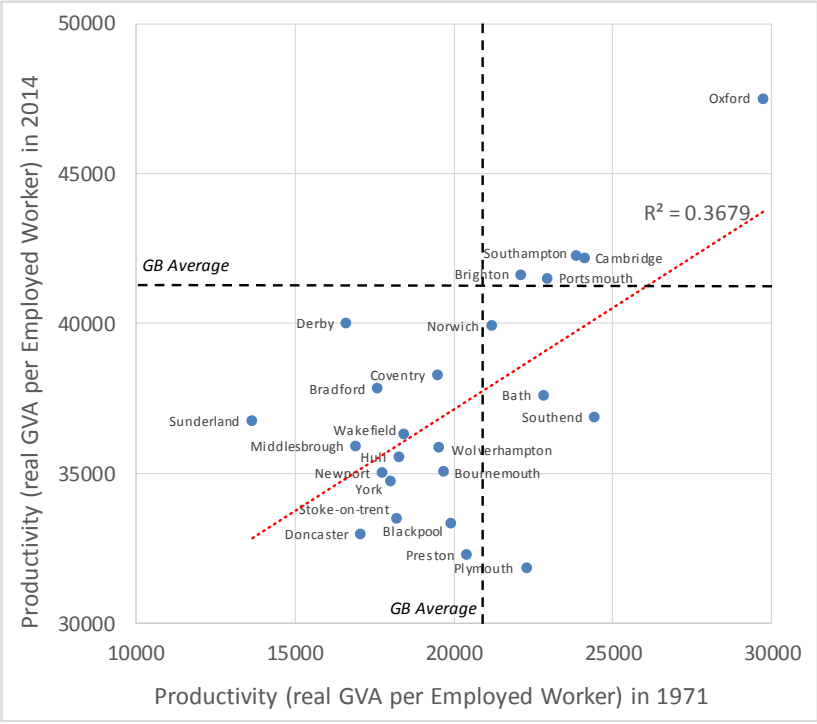


[6] see Martin et al, 2017

Labour Productivity

The following chart plots labour productivity (real GVA per employed worker) for each Key City in 1971 and 2014. While labour productivity has increased in real term in every city, the relatively low correlation indicates that rate of increase has varied significantly across cities. At the same time, all bar seven of the cities had productivity levels below the national average in both years. Most of these have in fact undergone a decline in their relative productivity levels over the period. Only five cities – Brighton, Portsmouth, Southampton, Cambridge and Oxford had productivity levels above the national average at both the beginning and end of the period. Four cities that had levels of labour productivity at or above the national level in 1971 – Plymouth, Southend, Bath and Norwich had, by 2104 seen their productivity fall below the national average.

Productivity cross the Key Cities, 1971 and 2014

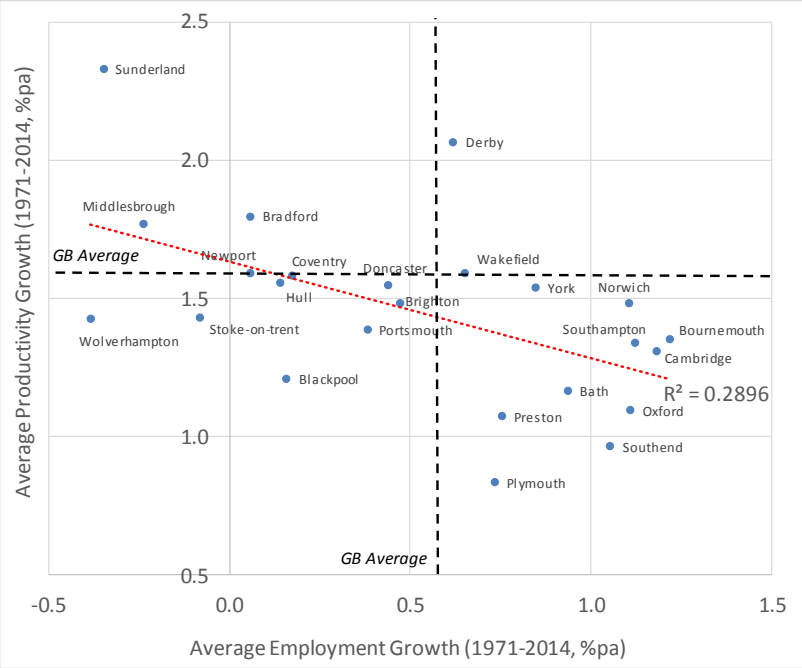


Productivity and Employment

A particularly worrying picture emerges when city productivity growth is compared to city employment growth. The relationship is negative. That is, the cities that have shown the fastest

growth rates of productivity growth have tended to be those in which employment growth has been slowest, and vice versa. Indeed, most of those cities that have recorded above average rate of productivity advance have seen an absolute decline in their employment bases - Sunderland, Middlesbrough, Bradford: only Derby has managed to maintain its employment whilst recording an above average rate of productivity growth. At the other end of the spectrum, none of those cities that have seen employment grow at rates significantly above the national average – Bournemouth, Cambridge, Southampton, Southend, Oxford – has managed to match national productivity growth.

The relationship between Employment Growth and Productivity Growth across the Key Cities, 1971-2014

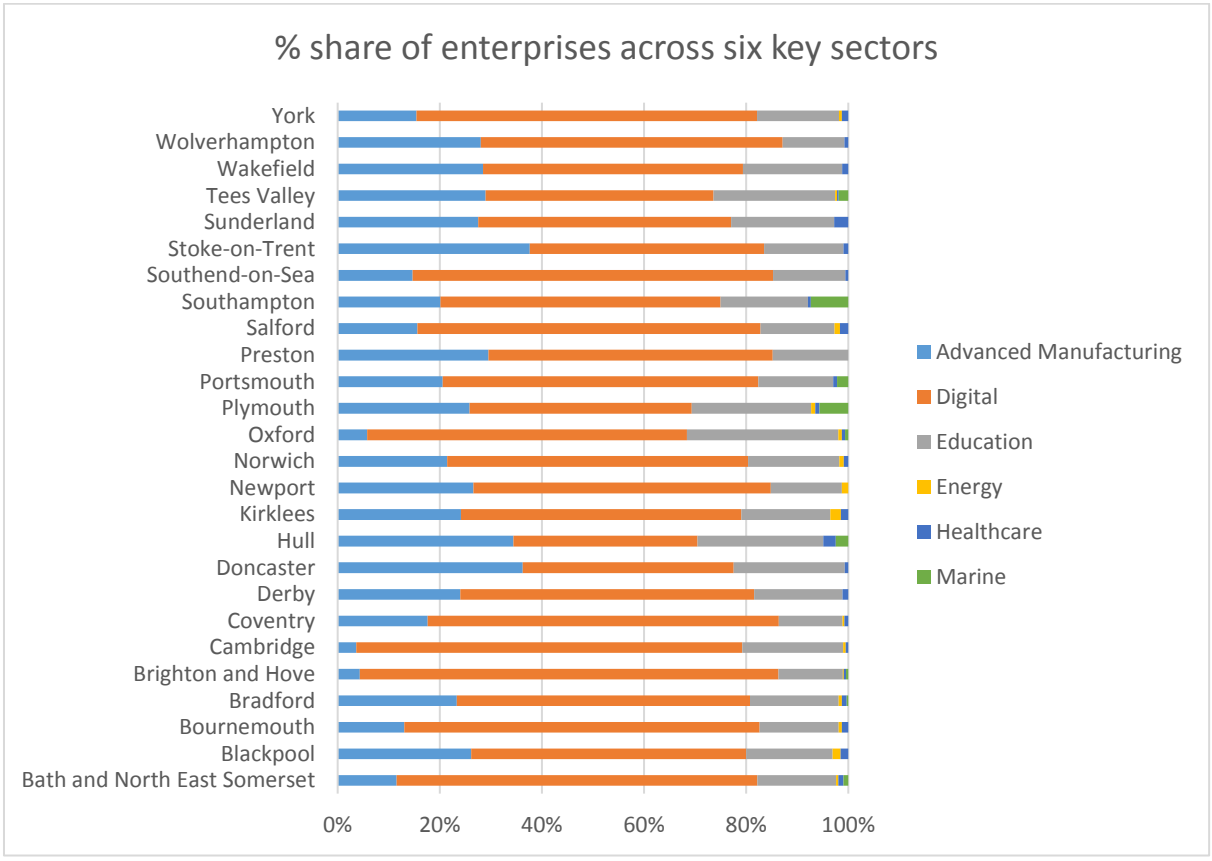


Aggregate Growth Performance of the Key Cities: Specialisation Analyses

The following commentary presents some additional findings relating to city specialisations for the Key Cities using the time series on employment, gross value added and productivity for 82 sectors that we have constructed for some 85 British cities for 1971-2014 as part of our ESRC project (see www.cityevolutions.org). We have calculated specialisation indices for each of the cities, both for employment and for output (gross value added), and some localisation indices for the specific sectors (or as close as we can approximate them from our data) requested.

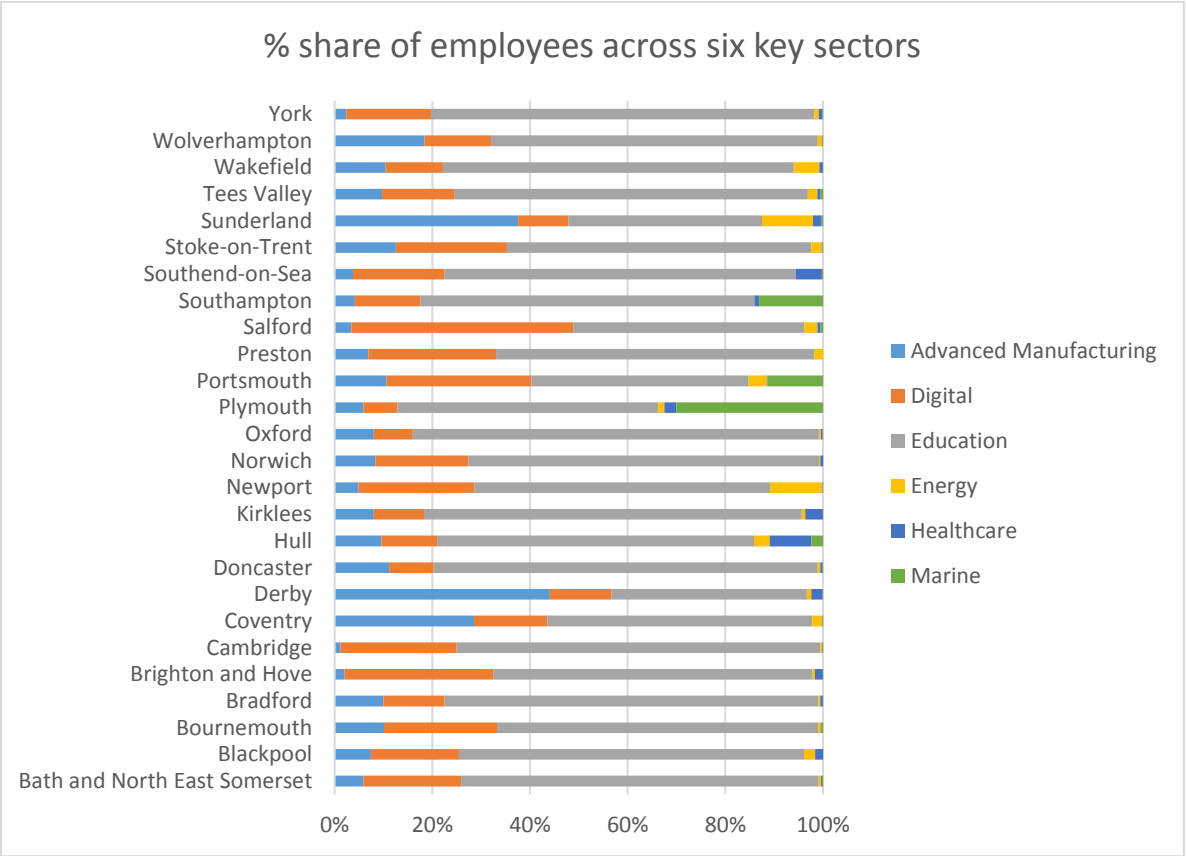
Most significant sector for each Key City

In terms of the number of enterprises, the digital sector is the single largest sector of the six covered in this report in all 26 Key Cities. It's importance amongst the six sectors varies considerably between the Key Cities, with digital making up 36% of the businesses in the six sectors in Hull, rising to 82% in Brighton and Hove. In all the Key Cities, the second largest sector by number of enterprises is either Advanced Manufacturing or Education, with the volume of enterprises in these sectors often, but not always, similar in scale. For example, Advanced Manufacturing forms only 4% of companies in the six key sectors in Cambridge with 20% in Education, whereas Advanced Manufacturing forms 38% of key sector businesses in Stoke-on-Trent with Digital forming just 16%.



For number of employees, the picture is different. Education is the largest employer of people in the Key Cities amongst the six key sectors identified (from 40% in Sunderland to 83% in Oxford), with the exception of Derby, where Advanced Manufacturing employs around 1,500 more than in Education, the largest share within this analysis. Digital employment is most highly focused in Salford, where 45% of employment in the six key sectors is based. Both Sunderland and Newport stand out as areas of high employment in the Energy sector, with 10% of employment in the six sectors. Marine employment is most heavily focused in Plymouth (30% of six sector employment) with Southampton

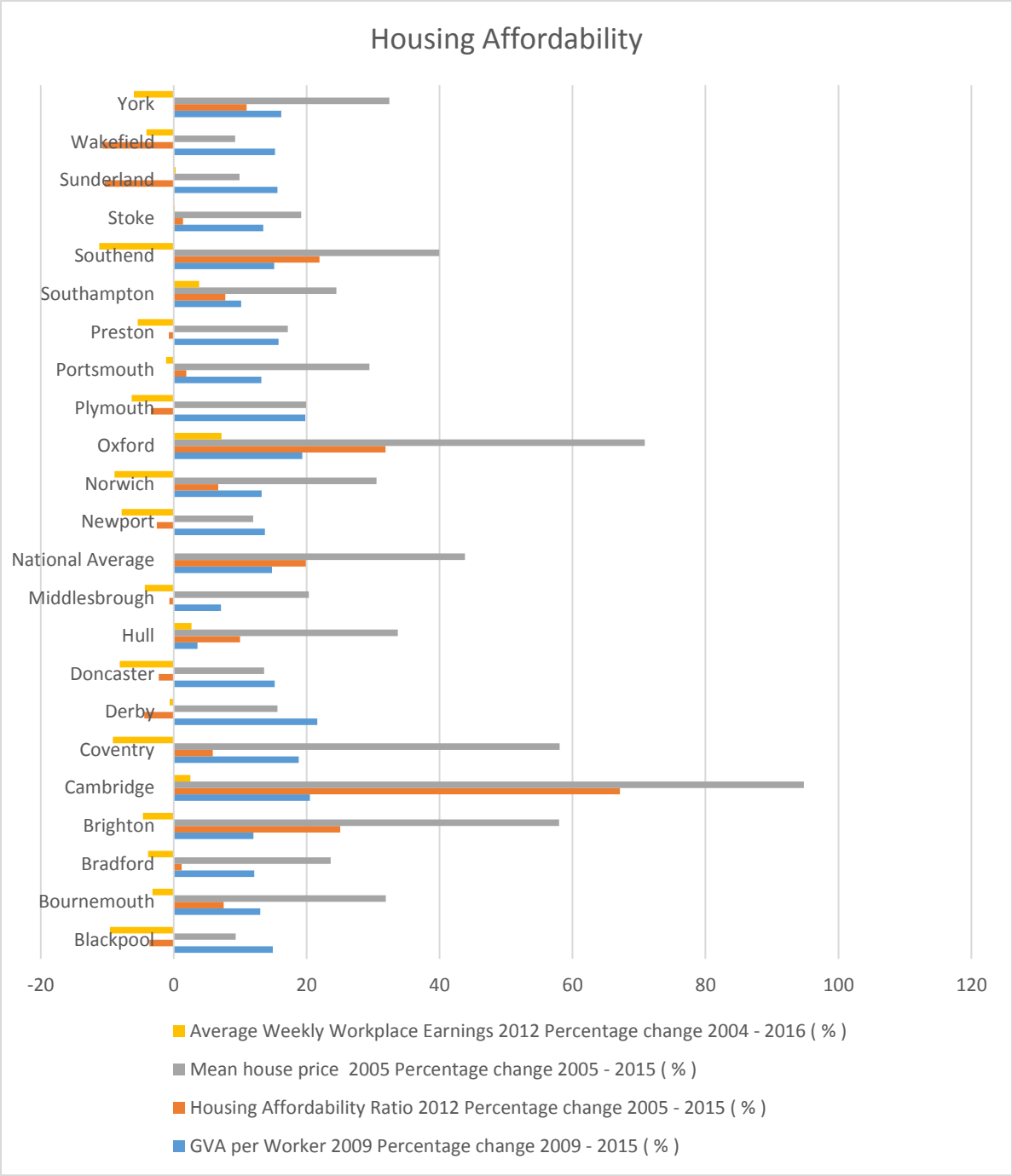
and Portsmouth also seeing larger shares. Healthcare is most heavily focused in Hull, with 9% of employment of the six sectors.



Housing and the needs of the wider economy

A key finding from the interviews was the awareness of wider social and environmental concerns by decision makers. A particular example of affordable housing needs for workers to support the wider economy was very impactful and signifies the understanding of the wider economy by Key Cities.

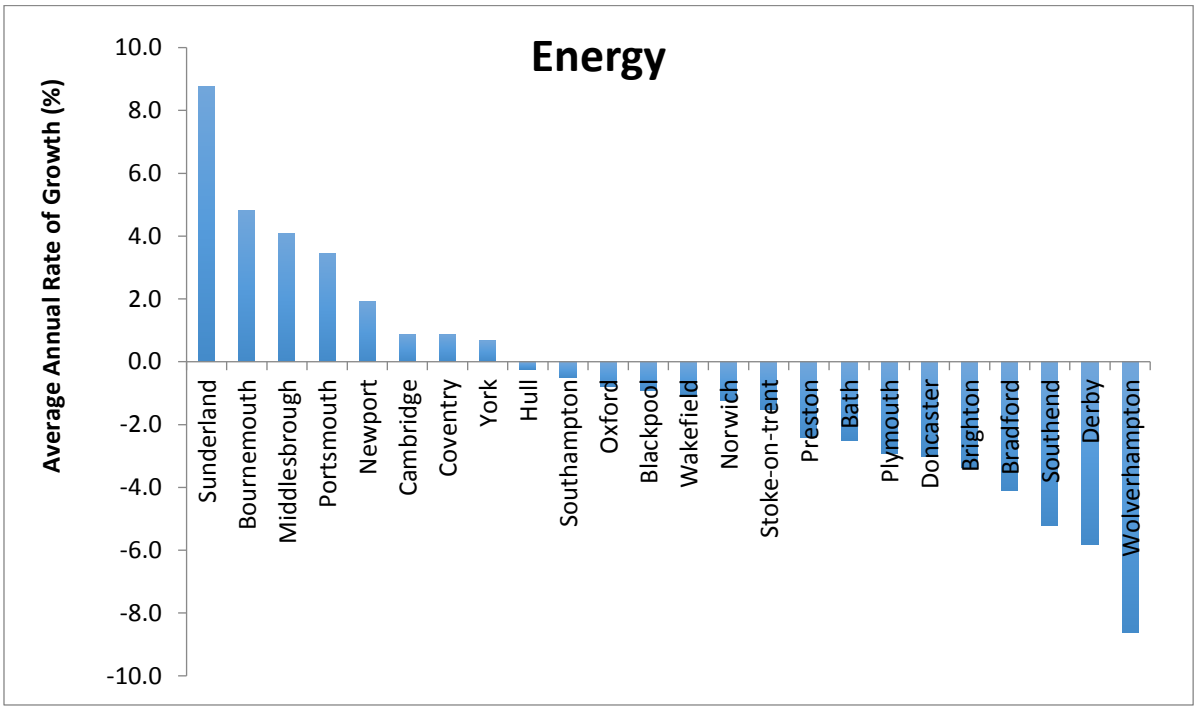
The below chart shows change in house prices, wages, GVA per worker and housing affordability ratio which can be compared to the national average, also displayed.

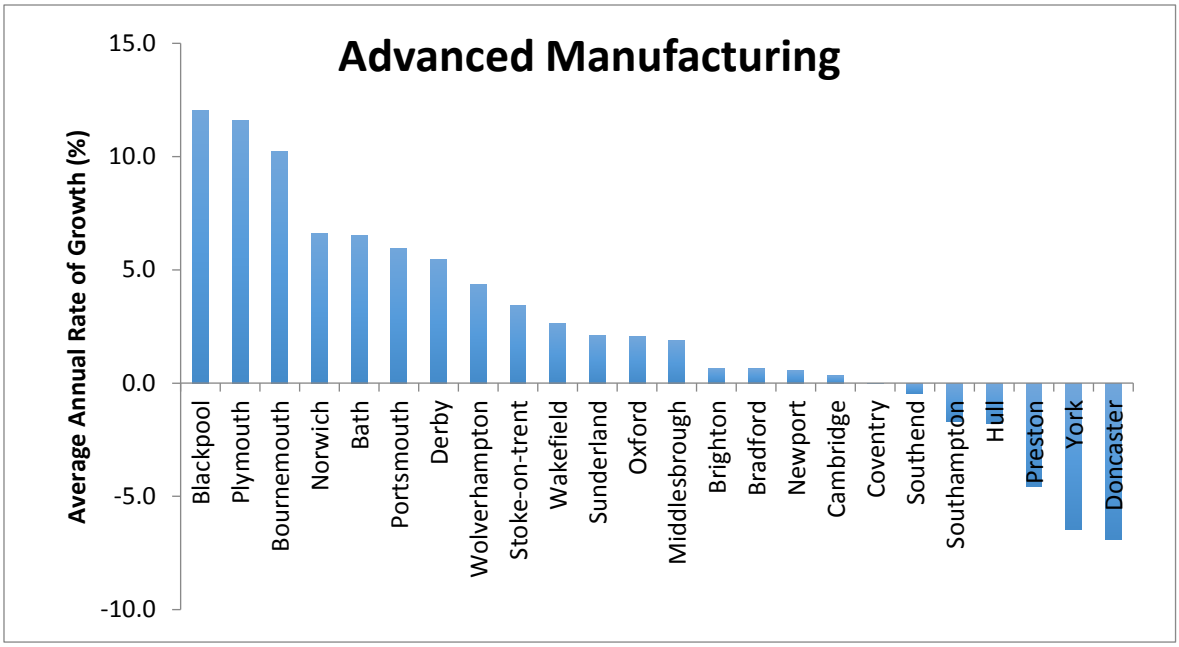


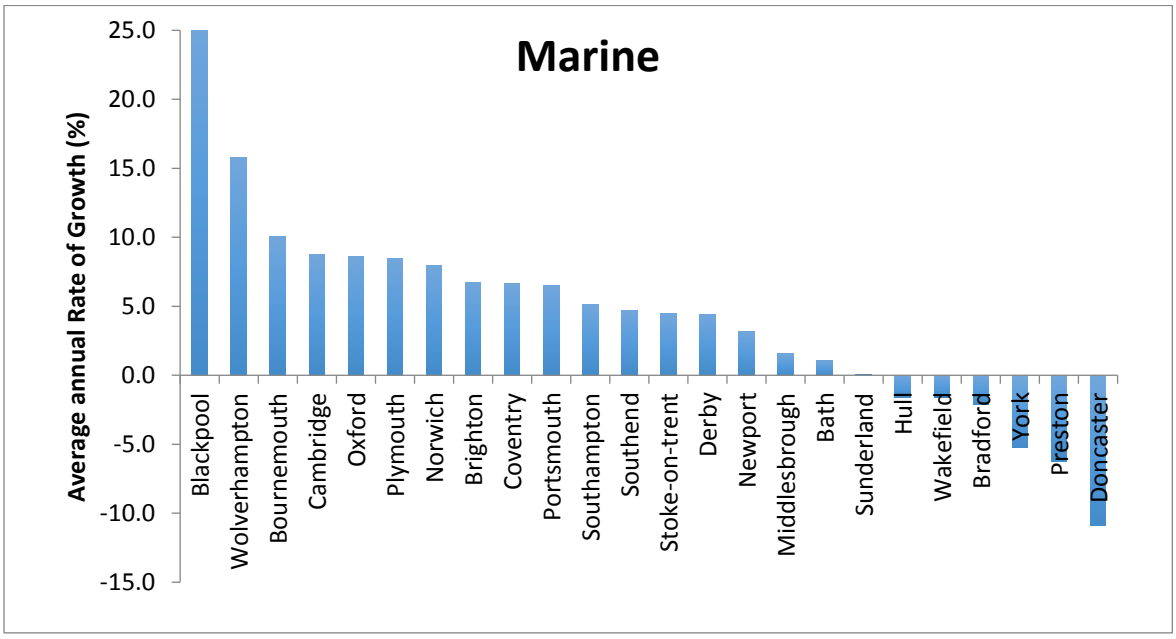
We also include an overview of the Gini Coefficient for 2013 for the Key Cities as an appendix and a 2016 overview of Key Cities Superfast Broadband Provision can be seen below:

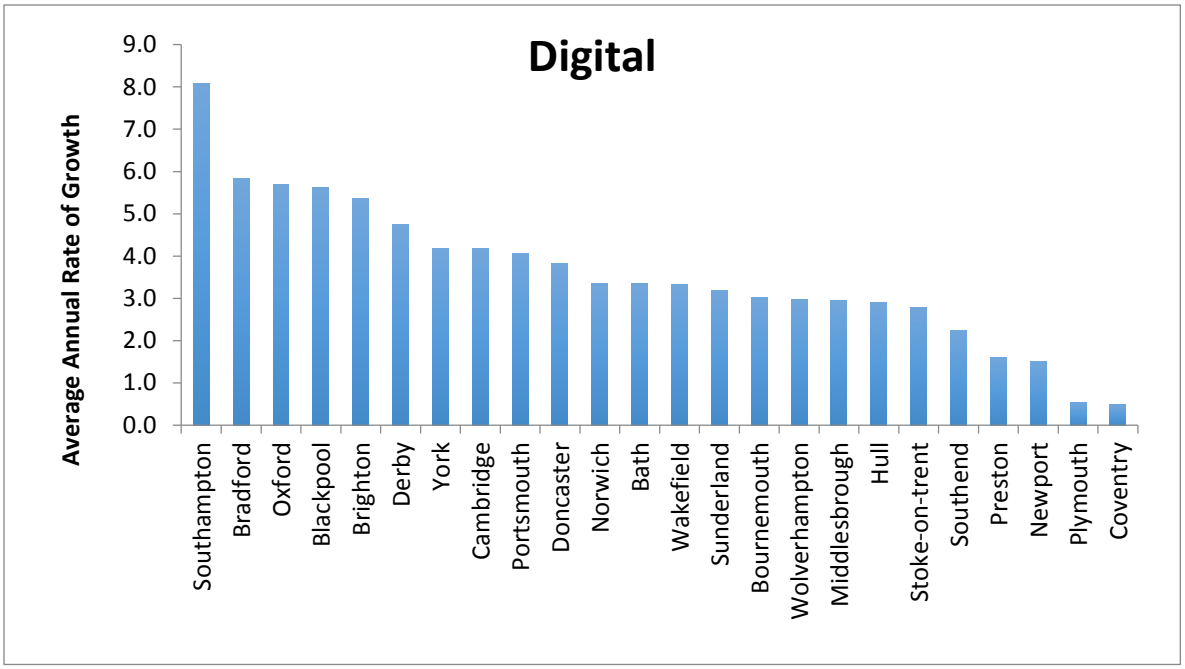
Growth Performance of the Selected Sectors

The following charts give the average annual rates of growth of output (GVA) by city for each of the selected sectors, over the period 1991-2014. Some notable features include the following. The majority of the cities show a decline in output in the Energy sector, around half a decline in output in Advanced Manufacturing. In contrast almost all cites have experienced an increase in output in Marine activities, Education and Research, and Healthcare, and all cities have expanded output in digital activities.




Advanced Manufacturing
Average Annual Rate of Growth (%)
15.0
10.0
5.0
0.0
-5.0
-10.0
Blackpool
Plymouth
Bournemouth
Norwich
Bath
Portsmouth
Derby
Wolverhampton
Stoke-on-trent
Wakefield
Sunderland
Oxford
Middlesbrough
Brighton
Bradford
Newport
Cambridge
Coventry
Southend
Southampton
Hull
Preston
York
Doncaster


Marine
Average annual Rate of Growth (%)
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
Blackpool
Wolverhampton
Bournemouth
Cambridge
Oxford
Plymouth
Norwich
Brighton
Coventry
Portsmouth
Southampton
Southend
Stoke-on-trent
Derby
Newport
Middlesbrough
Bath
Sunderland
Hull
Wakefield
Bradford
York
Preston
Doncaster


Digital
Average Annual Rate of Growth
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Southampton
Bradford
Oxford
Blackpool
Brighton
Derby
York
Cambridge
Portsmouth
Doncaster
Norwich
Bath
Wakefield
Sunderland
Bournemouth
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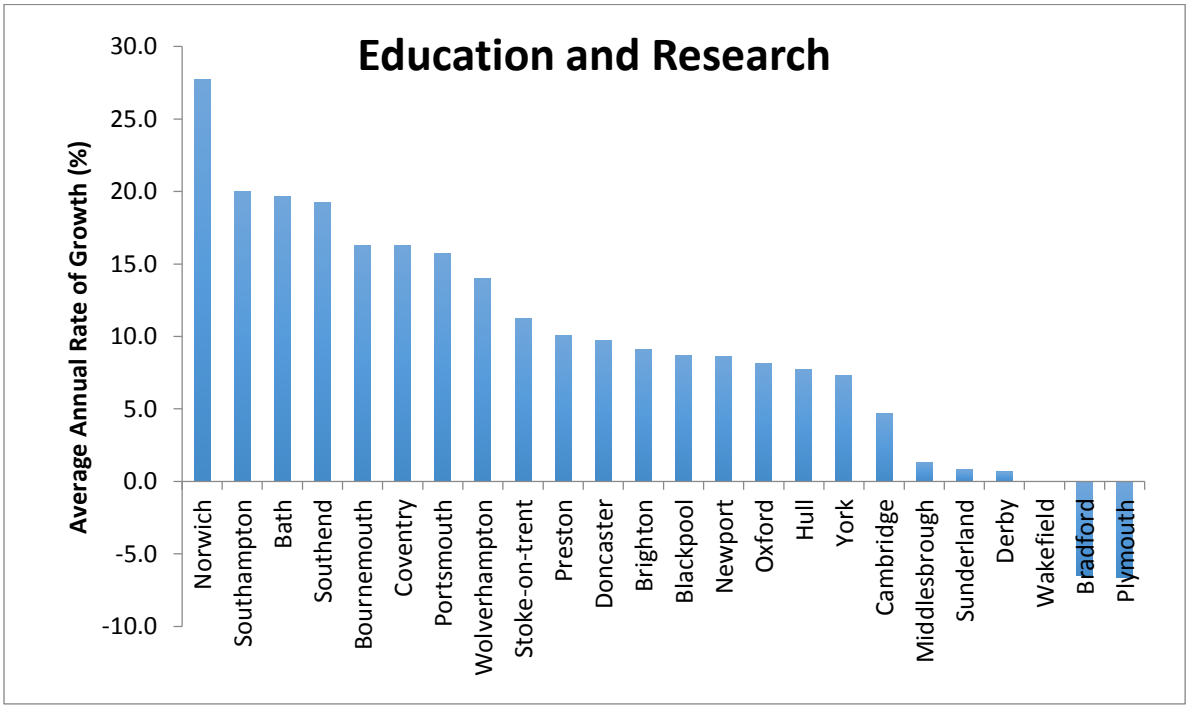
Middlesbrough
Hull
Stoke-on-trent
Southend
Preston
Newport
Plymouth
Coventry


Education and Research
Average Annual Rate of Growth (%)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
Norwich
Southampton
Bath
Southend
Bournemouth
Coventry
Portsmouth
Wolverhampton
Stoke-on-trent
Preston
Doncaster
Brighton
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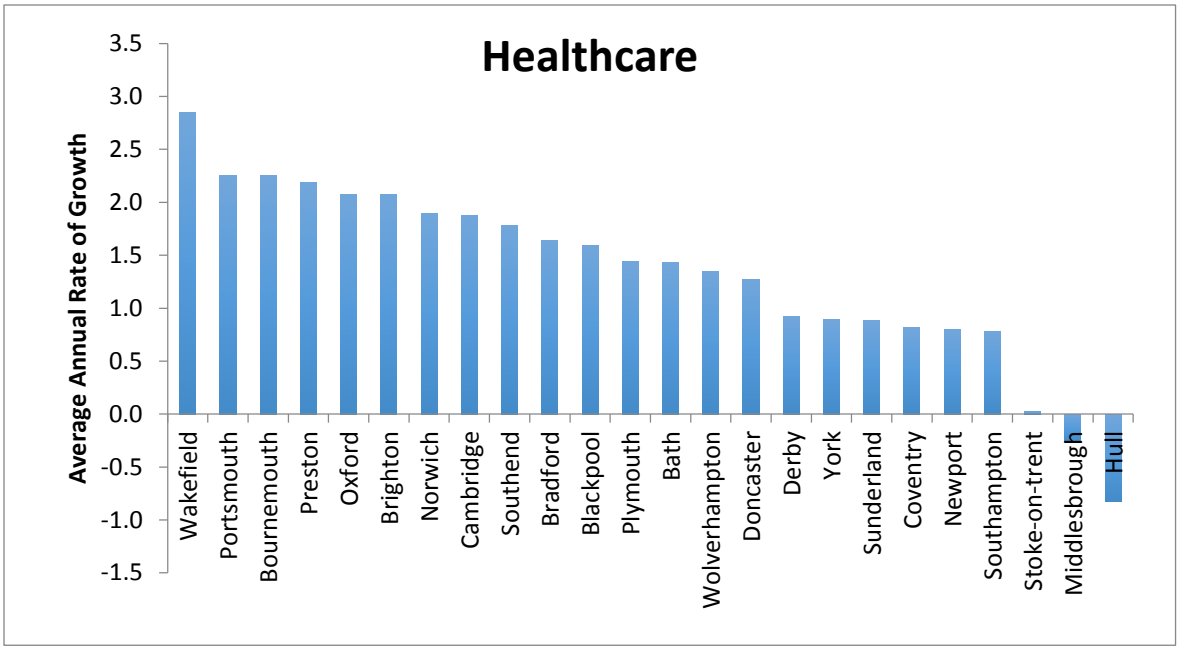
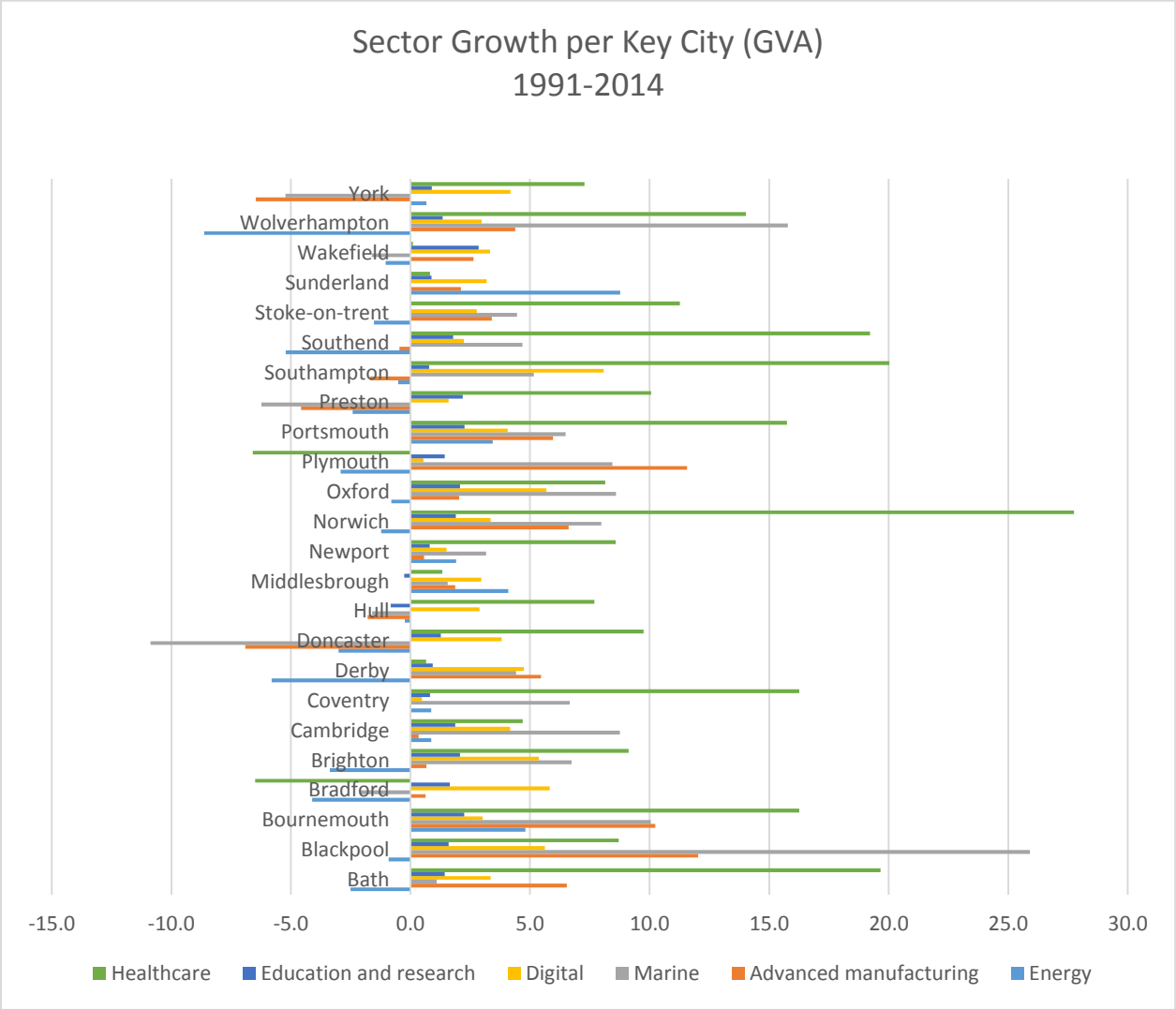
Bradford
Plymouth


Healthcare
Average Annual Rate of Growth
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
Wakefield
Portsmouth
Bournemouth
Preston
Oxford
Brighton
Norwich
Cambridge
Southend
Bradford
Blackpool
Plymouth
Bath
Wolverhampton
Doncaster
Derby
York
Sunderland
Coventry
Newport
Southampton
Stoke-on-trent
Middlesbrough
Hull

Potential for Growth in the identified Sectors

The below chart demonstrates the growth successes of the Key Cities in the identified sectors:



The Key Cities have considerable potential for further growth, particularly where they utilise the knowledge, expertise and local resources displayed in the interview responses presented in the next section. There is a good likelihood, that with appropriate support and investment, the Key Cities can continue strong growth in their identified sectors and wider economy.

Across the Key Cities and identified sectors the average GVA growth is 3.3% a year (1991-2014) suggesting a positive return on investment in the Key Cities. Over the period for every £1 invested in the Key Cities and identified sectors as a whole £2.1 would have been returned. Notably, the corresponding figures are higher for targeted sectors, thus for marine and maritime it is £2.63, for digital £2.26 and for health it is £7.73 (though care should be taken with the health data due to technical issues of measurement).

Summary and Conclusions

The picture that emerges from these aggregate trends is one of disparate and divergent growth among the group of Key Cities. There is some indication that the more southern members of the group have tended to out-perform more northern members, although there some exceptions, such as Derby and York. There also appears to have been a shift in the underlying dynamics of growth across the cities as between the 1971-1991 and 1991-2014 periods, with the growth rates of the leading cities falling back toward the national average in the second period, while those of the lagging cities as a group appear to have further deteriorated. It is also clear that whilst, overall, northern Key Cities may have led in terms of productivity growth, this seems to have been at the expense of employment growth – no doubt a result in part of the deindustrialisation and rationalisation of their manufacturing activities, especially in the 197s and 1980s, a shock from which they have struggled to recover.

The connectivity and relationships between Key Cities and their identified sectors

This section of the report details initial findings from a series of interviews conducted with relevant individuals in six key cities. The interviews revealed a picture of sophisticated, strategic and sustainable investment by Key Cities to develop, support and maintain their identified sector and wider economy.

Interviews[7] with representatives from five key cities and representatives of one broader region encompassing a key city council member were conducted in order to develop a detailed understanding of the key city and identified sector relationship. The interviews took a loosely structured conversational approach recognising the expertise of the participant and their generally extensive knowledge of the area, broadly discussing eight key topics:

1. What is the identified 'key sector' and why has this been chosen?
2. What is the main example of the sector in the area?
3. How does this link into the strategy for the area?
4. Do you have any evaluation / Cost Benefit Analysis / analysis of the sector you can send?
5. Issues around infrastructure, connectivity and partnerships?
6. How does the sector facilitate growth in the area?
7. What support for the sector does the region provide, e.g. enterprise zones, infrastructure.
8. Are there any environmental / social considerations?

The following themes emerged from the interviews, demonstrating that in many cases the key city approach to their identified key sector and wider economy is holistic, sophisticated and generally successful. Examples were given of investment designed to support the key sector and wider economy, which took a wholly holistic approach including direct investment in new facilities for the key sector, direct investment into a supply chain supporting the sector, funding and designing

[7] Remembering a relatively small number of interviews, a larger number will need to be conducted to obtain a complete picture of Key City investment in, and connectivity with their identified sectors. However several interviews included two or more participants increasing the number of participants to 14.

transport infrastructure to support the sector, and developing high quality affordable housing to encourage the highly skilled workers necessary for the sector to remain in or move to the region.

Interview themes

1. **Key cities often have targeted and sophisticated support strategies for the development of business and key sectors.**
2. **Key cities often have excellent, 'on the ground' knowledge of their geography and identified key sector.**
3. **Key cities often make excellent use of their local resources, particularly the University sector, to develop partnership and support for their key sector.**
4. **Key cities often have a wider view of the sector than simply their own geography noting the supply chains (national and international) and interrelating sectors and regions.**
5. **Key cities often utilise a wide and targeted range of funding sources, both public and private finance.**
6. **Key cities support their identified sectors without losing sight of the wider social and environmental issues.**
7. **The University and Key City relationship was very strong in the participating key city regions and acted as an engine for regional growth.**

Whilst we have separated the themes in order to provide an overview of the data gathered it should be remembered that they are often interlinked and present a holistic strategy. It was clear in the interviews that the key cities take a holistic overview approach to their wider regional economy and participants were often keen to point out that whilst their identified key sector was often the leading sector in one or more key criteria, often employment, this wasn't the whole picture. The key cities we spoke to were aware of their wider economy and how their key sector supports this but they were also aware of other strengths of their region. In particular one participant explained how they had seven key sectors of which their identified one was a large component but intrinsically linked to and supported by the remaining economy. Particularly impressive here was the use of local educational resource to develop a highly skilled workforce able to serve this multifaceted strategy.

Key interview themes:

The seven key themes emerging from the interviews present an overall view of targeted, long term, investment supporting the identified sectors and the wider economy.

Key cities often have targeted and sophisticated support strategies for the development of business and key sectors.

The key cities interviewed were able to make productive investment decisions based on an excellent knowledge of their key sector and their region to obtain an above average return on investment, which is primarily recorded as number of jobs created and support for the wider economy. A clear example of the use of city deal funds to improve site access and site improvement works was provided by one participant with the investment decisions made backed by considerable analysis. It was useful to see funds in conjunction with skills strategy bodies recommendations and support to help develop the required skilled workforce in the region. Considerable use was made of established investment structures such as enterprise zones to develop the key sector, supporting sectors and the wider economy.

Fundamentally the overall outcome within this theme is one of successful, well informed strategic investment by key city regions to develop and support their identified sector and wider economy.

Key cities often have excellent, 'on the ground' knowledge of their geography and identified key sector.

The interviews revealed a wealth of detailed knowledge and expertise of the key city region in their identified sector, the wider economy and supply chain and their geography. Often highlighted was the comparative cheapness of land and plant in the more Northern and rural key city regions than for instance within the Core Cities. In particular the notion of the unbounded key city was raised, where a key city having scope for growth can plan for a "continuous urban area, excellent for industry". This geographic resource and knowledge was seen as vital in developing a sector to full potential or supporting a cluster, with a role of the key city seen as developing and providing the necessary infrastructure to attract industry.

The expertise in the key sector was evident with examples of 'supply chain mapping' presented. This is where (generally with industry and academic partners) an identified sector's supply chain is exhaustively evaluated and key city strategy is developed to support the sector holistically, often through skills or infrastructure provision. For example one key city worked with a local university to produce a bespoke Master of Science programme to support their key sector and another provided hard transport infrastructure to secure supply of goods between science parks.

One key example of futureproofing the sector was given, where the key city commissioned a University to present an analysis of the requirements of their key sector in 2040 and are developing present strategy to support that sector in the future.

Overall the picture presented in the interviews was of key cities having enviable knowledge of their identified sectors and geographies, ultimately using this knowledge to effectively develop the wider economy.

Key cities often make excellent use of their local resources, particularly the University sector, to develop partnership and support for their key sector.

Within the interviews, evidence was gathered suggesting key cities are both well aware of any local resources and are able to utilise these to support and develop their identified sector and wider economy.

This was clearly evidenced by the number of partnerships with the local (and wider) University sector. Universities are effectively partnered with to both provide skills and training, and research services. Several examples of bespoke training courses designed to provide highly skilled, sector specific ready to work graduates were described as well as University training courses, Continuous Professional Development and Knowledge Transfer Partnerships, were provided in the interviews.

Research partnerships were also described where the University's research expertise was used to produce analysis of a sector, future trends and needs forecasts. This provided a rich source of expertise which enabled the key city to make well informed investment decisions. Wider University partnerships in terms of spin offs, joint research programmes and campus sites were also evident and are discussed further in the Universities theme.

The interviews presented a finding of key cities able to make effective partnerships at all levels and utilise local resources to support the wider economy.

Key cities often have a wider view of the sector than simply their own geography noting the supply chains (national and international) and interrelating sectors and regions.

The interviews are highly suggestive of a key city view of the identified sector at a holistic level and beyond their own geography (where relevant). Participants explained that the effective approach to supporting an identified sector lay in supporting all aspects of the sector including, workforce, skills, supplies and parts, infrastructure and investment as well as being cognizant of both how sectors interact and where nationally this investment should occur. A unanimous feature of the interviews however was that in terms of skills and workforce the priority was to upskill, retain and develop local workers.

Examples of this wider view of the sector involved the 'supply chain mapping' discussed earlier, key cities investing in links to national infrastructure and working with their identified sector to develop a detailed sector level understanding to allow better key city support.

The interviews displayed a key city view of their role in supporting the wider economy being holistic and focussed at all levels and stages of production.

Key cities often utilise a wide and targeted range of funding sources, both public and private finance.

The interviews revealed that key cities are well informed of various funding sources, for example the local growth fund, growth deal funds, European funding sources, private partnerships, pension funds and their own asset base.

Key cities support their identified sectors without losing sight of the wider social and environmental issues.

The interviews almost universally suggested again a holistic picture of the sector in the wider context, social, economic and environmental factors were considered in decision making. A key example of this came from a planning decision supporting an identified sector by creating sustainable

affordable housing in the area. Notably decision makers were aware of price increases in property which may occur through the successful development of the sector and wider economy and were taking measures, such as increasing the supply of affordable housing to counter this and avoid 'pricing out'.

Investment decisions centred around problem solving, with the attraction, development and maintenance of the identified sector intended to provide industrial regeneration to old heavy industry sites or cleaning and development of waste land. A programme of skills development was again targeted primarily at the region and used to support improvement in social targets, e.g. JSA claimant reduction.

It was also interesting to note that many longer term investment plans and strategies included decommissioning and other costs, decision makers noted lessons from deindustrialisation and attempt to avoid sectoral unemployment if the identified sector diminishes.

The interviews displayed a strong recognition of social and environmental factors being included in decision making and an awareness of the impact of the sector on society.

Key Cities utilise their respective universities, harnessing them as engines of regional growth.

Within the interviews all participants described a strong relationship with local Universities to develop and support the identified sector and local economy. Numerous examples of successful partnerships were described, however these tended to fall within three broader categories:

1. Targeted and bespoke courses to provide highly skilled workers for the identified sector, as well as supported programmes, training and professional development.
2. Utilising and commissioning university research in planning and targeting support for the identified sector and wider economy.
3. Larger joint projects including infrastructure support and support for 'spin outs'.

When describing joint programmes, participants explained how targeted University provision could help create an environment to support and strengthen their targeted sector, particularly impressive were courses targeted at forecast future skills need developed in conjunction with the targeted sector and relevant research to provide a supply of skilled labour where and when necessary.

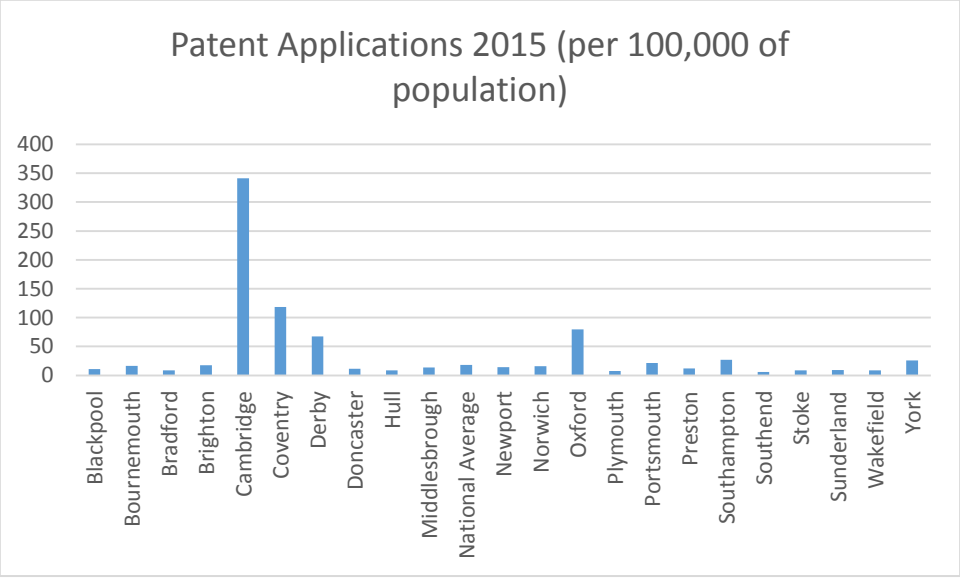
The interviews demonstrated a willingness and appetite to utilise available research in planning decisions, research described included feasibility studies, strategic planning and future proofing the

identified sector, supply chains and wider economy. Using and commissioning university research creates a situation where Key Cities have excellent knowledge of their local area and are able to adapt planning and support based on recognised expertise. This presents a considerable resource to Key Cities, which in conjunction with local and sectoral knowledge allows for flexible and effective decision making.

In the interviews a clear strand of activity concerned larger projects. For instance the creation of science parks supporting university spinouts and advanced manufacturing, the strategic decision to co-locate relevant university researchers and identified sectors to promote R&D synergies or decisions to locate university infrastructure to achieve redevelopment, growth or sectoral support aims.

The interviews suggested that partnership with local Universities can be a key aspect of creating an environment for the support of the identified sector and development of the wider economy. A local university provides a considerable resource to the Key City which, if used effectively, can facilitate sustainable economic growth.

It is notable that the Key Cities whose identified sector was education and research (e.g. Cambridge and Oxford) perform particularly well in the number of patents awarded per head as shown in the chart below.



Sector Analysis

Developing on from the interviews, an analysis of the identified sectors is provided in this section. A clear steer from the interviews was that sectors need to be considered holistically and that whilst the connectivity and relationships with the individual Key Cities are vital, it is also important to view the sector in its entirety to develop a view of how the sector interacts with all relevant regions. This prevents decisions in a sector affecting several regions being taken in isolation. Indeed a notable finding from the interviews was an awareness of the interconnectivity of the identified sector.

The research has shown that to be successful, an industrial policy that targets specific sectors must avoid straight competition, which attempts to displace economic activity from A to B. Instead, it must focus on building connections and synergies with:

i. other sectors in the region,
ii. wider geographies be it in the surrounding area or elsewhere in the UK and,
iii. the broader local economy and in particular the 'foundational economy',[8] i.e. that part of the economy which is the majority of economic activity and involves the daily reproduction of households e.g. food, heat, transport, health, education.

Such connections will bring mutual benefits to the region (and avoiding a ghetto of small scale, quality jobs surrounded by wider economic and social stagnation and even decline)[9]. As well as to the sector in question, not least because by tying it to the local economy the impact of globalised low-cost competition is reduced, the key cities shows us that ties to the local economy provide short and responsive supply chains as well as a tied-in customer base.

Done right in this way a sector's "value" to an area and to the UK more generally moves beyond GVA and employment to include resilience (e.g. reducing fuel poverty, or the threat of "offshoring"), environmental benefits (e.g. helping the necessary energy transition including meeting the

[8] Bowman, A. Ertürk,I. , Froud,J., Johal, S., Law, J., Leaver,A., Moran, M. & Williams,K. 2013, The end of the experiment? From competition to the foundational economy. Manchester & New York: Manchester University press

[9] Folkman et al (2016) show how regeneration of central Manchester has failed to bring substantial benefits to the surrounding area and to other areas of the economy, if anything it has competed with these to displace activity away from them. Folkman et al, 2016, MANCHESTER TRANSFORMED: why we need a reset of city region policy. CRESC public Interest Report November 2016. ONLINE. Available at: www.cresc.ac.uk/medialibrary/research/ManchesterTransformed.pdf

government's statutory carbon reduction targets), as well as social benefits (helping secure the social safety net, reducing the burden on the social and health services, improving education outcomes to provide skilled workers etc).

Approach

For each sector now answer the following questions

- Where is the sector prevalent?
- What is a sector's value to a place (economic, social and environmental)?
- What is the sector's growth potential in specific locations or combination of locations?
- How that place is already working closely with its industries to incentivise/grow etc. (including intentionally forming links between sectors)?
- Connections to other geographies: Examples of collaboration between key cities but also between key cities and other towns/cities and with their surrounding areas (including if that collaboration has created specific value).
- Any examples of things that would support those sectors or particular barriers to growth?

Please note that often it was not possible or practical to separate the material out to answer every question, thus some in the following sections, some questions are merged and answered in one section.

The Digital Sector :

Where is the sector prevalent?

Many Key Cities have large and growing digital technology sectors that are driving growth throughout their economies. These digital businesses typically account for a large proportion of total businesses, so that some Key Cities have been identified as "digital clusters" in the TechNation 2016 report[10]. These are: Cambridge, Norwich, Brighton, Oxford, Southampton, Hull, Sunderland, Bournemouth and Poole, and Bath.

What is a sector's value to a place (economic, social and environmental)?

Key City digital clusters generate considerable employment in the local economy. Digital businesses consistently account for 16%- 23% of all businesses operating in these cities. Moreover, since 2010, these clusters have seen double digit growth in both turnover, GVA and, in most cases, employment as well.

The economic impact of digital technology sectors in Key City digital clusters.

Key City	Digital businesses % of total businesses, 2010-2014	Average growth in turnover, 2010-2014	Average growth in GVA, 2010-2014	Average growth in employment, 2011-2014	Digital economy jobs
Cambridge	21%	46%	12%	1%	18,532
Brighton	23%	17%	42%	11%	15,536
Oxford	19%	42%	19%	32%	24,680
Southampton	18%	180%	67%	N/A	24,975
Hull	16%	N/A	14%	2%	6,070
Norwich	16%	22%	22%	N/A	5,306
Sunderland	16%	44%	29%	17%	3,675
Bournemouth and Poole	21%	39%	68%	15%	13,965
Bristol and Bath	18%	53%	26%	9%	36,547

[10] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf

Souce: Based on information from the TechNation's 2016 report[11]. GVA=Total output (goods or services) minus value of inputs e.g. cost of production, taxes, subsidies

As shown in Table 1, 21% of all businesses in Cambridge were digital businesses, and 15 of these businesses are worth over £1 billion dollars each. Between 2010-2014, Cambridge's digital sector experienced 46% increase in turnover and 12% increase in GVA. However, employment in the sector only increased by 1% between 2011-2014. Between 2010-2014, the digital technology sector's turnover in Brighton increased by 17%, and GVA increased by 42%. In contrast to Cambridge, Brighton's digital sector also experienced strong employment growth of 11% between 2011-2014. Among UK cities, Brighton has the highest number of digital technology jobs in non-digital sectors, suggesting that it is a truly digital economy; 23% of Brighton's businesses are digital businesses. In Oxford, 19% of all businesses are digital businesses and, between 2010-2014, the industry's turnover and GVA grew by 42% and 19% respectively. In addition, employment in digital industries grew by 32% between 2011-2014. In Southampton, 18% of all businesses belong to the digital sector. Remarkably, between 2010 and 2014, the sector's productivity, turnover and GVA grew by 65%, 180% and 67% respectively. Digital businesses account for 16% of businesses in Hull, with the sector's GVA growing by 14% between 2010 and 2014, and employment growing by 2% between 2011-2014. MediaCityUK is a large European centre of digital and creative industries. The digital, creative and media cluster at Salford Quays comprises more than 250 related firms, accommodating around 7,000 jobs. 30% of BBC staff at the MediaCityUK work in digital and technology roles.

The cluster is an often quoted example and Key Cities, with an in-depth knowledge of their local situation (social, economic and geographic), have the opportunity to develop such clusters to benefit Key City regions as a whole, e.g. as suggested by Folkman et al (2016).

The digital sectors in Oxford and Southampton each had £1.2 billion turnover in 2014, more than Birmingham's £1.13 billion and Leeds's £671 million. In Norwich, 16% of businesses are in the digital sector and, between 2010-2014, this sector's turnover and GVA increased by 22% each. Norwich's digital cluster is, however, still in its early stage, employing only about 5, 000 people. In Sunderland, digital businesses account for 16% of all businesses and, between 2010-2014, the sector's turnover and GVA grew by 44% and 29% respectively; employment grew by 17% between 2011-2014. 21% of digital businesses in Bournemouth and Poole are digital businesses; employment in the sector grew by 15% between 2011-2014, while turnover increased by 39% and GVA by 68% between 2010-2014.

[11] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf

How that place is already working closely with its industries to incentivise/grow etc. (including intentionally forming links between sectors)

Key Cities support their digital sectors, especially through local Universities. The University of Cambridge plays a major role in the city's digital sector: it provides a steady stream of highly skilled talent, a "digital hub" to support start-up businesses, and forums to encourage early stage digital innovation- the Cambridge University Entrepreneurs to Innovation forum and the Judge Business School's Accelerate Cambridge program. Indeed, in 2014, 80% of digital businesses in Cambridge cited access to graduate-level talent as a key benefit of doing business in Cambridge[12].

In Brighton, both the University of Brighton and the University of Sussex offer young digital entrepreneurs access to their graduates at a reduced commercial rate, ensuring that skilled labour is always available[13]. A report of Brighton's digital sector by Brighton Fuse found that Brighton houses multi-disciplinary digital firms that combine creative arts and design skills with technological skills, so called "fused " companies[14]. This report also found that over half of the digital businesses surveyed have had some form of contact with universities, dominated by informal networking, the use of university facilities, and placement schemes in some of Brighton University's creative or digital programmes. About 10% of Brighton's digital firms were found to engage in research collaborations with universities. For instance, a mobile app company collaborated with a computer science lecturer who conducted user testing trials for their App. The Brighton Fuse report found that University engagement is positively associated with both digital firm innovation and digital firm growth in Brighton. Brighton hosts several industry events, such as Brighton Digital Festival and dConstruct, that allow it to sustain a strong digital community. The City also has organisations that foster the growth of digital industries, such as the Sussex Innovation centre, Barclays Eagle Lab and Natwest Hatch. The organisation, Wired Sussex, has proven instrumental in fostering growth by ensuring all digital businesses have access to high speed broadband across Brighton.

Hull is home to LabelWorx, the global leader in the distribution of Dance and Electronic music to iTunes, Amazon, Google Play and other companies. Although the number of digital business in the area is small, digital start-ups are supported by local incubators such as C4Di. Grant and loans are also available to new business. For instance, the Hull Business Development Fund provides up to

[12] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf
[13] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf

[14] http://www.brightonfuse.com/wp-content/uploads/2013/10/The-Brighton-Fuse-Final-Report.pdf

£25,000 to businesses that can prove they have a sustained benefit to the local economy, and the Youth Enterprise Bank provides grants to entrepreneurs younger than 19 years[15].

The University of Oxford and Oxford Brooks University provide access to graduate level talent in Oxford, while local organisations such as Digital Oxford and Said Business School provide support and co-working spaces for new businesses[16].

The University of Southampton is central to the growth of digital businesses in the city. Its SETSquared centre connects early stage start-ups with academics and entrepreneurs, to help these start-ups grow into successful businesses. It helps businesses with grant applications and provides works spaces for digital businesses through its Science Park[17].

Norwich has a high concentration of Science and Research Park, and two high quality Universities, all of which support digital technology businesses. Norwich University of Arts produces graduates in video games art and digital photography and film, while University of East Anglia offers courses in computer systems, software engineering, and media studies, among others. In 2017, the Norwich University of Arts announced that it would introduce three additional courses to support the needs of the growing digital industry: BSc. games development, BSc. user experience Design and BSc. interaction design[18].

The Sunderland City Council, the University of Sunderland and Sunderland College work closely with the Sunderland Software City to ensure that software businesses in North East England get access to the skills, connections and opportunities they need to grow. The program has already helped over 400 businesses and hopes to create 2,000 new jobs by 2020[19].

In Bournemouth and Poole, the Universities support digital businesses by allowing these businesses to provide courses, free of charge, to students, and to offer jobs and apprenticeships to exceptional students. The National Centre for Computing Animation at Bournemouth University produces skilled graduates that go on to work on successful films and video games. The Bournemouth Borough Council won the Digital Council of the year award in 2015, in recognition of its support for digital technology businesses[20].

[15] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf
[16] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf
[17] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf
[18] http://www.eveningnews24.co.uk/news/business/adult_apprenticeships_and_better_technical_teaching_on_norwich_tech_sector_s_government_wish_list_1_4959747
[19] http://www.sunderlandsoftwarecity.com/about-us/
[20] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf

Connections to other geographies: Examples of collaboration between key cities but also between key cities and other towns/cities and with their surrounding areas (including if that collaboration has created specific value).

Key Cities often support multi-city collaborations within the digital sector. Like with the Life Sciences sector, this is mostly achieved through local Universities. The Universities of Southampton and Bath are among the founding members of the SETSquared Partnership, a collaboration between the Universities of Bath, Bristol, Exeter, Southampton and Surrey. This Partnership, established in 2003 and funded by the Higher Education Innovation Fund (HEIF), aims to facilitate business creation for its five member Universities[21]. In 2015, SETSquared was identified by UBI Global as the Number 1 University Business Incubator in the world. Since its inception, SETSquared has supported over a thousand digital business start-ups across the UK. These businesses have raised over £1 billion worth of investments in the UK, and contributed £3.8 billion to the UK economy, projected to increase to £10 billion in the next 10 years[22]. Currently, this partnership supports 265 businesses across the UK and has created 10,000 new jobs[23]. The Southampton cluster is also highly globalised, with 80% of its businesses trading outside the UK.

Sunderland is home to Sunderland Software City, which aims to enable growth in software businesses not only in Sunderland but in the wider North East of England[24]. The program, initiated in 2008, is a partnership between the public, private and education sectors. Sunderland Software City is partly funded by the European Regional Development Fund (ERDF), which is bringing £330 million into North East England to support software businesses though the Sunderland Software City[25]. Also within the Sunderland Software City is the North East and Tees Valley Catapult Centre, which provides incubation space for digital SMEs and connects them to industry experts and academics[26].

Networking across cities and regions is central to the success of modern digital technology industries. One way this networking is made possible is through digital "meet-ups", where participants from all over the country come together to collaborate. The TechNation report showed that Key Cities dominate meet-up activities: Education technology meet-ups occur mostly in Oxford and Bath, gaming met-ups in Brighton, and information security meet-ups in Belfast and Norwich. London is also found to be closely linked with these Key cities[27].

[21] http://www.setsquared.co.uk/setsquared-partnership
[22] http://www.setsquared.co.uk/global-1-university-business-incubator
[23] http://www.setsquared.co.uk/global-1-university-business-incubator
[24] http://www.sunderlandsoftwarecity.com/about-us/
[25] http://www.sunderlandsoftwarecity.com/about-us/
[26] https://www.digitalcatapultcentre.org.uk/local-centre/netv/
[27] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf

Any examples of things that would support those sectors or particular barriers to growth?

The recent TechNation report identifies key challenges and benefits of operating in digital clusters within Key Cities [28]. According to the report, at least 80% of digital technology businesses in Cambridge say that they benefit from access to local networks, highly skilled talent, and business support. The main challenges, affecting 40-45% of companies, are limited access to finance and to commercial property.

Similarly, over 70% of businesses in Brighton cite access to highly skilled talent and local networks as key benefits, as well as the presence of a positive "cluster brand". In a study of Brighton's digital cluster, Brighton Fuse found that Brighton's proximity to London is also one growth enabling factor, as more than half of Brighton's digital businesses have London based clients[29]. The main challenges, affecting over 30% of digital businesses in Brighton, are weak digital infrastructure, limited access to finance, and limited access to commercial property. An additional challenge found by the Brighton Fuse study is the artistic culture and community, which some businesses cited as promoting a "laid back" attitude that discourages hard work.

The TechNation report reveals that over 70% of digital businesses in Oxford cite access to local networks as a key benefit of doing business in the city, and around 60% of businesses cite access to graduate level talent and business support as additional benefits. The main challenges, affecting over 30% of digital businesses in Oxford, is a weak digital infrastructure, low access to affordable property, and limited access to finance. 40% of customers for Oxford's digital businesses are outside the UK, as the sector is dominated by Education Technology and Health Technology firms, and these usually have a strong international outlook.

A growth enabling feature of Southampton is its physical and electronic connectivity: It has extensive rail, road, airport and ferry networks, giving it easy access to the UK as well as mainland Europe[30].

In Hull, the strong digital infrastructure provided by the KCOM Group has been instrumental to growth. In addition, lower rent, living costs and wages mean business can operate at a significantly lower cost than, for example, London. 77% of digital companies in Hull cite access to local networks and commercial property as a key benefit of operating from Hull, and 50% cite access to graduate

[28] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf
[29] http://www.brightonfuse.com/wp-content/uploads/2013/10/The-Brighton-Fuse-Final-Report.pdf

[30] http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf

level talent as an additional benefit. However, over 30% of firms say low access to finance and low sector awareness are challenges to their businesses.

In Norwich, over 60% of digital businesses cite access to talent and local networks as benefits of doing business in the city, and 55% additionally cite access to commercial property. On the other hand, around 40% of businesses cite low access to finance, weak digital infrastructure and low sector awareness as challenges facing their businesses.

In Bournemouth and Poole, access to graduate level talent, local networks and business support are the main benefits cited by digital businesses; the main challenges are limited access to finance, affordable property, and industry-specific talent.

Overall, compared to Core City clusters such as Birmingham and Leeds, Key City clusters face the challenge of limited access to commercial property. Since in many cases Key Cities provide better access to highly skilled talent and local networks, as well as better sector awareness and economic climates, improving access to commercial property can propel these cities to become leading digital technology clusters, with potential positive spill-over effects on their wider regions. Increasing access to finance for digital start-up business will also support the growth of this sector.

The Healthcare (Life Sciences) Sector:

Where is the sector prevalent?

In England, pharmaceutical companies are mainly concentrated in South East, East of England and London; together, these areas account for 65% of UK pharmaceutical companies. Companies in the medical technology sector are more evenly distributed across the UK, with 15% in South East England, followed by East of England and West Midlands. The Key Cities with notable biopharmaceutical and medical technology industries are Bradford, Cambridge, Hull, Oxford, Southend-on-Sea, and York.

What is a sector's value to a place (economic, social and environmental)?

Cambridge, Essex and Oxford are part of Europe's largest Life Sciences cluster, the London Stansted Cambridge Corridor (LSCC). This cluster is important because it has 37 world-class Life Science research institutes, and in 2011, it accounted for 19.6% of all UK employment in the Life Sciences sector[31]. It also houses least 60% of the UK life sciences industry base, and four out of five Academic Health Science Centres in the UK, and 3 of the world's top 10 universities[32]. A fifth of all UK investment in the Life Sciences and digital sectors are concentrated in this cluster[33].

What is the sector's growth potential in specific locations or combination of locations.

The potential for growth in the Life Sciences industries in Cambridge and Oxford is high. Indeed, the clustering of this sector is mainly due to support from the world leading Universities that provide research expertise. Often, business ideas are spun out of research findings within these universities[34]. The clustering of Life Sciences industries along the LSCC has growth inducing effects on nearby cities, including Stevenage (as in the creation of the Stevenage Bioscience Catalyst), and in Key Cities like Essex. Located between Cambridge and London, Essex is a short distance from these core life sciences clusters. It thus offers easy access to world class talent and research excellence, with significantly lower costs for businesses and employees (in terms of office and laboratory spaces, living costs, etc.). Indeed, several Life Sciences companies have started up and expanded in Essex, including Arecor, a leading biopharmaceutical company[35].

[31] http://lscc.co/wp-content/uploads/2013/11/report-mapping-this-sector.pdf
[32] http://www.onenucleus.com/about-one-nucleus
[33] http://lscc.co/wp-content/uploads/2014/07/LSCC-brochure-inserts-Life-Science-Lres.pdf
[34] http://lscc.co/wp-content/uploads/2014/10/LSCC-Demand-side-report.pdf
[35] http://investessex.co.uk/blog/why-life-sciences-companies-are-choosing-essex-for-uk-business-expansions#.WN6Yq9Lyvcs

How that place is already working closely with its industries to incentivise/grow etc. (including intentionally forming links between sectors)

Key Cities are already supporting their Life Sciences sectors, especially through local Universities. The University of Cambridge is actively engaged in life sciences research and serves as a skills base that attracts companies to invest in the area. An example of the impact of this University-industry collaboration was the announcement that the headquarters of Astrezeneca would move to the Cambridge Biomedical Campus in 2016, bringing with it £330 million worth of investments, and employing 2,000 people[36]. To support the growth of this sector in the face of high housing costs that deter skilled workers, local planning authorities are working closely with the LSCC to increase the delivery of new homes in the area and to improve access to more affordable areas within the corridor[37]. The UK Medical Research council is investing £10 million in AstraZeneca, a collaboration that would give academics unprecedented access to some of AstraZeneca's resources that form the back bone for the formation of new medicines. In 2015, the Department for Business, innovation and skills pledged to invest £75 million to expand the European Bioinformatics Institute in Cambridge, and to develop a new technical hub- Hinxton, Cambridge.

In Bradford, the Council was instrumental to the establishment of the Digital Health Enterprise Zone (DHEZ), a £13 million project aimed at accelerating digital health innovation not only in Bradford, but in the wider Leeds City Region and across West Yorkshire[38]. The programme is a partnership between the University of Bradford, BT, City of Bradford Metropolitan District Council and the UK government. Department for Business, Innovation and Skills has invested £3.8 million into DHEZ, while the unique contribution of BT is to provide access to its skilled labour, its innovation process and its technical solutions. BT also provides Small and Medium-term Enterprises (SME's) with access to global markets through its own networks[39]. The keen involvement of the local council in the Digital Health Enterprise Zone (DHEZ) shows an understanding of the value of multi-sectoral collaboration in delivering innovative and inclusive growth, since the program is a unique partnership between the education sector, business sector, healthcare sector, digital sector and the local authority, aimed at providing a holistic local solution to national public health issues[40]. This process not only generates local jobs and increases value added, but also drives innovation and stimulate investments in the wider regional health economy[41]. Part of DHEZ is a digital health incubator, the Digital Exchange, which provides

[36] http://lscc.co/wp-content/uploads/2014/10/LSCC-Demand-side-report.pdf
[37] http://lscc.co/wp-content/uploads/2013/11/report-mapping-this-sector.pdf
[38] http://www.bradford.ac.uk/alumni/get-involved/digital-health-enterprise-zone/
[39] https://www.localgov.co.uk/Bradford-leads-the-way-in-digital-health/40309
[40] https://www.localgov.co.uk/Bradford-leads-the-way-in-digital-health/40309
[41] https://www.localgov.co.uk/Bradford-leads-the-way-in-digital-health/40309

start-up businesses in digital health with access to University academics, BT specialists, and healthcare professionals. The Council's Business, Investment and Enterprise team are also on hand to provide advice and funding sources[42]. Complementing the Digital Exchange is a £7 million Health and Wellbeing Centre which offers academic programmes across six health themes. With the help of the Bradford City Council, therefore, the DHEZ is well equipped to identify health challenges facing the public, analyse them, and come up with technological solutions that can have national implications by reducing the NHS funding gap[43]. This is because DHEZ is designed to address chronic illnesses by using innovative new technology that is potentially cheaper and more effective than the national status quo. The programme also has global potential, and has already established links in Europe, US and China[44].

To foster growth in high-tech sectors including medical technology and pharmaceuticals, the University of Oxford plans to establish a 'Science Area', which will provide spaces in new buildings to facilitate interdisciplinary collaborations, and to enable firms identify and sustain relevant contacts within the University[45]. The University actively encourages its academic staff to engage with businesses so that their research findings inform product development. In 2011, University of Oxford provided £39 million pounds in industry funding, the highest among UK universities[46]. Evidence of confidence in the value of Oxford University's collaboration with the health sector is the investment, between 2007-2012, of a total of £152 million, by the Government into the Biomedical Research Centre (OxBRC), based in Oxford University Hospitals[47].

In March 2017, the Essex City Council pledged to provide £2.5 million, towards the development of Anglia Ruskin University's £5 million MedTech Innovation Centre. This deal should create 500 new jobs[48].

[42] https://www.localgov.co.uk/Bradford-leads-the-way-in-digital-health/40309
[43] https://www.localgov.co.uk/Bradford-leads-the-way-in-digital-health/40309
[44] https://www.localgov.co.uk/Bradford-leads-the-way-in-digital-health/40309

[45] http://www.sqw.co.uk/files/2613/8690/7243/Oxford_engine.pdf
[46] http://www.sqw.co.uk/files/2613/8690/7243/Oxford_engine.pdf
[47] http://www.sqw.co.uk/files/2613/8690/7243/Oxford_engine.pdf
[48] http://lscc.co/essex-puts-cash-into-harlow-medtech/

Connections to other geographies: Examples of collaboration between key cities but also between key cities and other towns/cities and with their surrounding areas (including if that collaboration has created specific value).

Key Cities collaborate with other cities to grow their Life Sciences sectors and to have a wider regional or national impact. In doing this, Key Cities again exploit their strong higher education sectors to facilitate these collaborations.

The university of Oxford demonstrates an understanding of the importance of collaborations with industry in developing products that not only impact the local economy, but the UK and the world at large. For example, its Institute of Biomedical Engineering is undertaking research with large potential social and economic benefits, including therapeutic ultrasound, liver preservation, and remote patient monitoring using mobile phones. Output from this and similar research generate large social and economic impacts beyond the city of Oxford. Between 2010-2012, University of Oxford had the highest number of business spinouts in high-tech industries like biopharmaceuticals, with a large proportion of these spin-outs established by its graduates[49].

There are close connections between Cambridge and Oxford, where these Key Cities exploit each other's academic expertise and research excellence, for example in developing the science of experimental medicine[50]. Evidence of the importance of this collaboration is the support it received in 2014, when the Mayor of London launched Medcity, a £4.1 million investment partnership between UCL Partners, Imperial College, Oxford, Cambridge, and the Greater London Authority[51]. The aim of the program is to foster a "Golden Triangle" of innovation between London, Cambridge and Oxford.

Any examples of things that would support those sectors or particular barriers to growth?

The continued growth of the Life Sciences clusters in Key Cities is fostered by the right mix of proximity to factors that support and enable growth in Life Sciences. These include good access to IT companies, financial services, an excellent research base, and a political climate that issues growth enhancing regulations[52]. In Oxford, growth enabling factors include the proximity of Oxford to

[49] http://www.sqw.co.uk/files/2613/8690/7243/Oxford_engine.pdf
[50] http://lscc.co/wp-content/uploads/2013/11/report-mapping-this-sector.pdf
[51] http://www.sqw.co.uk/files/2613/8690/7243/Oxford_engine.pdf
[52] http://lscc.co/wp-content/uploads/2014/10/LSCC-Demand-side-report.pdf

Heathrow airport, its strong international reputation for academic excellence and its highly skilled labour force. These factors continue to attract investments in life sciences, and support the growth of existing businesses in the sector.

A key challenge for the Life Sciences sector in Key Cities is the limited availability of enabling infrastructure, such as manufacturing capacity that can easily mass-produce the drugs developed by pharmaceutical companies. Other challenges include securing investments and suitable workplaces[53]. In terms of workplaces, expansions are needed to increase space availability both within the Universities and across the cites, if start-up business are to be encouraged[54].

[53] http://lscc.co/wp-content/uploads/2014/10/LSCC-Demand-side-report.pdf
[54] http://www.sqw.co.uk/files/2613/8690/7243/Oxford_engine.pdf

The Education Sector:

Where is the sector prevalent?

Most Key Cities have well established Universities that have been around longer than most other sectors, and Universities are much less likely to relocate to other cities or countries because their identity is typically linked to their city. Key Cities with highly successful Higher Education sectors that have acquired world recognition as leaders of research excellence are Cambridge and Oxford. The Universities of Warwick, Bath and York are also highly acclaimed internationally.

What is a sector's value to a place (economic, social and environmental)?

Universities depend on the attractiveness of their location to attract students and staff, so they have an incentive to support their cities to grow. Universities support innovation driven growth in their local economies through knowledge exchange activities, commercialising innovative output, supporting innovative businesses, and promoting entrepreneurial talent among their students[55]. For instance, the University of Warwick is one of the largest employers in Coventry and the entire Warwickshire region. It employs more than 5,000 staff directly and it is estimated that it has generated 5,000 additional jobs elsewhere in the local economy. The Warwick Manufacturing Group is located on-site, and has brought in an investment of £85 million from Tata Motors. The University's Science Park contains more than half of the fastest growing firms in Coventry and the wider Warwickshire, employing about 2,000 staff across 150 companies[56].

Universities also help shape the workforce of their local areas by responding to skills needed in local industries. They often support their Local Enterprise Partnerships (LEPs) in developing economic strategies. They attract Foreign Direct Investment (FDI) to their local areas by providing a pool of skilled workers that encourage the development and growth of industry clusters, as seen in the Life Sciences and digital technology clusters in Oxford and Cambridge. Universities are also generators of employment, directly and indirectly. In 2011, through direct and multiplier (indirect) channels, UK universities generated over £73 billion, and over 750,000 new full time jobs, equivalent to almost 3% of UK employment in that year[57].

[55] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2015/the-economic-role-of-uk-universities.pdf

[56] https://www.gov.uk/government/publications/universities-and-growth-the-witty-review

[57] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2014/the-impact-of-universities-on-the-uk-economy.pdf.

How that place is already working closely with its industries to incentivise/grow etc. (including intentionally forming links between sectors)

Universities work closely with their local authorities and industries to facilitate innovative and inclusive growth. In Key Cities, there are several examples of these University-Industry collaborations.

The University of Warwick in Coventry has led multidisciplinary research into technologies that support the treatment of neurological disorders since 2000. In 2001, a spin out company was created from this research: Neurosolutions. This company was created to foster collaboration between industries and the University, and to commercialize research output. Neurosolutions employs 15 full time staff and generates an annual revenue of £1.4 million. Over the years, it has generated over £7 million worth of contracts from Life Sciences industries, and it supports around 100 industrial clients. It has also developed two patent protected compounds used in treating neurological disorders, and collaborates with Ampika Ltd, a life science business that was also spun out of research at the University of Cambridge, another Key City. Neurosolutions collaborates internationally, for instance with Japanese pharmaceutical company Sosei.[58]

The University of Bath is home to the Centre for Research in Strategic Purchasing and Supply (CRiSPS), a leading public procurement organisation that has worked with the NHS for 15 years. It is supported by several grants from the NHS, the Engineering and Physical Sciences Research Council (EPSRC) and the Chartered Institute of Purchasing and Supply. CRiSPS has helped save the NHS £500 million annually through informing an MBA module that trains NHS buyers on new approaches to procurement[59]. It has also designed methods for more efficient engagements between the NHS and small businesses, informing the Department of Health's commercial strategy. Supported by CRiSPS, the NHS negotiated a hearing aid contract which saved it £252 million on purchasing price alone, and £45.5 million pounds annually on maintenance costs. This is because the NHS previously purchased 450,000 analogue hearing aids annually, which cost £222 pounds per patient. With the changes informed by CRiSPS, the NHS now purchases 260,000 digital hearing aids that cost £60 each. This change is also beneficial to patients who now receive a superior hearing aid free of charge[60].

[58] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2015/the-economic-role-of-uk-universities.pdf
[59] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2015/the-economic-role-of-uk-universities.pdf
[60] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2015/the-economic-role-of-uk-universities.pdf

A University of Oxford's Edgeworth Professor of Economics, Paul Klemperer, helped the Bank of England respond to the Global Financial Crisis in 2007. He developed the "Product-Mix Auction" system that enables the Bank allocate loans to commercial banks within minutes, based on individual preferences and their balance of risky assets and government bonds. The use of the Product-Mix Auction system has continued even beyond the crisis, and it was adopted in 2010 as the Bank's standard system for long-term repurchase operations; its expanded use was further announced in 2013[61].

Coventry University, through its Enterprises Limited's Innovation Networks, has supported hundreds of SMEs; the University of Bradford's Centres of Polymer, Micro and Nano Technology has also done the same in Bradford. The University of Plymouth, in collaboration with the Plymouth City Council and Tamar Science Park, has brought together £120 million worth of business infrastructure and research facilities that support networking across the region and creates the potential for FDI[62].

Connections to other geographies: Examples of collaboration between key cities but also between key cities and other towns/cities and with their surrounding areas (including if that collaboration has created specific value).

Key City Universities collaborate extensively with Universities and industries in other cities to achieve growth inducing outcomes. The Key City Universities of Bath and Southampton, along with the Universities of Bristol, Exeter and Surrey, are the founders of the world's best University-led business incubator, SETSquared. This collaboration is aimed at supporting start-up businesses, by giving them access to academic research, enabling them to form research partnerships and collaborate with industry specialists. By 2016, SETSsquared had incubated more than 1,000 UK businesses and created 10,000 jobs; it generated £3.8 billion GVA and in 2015[63]. SETSquared also supports several graduate entrepreneurs through activities such as its annual Student Enterprise awards, its Innovation Training Programme for postgraduates, and its Business Planning and Pitching competitions.

The Universities of Bradford, Hull, York and York St John University, in partnership with the University of Leeds, Leeds Beckett University, Leeds Trinity University, University of Sheffield and Sheffield Hallam University, founded the Graduate Entrepreneurship Fund (GEP). This project, which ended in

[61] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2015/the-economic-role-of-uk-universities.pdf
[62] https://www.gov.uk/government/publications/universities-and-growth-the-witty-review
[63] http://www.setsquared.co.uk/global-1-university-business-incubator

2014, provided support to students and graduates that had excellent business ideas. The Universities secured two rounds of funding for the GEP, between 2007-2010 and 2011-2014, from the European Regional Development Fund (ERDF). The GEP project offered students and graduates access to a full time, on-site business advisor, a competitive proof of concept fund of up-to £1,000, and start-up grants of up to £2,500. It also offered workshops where participants are given the opportunity to work on their business ideas while having access to expert business advisors over a four-day "Boot Camp" period. This is in addition to networking events and workshops aimed at developing business and entrepreneurial skills in students. Between 2007-2014, GEP created 351 full time jobs and 278 businesses that survived for over a year. It helped a student develop a highly successful web browser, Waterfox, which attracted private investment from online security company VGA, and currently has over 3 million users world-wide[64].

The University of South Wales, which has campuses in Newport, Cardiff and Pontypridd, has a partnership with British Airways (BA), under which the University delivers courses in Aircraft maintenance, with industry training approved under the BA license. This has help address the shortage of skills in aircraft maintenance engineering, and has also provided opportunities for BA employees to take academic courses at the University, at both undergraduate and post-graduate levels[65].

In 2012, the University of Cambridge, in collaboration with University of Manchester, Imperial College London and Urbana Champaign University of Illinois, formed a partnership with BP to develop a $100 million, 10-year investment in the International Centre for Advanced Materials (BP-ICAM). This partnership aims to addresses the challenges faced by the oil and gas sector[66].

The University of Cambridge, University of East Anglia and the Cambridge and New Anglia LEPs also collaborated to exploit the benefits of common agricultural-technology research between their cities, with the aim of fostering and strengthening their comparative advantage in this area[67].

Coventry University was selected as one of the UK universities to lead research and teaching into Low Carbon Technologies. This entailed £8 million pounds of investment from HEFCE, which could lead to

[64] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2015/the-economic-role-of-uk-universities.pdf
[65] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2015/the-economic-role-of-uk-universities.pdf
[66] https://www.gov.uk/government/publications/universities-and-growth-the-witty-review
[67] https://www.gov.uk/government/publications/universities-and-growth-the-witty-review

a further £20 million of private sector investment. This initiative has also been supported by the Coventry and Warwickshire LEP[68].

Any examples of things that would support those sectors or particular barriers to growth?

A factor that supports the growth of UK Universities is the sustained government investment and funding they receive. This funding is sustainable and allows Universities to operate both autonomously and accountably[69]. Universities should also continue to be supported in their collaborations with industries and local authorities to foster innovative and inclusive growth. A potential barrier to growth is Brexit, which threatens to reduce flow of international talent to Universities, and to limit EU sources of funding and collaborations. There is also scope to better align collaborations and funding schemes in a way that facilitates efficient transformation of research output into inventions[70]. This would not only reduce delays in innovative ideas reaching maturity, but would also prevent "British ideas creating foreign industries"[71].

[68] https://www.gov.uk/government/publications/universities-and-growth-the-witty-review
[69] http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2015/the-economic-role-of-uk-universities.pdf
[70] https://www.gov.uk/government/publications/universities-and-growth-the-witty-review
[71] https://www.gov.uk/government/publications/universities-and-growth-the-witty-review, pp4.

Energy

Where is the sector prevalent?

Energy supply is ubiquitous across the UK and given the material nature of its distribution all Key Cities are implicated in one way or another in the energy sector. The Key Cities can be divided into three groups depending on the role of the energy sector in their economy.

The first group encompasses those cities that are carrying out important programs to become more efficient in the use of energy but whose energy sector has not had a strong link with other industries. This group includes Wakefield[72], Kirklees, Stoke-on-Tent, Newport, Oxford, Bath & North East Somerset and Derby, Salford, Wolverhampton, Southampton, Bournemouth, Portsmouth, Brighton & Hove energy and Southend-on-Sea.

The second group is formed of those cities which were historically involved in the energy sector and in which local governments have continued developing both traditional and renewable energies. This group includes Preston and Blackpool, Doncaster, Norwich, Kingston upon Hull.

The third group includes those key Cities where energy forms part of a separate industrial cluster, ie where the energy sector interacts with other industries in the area creating new business possibilities. Such places include York, Sunderland, Coventry, Plymouth & Tees Valley.

What is a sector's value to a place (economic, social and environmental)?

Energy is a key and rapidly changing sector: it is a critical input for most other sectors, for households and at the same time is undergoing massive changes as the UK makes the necessary transition to a sustainable economy. As such energy is important to all Key Cities, whether it be through improving the energy efficiency of their housing stock, through offshore energy initiatives or through local, small scale generation and supply. Energy is a clear example of a system of provision which has economic (it is a critical input to most other systems of provision), social (fuel poverty is a critical issue for many UK households) and environmental value for key cities (the transition to a sustainable way of living is, simply put, critical to the survival of the species).

[72] Wakefield did not have any specific plan of clean energy. The main source of income is the global companies Coca-Cola, Haribo and Warburtons. Thus, a waste power plant could be a good idea as it could use the organic waste of these companies. It could be something like the example of York.

What is the sector's growth potential in specific locations or combination of locations..

The transition to renewable energy is an urgent and imperative change for the UK in the coming years. This transition offers enormous potential for Key Cities as the energy sector moves away from fossil fuels towards renewable energy and implements energy saving measures.

To a greater degree than fossil fuels renewable energy can be locally generated (e.g. on-shore wind and solar energy). Local generation by very small firms and co-ops is growing, albeit from a low base, for example through community energy schemes for renewable energy[73], and has the potential to grow and to offer considerable benefits to Key Cities and local regions.

Furthermore the inevitable shake-up of the sector provides the opportunity for local supply which can help Key Cities. 'Focussing on supply in a defined geography has the potential to: expand the penetration of renewable energy, create new opportunities for smart grid investment, enable full utilisation of smart meter features such as demand management, enable new business models for energy efficiency, re-localise a portion of energy value, and address socio-economic issues such as fuel poverty.' [74]

Renewable technologies, such as offshore wind, are a great opportunity to create added value and jobs in small cities. An example of the size of this new industry is the new Siemens' turbine-blade plant opened in Hull in December which has created a thousand new jobs and sustaining a supply chain of smaller businesses servicing the industry[75] (notwithstanding the possible threats to this development from Brexit[76]). Furthermore such local energy developments are closely linked to other sectors including other target sectors. In particular new renewable energy generation is often linked to the digital sector, to research and development in the Universities sector, to advanced manufacturing and to Marine and Maritime as the UK seeks to harness tidal, wind and offshore sources of energy.

How that place is already working closely with its industries to incentivise/grow etc. (including intentionally forming links between sectors)

As noted all Key Cities are working closely with the energy sector for example to achieve energy efficiencies, to invest in carbon capture or to generate renewable energies. Here we present some examples:

[73] For Example, http://energy4all.co.uk/
[74] Hall & Roelich, 2015: 8
[75] Green book, 2015:93
[76] https://www.theguardian.com/politics/2017/apr/02/hull-after-brexit-will-the-city-of-culture-regret-voting-out?CMP=share_btn_tw

Preston and Black Pool. The energy sector employs more than 37,000 people in Lancashire and is closely linked to the University of Lancaster and the University of Central Lancashire, both internationally recognized as centres of excellence in energy and environmental studies. Heysham's two nuclear power plants currently represent one of the largest concentrations of power generation in the United Kingdom. Springfields Fuels is one of the leading fuel producers for all reactor designs and nuclear weapons in the world and it is located in the area. Regarding the new national nuclear strategy, the Lancashire Enterprise Partnership (LEP) aims to create a joint industrial strategy between Cumbria, Manchester, Cheshire and Sheffield for the nuclear sector throughout the north of England with the help of the Nuclear Advanced Manufacturing Research Center (NAMRC), based in Sheffield. The Heysham Port is also a major UK offshore supply base providing logistical support to one of the largest offshore gas fields in UK waters. Lancashire has potentially one of the largest shale gas reserves in Europe. Business zones near Blackpool Airport and Hillhouse International Business Park are important to the development of the energy sector. The main companies in the area are: Springfield Fuels, EDF, AMECPLC, SITA, Assystem and Westinghouse-Toshiba[77].

Doncaster. The Yorkshire and Humberside region produces the most CO_2 emissions in the UK thanks to the concentration of coal and gas fired power stations. To counteract this the Don Valley Power Project is the UK's leading carbon capture and storage project and will be based in Doncaster. It facilities the region to continue generating power from fossil fuels although it will also allow other energy intensive industries such as steel and cement production to install carbon capture technology to reduce their CO_2emissions[78].

Norwich. The Southern North Sea gas reserves make Norwich and Norfolk an important location for the the UK energy sector, e.g. Bacton Terminal on the North Norfolk coast processes around half the UK's natural gas and has the potential to act as a European hub for the large-scale storage of gas and captured carbon (CCS) from a new generation of coal and gas-fired power stations. Norfolk and Suffolk have offshore, marine, and subsea engineering, drilling technology and offshore decommissioning capabilities. The local supply chain has over 40 years' experience in oil & gas, nuclear, bio-energy and wind power. It is exploring prospects within 'new or early stage' subsectors such as CCS, gas storage, biomass energy, fuel cell technology and biofuels. The decommissioning of offshore gas platform is a major growing business opportunity, including replacing these traditional energy sources with off shore wind, wave and nuclear clean-up energy. The area also has the East of

[77] Lancashire Enterprise Partnership, 2016.

[78] Sheffield City Region, 2012.

England Energy Group and important incubation and innovation centers, including OrbisEnergy (offshore wind, wave and tidal) and Beacon Innovation Center (oil and gas and offshore engineering). OrbisEnergy is an international hub for supply chain development and has attracted major offshore wind developers in the region, including Scottish Power Renewables, Vattenfall and SSE Renewables[79].

Kingston upon Hull. Local government is focusing on supporting energy investment, energy production, energy conservation and future industrial energy possibilities as Vivergo's bio-fuels plants or the manufacture of off-shore wind turbines.[80]

York. The citiy's energy strategy is partly linked to the agro-industry for example a new horticultural glasshouse facility, using heat and electricity provided by a co-located Anaerobic Digestion (AD) facility will generate electricity from up to 60.000 tonnes of organic waste. In addition, it has extra-capacity to supply around 3.500 homes and inward investment into the area of around £23 million. It could save 20.000 tonnes of CO_2 emission per year and provide a boost for the bio-fertiliser industry in the area, which could be used by the local farming community[81].

Sunderland. The energy sector and automotive sector works together in Sunderland. For example Nissan is investing in electric vehicle production, including a battery plant and production of the LEAF car. This makes the city a natural leader in technological development and supports the supply chain in the area by transforming the North Eastern Local Enterprise Partnership (NELEP) to a Low Carbon Enterprise Zone. The city has been designated as the UK's low Carbon Economic Area for Low Carbon Vehicles, offering a wide range of opportunities for growth. On the other hand, the offshore renewables sector is growing in the Port of Sunderland, creating new opportunities in the surveying, construction and servicing elements of the offshore sector and the continuing development of develop sub-sea engineering services. Sunderland city Council are well aware of the potential of these low carbon activities (electric vehicles, offshore wind energy and software).[82]

Tees Valley. Renewable energy has a significant presence in Teeside, for example the Teeside Ofshore Wind Farm is a '27 turbine scheme … capable of delivering 62MW of low carbon electricity, … enough to meet the average annual needs of all the homes and businesses in nearby towns Redcar, Marske and Saltburn – approximately 40,000 homes.'[83] It is part of a Offshore Wind Cluster

[79] New Anglia, 2013
[80] Brady, 2013.
[81] Peel website.
[82] Council, S.C., 2014.
[83] https://www.edf.fr/sites/default/files/contrib/groupe-edf/espaces-dedies/espace-medias/dp/dp_edf-teesside-offshore-wind-farm.pdf

featuring the much larger wind farm development zones of Dogger Bank, and, closer to Hull, another Key City, of Hornsea.[84] The Port Hartlepool was site of much of the construction for the windfarm and remains the base for the operation and maintenance team, illustrating the importance of links between Energy sector, advanced manufacturing and the Marine & Maritime sector. At the same time 'Tees Valley emits approximately three times the amount of CO2 than other parts of the country' – offering the potential to reduce these emissions.[85] The Tees Valley aims to achieve these potential savings with a commitment to a circular economy, with carbon capture and storage and energy generation from chemical and polymer waste from its manufacturing firms.[86]

Coventry. The energy sector plays a crucial role in the economic development of Coventry and Warwickshire. It is the second most important industry after the automotive sector. The two sectors are linked are part of a cluster of advanced manufacturing with potential in the region (including aerospace, energy and renewable energy, automotive and automotive supply chain including low carbon vehicles and smart mobility). The West Midlands' low carbon vehicle and transport research capabilities include: MIRA near Nuneaton; TATA Motor's Technical Centre and research facilities in Ansty, Coventry; Jaguar Land Rover's design, engineering and research centres in Coventry and Warwickshire; Coventry University's Automotive Applied Engineering Research Group; the Centre for Hydrogen and Fuel Cell Research at University of Birmingham; the Manufacturing Technology Centre at Ansty Technology Park; Birmingham City University's Advanced Powertrain group within the University's Centre for Low Carbon Research; the National Automotive Innovation Campus at the University of Warwick; and Warwick University's UK Energy Storage R&D Centre for the advancement of electric and hybrid vehicle batteries. The major cities of the West Midlands (Birmingham, Black Country, Coventry, Solihull and Stoke) have great potential for the development of large and small scale renewable energies including biomass, biofuels, anaerobic digestion, wind energy, geothermal, photovoltaic, solar thermal, heat of terrestrial and aerial origin and chains of energy supply. There are also large-scale opportunities for energy recovery from waste, district heating networks and the combination of heat and electricity linked to new developments and regeneration schemes in urban areas.[87]

Plymouth. The Research Institute for Marine Renewable Energy (PRIMaRE) is an institute formed by a partnership between Exeter and Plymouth Universities. it works at the core of a cluster that joins the

[84] http://www.pdports.co.uk/Documents/Media%20Centre/Additional%20Downloads/The%20UK%20Offshore%20Wind%20Supply%20Chain%20-%20Why%20Clusters%20Matter%20(Final).pdf

[85] https://teesvalley-ca.gov.uk/wp-content/uploads/2016/03/Tees-Valley-Economic-Assessment-2016.pdf

[86] https://teesvalley-ca.gov.uk/what-we-are-delivering/key-strategies/strategic-economic-plan/

[87] Sustainability west midlands, 2012. Available at: http://www.sustainabilitywestmidlands.org.uk/wp-content/uploads/SWM_Low_Carbon_Prospectus_LoRes-FINAL.pdf.

Royal Navy, which has a large experience in naval engineering skills, the Plymouth Marine Laboratory, the Sir Alistair Hardy Foundation, the Marine Biological Organisation and the National Marine Aquarium in order to develop wave, tidal and offshore wind energy resources and became one of the UK's very important future energy sources.[88] South West Marine Energy Park (SW MEP) is a collaborative partnership between local and national governments, Local Enterprise Partnerships, technology developers, academia and industry that seeks to boost the marine energy sector in the South West region. One of the main goals is to support the commercial expansion of the renewable energy industry by providing infrastructure, fostering collaboration and creating a positive business environment to attract investment. It also promotes nuclear energy as an opportunity for energy development[89].

Kirklees. Local government has invested in small-scale energy projects, a process that has seen several council buildings and municipal housing equipped with small-scale renewable power plants[90].

Stoke-on-Tent. Stoke has focused its energy strategy in Low Carbon Energy Generation (Technology) District. The City Deal has proposed to use the pioneering geothermal district heating system.[91]

Newport. Renewable energy targets for the county have been proposed for high and low scenarios of resource exploitation. Thera are opportunities for communal energy systems in three areas: Mamhilad, Llanfrechfa Grange, and to a lesser extent the Canalside mixed use development, although without linkage to surrounding areas. There are potential opportunities to link in with standalone projects at two of the sites: wind and hydro at The British; anaerobic digestion and solar at Mamhilad.[92]

Oxford. The Oxford County 100% Renewable Energy Plan is a community energy program based on the commitment of Oxford County on June 24, 2015 to achieve 100% Renewable Energy by 2050. It aims to use the development of photovoltaic, biomass, biogas and solar thermal energy.[93]

Bath. Bath & North East Somerset have focused their energy strategy on the reduction of carbon emissions with the following targets: increase the use of renewable energies as sources of funding; increase local control over energy costs; retain economic benefits locally to make sure that money and jobs stay in the area; and involve the community in the process of energy change.[94]

[88] South West RDA; Vantoch-Wood et, al., 2012.
[89] Regen SW, 2014
[90] Burton and Huvacek, 2007.
[91] Stoke-on-Trent Council, 2015.
[92] Evans, et al., 2013.
[93] Warden and Members of County Council, 2016.
[94] Community Energy Strategy 2015- 2018, 2015.

Derby. Derby has tried to reduce its reliance on energy from fossil fuels through a locally generated, diverse, efficient and more secure energy supply. It will promote a wide range of commercial and domestic heating and electricity technologies, such as combined heat and power, heat pumps, biomass boilers and other efficient applications. The city will also develop a network of different sources of heat and energy including combined heat and power, renewable energy such as wind, solar energy and energy through anaerobic digestion and gas.[95]

Southampton. Southampton started an ambitious project of energy reconversion trying to lay down a low-carbon energy supply mix instead of the previous carbon intensive supply. The city is aware of its exposition to floods and the problems that change climate can cause in the area. The city is following a planning policy which tries to coordinate different social agents: universities, private sector and citizens in its effort to prepare for these contingencies. It is developing sectors such transport, telecommunications, housing, green network and open space, waste management, and energy supply to provide the right environment for low carbon business as a tool for cementing inward investment.[96] Southampton is also pioneering the use of eco-friendly transport services and one proposal was to build a coastal hydrogen power plant to achieve zero-carbon emissions public transport.[97] The city is participating in the development of South West Marine Energy Park which aims for job creation, private investment, and an opportunity for fostering sustainable development through renewable energy (wave and tidal) at the core of the process[98].

Bournemouth. Dorset contains key businesses working directly in renewable energy. The county wants to attract companies and there are opportunities for wave and tidal power as well as good levels of solar radiation services. These activities will be supported by Local Authority Leaders.[99]

Portsmouth. The city has made it a priority to reduce the demand for energy and to ensure that the sources of energy are sustainable. This includes increasing renewable energy usage and decentralized energy schemes such as community heating, combined heat and power and energy from waste. Within Portsmouth's Local Development Framework is the Portsmouth Plan, outlining the policies necessary to assess planning applications for new buildings in the city. In this sustainable development policy, there are proposals for new developments to maximise solar energy generation and contribute to the provision of renewable energy as a means to achieve carbon neutrality.[100]

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[95] Derby City Council, 2014
[96] Southampton City Council, 2011.
[97] Chakraborty et at., 2013.
[98] South West Marine Energy Park, 2015.
[99] MacRury, I., 2014.
[100] Portsmouth Sustainability Action Group, 2009.

Marine & Maritime (M&M)

Where is the sector prevalent?

Maritime and Marine activities are present across the coastal Key Cities, important examples include:

- Portsmouth is one of the largest ports in the UK[101].
- Plymouth has a large and vibrant M&M sector, e.g. it is home to PRIMaRE, which is a reference centre for research and technology in off-shore renewable energy[102],
- The port of Southampton is a key international gateway in the UK, is a critical component of the nation's transport system to both the functioning of the very transport system, and to the economic success of the country as a whole[103].
- The Port of Newport is the largest general cargo port and the UK's second largest conventional steel handling port
- Teesport is one of the UKs biggest ports. It has two container facilities, three general cargo berths, roll-on roll-off ferry services to Europe, and a vast storage and warehousing capacity.[104]

Note that the EU's Blue Growth Strategy targets a broad range of maritime activities as Blue Growth Sectors including: aquaculture (including fisheries); coastal tourism; marine biotechnology; ocean energy; seabed mining. [105]

- Blackpool has extensive coastal tourism and is attracting business in the form of conventions and conferences[106].
- Brighton marina is a multipurpose leisure complex and the largest marina in the UK. Brighton belongs to Sussex County, which is primarily a marine service area, although boat building and marine engineering are present[107].

but also in London thanks to UK's strong position in marine business services e.g. Lloyds of London.

What is a sector's value to a place (economic, social and environmental)?

The importance of global value chains to the wider economy suggests ports and shipping will continue to be an important element of infrastructure in the UK economy: 'around 95% of goods that

[101] UK Trade & Investment, 2013.
[102] Robins, 2011.
[103] ABP Port of Southampton, 2009
[104] http://www.pdports.co.uk/en/our-locations/teesport/
[105] Salvador, Simões, & Soares (2015)
[106] The Grown Estate, 2008.
[107] Robins, 2011.

the UK imports and exports are transported by sea. This includes about 40% of our food and about one quarter of our energy, around 95% of goods'[108]. Ports, shipping and associated logistics will continue to provide jobs for the UK as well as facilitating wider economic benefits for UK trade.

Some examples…

'The Port of Southampton is: The UK's number one vehicle handling port; Europe's leading turnaround cruise, welcoming 1.7m passengers every year; Contributes over £1bn to UK economy every year; is home to the new 500m deepwater quay SCT5, which was purpose built to handle the biggest ships in the world

The Naval Base in Portsmouth employs 12,130 split between MOD, Flotilla, BAE Systems and Serco. It contributes £450m to the Portsmouth economy every year with £1.6bn GVA of output per annum. The Base supports 1200 suppliers, 23 of these are based within the Base.

The Naval Base & Dockyard directly support 8.4% of Plymouth's total Full-Time Equivalent (FTE) employment and 11.8% of its Gross Value Added (GVA). It is the primary UK location for deep maintenance of surface and submarine vessels, including up-graded facilities for nuclear submarine work. Devonport is the largest Naval Base in Western Europe (650 acres).'[109]

What is the sector's growth potential in specific locations or combination of locations..

"The maritime sector is global in nature, mobile and growing with ships carrying 80% of global trade. Seaborne trade is predicted to double by 2030 in line with the forecast growth in international trade. The UK is ideally positioned to exploit these conditions and drive growth in the UK maritime sector. The evidence collected during the Study demonstrates that the UK continues to be seen by the international market as a world-leading maritime centre. It also shows that the UK remains highly competitive, particularly in the field of maritime business services, maritime education, training and skills and marine manufacturing, engineering and research. The UK maritime cluster's contribution to the economy is already substantial and, with the right conditions, can be grown further. However, this potential growth and the UK's international position cannot be taken for granted. In the face of

[108] 'Around 95% of goods that the UK imports and exports are transported by sea. This includes about 40% of our food and about one quarter of our energy. The sector employs at least 113,000 people and generates at least £11 billion as a contribution to the UK economy. An estimated 23,000 UK nationals were seafarers working regularly at sea in 2014.' Ibid: 14 Dept of transport (2015) Indeed the World Bank's Liner Connectivity Index suggests the UK is improving it's ports. (http://data.worldbank.org/indicator/IS.SHP.GCNW.XQ?locations=GB)

[109] Great South Coast Brochure

increasing competition from fast-growing maritime centres in other countries the UK maritime sector must be willing to adapt, improve and change to successfully exploit these opportunities."[110]

The Maritime sectors off potential for shipping and port management and for maritime business services. 'Transport investments can induce positive productivity benefits through agglomeration economies, increasing the scale and efficiency of spatial economic interactions'. [111] The importance of just-in-time delivery for today's global value chains means that investments in ports, shipping and associated logistics can benefit the broader economy facilitating both necessary imports and exports. For example Tilbury's expansion is in part based on the importance of just-in-time delivery and is accompanied by the development of new logistics centres. [112]

The UK is dependent on seabourne trade and ports are obviously very location specific (they cant easily be moved!), never-the-less globalisation offers both a threat and an opportunity in shipping, ports and associated logistics. Shipping ownership / management / registration , maritime business services and port management (e.g. Pireus[113]), are subject to global competition. Brexit too offers both threats and opportunities, in fishing in particular, some expect closure of UK waters to European fishing boats to provide a net gain for the UK's fishing sector.[114]

Perhaps the greater potential for growth comes from developing a 21st century marine sector around ports already handling shipping of imports and exports. In the Marine sector global competition is also an important factor: Marine sector activities are typically part of a global value chain and activities can easily be switched to other locations. Indeed, the problems of de-industrialisation are often linked to global competition and to the dependence of many medium sized cities on a single industry, for Key Cities the decline of coal mining and ship-building offer painful examples. Attempting to compete for high-value parts of the value-chain can help increase stickiness as there is less global competition but competitive pressures remain and vulnerability remains.

Key Cities however are showing that by clustering a range of activities based broadly around Marine and Maritime it is possible to compete on more than price and thereby insulate themselves against simple displacement of activities by low cost global rivals. ***Such clusters offer great potential to Key Cities, and to combinations of Key Cities.*** Marine & maritime clusters typically feature a range of marine and maritime activities as well as strong links to other sectors including renewable energy (e.g. tidal, wind and other offshore energy) and local universities e.g. universities of the south coast

[110] Department for Transport. 2015
[111] Department for Business Innovation & Skills (2012: 12)
[112] https://www.ft.com/content/f4c2363a-e88e-11e6-967b-c88452263daf
[113] https://www.theguardian.com/world/2014/jun/19/china-piraeus-greece-cosco-thessaloniki-railways
[114] https://www.ft.com/content/aa38a210-faaa-11e6-9516-2d969e0d3b65

marine cluster provide research and facilities and in return develop world class academic research. As noted above this can be extended to include coastal tourism, aquaculture (including fisheries), marine biotechnology and so on. Plymouth for example is 'pushing ahead with plans for a £10million-plus international cruise ship terminal'[115]

How that place is already working closely with its industries to incentivise/grow etc. (including intentionally forming links between sectors)

The Key Cities of Portsmouth, Plymouth and Southampton are working together to grow the sector across the south coast. They are a part of the South Coast Marine Cluster (SCMC) who's 'purpose is to stimulate greater marine and maritime-related economic growth and productivity across the UK's south coast'[116]

'This will be achieved by research institutions, LEPs and local government collaborating to; stimulate further innovation within existing south coast businesses; help businesses to export; showcase our region's strengths nationally and internationally; and promote the importance of the sector to policy-makers.' For example Plymouth's South Yard 'will become a new enterprise zone and hub for marine companies', following transfers from the ministry of defence to Plymouth City Council.[117]

As they claim, a 'Strong maritime heritage and cutting-edge R&D attract a growing network of scientific, advanced engineering and high-tech manufacturing companies. This exciting industry cluster, allied to world-leading universities, boasts a highly skilled workforce, significant business support and attractive relocation sites.'

When it comes to research activities the south coast includes the 'UK's two largest marine universities' and the 'UK's four largest and most renowned non-university institutions undertaking marine research' and the region's universities head tables of published papers researching Marine, Ocean and Coastal Marine subjects.[118] Connections with the education sector, in particular here higher education, are of critical importance to the sector in these Key Cities, helping tie the sector to the local economy and society. The SCMC features Universities of Exeter, Portsmouth, Plymouth and Southampton and the Southampton Solent University.

[115] http://www.plymouthherald.co.uk/city-pushing-cruise-ship-terminal-scheme/story-26420914-detail/story.html#rJ7ajIm1buB8F00m.99
[116] SCMC Terms of Reference.
[117] Investment Is Great Britain, undated, 'Opportunities on the UK's south coast Home of world-class marine and maritime expertise'.
[118] SCMC World Leading Innovation-led Marine & Maritime Cluster

Ports also form key components of other industry clusters which look to connect firms all along the supply chain. Links to offshore energy can be found in many of the Key City ports, for example Teesport is a hub for an offshore and renewable energy cluster in the North East, building on its history in offshore oil and gas energy[119]. But Teespoort is also part of the North Each Process Industry Cluster. [120]

[119] http://www.pdports.co.uk/Documents/Media%20Centre/Additional%20Downloads/The%20UK%20Offshore%20Wind%20Supply%20Chain%20-%20Why%20Clusters%20Matter%20(Final).pdf

[120] http://www.pdports.co.uk/Documents/Media%20Centre/Brochures/Teesport_2013-14.pdf

Advanced Manufacturing

Where is the sector prevalent?

Key Cities where the advanced manufacturing sectors of automotive and aerospace are present include: Preston and Blackpool, Derby, Portsmouth, Coventry, Wolverhampton, Stoke-on-Trent, Tees Valley, Oxfordshire, Yorkshire & Sunderland

What is a sector's value to a place (economic, social and environmental)?

The British aerospace industry is one of the largest in the world[121]. Studies show that both aerospace and automotive industries generate significant pull through demand on key goods and services across the economy[122]. Gross value added grew on average by 4% per annum between 2009 and 2015 (in real terms), compared to only 2% for the manufacturing industry and 1% for the whole economy. Increased global aviation traffic demand is expected to drive growth in the global civil aerospace sector in the medium-term, with forecasted demand rising to 33,000 new aircraft worth over $5 trillion up to 2034[123].

What is the sector's growth potential in specific locations or combination of locations..

Preston and Blackpool. Lancashire is one of the UK's leading regions for aerospace manufacturing and related industries. It has rapidly introduced the creation of a cluster energy, advanced manufacturing, chemicals and automotive sectors, in doing so becoming one of the largest such groupings in the world. The county hosts the single largest concentration of aerospace production in the UK, employing over 20,000 people. The main companies in the area are BAE Systems, Rolls Royce and Safran-Aircelle, although PACCAR (Leyland Trucks), Piolax, Sanko-Gosei, Erlson, Futaba-Tenneco and TRW Automotive also are investing in the region. These companies have attracted and support strong supply chains, focussed on the supply of high value parts to the UK and European Original Equipment Manufacturers (OEMs), but also in activities such as design, testing, repair or maintenance. In short, Lancashire has developed a significant cluster of innovative design and development companies, including Torotrak, Clean Air Power and Scorpion Automotive[124].

[121] Bis, 2016: 1: https://www.gov.uk/government/publications/uk-aerospace-supply-chain.
[122] Bis, 2012: 32: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/34607/12-1140-industrial-strategy-uk-sector-analysis.pdf.
[123] Bis, 2016: 4: https://www.gov.uk/government/publications/uk-aerospace-supply-chain.
[124] Lancashire Enterprise Partnership, 2016.

Derby. Derby is home to a significant part of the industry in the region. Its good connections make it a hub for labour, goods and services flows. It is an area of engineering excellence in the Aerospace, Rail and Automotive sectors and is an attractive place to live due to a relatively affluent and highly skilled workforce.[125] The aerospace and rail industries are two of the main drivers of regional economy[126] and Rolls Royce and Bombardier have an important presence in the city. The rail cluster is mainly focused on growth markets with core competencies in consultancy, infrastructure engineering and rolling stock supply. The main activities and competencies of this cluster are: rolling stock and high-reliability component manufacturing supply chains; infrastructure design and construction; rail engineering consultancy and project management; and, rail vehicle leasing and train operation companies. Overall, over 250 East Midlands supply chain companies are part of this industrial agglomeration that produces a high level of innovation and indirect positive effects. The Derby cluster has a world-renowned reputation for advanced rail engineering. The Midlands Aerospace Alliance and the Derby and Derbyshire Rail Forum are members of the East Midlands Business Sector Alliance which plays an important role as an association with the capacity to manage a full network of companies with diverse knowledge of their sectors; as a lobby specialised in policy interventions, particularly, in innovation area, productivity and skills; as a unified voice for their industry, and as a strategic partner for EMDA and other regional and sub-regional public sector bodies.[127]

Portsmouth. Aerospace and defence are significant industries in the city and the wider area, and the manufacture of aircraft and spacecraft is an important source of employment (direct and indirect).[128]

Coventry. Coventry remains a powerhouse of the automobile industry. One of the most significant firms in the region is Jaguar Land Rover (JLR)[129]. The automobile sector is strongly linked with Coventry University, which is well-known for its courses on automotive design including participation by leading firms.[130] In the wider area around Coventry, Warwickshire more generally is world-renowned as the home of advanced manufacturing and automotive engineering. Academically, their research in the sector is also recognized worldwide. The sector generates a large number of jobs directly but also indirectly thanks to its spill-overs onto other sectors such as energy. There are also projects fostering investment in low carbon vehicles, which involve both automotive and energy industries with a strong participation of the local vehicle engineering expertise. The area is becoming

[125] Derbyshire Economic Partnership.
[126] Dhirendra Kumar, 2010.
[127] EMDA, 2007.
[128] Hampshire et al., 2006.
[129] Amison & Bailey, 2014.
[130] Macneill & Liu, 2012.

a reference in supporting organizations that operate in the fields of electric, electric hybrid, fuel cells, hydrogen power systems and light-weight materials. Firms dedicated to Intelligent mobility sector are adapting technologies for designing the future transport networks; from remotely-operated vehicles to developments in iPad applications and medical diagnostic equipment[131].

Wolverhampton Wolves has a an international cluster of firms working on the design and manufacture of aircraft and automotive components based on aero-engine parts and subassemblies (manufacture), general engineering in treatment and coating or metals and air navigation instruments and systems (electronic manufacture).[132] The city has become a global innovation centre with expertise in design, manufacturing and materials, university research, world class supply chains and skilled labor. There exist collaborative relationships such as the Caparo Innovation Centre at Wolverhampton Business Solutions Centre, and Knowledge Transfer Partnerships (KTPs) provided by the University of Wolverhampton to allocate resources to high-tech researches.[133]

Stoke-on-Trent. Stoke is linked to the aeronautical and the automotive technology sectors that are present across the Midlands. This city has a large number of transport-related supply chain companies[134].

Tees Valley. The Tees Valley is one of the cities with most potential in the UK. It has a strong advanced manufacturing sector with expertise across automotive, subsea, renewable energy and engineering design[135]. Tees Valley's business base is critical to supplying key UK industries, particularly automotive, oil and gas and aerospace and has seen a net increase of private sector jobs since 2011, and excellent connectivity and leading knowledge centres. All these industries compose a cluster of multinational corporations and innovative SMEs developing high level expertise in manufacturing, design and research and development. The city is in the vanguard of the UK's drive for export-led growth based on advanced manufacturing, and it is a source of opportunities in engineering, automotive and rail sectors. Process engineering is developing thanks to innovative SMEs and OEMs such us Airbus, Boeing, Honda and Jaguar Land Rover. In the automotive industry, the city is endowed with a growing supply chain of SMEs and larger businesses supplying major Tier 1 and Tier 2 automotive manufacturers, including Cummins designing the next generation of diesel engines at Darlington, Mitsubishi Chemical Corporation producing chemicals for electric vehicle batteries, Caterpillar working on cranes and trucks and Nifco, ElringKlinger, TMD Friction and others

[131] Partnership, L.E., Clink, T.O. & Holloway,
[132] Invest Black Country, 2014.
[133] City of Wolverhampton Council, 2015.
[134] Stoke-on-Trent & Staffordshire Local Enterprise Partnership, 2014.
[135] Helyer, A.R. & Lee, D., 2010

supplying parts to OEMs, such as Nissan and Jaguar Land Rover. Finally, the rail sector has a strong position with firms like Henry Williams, which supply the rail industry.[136]

Oxford. Oxfordshire is a leading city in the advanced engineering and sector internationally manufacturing (especially in automotive and motorsport). It is at the heart of 'Motorsport Valley', hoem to four Formula 1 teams: Lotus F1, Williams F1, Caterham F1 and Marussia F1 supporting 4,000 high performance engineering companies employing around 40,000 people in the area. The automotive sector is strengthened by the presence of BMW Mini and Prodrive, a consultancy that designs, builds and runs motorsport and vehicle technology programmes for vehicle manufacturers and that works with the motor, aerospace, defence, marine and other high tech sectors to produce machined, fabricated and composite parts. The automotive sector has a strong link with Oxford Brookes University that offers a diverse range of undergraduate and higher degrees in automotive and motorsport technologies. The Oxford advance Propulsion Centre is seeking to become the UK's leading developing technology institution and a stream of skilled engineers[137].

Yorkshire has a significant proportion of automotive component supply and engineering with a concentration of more than 500 automotive suppliers, employing around 13.500 people involved in the manufacture of raw materials, door seaks, bearing, mechanical products and clutches[138].

Sunderland. Sunderland is well known for its important Nissan plant which has grown significantly and has invested in alternative fuel technology, linking it to the energy sector.[139]

How that place is already working closely with its industries to incentivise/grow etc. (including intentionally forming links between sectors)

Much interaction between government and the aerospace and automotive industries occurs at national level. Here we highlight a few examples.

Aerospace industry

In aerospace there is almost a monopsony of military aircraft, helicopters and missiles, where all demand comes from governments. Therefore, the government can use their purchasing power to influence in the Industry's size, structure, conduct, performance or ownership. The government is

[136] Hon, T.R., Heseltine, Lord & Ch, T., 2016
[137] Oxfordshire LEP, 2014.
[138] Mullen et al., 2009.
[139] Henry, 2012

also highly influential in civil aerospace markets. It controls and regulates property rights determining landing and over-flying rights for UK airspace[140].

The Government supports aerospace exports mainly though the UK Trade and Investment Defence and Security Organisation (DSO) and UK Export Finance. The UK Trade and DSO work with UK companies for export and to build and strengthen relationships with overseas customers and to promote the UK's brand.[141]

UK Export Finance (UKEF) is the UK's export credit agency. It provides insurance to exporters and guarantees to banks in order to earn a share the risk of financing UK exporters. UKEF also supports loans to foreign companies that buy goods and services from UK companies[142]. UKEF support for the export of Airbus aircraft is provided alongside that of the French and German ECAs; usually, it is arranged on a reinsurance basis whereby one of the three ECAs leads a transaction while the other two provide support to the lead ECA. The percentage of the financing varies depending on the aircraft type and the engine[143].

The Sharing in Growth (SiG) organisation through Regional Growth Funds is involved funding the National Aerospace Technology Exploitation Programme (NATEP), for example introducing a £6m bursary to fund 500 new graduates and employees to study Masters (MSc) level degrees in aerospace engineering, and through greater collaboration within the supply chain[144].

The Aerospace Growth Partnership (AGP), composed by industrial companies and Government[145] has tried to keep the UK's international competitiveness by boosting the opportunities and minimizing the threats and barriers to growth for the industry. In addition, it has defined the areas where the government can help to create a sustainable, long-term future for the industry[146]. The main points of collaboration between Government and industry are[147]:

- Supporting successful Industrial Strategies with impact in global investment towards the UK.

[140] Bis, 2010: 164-165: http://webarchive.nationalarchives.gov.uk/20121212135622/http:/www.bis.gov.uk/assets/biscore/economics-and-statistics/docs/10-781-bis-economics-paper-06.
[141] Bis, 2016: 1-10: https://www.gov.uk/government/publications/uk-aerospace-supply-chain.
[142] Bis, 2016: 1-10: https://www.gov.uk/government/publications/uk-aerospace-supply-chain.
[143] Finance, U.K.E., 2013: 13-14.
[144] Bis:2016: 8: https://www.gov.uk/government/publications/uk-aerospace-supply-chain.
[145] It is managed The Department for Business, Innovation and Skills (BIS).
[146] Bis: 2016: 13: https://www.gov.uk/government/publications/uk-aerospace-supply-chain.
[147] ADS, 2016: 4: https://tfl.gov.uk/corporate/about-tfl/what-we-do/london-underground/facts-and-figures.

- Improving productivity throughout the supply chain (thought investment in skills, technology and innovation).
- To support the R&D in the UK to upgrade internationally.
- To maximise opportunities and remove barriers in new markets.
- To improve exports, SMEs international posts, and refreshing defence industrial policy.

Automotive industry

Government and industry have co-invested in R&D initiatives. The High Value Manufacturing Catapult, which has encouraged Foreign Direct Investment (FDI). The Advanced Propulsion Centre (APC) to develop connected and autonomous vehicles[148].

The Automotive Council creation has been one of the most important government support institutions to the automotive industry. It brings the possibility to raise problems and formulate solutions across the supply chain and with government[149]. It leads the Long-term supply chain competitiveness programme (LTASC), with the SMMT. It supports the individual needs of automotive suppliers of all sizes in the next years. The most relevant LTASC project is Delphi and Toolspec[150].

The Automotive Investment Organisation (AIO) was founded in 2013 by UK Trade and Investment to lead international automotive component manufacturers to fill the gaps in the UK supply chain through inward investment in UK production facilities. The goal was to safeguard 15,000 supply chain manufacturing jobs through inward investment over 3 years. This represents a doubling of the figure for 2010-2013.

[148] Automotive Council, 2015: 12: http://www.automotivecouncil.co.uk/wp-content/uploads/2015/11/1511-Automotive-Council-UKIC-Report.pdf.
[149] Rhodes, 2015
[150] Davies, 2015: 6: http://www.automotivecouncil.co.uk/wp-content/uploads/2015/03/Growing-the-UK-auto-supply-chain-March-2015.pdf.

Final Summary

The overall picture developed in this initial research is of a strong connectivity between the Key Cities, their identified sector and the wider economy. This connectivity delivers numerous benefits including sophisticated, targeted investment to support and develop the identified sector and regional economy, but also a comprehensive understanding of the economic, social and environmental costs and benefits of a decision. Key Cities are flexible and adaptive, often able to utilise local knowledge and resources to develop sustainable growth in the identified sector and wider economy.

This report presents an initial investigation (supplemented in the appendices) of the various Key Cities and sectors, including an examination of their growth, employment and enterprise creation as comparisons between the cities. Following this investigation, a series of interviews were conducted providing in depth insight into the connectivity and relationships between Key Cities and their economies and sectors. This revealed a strong, mutually beneficial relationship and a view of the local university (or universities) acting as a vital component in the creation of a successful economic system. Several success stories of Key City and University collaboration suggest that universities are a strong driver of regional growth and help create the environment for growth in the Key City region. Furthermore we present a holistic overview of the identified sectors in order to develop an understanding of the interconnectivity of Key Cities and the identified sectors. We find from the interviews, that Key Cities often have the ability to respond to challenges and opportunities in a timely yet strategic manner due to their in depth local knowledge and strong partnerships with their identified sector, wider economy and reginal stakeholders.

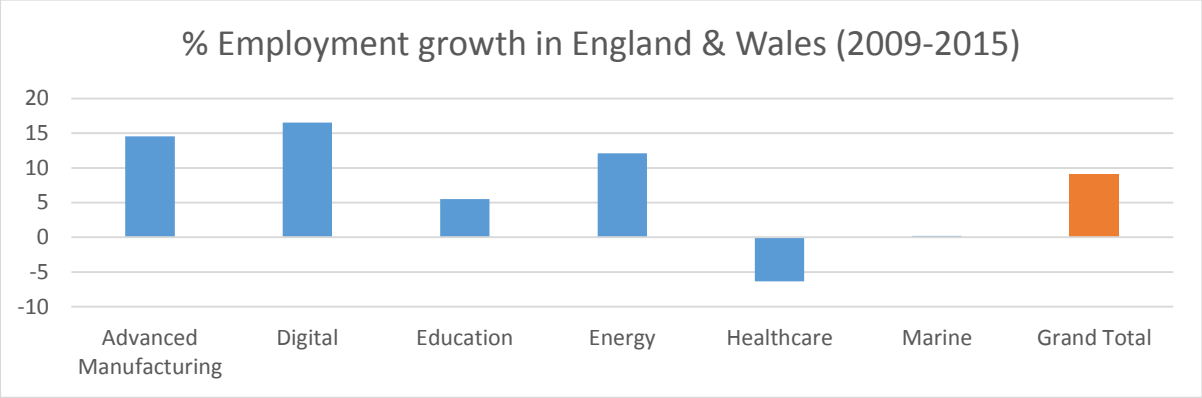
Key Cities face numerous challenges, from the legacy of deindustrialisation to the contemporary challenges of Brexit. However their strong knowledge of their geographies, willingness to use local resources and partner with regional stakeholders could allow them to create an environment for growth.

Appendices

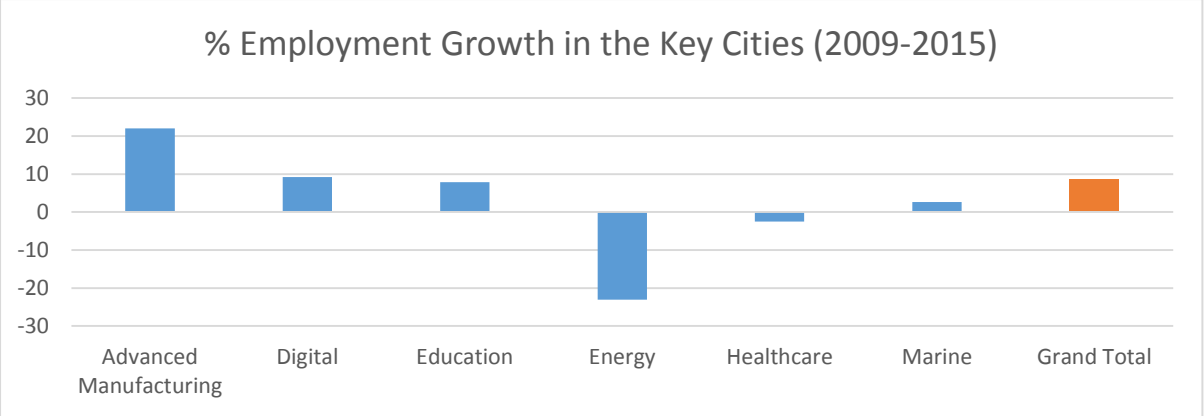
Further examination of Key Cities and the Identified Sectors

Key trends

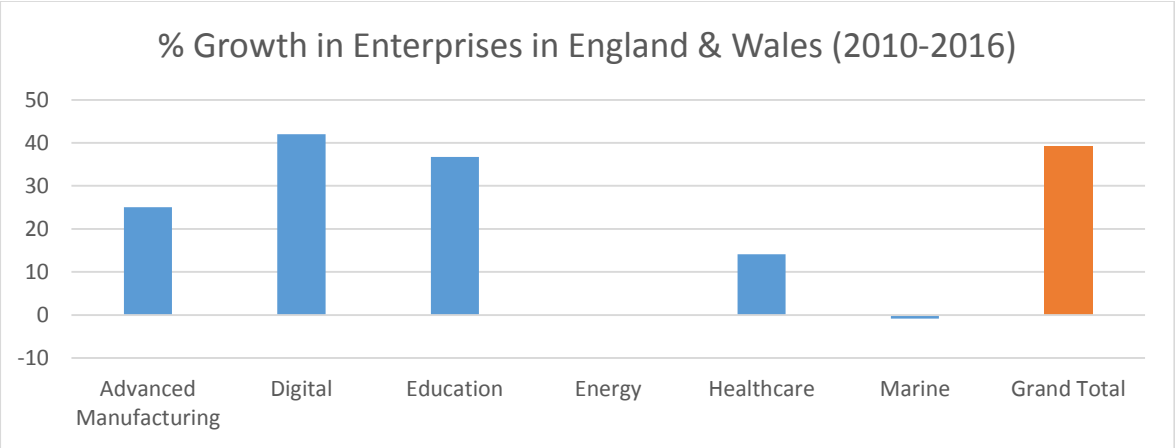
The six identified sectors, across England and Wales, have seen employment average employment growth of 9.1% between 2009 and 2015, though differences emerge across each of the key sectors. Digital (17%), advanced manufacturing (15%) and energy (12%) see the largest growth, with education (5%) and marine (0.2%) much lower. Healthcare is the only one of the key sectors across England & Wales that shows a contraction in employment over this period (-6%), likely caused by continued fiscal consolidation by government



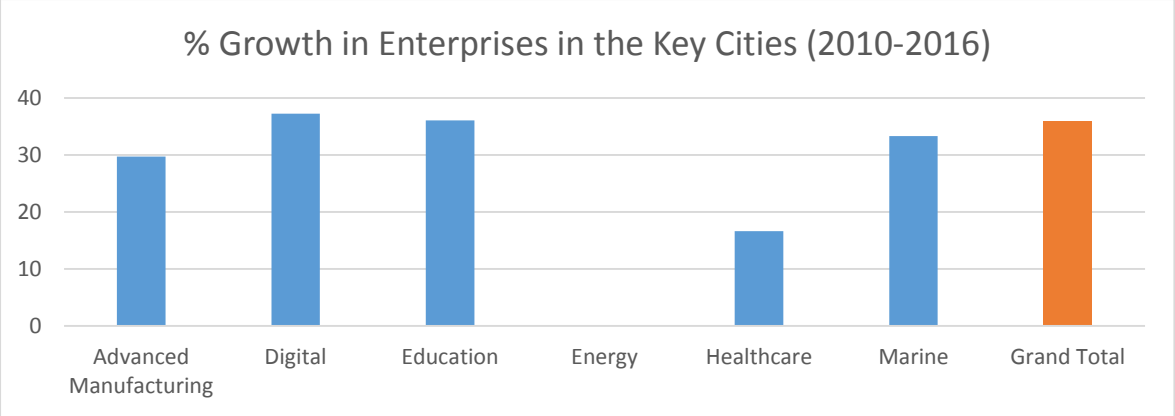
Across the Key Cities at local authority level, the pattern is similar (8.5% growth overall), though with differences in the make-up of each sector to the overall growth patterns. Advanced manufacturing makes up a larger share of overall employment growth compared to the England and Wales average with an increase of 22% over the period 2009-2015 and education, too, sees growth of larger than that of the country overall (8%). Digital, whilst expanding in the Key Cities by 9% over this period, is somewhat lower that the average, likely caused by growth in the digital sector heavily focused on a small number of major cities such as London and Manchester. Healthcare also shows a loss of headcount, but lower than that on average (3%) whilst marine shows a small increase of 3%, though heavily focused around a small number of cities.



For the number of enterprises across England & Wales in the key sectors there is also strong growth across England & Wales with an increase of 39% between 2010 and 2016. Growth is strongest in the digital (42%) and education (37%) sectors, but advanced manufacturing (25%) and healthcare (14%) also see healthy expansion. The marine sector sees a small contraction of 1%. The energy sector shows in the raw data a very large increase in the number of enterprises, from under 200 to over 3000, but there are limitations to the use of this data that are discussed in the methodology. For this reason, growth rates for the energy sector are not shown.



Within the Key Cities themselves, the pattern is similar, though the marine sector has seen much stronger growth than the national average, caused by large increases in those cities with existing port facilities such as Tees Valley and Southampton, albeit from low nominal base.

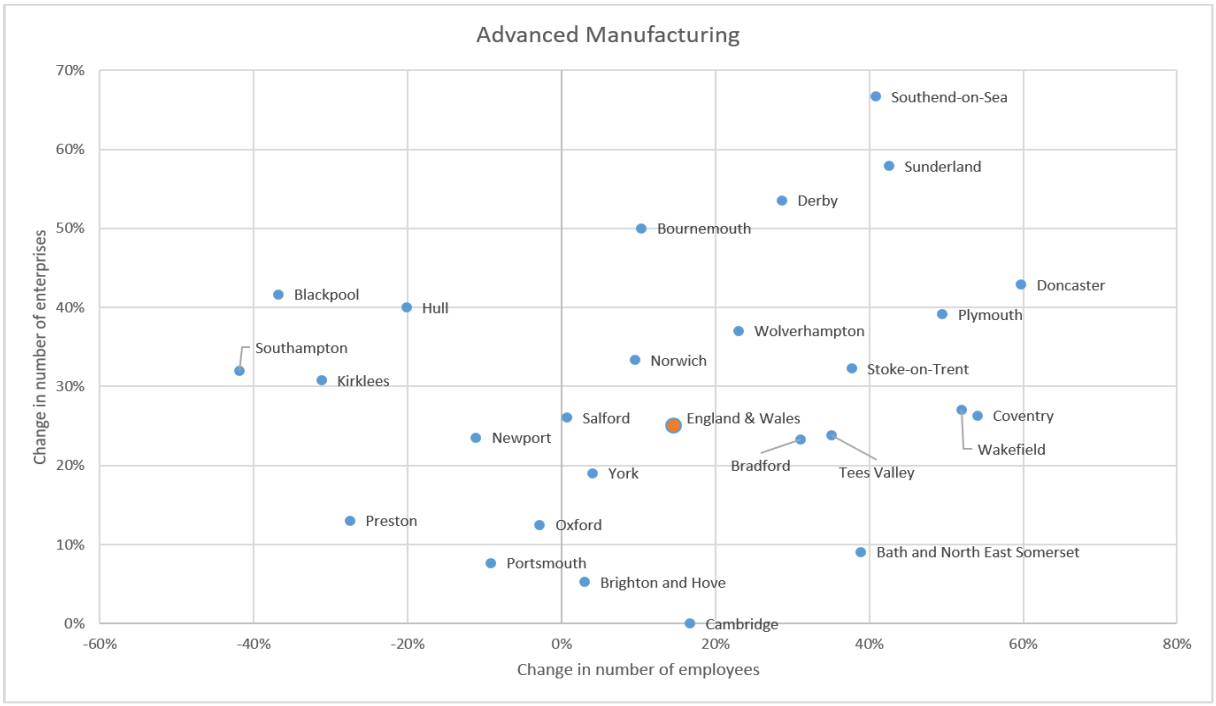


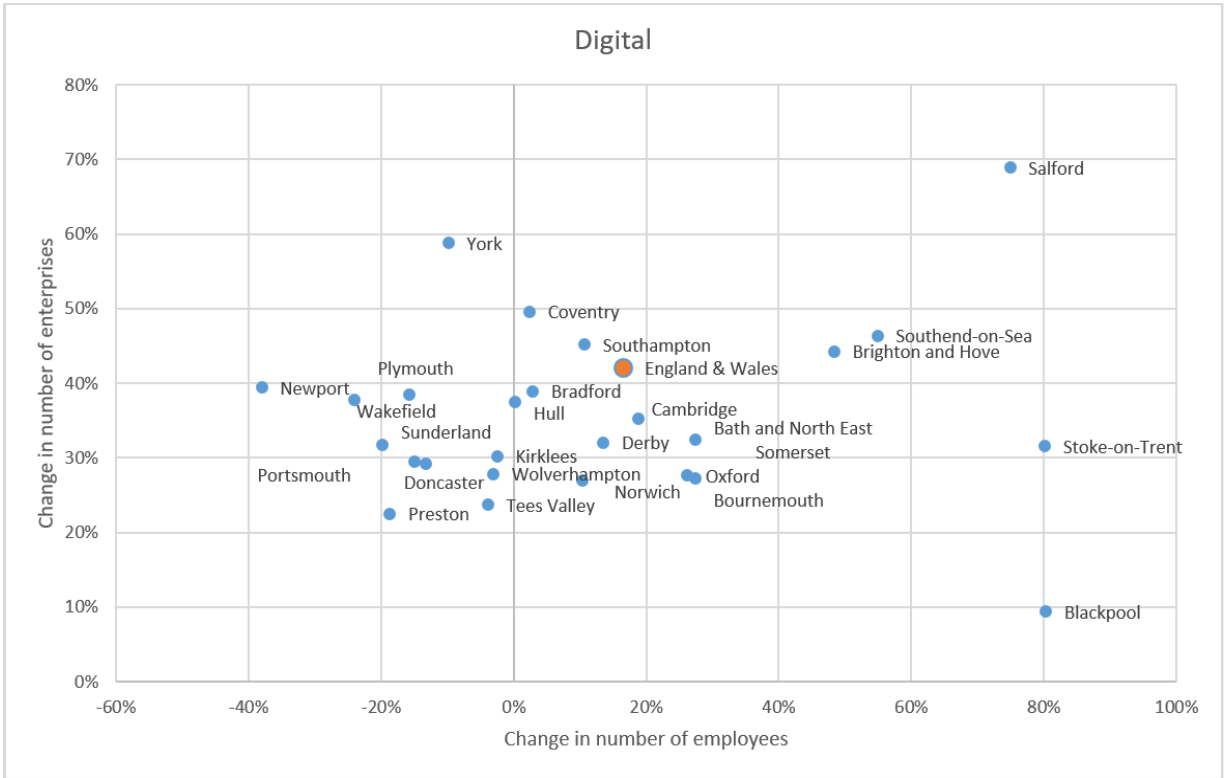
Comparisons between cities and England/Wales average

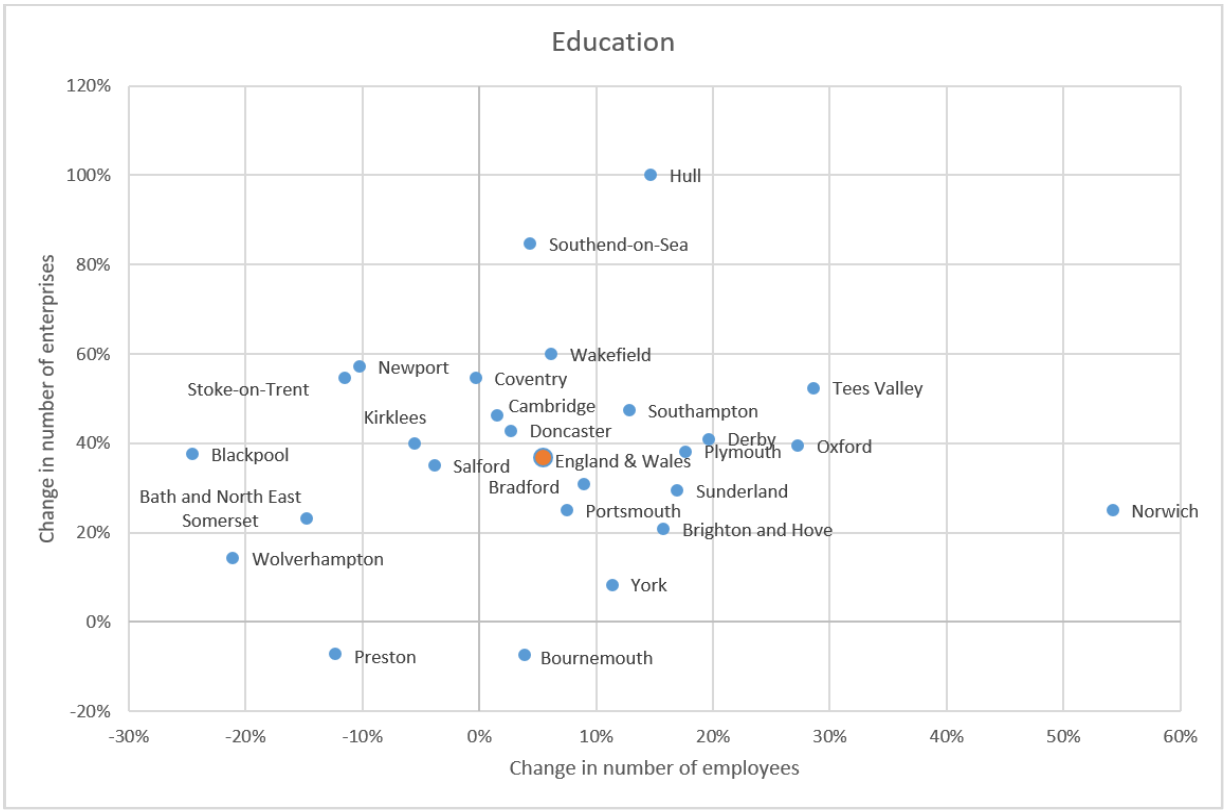
Looking at the respective rates of growth for number of employees and number of enterprises shows some interesting patterns emerging across the different cities and sectors. The average for England and Wales shows that, on balance in the advanced manufacturing key sector, growth in the number of enterprises is outpacing that of the growth in the number of employees, meaning that there is a trend for smaller companies overall.

There are some key cities where the data shows that there has been a net loss in the number of employees despite a continued growth in the number of enterprises. This may be the result of the loss of a small number of higher employing companies to an area; analysis could be undertaken to further investigate this issue but this is beyond the scope of this report.

There are limitations to the use of this data because of the rounding of the number of employees and enterprises at a local authority level. This means that, when aggregated, there is an increased error of margin to accurately identify the scale of the change. However, it is our opinion that the data is suitable for a broad analysis, but care should be taken, particularly where sector size generally is very small. For this reason, in this section, we have not produced charts for the energy, healthcare or marine sectors, as the small volume of enterprises in these sectors produced highly volatile data on comparison with previous years.


Advanced Manufacturing
Change in number of enterprises
Change in number of employees
70%
60%
50%
40%
30%
20%
10%
0%
-60%
-40%
-20%
0%
20%
40%
60%
80%
Southend-on-Sea
Sunderland
Derby
Bournemouth
Doncaster
Blackpool
Hull
Plymouth
Wolverhampton
Southampton
Norwich
Stoke-on-Trent
Kirklees
Salford
England & Wales
Coventry
Newport
Wakefield
Bradford
Tees Valley
York
Preston
Oxford
Bath and North East Somerset
Portsmouth
Brighton and Hove
Cambridge


Digital
Change in number of enterprises
Change in number of employees
80%
70%
60%
50%
40%
30%
20%
10%
0%
-60%
-40%
-20%
0%
20%
40%
60%
80%
100%
Salford
York
Coventry
Southampton
Southend-on-Sea
Brighton and Hove
Plymouth
England & Wales
Newport
Bradford
Wakefield
Hull
Cambridge
Sunderland
Bath and North East
Somerset
Derby
Stoke-on-Trent
Kirklees
Portsmouth
Doncaster
Wolverhampton
Oxford
Norwich
Bournemouth
Tees Valley
Preston
Blackpool


Education
120%
100%
80%
60%
40%
20%
0%
-20%
-30%
-20%
-10%
0%
10%
20%
30%
40%
50%
60%
Change in number of enterprises
Change in number of employees
Hull
Southend-on-Sea
Wakefield
Newport
Coventry
Stoke-on-Trent
Tees Valley
Cambridge
Southampton
Kirklees
Doncaster
Derby
Oxford
Blackpool
Plymouth
Salford
England & Wales
Bradford
Sunderland
Bath and North East Somerset
Portsmouth
Norwich
Brighton and Hove
Wolverhampton
York
Preston
Bournemouth

Key relationships

A significant finding is that current importance by employment does not necessarily indicate historic growth potential. Naturally, large-scale employment growth within areas such as health will be driven by large employers who are unlikely to have any considerable effect in the workplace on aggregate. Energy, whilst a relatively small sector, has seen significant corporate births since 2010 with employment also rising quickly. Perhaps the strongest areas of growth are in the advanced manufacturing, digital and education sectors, where strong private sector competition is giving birth to new companies with rapid employment growth. In advanced manufacturing, Southend-on-Sea, Sunderland and Derby are seeing both strong enterprise and employment growth, though in the former the base is small and currently only a small part of the economy. In Bournemouth, companies are being created more quickly than employment overall, suggesting a rapid creation rate of small companies, who may be more specialised and agile than existing companies in the marketplace, which may help to spur innovation. Cities like Southampton, Blackpool, Kirklees and Hull all show strong business growth over the past seven years, though employment in this sector is falling in these areas. Whether this is due to single, large employers moving out, or that these areas have historically been home to companies or sub-sectors that are being out-competed on a national or global scale can only be answered by further research.

The digital sector sees three rapidly changing outlier cities: Salford, Stoke-on-Trent and Blackpool. In each of these cities employment growth is rapid, with over 70% expansion since 2009, though each of these cities' pattern in company growth is different. In Salford, 75% employment growth is mirrored with 69% growth in the number of companies, testament to the fertile ground of the BBC (and other organisations') home at MediaCityUK. Whilst Stoke-on-Trent and Blackpool have both seen faster growth in employment (80%), the growth of companies is smaller, at 32% in Stoke-on-Trent and just 9% in Blackpool, perhaps reflecting the growth, or recent moving in, of relatively larger employers.

The education sector sees less divergence in patterns than other sectors, with the exception of Hull (a doubling of companies but growth of only 15% in employees) and Norwich (25% growth in company numbers but a 54% increase in employment). In this sector, expansion rates are clustered more closely around an area which shows moderate growth in the number of companies but only a minor increase in the amount of employment. In this sector, this is likely to be caused by a sharp growth in the number of private training companies, delivering bespoke accredited training to specific sectors.

Whilst the growth relationships for Energy, Healthcare and Marine are less clear because of small sample sizes in the data, there are some obvious stories. Kirklees sees the largest number (30) of enterprises in the Energy sector, employing 170 people, whereas Sunderland employs the most people in this sector (3,180) but from a much smaller number of companies (<5).

The Marine sector sees employment focused overwhelmingly in Plymouth (7,300), Portsmouth (2,765) and Southampton (2,625), whereas for number of companies Southampton (60), Plymouth (35) and Tees Valley (25) rank as the highest.

Overall Specialisation and Diversity of Economic Structure

There are several possible measures that can be used to calculate the degree of specialisation (or diversity) of a city's economy. Each has its advantages and disadvantages (see Palan, 2010). The obvious approach to measuring the *degree of diversity* of a city's economic structure is to compare actual sectoral (employment or output) shares against an equi-proportional distribution of shares, that is a state of complete diversity or balanced structure, where each sector has the same share of total city output or employment. As Palan (op cit) shows, although a simple measure, the Herfindhal-Hirschman index satisfies most of the key criteria required for a useful and meaningful measure of diversity.

The Herfindhal-Hirschman index is defined as the sum of the squared sectoral shares,

$$HHI_{jt} = \sum_{i=1}^{N} s_{ijt}^2$$

where S_{ijt} is the share (proportion) of sector *i* in city *j*'s city's total employment (or output) at time *t*. The index ranges from a minimum of 1/*N*, when all sectoral shares are equal (maximum diversity or a perfectly balanced economy) to an upper bound of 1, in which case a city would be mono-specialised, that is all of its activity is in just one industry. The arithmetic definition of a perfectly balanced or diversified structure clearly varies with the level of sectoral disaggregation used. Thus if we had only a ten-sector level of disaggregation, a balanced or diversified structure would be given by the value HHI of 1/10=0.10. For our 82-sector analysis, a perfectly balanced or diversified city economy would be represented by an HHI value of 1/82=0.0121.

Specialisation/Diversity of City Economies, by Sectoral Output Shares (Herfindhal-Hirschman Indices for 1971, 1991, 2014), 82 Sectors

	1971	1991	2014
Bath	0.1226	0.0811	0.0472
Blackpool	0.0393	0.0451	0.0425
Bournemouth	0.0582	0.0430	0.0404
Bradford	0.0530	0.0416	0.0417
Brighton	0.0540	0.0477	0.0435
Cambridge	0.0603	0.0445	0.0387
Coventry	0.0638	0.0543	0.0387
Derby	0.0524	0.0436	0.0467
Doncaster	0.0585	0.0550	0.0532
Hull	0.0426	0.0449	0.0392
Middlesbrough	0.0600	0.0525	0.0473
Newport	0.0602	0.0429	0.0455
Norwich	0.0577	0.0432	0.0406
Oxford	0.1447	0.0572	0.0460
Plymouth	0.1042	0.0784	0.0537
Portsmouth	0.1033	0.0542	0.0451
Preston	0.0517	0.0397	0.0440
Southampton	0.0591	0.0479	0.0383
Southend	0.0488	0.0420	0.0444
Stoke-on-trent	0.0644	0.0485	0.0399
Sunderland	0.0621	0.0432	0.0452
Wakefield	0.0512	0.0466	0.0436
Wolverhampton	0.0662	0.0440	0.0402
York	0.0542	0.0447	0.0410

Specialisation/Diversity of City Economies, by Sectoral Employment Shares,

(Hirschman-Herfindhal Indices for 1971, 1991, 2014), 82 Sectors

	1971	1991	2014
Bath	0.0669	0.0621	0.0574
Blackpool	0.0366	0.0468	0.0451
Bournemouth	0.0466	0.0428	0.0448
Bradford	0.0599	0.0447	0.0454
Brighton	0.0401	0.0443	0.0492
Cambridge	0.0436	0.0439	0.0435
Coventry	0.0505	0.0423	0.0427
Derby	0.0463	0.0413	0.0408
Doncaster	0.0464	0.0485	0.0506
Hull	0.0385	0.0456	0.0434
Middlesbrough	0.0598	0.0454	0.0495
Newport	0.0449	0.0420	0.0479
Norwich	0.0406	0.0397	0.0438
Oxford	0.0814	0.0521	0.0543
Plymouth	0.0592	0.0555	0.0511
Portsmouth	0.0556	0.0439	0.0486
Preston	0.0428	0.0412	0.0463
Southampton	0.0381	0.0420	0.0446
Southend	0.0460	0.0468	0.0475
Stoke-on-trent	0.0715	0.0498	0.0438
Sunderland	0.0766	0.0429	0.0448
Wakefield	0.0413	0.0458	0.0449
Wolverhampton	0.0560	0.0389	0.0434
York	0.0458	0.0453	0.0454

Three points are worth noting. First, none of the Key Cities has a perfectly balanced economic structure. Second, at the beginning of the period, in 1971, cities tended to be less diversified (more 'specialised) in terms of output than in terms of employment (compare Table 1 and Table 2). Third, in terms of output, the most specialised cities were Oxford, Plymouth, Portsmouth and Bath; in terms of employment, Oxford and Stoke on Trent. Fourthly, for output, there is a clear tendency across almost all of the cities for economic structures to become more diversified (a fall in the HHI over time – Table 1). Fifthly, this is not evident for employment (Table 2).

Degree of Localisation of Particular Sectors

It is a fact that a city economy can be diversified overall, yet contain particular sectors that are concentrated there relative to their presence in the national economy. In this sense a city can be described as having particular specialisms. Yet the presence of particular localised specialisms is not

necessarily at odds with having a diversified structure overall (the notion of 'clustered diversity' might be applicable here). It is important to keep this point in mind.

The usual method for measuring the degree of localisation (specialisation) of different sectors in particular regions or cities is to calculate location quotients, given as

$$LQ_{jt} = s_{ijt}/s_{iNt}$$

where S_{ijt} is the share of sector *i* in total city *j*'s employment (or output), and S_{iNt} is the corresponding share of that same sector in national employment (or output), here defined by the Great Britain average. An LQ of >1.0 indicates a relative localization (specialization) of that sector in the city concerned; that is the sector in question has a higher relative presence in the city than it does nationally. A value of <1.0 indicates a relative under-representation of that sector in the city compared to the national economy. Some authors only use LQs of >2.0 as indicating significant sectoral localization (specialization).

The tables below give the city LQs, for output, for the individual sectors specified as being of particular interest, for the years 1971, 1991 and 2014. LQs >1.0 are shown in bold. A number of features are worthy of comment.

Location Quotients for Selected Sectors, Output, 1971, 1991 and 2014

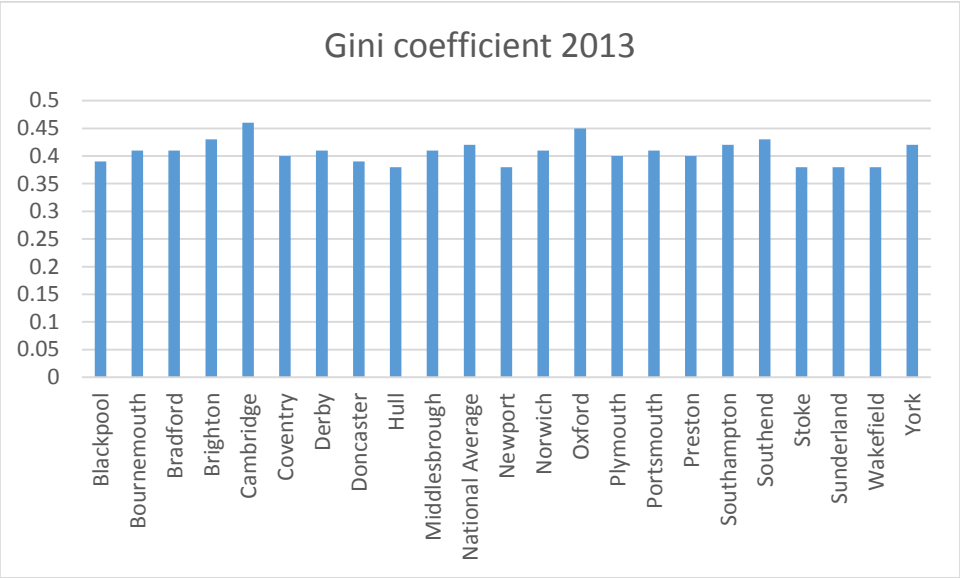
1971						
	Energy	**Advanced manufacturing**	**Marine**	**Digital**	**Education and research**	**Healthcare**
Bath	0.6	0.1	0.1	0.8	**1.1**	0.0
Blackpool	0.4	0.8	0.1	0.4	0.7	0.7
Bournemouth	0.3	0.3	0.3	1.2	0.8	0.0
Bradford	**1.4**	0.1	0.2	0.6	1.0	0.2
Brighton	0.5	0.0	0.4	**1.2**	**1.2**	0.1
Cambridge	**2.5**	0.6	0.7	**1.4**	**1.5**	**2.0**
Coventry	**1.1**	**5.3**	**1.4**	**3.4**	0.8	0.1
Derby	**5.6**	0.8	1.7	0.4	0.1	0.5
Doncaster	**1.5**	**1.3**	**2.4**	0.3	**1.3**	0.0
Hull	**2.2**	**2.3**	**5.2**	0.6	0.9	0.9
Middlesbrough	**2.4**	0.5	0.8	0.3	**1.1**	0.0
Newport	**1.4**	**2.6**	0.3	0.8	**1.3**	0.1
Norwich	0.3	0.7	0.2	**1.1**	**1.2**	0.0
Oxford	0.8	**2.3**	0.0	**1.3**	**1.8**	0.0
Plymouth	0.5	**1.3**	**2.4**	**1.4**	0.7	0.0
Portsmouth	0.7	0.4	0.5	**2.6**	0.6	0.4
Preston	**2.2**	**3.7**	0.6	**1.2**	**1.2**	0.6
Southampton	0.8	0.8	**3.9**	0.5	**1.1**	0.0
Southend	0.7	0.9	0.7	**1.5**	1.0	0.0
Stoke-on-Trent	**1.3**	0.1	0.0	1.0	0.6	0.0
Sunderland	**1.7**	**4.0**	**7.0**	0.6	**1.1**	0.8
Wakefield	**3.1**	**1.8**	**3.3**	0.3	0.8	0.0
Wolverhampton	1.0	**5.5**	0.2	0.5	0.8	0.0
York	**2.1**	**3.0**	**2.9**	0.3	0.9	0.1

1991						
	Energy	**Advanced manufacturing**	**Marine**	**Digital**	**Education and research**	**Healthcare**
Bath	1.0	0.2	0.4	1.0	**1.2**	0.0
Blackpool	0.6	0.5	0.1	0.4	0.8	0.5
Bournemouth	0.2	0.2	0.3	0.9	0.8	0.0
Bradford	**1.1**	0.5	0.9	0.5	**1.2**	**1.4**
Brighton	1.0	0.1	0.2	0.9	**1.1**	0.3
Cambridge	0.3	**1.8**	0.5	**1.3**	**1.3**	**2.7**
Coventry	0.7	**7.1**	**1.4**	**1.5**	**1.5**	0.0
Derby	**1.7**	**4.3**	**7.9**	0.5	**1.2**	**2.1**
Doncaster	0.8	**1.4**	**2.6**	0.3	**1.2**	0.0
Hull	**2.4**	**2.6**	**5.0**	0.4	**1.4**	**1.5**
Middlesbrough	0.5	**1.9**	**3.8**	0.5	**1.6**	0.1
Newport	0.7	**1.2**	0.8	1.0	1.0	0.1
Norwich	0.7	0.7	0.2	0.8	1.0	0.0
Oxford	0.9	**1.4**	0.1	**1.2**	**1.6**	0.3
Plymouth	**1.2**	0.4	**1.4**	0.9	**1.2**	**1.6**
Portsmouth	0.8	0.6	1.2	1.6	0.9	0.0
Preston	**1.4**	**6.0**	**8.3**	1.0	0.8	0.1
Southampton	0.7	**1.5**	**2.4**	0.5	**1.1**	0.0
Southend	**1.2**	**1.1**	0.8	0.8	0.7	0.0
Stoke-on-Trent	1.0	0.4	0.2	0.6	**1.1**	0.0
Sunderland	**1.3**	**4.4**	**5.0**	0.6	**1.1**	**1.4**
Wakefield	**2.6**	0.1	0.1	0.5	0.7	0.0
Wolverhampton	**1.1**	1.0	0.1	0.5	1.0	0.0
York	**3.6**	**2.7**	**5.1**	0.4	**1.1**	0.1

2014						
	Energy	**Advanced manufacturing**	**Marine**	**Digital**	**Education and research**	**Healthcare**
Bath	0.5	0.5	0.3	0.9	**1.3**	0.2
Blackpool	0.4	**5.0**	**7.3**	0.6	1.0	**2.6**
Bournemouth	0.4	1.0	**1.1**	0.7	0.9	0.2
Bradford	0.4	0.4	0.3	0.8	**1.4**	0.2
Brighton	0.3	0.1	0.4	**1.2**	**1.2**	**1.3**
Cambridge	0.3	**1.1**	**1.7**	**1.3**	**1.4**	**5.0**
Coventry	0.7	**4.6**	**3.1**	0.7	1.4	0.0
Derby	0.3	**9.5**	**10.7**	0.5	**1.1**	**1.7**
Doncaster	0.4	0.2	0.1	0.4	**1.3**	0.2
Hull	**2.2**	**1.3**	**2.1**	0.4	1.0	**6.9**
Middlesbrough	**1.2**	**2.1**	**3.2**	0.4	**1.3**	0.2
Newport	1.0	1.0	0.9	0.7	**1.1**	0.8
Norwich	0.4	**1.9**	0.5	0.7	**1.1**	**1.5**
Oxford	0.5	**1.2**	0.3	1.4	1.6	1.0
Plymouth	0.6	**3.9**	**5.6**	0.5	1.6	0.3
Portsmouth	**1.4**	**1.4**	**2.5**	**1.6**	**1.2**	0.3
Preston	0.7	**1.4**	1.0	0.6	1.0	0.8
Southampton	0.5	0.6	**3.7**	**1.2**	1.0	0.5
Southend	0.3	0.7	**1.4**	0.7	0.9	0.3
Stoke-on-Trent	0.7	0.7	0.4	0.5	1.0	0.4
Sunderland	**7.3**	**4.7**	**2.6**	0.5	**1.1**	**1.2**
Wakefield	**1.7**	0.1	0.0	0.4	**1.1**	0.1
Wolverhampton	0.1	**1.9**	**2.0**	0.4	**1.1**	0.2
York	**4.0**	0.4	0.9	0.5	**1.2**	0.4

The Table shows that different Key Cities have different industrial specialisms (localised relative industrial concentrations). It is also apparent that the degree of specialisation (relative localisation) has changed over time in many instances. For example, over the forty-odd year period, Derby seems to have lost its early relative focus on Energy but developed a significant relative focus on Advanced Manufacturing and Marine. Hull, on the other hand has seen a decline in its relative focus on Marine, but a significant increase in relative focus on Healthcare. As another example, Cambridge's increase in relative specialisation on Healthcare is evident. Yet another is Sunderland's decline in relative specialisation in Marine, but its increasing relative specialisation in Energy.

Key Cities Gini Coefficient Chart



Cumulative Differential Growth of Employment across Key Cities by SubPeriod (percentage points)

	1971-2014	1971-91	1991-2014
Bournemouth	29.5	27.5	2.0
Cambridge	28.1	20.1	8.0
Oxford	25.4	11.3	14.1
Southampton	25.3	26.3	-1.0
Norwich	24.9	25.8	-1.0
Southend	23.4	33.2	-9.8
Bath	19.2	23.9	-4.7
York	13.9	14.6	-0.7
Preston	10.5	2.8	7.7
Plymouth	8.4	19.1	-10.7
Wakefield	5.3	7.3	-2.1
Derby	5.2	14.3	-9.1
Brighton	-1.6	-7.6	6.0
Doncaster	-3.0	-2.3	-0.7
Portsmouth	-4.4	0.9	-5.4
Coventry	-15.1	-10.4	-4.7
Hull	-15.1	3.5	-18.6
Blackpool	-15.6	0.6	-16.2
Newport	-19.7	-2.8	-16.8
Bradford	-21.0	-5.0	-16.0
Stoke-on-trent	-25.9	-11.2	-14.8
Middlesbrough	-32.9	-18.3	-14.6
Sunderland	-37.6	-30.3	-7.3
Wolverhampton	-39.0	-23.1	-15.9

Cumulative Differential Growth of Output (Real GVA) across Key Cities by SubPeriod (percentage points)

	1971-2014	1971-91	1991-2014
Derby	26.7	28.1	-1.4
Norwich	21.1	17.3	3.7
Bournemouth	20.1	17.7	2.4
Cambridge	17.1	11.2	5.9
York	15.8	32.4	-16.6
Southampton	14.9	12.5	2.4
Wakefield	10.8	14.7	-4.0
Oxford	5.5	-10.8	16.3
Doncaster	5.0	16.4	-11.5
Bath	2.5	9.1	-6.6
Southend	-3.4	16.4	-19.8
Sunderland	-3.8	1.0	-4.8
Brighton	-6.4	-12.0	5.6
Preston	-11.4	-2.0	-9.3
Bradford	-12.4	-2.4	-10.0
Portsmouth	-13.7	-11.1	-2.6
Coventry	-14.4	-10.3	-4.1
Hull	-15.9	4.3	-20.2
Newport	-19.1	0.0	-19.2
Middlesbrough	-23.8	-5.7	-18.1
Plymouth	-24.4	-0.7	-23.7
Blackpool	-32.7	-18.4	-14.3
Stoke-on-trent	-33.0	-10.1	-22.9
Wolverhampton	-46.0	-31.4	-14.6

In both cases, while the top performing cities led in both periods, the bulk of their differential gains occurred during the first subperiod, 1971-1991, and their relative growth was much less impressive in the second period, 1991-2014. The converse is the case for the poor performing cities: while lagging in both subperiods, their relative performance deteriorated in the second period, 1991-2014.

There is a relatively strong correlation between average employment growth and average output (real GVA) growth (below): those cities that have growth fastest in terms of employment tend to be those that have also grown fastest in output growth, and vice versa. But when compared to the national (Great Britain) average, half of the Key Cities have underperformed. Only 7 have outperformed the nation on both employment *and* output (Wakefield, York, Derby, Southampton, Oxford, Cambridge, Norwich and Bournemouth).