FURTHER HIGHER?

Tertiary education and growth in the UK's new economy

IPPR

UCU University and College Union

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Introduction

The philosophical debate concerning the purpose of education has endured for centuries. Differences in opinion on the 'idea of a university' – whether students should be taught with an end result in mind or to impart pure knowledge – are very much alive today. What both perspectives have in common, however, is an appreciation that the strength of our higher and further education systems is critical to the strength of our societies.

As knowledge replaces other capital accumulation and resource extraction as the main driver of economic growth in developed countries, the contribution of tertiary education to countries' economic success has become the focus of greater attention. There is heightened recognition of tertiary education's role in driving growth through stimulating innovation, providing skilled workers and supporting business start-ups, particularly at a time when the UK is struggling to emerge from the global financial crisis and create growth in the economy.

However, radical reforms in higher education, in light of the Browne review, extensive cuts to the university teaching budget and government reforms to give colleges greater flexibility and discretion, are challenging universities and colleges to think about how they can best adapt to new conditions and continue to play their vital economic and social role.

A central plank of the UK Coalition government's growth strategy is to rebalance the economy and place it on a more sustainable footing by moving away from a reliance on government and consumer spending towards net trade and investment (HM Treasury 2011). It aims to move the UK away from relying on the financial and banking sectors and towards growth in other economic sectors, particularly the manufacturing sector, as well as building a stronger economic base outside of London and the South East and producing more for export to balance the UK's trade deficit.

The country will need to 'reindustrialise' in this way for the government to achieve the growth plans set out in the budget (HM Treasury 2012). Growth sectors however need a number of external factors to succeed. These include policy stability, a competitive business environment, long-term investment, the conditions for innovation and skilled workers. In this paper we focus on these last two factors: innovation and skills.

Tertiary education is central to these two factors by helping to create the conditions for innovation and supplying skilled workers. Further education institutions help provide important technical and vocational skills and produce critical, curious students. Universities similarly play a vital role in equipping individuals with the skills for work and life and also play a crucial role in innovation, through attracting inward investment, developing research infrastructure and supporting the commercialisation of research.

Nowhere are these factors more important than in emerging growth sectors, such as those at the forefront of the low-carbon economy. The low-carbon market, projected to grow globally at 4 percent a year for the next five years (BIS 2011a), has been identified by the government as a key area for more creating productive growth in the UK. This sector of the economy provides a specific context for this briefing. We consider how the wider economy benefits from the investment – whether by students or the state – in tertiary education and what the effect of investment is in low-carbon-related skills for achieving the UK's low-carbon growth objectives.

First we consider the costs and benefits of tertiary education; secondly we consider the role of low-carbon sectors in meeting the UK's growth objectives. We study two low-carbon sectors in particular: the wind industry and the low-carbon vehicles sector, which are both becoming areas of competitive advantage for the UK. We examine the potential of these sectors to create growth and jobs and analyse the skills which will be needed by businesses to facilitate this growth over the medium to long-term[1]. Finally we consider the role of tertiary education in meeting those needs.

[1]A number of discussions with employers informed this research including with industry bodies as well as individual employers in both case study sectors

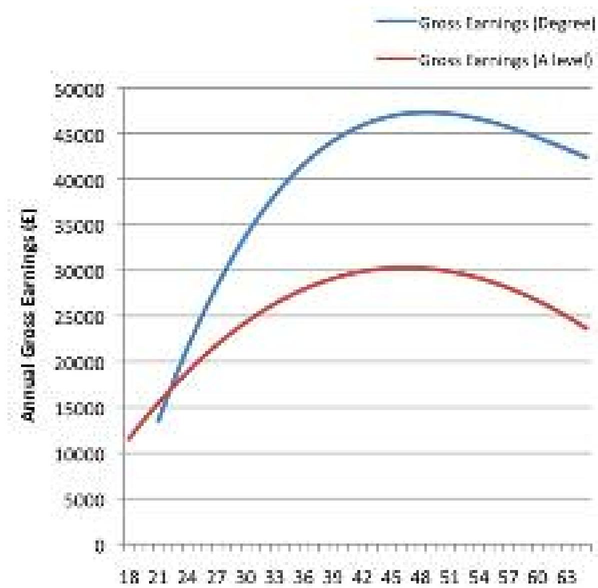
1 Costs and benefits of tertiary education

Tertiary education plays a substantial part in developing the skills and knowledge that determine a country's long-term economic productivity and growth (London Economics 2005). We examine the different aspects of economic development tertiary education contributes to, including returns to the economy and the individual from tertiary education and innovation and growth, both at a national and regional level.

Returns to the economy

The financial benefit to the taxpayer of higher and further education can be calculated based on the costs and benefits to the state of providing higher and further education. IPPR analysis in *Table 1* below shows the additional gross earnings (excluding tax and NI contributions) for a graduate in comparison to an individual with A-levels.

Table 1: Gross earning comparison for degree and A-level education



The economy benefits substantially from individuals gaining higher level skills and qualifications. Taking the costs of a university education into account, the additional contribution to the Exchequer of a graduate compared to an individual with A-levels over a working lifetime is approximately £180,000. Using a similar approach, our findings suggest that the additional gross earnings for an individual with A-levels compared to one with GCSE's is approximately £47,000 (see Appendix for full details).

A number of other studies have produced similar results. In 2007 KPMG for Universities UK found that the combined income and employment effects, the gross additional lifetime earnings of an undergraduate degree over and above two A-levels is approximately £160,000. The study also found that the equivalent rate of return to the Exchequer was approximately 12 percent before the introduction of variable fees (Universities UK 2007).

A recent study carried out by London Economics found that the Exchequer rate of return from the funding of undergraduate degrees had changed little with the introduction of variable fees, at between 11 and 12 percent (London Economics, 2011). A recent report by the Department for Business, Innovation and Skills found that those who gain further education qualifications have the potential to increase value added output through higher productivity and increased competitiveness for employers (BIS 2011b).

Returns to the individual

As well as its contribution to the wider economy, having a tertiary education brings substantial social and economic benefits for individuals. We examined the financial benefits to individuals of attaining A-levels or a degree. An individual with a degree can expect to earn £98,000 more over their working lifetime than an individual with two or more A-levels; this is the so-called graduate premium. Looking ahead to the introduction of higher tuition fees in 2012, this is projected to decline slightly to between approximately £79,500 to £86,000 depending on the levels of tuition paid[2]. Individuals with an A-level or degree can expect to earn approximately £45,300 more than an individual with GCSEs or equivalent qualifications.

A study looking at the benefits of college education in England found that, compared to those with no formal qualifications at all, individuals with a level 3 qualification receive £6,400 more annual earnings, equating to £196,400 throughout the course of their career, as *Table 2* shows. In addition they were found to be healthier, less likely to be unemployed, imprisoned or dependent on social benefits (Economic Modelling Specialists Inc 2008).

Table 2: Earnings by education level

Source: Economic Modelling Specialists Inc 2008

Similarly, a report by the Department for Business, Innovation and Skills on the economic value of further education (specifically apprenticeships and vocational qualifications)

[2]See Appendix. This range represents scenarios based on tuition fees of £7,000 and £9,000 respectively.

found that future benefits included higher wages, better employment prospects and a beneficial impact on other individuals and employers (BIS 2011b).

Table 3: Social benefits of higher education

Compared to those with no formal qualifications, those educated to level three are likely to be:

- Healthier

Less likely to be unemployed

- Imprisoned
- Dependent on social benefits

Future benefits include:

- Higher wages
- Better employment prospects
- A beneficial impact on other individuals and employers

Based on Economic Modelling Specialists Inc (2008) and BIS (2011)

Across OECD countries a person with a tertiary education can expect to earn over 50 percent more than a person with qualifications gained at school or in a post secondary non-tertiary education (OECD 2011). The demand for tertiary educated individuals has also kept up with increasing supply from higher educational institutions in most OECD countries. In addition, the earnings premium has remained strong despite greater supply, in fact increasing by six percentage points from 1999 to 2009 (OECD 2011).

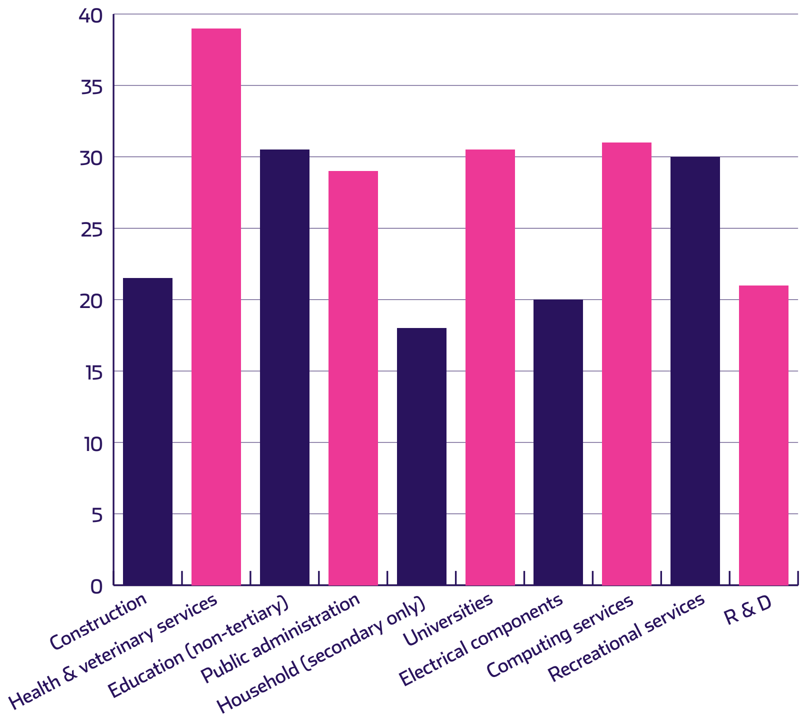
Innovation and growth

There are also wider benefits to the economy from tertiary education in terms of innovation and growth. The most obvious kind is associated with the direct benefit from universities (as businesses) to the UK economy. A report by Kelly et al on the impact of universities on the UK economy, suggested that tertiary education forms a 'core part of the [UK's] economic infrastructure', contributing to GDP by generating employment and output and attracting export earnings.

In addition, the report argues that universities – as enterprises – provide 'knock-on' economic effects of expenditure by students, staff and visitors. Through direct and indirect effects, UK universities generated £59 billion of output and provided over 668,500 jobs (equivalent to 2.6 percent of all full time employment) in 2007. In 2008, a combination of university expenditure and off-campus expenditure of international students and visitors (£33.4 billion) amounted to the equivalent of 2.3 percent of UK GDP in 2008. In addition, a key finding was that higher education is particularly effective in generating GDP per capita; comparable to the contribution made by computing services and recreational services and greater than other sectors of the economy such as public administration and industry research and development (Kelly et al 2009)[3].

[3]The role of universities in economic development can be overstated if account is not taken of alternative uses of public expenditure, however universities generate over a third of their funds from non-public sources and this includes over £2.9 billion in export earnings (Schmuecker and Cook 2012)

Table 4: Universities UK economic impact modelling system (2009)



Source: Kelly et al (2009)

Innovation is a key driver of productivity growth, and therefore of economic growth (Lent and Nash 2011). The OECD's Technology and Industry Outlook (2010), which looks at the contribution of science, technology and innovation (STI) to economic growth around the world, highlights the importance of R&D investment – including contributions from tertiary education – to a country's economic growth prospects. For example, developments in areas such as nanotechnology and biotechnology offer a wide range of benefits, such as providing renewable energy and clean water and improving the health of society. Commercialising university research through spin-off businesses and licensing is another aspect of universities' role in stimulating economic growth, though the overall number of these remains low (Swinney 2011).

Countries with high levels of innovation tend to have, on average, higher proportions of graduates among the general population and a stronger track record of investment in higher education (Universities UK 2011). There is similarly a clear association between high levels of GDP per capita in wealthy countries and levels of enrolment in tertiary education (Stevens and Weale 2003).

Recent research suggests that GDP-related productivity is correlated with higher education attainment rather than purely rates of higher education enrolment. Analysis of OECD data suggests a strongly significant positive correlation between higher education attainment among 25-64 year olds and GDP per head of population in 33 OECD member states.[4]

[4]Excluding Luxembourg because of its extremely high GDP

Table 5: Patterns of spending on tertiary education

Country	Public expenditure on tertiary education as a percentage of total public expenditure (2008)	Expenditure on tertiary education as a percentage of GDP by level of of education (2008)
Australia	3.0	1.5
Canada (2007)	4.5	2.5
Chile (2009)	2.2	2.2
Finland	3.9	1.7
France	2.3	1.4
Germany	2.8	1.2
Ireland	3.1	1.4
Israel	2.2	1.6
Italy	1.7	1.0
Japan	1.8	1.5
Korea	2.2	2.6
Mexico	3.9	1.2
New Zealand	5.5	1.6
Norway	5.1	1.7
Portugal	2.2	1.3
Spain	2.6	1.2
Sweden	3.5	1.6
Switzerland	4.0	1.2
United Kingdom	1.7	1.2
United States	3.2	2.7
OECD Average	3.0	1.5
EU21 Average	2.7	1.3

Source: OECD (2011)

National and regional economic impact

Universities and colleges act as anchor organisations in their local economies; highly unlikely to relocate, they play a distinct role in creating the long-term conditions needed for economic growth. Frequently one of the largest employers in their area, universities, in particular, can boost consumer spending through student numbers, boosting local business, and can have an important impact on housing and tourism. Kelly et al found that altogether universities contributed over £31 billion to UK GDP in 2007/8. The off-campus expenditure of their international students and visitors made a further £2.4 billion contribution to GDP. Taken together, this contribution came to over £33.4 billion – equivalent to 2.3 percent of UK GDP in 2008 (Kelly et al 2009).

Colleges have a vital impact on the local economy as well as on the labour needs of local businesses. As the Independent Commission on Colleges found, many colleges are firmly embedded within their local communities contributing to the development of enterprise and access to learning. Colleges also play an important role – reaching out to disadvantaged, hard-to-reach groups within their communities not only leads to a steady supply of learners for higher-level, qualification-based study, but supports colleges' wider role in promoting the well-being and cohesion of their communities (Independent Commission on Colleges 2011).

The regional economic impact of universities and colleges is particularly important in the context of the Coalition's rebalancing strategy and the growing gap between employment and growth in the south and the north of the UK.

Industrial clusters are increasingly being seen as important for developing regional advantage. Clusters occur when firms within the same sector locate in the same place, benefiting from contact with each other and access to supporting institutions like universities (Mateos-Garcia and Sapsed 2011). Universities play an important role in clusters. They generate knowledge through research, providing talent in the form of skilled workers, developing networks, problem solving through research and consultancy, and nurturing entrepreneurship through spin-off firms.

Universities also have an important role in attracting inward investment. The OECD has argued that for securing foreign direct investment, the world class research infrastructure and skilled labour provided by universities is arguably more important than financial incentives (Guimon 2008).

The economic impact of the tertiary education sector has to be cultivated however and is not guaranteed simply by its existence in local communities. Schmuecker and Cook (2012) have argued that universities – and by extension colleges – can do more to contribute to their local economy in the new economic development landscape.

There is a new focus on collaboration with local employers in order to support growth and employment. Encouraged by successive governments, many further education colleges engage on a regular basis with employers (Independent Commission on Colleges 2011). Similarly, many universities have adapted to the changed regional development environment over the past few years, for example by being well represented on the boards of LEPs and in getting support from the Regional Growth Fund. But in the future, competition for economic development funding is likely to be strong and centralised funds present a challenge to ensuring that universities and colleges contribute to even economic growth across the country (Schmuecker and Cook 2012).

Conclusion

We have seen that the attainment of higher-level qualifications provides a significant boost to the UK economy, with the Exchequer gaining an additional £180,000 from a graduate over their working lifetime compared to an individual with A-levels. The 'graduate premium' has also held strong at £98,000 despite a rising supply of graduates in the workforce. Those with further education qualifications will have higher wages and better employment prospects than those with GCSE qualifications as well as being healthier, less likely to be unemployed and/or face imprisonment.

Universities and colleges are also playing a key role in supporting industrial clusters, attracting inward investment and encouraging entrepreneurship. But competition for economic development funding is likely to be strong in the future and those institutions that can demonstrate their potential impact on innovation, growth and employment in the private sector will be best placed to compete.

One such area is in the low-carbon economy. The UK is on the cutting-edge of research in the fields of alternative energy and climate change. Universities are creating and updating technologies that will reduce our impact on the environment; decarbonise our power networks, building stock, transport systems and industrial processes; and help us adapt to climate change if it is not averted. Universities and colleges are providing the vocational and technical skills needed to equip the workforce for these objectives. In the next section we examine the role universities and colleges can play in encouraging innovation-led growth in this growing sector of the economy.

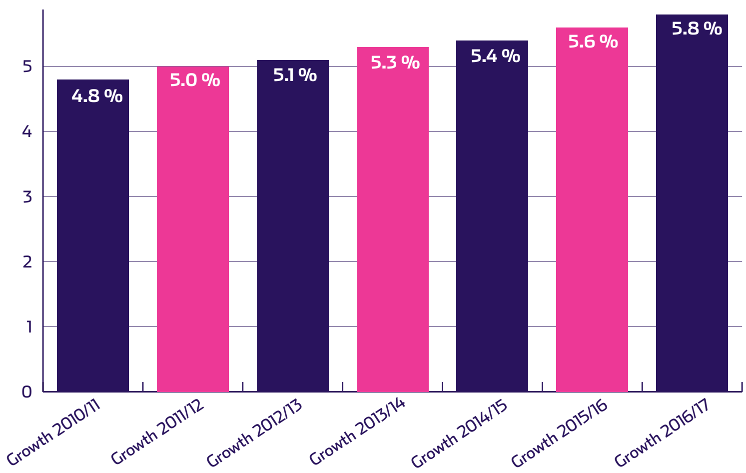
2 UK economy and low-carbon growth

The UK economy shrank by 0.3 percent in the first three months of 2012 following a decline of 0.3 percent in GDP in the final three months of 2011, prompting a double-dip recession (ONS 2012). The independent Office for Budget Responsibility (OBR) forecasts suggest that growth will fall to 0.7 percent in 2012 and rise to 2.7 percent by 2014 – 0.2 percent lower than forecast in March 2011 (OBR 2011). Total output in the economy is expected to be 3.5 percent lower in 2016 than previously forecast. Weak short-term growth is thought to reflect a permanent problem in the UK economy, prompting concern about where growth will come from to restore momentum to the UK economy.

low-carbon industry has been identified by the Coalition as an important area for creating more productive growth. Indeed, an ambition of the government's rebalancing strategy is to move from an over-reliance on carbon-intensive industries and energy generation towards a low-carbon economy (UKCES 2011). Increased investment in low-carbon technologies is an ambition and 'measurable benchmark' of the Treasury's Plan for Growth (HM Treasury/BIS 2011).

low-carbon sectors feature prominently in the government's plans for greater export-led growth (HM Treasury 2011). The UK's low-carbon and environmental goods and services (LCEGS) sector performed well during the recession and is expected to grow steadily over the next few years, outstripping growth for the UK economy as a whole, as *Table 6* shows.

Table 6: Growth of UK low-carbon, environmental goods and services sector



Source: BIS 2011a

Securing competitive advantage

The landmark Stern Review in 2006 argued that the benefits of strong, early action to tackle climate change through the transition to a low-carbon economy would considerably outweigh the costs of failing to do so. Stern suggested that on a 'business as usual' scenario, climate change could cost the world at least 5 percent of GDP each year. If more dramatic predictions come to pass, the cost could be more than 20 percent of GDP.

Yet worldwide, shifting to a low-carbon path could eventually benefit the economy by $2.5 trillion a year (Stern 2006). Regardless of the need to tackle climate change, moving to renewable sources of energy, achieving greater energy efficiency and building low-carbon industries have inherent economic benefits in leading to greater sustainability, improved energy security, costs savings and economic growth.

The UK has an ambitious policy framework for emissions reduction. The 2008 Climate Change Act aims to encourage the low-carbon transition through unilateral, legally-binding emissions reduction targets for at least a 34 percent reduction in greenhouse gas emissions by 2020, and at least 80 percent by 2050. This policy framework provides strong opportunities for the UK to benefit from the 'low-carbon dash', where countries seek to benefit from early mover advantage and secure competitive advantage in key low-carbon industries.

Climate change policies are opening up new markets for low-carbon goods and services with an estimated global value of over £3.5 trillion (HM Government 2009). The UK government and many industries recognise this and are tapping into new markets underpinned by climate change regulations and policies, while others are gaining a competitive advantage by deploying low-carbon products. But this is a highly competitive market and with the UK sixth behind other leading economies in the race to secure low-carbon investment (Pew Charitable Trust 2012), the pressure is on for UK industry to identify and harness opportunities for low-carbon growth.

Stimulating innovation-led growth

Growth sectors need substantial research, development and demonstration (RD&D) capacity in order to engage in technological and process innovation and to access niche markets. Many of the UK's most successful low-carbon growth sectors have benefited from innovative government-backed organisations, research institutions and companies, many of which are clustered around higher education institutions. Strategic public-private partnerships at the sector level – based on the model successfully established by the Automotive Council, which brings together leading industry players, policymakers and expert academics – are likely to be critical in stimulating innovation-led growth in the future.

The UK ranks seventeenth out of 28 EU member states in terms of the number of businesses classed as 'innovation active'. Only 46 per cent of UK businesses undertake some form of innovation activity – whether product or process based – compared to a reported 80 per cent of German firms and 50 per cent of French firms (Eurostat 2011). Increasing the number of individuals with higher level skills would therefore significantly benefit the economic prosperity of the country.

An astonishing one in three firms in the low-carbon and environmental goods and services (LCGES) sector of the economy suffers from a shortage of skilled staff, from those needed to install new technology, to scientists and engineers (Aldersgate Group 2009). In an interview for this research, the Vice President for Vehicle Design and Development for Nissan, Jerry Hardcastle, warned that the supply of skilled graduates was needed for the UK to compete on the global stage:

'In India they are churning out hundreds of thousands of graduates and we are churning out a small number and that will restrict our ability to expand. We can't have any shrinking of mechanical engineering graduates – we need more engineering graduates. If they're not available here, the jobs will move to India, Brazil and China.'

In 2000, the UK was third among advanced industrialised nations in terms of the proportion of young people graduating. In 2008 the UK had fallen to fifteenth position because competitor countries have been investing at a faster rate. For example, China quadrupled the number of students graduating from higher education between 1999 and 2005, and is expected to become the world's largest producer of PhD scientists and engineers. India is planning 800 new institutions of higher education by 2020 in order to raise the percentage of college-age population enrolled in institutions of higher education from 12.4 percent to 30 percent (Faust 2010).

Recent research has suggested that the number of students graduating in the UK is likely to fall further following tighter restrictions on student numbers, with 15,000 fewer higher education places in September 2012 compared to the previous year and around 25,000 fewer places in English universities (University Alliance 2012).

Recent UK reforms to the higher education system have led to reductions in courses available in key areas such as science, technology, engineering and mathematics (STEM) skills. A recent study found that the provision of single subject STEM courses has gone down by 15 percent over the past six years in England (UCU 2010). This is concerning because the major skills requirement for low-carbon sectors, particularly in energy generation, will be in higher levels skills including management and STEM skills, technical and engineering skills, which are already in short supply across the UK (UKCES 2010).

Over the last five years, participation in further education for all levels of engineering and technology, training and education has fallen by over 25 percent. There has been an increase of seven percent in numbers of STEM higher education graduates since 2002. However this should be seen in the context that general graduate numbers have increased by 22 percent (UKCES 2010). Estimates suggest that the number of engineers graduating each year in the UK is unlikely to increase over the next decade (Boettcher et al 2008).

OECD countries would appear to have much higher rates of enrolment for engineering, manufacturing and construction on average, although the UK performs much better when it comes to science. The percentage of new entrants into tertiary programmes choosing to study science in 2009 was among the highest in OECD countries at 13.3 percent in the UK, compared to the OECD average of 9.2 percent. However the percentage of new entrants into tertiary programmes choosing to study engineering, manufacturing and construction was 8.1 percent which was among the lowest in the OECD, where the average is 15 percent (OECD 2011).

However, the challenge of STEM skills gaps in low-carbon growth sectors is less straightforward than simply an issue of supplying enough skilled graduates. As we have seen, the number of STEM graduates has increased, even if only slightly, since 2002, but many of these graduates do not seem to be entering into STEM professions despite a clear wage premium for doing so. A recent study found that just over a half of STEM graduates in the labour market are in non-STEM occupations, (Levy and Hopkins 2010).This suggests that although we should be looking to increase the supply of STEM graduates, this alone won't solve the problem of the UK's skills gaps in this area.

Finally, the low-carbon transition will require more than the specialist knowledge of scientists and engineers in technological sectors. It will also need the skills of arts, humanities and social sciences graduates, for example in managerial, communication and planning and development roles. The government has cut 80 percent of its teaching grant for universities and replaced it with income from tuition fees while ring-fencing the remaining 20 percent for STEM subject areas. It would also therefore be of concern for growth in low-carbon sectors if this began to impact on skills provision in arts, humanities and social science subjects.

In the next section we look at the relationship between tertiary education and innovation in two key low-carbon growth sectors to examine further the relationship between education and innovation and to explore the prospects for jobs and growth in specific low-carbon sectors.

3 Tertiary education and innovation in low-carbon sectors

Decarbonising the transport and power sectors is central to achieving the 2050 targets set by the European Union. Energy supply accounts for almost 40 percent of Co2 emissions and impacts on every aspect of the UK economy. Moving to low-carbon energy supplies presents business opportunities for the nuclear and renewable industries. Off-shore wind currently presents the best prospects for growth across the LCGES sector (BIS 2011a).

Domestic transport accounted for around 24 percent of all UK Co2 emissions in 2006, with the vast majority from private road transport cars. De-carbonising the transport sector alongside the power sector is essential if the UK is to achieve its carbon reduction targets. The UK is rapidly becoming a global leader in the development and manufacture of low carbon vehicles (BIS 2011a).

Given the strategic economic and environmental importance of these sectors, we analyse prospects for growth in the wind power and low-carbon vehicle sectors, the barriers to achieving this and the role of tertiary education.

UK wind sector

The wind sector in the UK has seen unprecedented growth over the past few years, driven by the UK's renewable energy policy framework. Wind turbines can be installed either on-shore or off-shore. On-shore wind capacity is expected to continue to grow over the next decade, but off-shore wind is the key growth area. The UK's excellent off-shore wind resources and status as the world leader in terms of installed capacity have helped to boost hopes that Britain could gain a strong competitive advantage in this area.

As well as providing a greater supply of renewable energy for the UK, the wind sector is likely to play an important (if limited) role in the Coalition government's rebalancing and reindustrialisation strategy. In addition to strengthening the UK's manufacturing base, the sector will help provide jobs in areas of low employment, such as coastal areas with a history of industrial decline (UKCES 2011).

The UK is already the world's largest generator of energy from off-shore wind farms and with government ambitions for a 30-fold expansion in off-shore wind farms by 2020 the sector is set to grow considerably. Development so far has come from several rounds of licensing by the Crown Estate[5]. As a result of the most recent two rounds of licensing, 6,400 turbines will need to be installed over the next 8–10 years, making this one of the largest engineering projects in the UK's history.

The Carbon Trust expects UK-based business to capture a share of the global off-shore wind industry of between 3-15 percent, depending on the part of the supply chain. A medium range scenario puts the contribution the sector could make to the UK economy at between £3-10bn a year or between £50-100bn cumulatively between 2010 and 2050

[5]The Crown Estate manages the property portfolio owned by the Crown which includes extensive marine assets across the UK

(Carbon Trust 2011). However while many British firms will provide components, the UK does not yet have a large-scale turbine manufacturing plant to serve the growing market so many of the economic benefits will be lost overseas, with the turbines being imported.

There are a range of factors that could yet limit the growth potential of the sector beyond the policy framework established by the government. These include regulation and pricing, technological challenges, access to finance, pressures on materials required for the expansion of the sector and, finally, demand for highly skilled and often specialist technical personnel (UKCES 2011).

Tertiary education, innovation and the UK's wind sector

As well as physical infrastructure, an 'intellectual infrastructure' of colleges, universities and research institutes is vital to generate the intellectual property and skilled staff that the wind industry requires for growth (Renewable UK 2011a). Whether or not this is in place is a key factor for companies in determining whether to do research development and deployment (RD&D) in the UK or elsewhere. There are several examples of this framework in development in the UK:

- Narec is the UK's national centre for the development and deployment of off-shore wind and marine generation technologies. This year, Narec will open the UK's first Wind Turbine Training Tower, the result of a collaborative training partnership between Northumberland College, Mainstream Renewable Power and Narec.
- Part of a network of 'Catapult centres' across a number of sectors, the Off-shore Renewable Energy Catapult was recently launched by the Department for Business, Innovation and Skills (BIS). It is a national centre which will focus on technologies for off-shore wind, wave and tidal power and is designed to bridge the gap between university research and full commercialisation.
- Northumberland College is leading the way in developing vocational programmes in the renewable energy sector. The college aims to become an international centre of excellence in Wind Energy (on and off shore) as it trains those in the sector to gain skills in turning farm waste into energy.
- The Centre for Intelligent Asset Management (CIAM) is a partnership between the University and SgurrEnergy, a renewable energy consultancy, part of Wood Group and will be based at the University of Strathclyde in Glasgow. It is a new centre to develop and demonstrate off-shore and onshore wind turbine asset management to help Scotland meet its ambitious renewable energy targets.

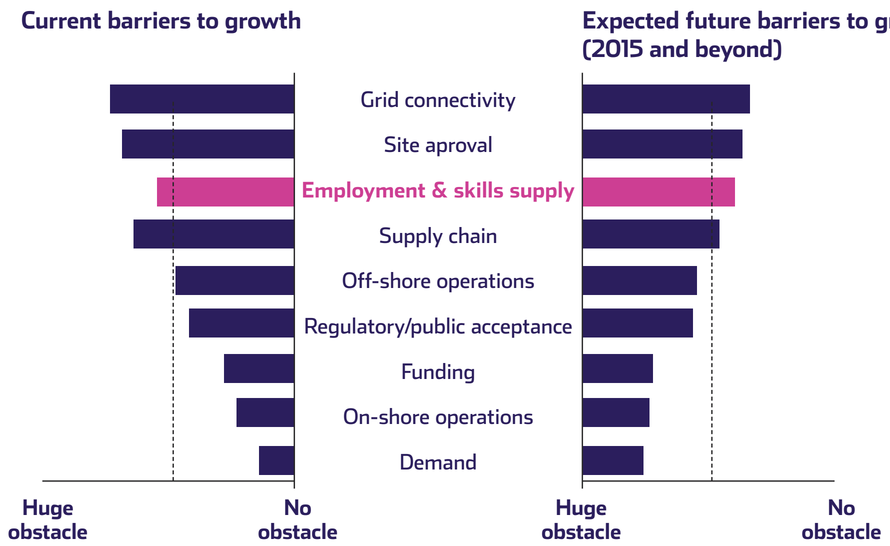
These collaborations between government agencies, academic institutions and the private sector are important to driving the investment that could produce much-needed supply chain jobs in the UK. But although the research base in the UK has some strengths, it is also in need of further investment. The Energy Research Partnership has identified that there is still a 'paucity' of wind R&D facilities and expertise in the UK. Similarly Renewable UK has argued that what renewable energy expertise there is in the UK is spread too thinly and that there should be increased funding for a few select centres of excellence.

Concentration of research expertise has been instrumental in the development of the Danish wind industry. Its Risø National Laboratory is widely regarded as the leading institution for independent wind research and a key resource in creating and maintaining the leadership of Denmark in the wind sector. Similar centres in the UK such as the New and Renewable Energy Centre (NaREC) in Blyth could step up to be the UK equivalent of Risøs for off-shore wind. This would greatly improve the attractiveness of the UK for foreign investors but it will require an even stronger relationship between academic institutions and industry and a clear strategy to accelerate and consolidate technological innovation in the UK.

Employment projections and skills demands for the wind sector

A lack of skilled workers is already acting as a barrier to the growth in the UK. *Table 7* below produced by Bain and Company from their 2008 report for Renewable UK (Boettcher et al 2008) shows that skills supply has been a barrier to growth in the UK for some time – in fact the third greatest barrier to growth – and is expected to become more of a barrier over time.

Table 7: Current and expected barriers to growth



Source: Boettcher et al 2008

Anticipating demand for skills in the sector is complex because of the various factors influencing growth, such as the success of development and planning applications, the share of manufacturing likely to be carried out in the UK, and the likely scale of exports. However, a number of studies have forecasted employment growth in the sector, from which skills demands have been extrapolated.

In 2010, PricewaterhouseCoopers for the UK Commission for Employment and Skills projected growth in the wind industry as a whole according to three scenarios based on different levels of innovation and governance in the sector. A low innovation, low governance scenario saw employment grow by 15,000 up to 2020; a high innovation, high governance scenario saw employment grow by 40,000 up to 2020 (UKCES 2010). A report for Renewable UK projected a ten-fold increase in jobs in the off-shore wind sector from 5,000 to 57,000 in 2020, if 20GW are installed off-shore by this point (Renewable UK 2010).

Recent projections for the wind industry come from a study commissioned by RenewableUK and EU Skills. The 2011 study forecasts employment increases according to three different scenarios:

High: Strong and steady growth, with 30.7GW operating by 2020 and UK based suppliers taking a large share of European exports in the Design and Manufacturing stage (high scenario).

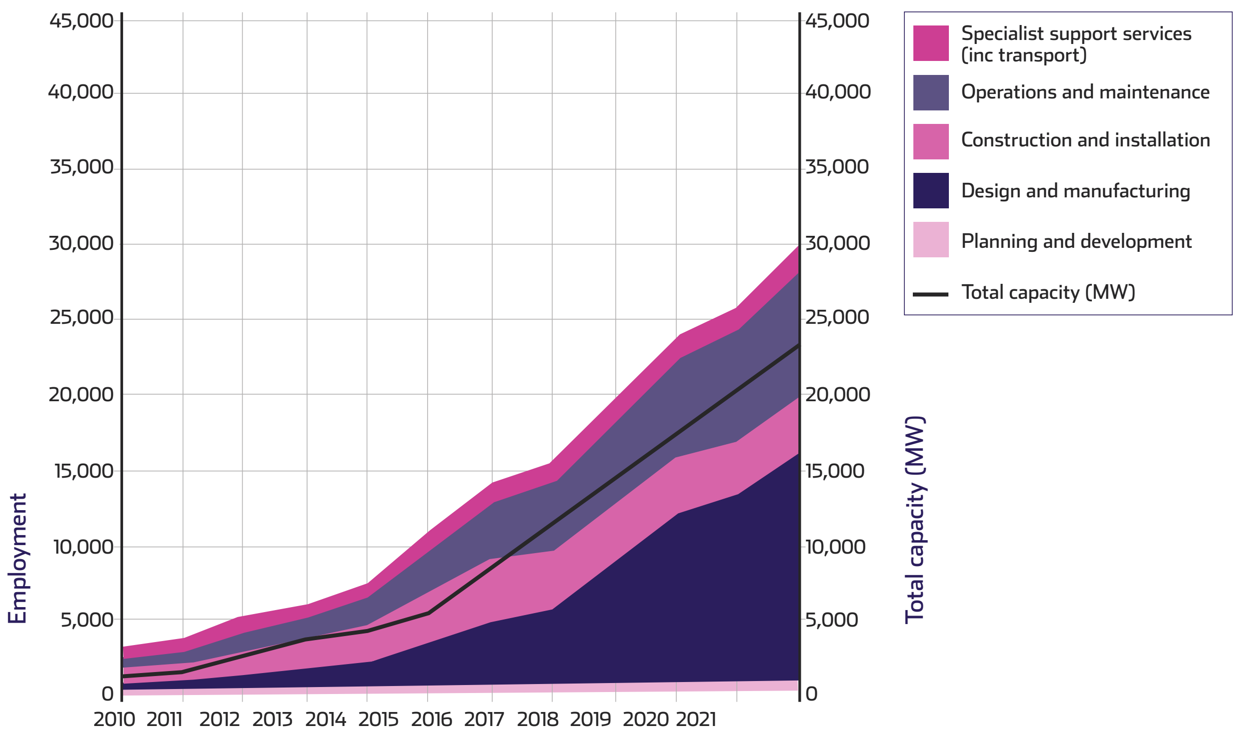
Medium: Healthy growth, with 23GW operating by 2020 and UK-based suppliers taking a relatively good share of European exports (medium scenario).

Low: A stalling industry, with 13GW operating by 2020 and limited exports (low scenario).

The study found the 'medium' scenario to be most probable, according to recent trends in the market and government targets for renewable energy. Under this scenario employment in the wind sector (onshore and off-shore) will increase to 40,000 by 2021. The 'high' scenario sees employment rise to 53,900, which the study concludes is highly ambitious but achievable.

Table 8 below shows how this jobs growth will break down by occupation under the 'medium' scenario. The largest growth by occupation is projected in manufacturing and design which will see a 25 times increase in demand for employees across the sector – over 22,500 new recruits between 2010 and 2021. This will mean a significant hike in the demand for relevant skills sets. In order to lead innovation in the design of individual turbine models and entire plant systems, there will be continued need for experts with post-doctoral qualifications. The majority of the manufacturing and design workforce will need to hold more generic vocational and degree-level qualifications. Operations and maintenance roles will also see significant growth, with construction and installation roles growing more modestly (Renewable UK 2011b).

Table 8: Jobs growth by occupation



Source: Renewable UK 2011b

Key skills shortages in the wind sector

A key conclusion of the Renewable UK study as well as previous similar studies is that the majority of posts that will be created in the sector are for skilled trades (occupations traditionally associated with levels 3 and 4 vocational and apprenticeship training) and roles requiring higher-level skills (graduate and post-graduate education). These roles will pose the greatest challenge in terms of meeting demand for skills.

There are already significant skills shortages in the sector. In the off-shore wind energy sector 26 percent of employers have had one or more hard-to-fill vacancy in the previous 12 months, and around one in five vacancies in the sector is likely to be hard-to-fill at any given time (UKCES 2011). The areas where recruitment is particularly difficult are shown in *Table 8* below.

Table 8: Hard-to-fill vacancies

Technical Occupations:
Construction Manager, Ecologist, Electrical Engineer, Environmental Consultant, Environmental Impact Assessor, Geophysical Surveyor, Hydro-Dynamic Surveyor, Noise Assessor, Off-shore Structural Engineer, Ornithologist, Technical Planner, Power Systems Engineer, Project Engineer, Structural Design Engineer, Operations and Maintenance Technician.
Generic Occupations:
Commercial Manager, Contract Manager, Health & Safety Manager, IT Project Manager, Project Manager, QSHE Manager, Software Engineer, Supervisor, Sales.

Source: Renewable UK 2011b

The majority of these roles require management and STEM skills, specifically technical and engineering skills, which are in short supply across the UK as a whole. A recent CBI survey found that 43 percent of the 566 employers interviewed were currently struggling to hire STEM-qualified employees, rising to 53 percent who expected to have difficulty recruiting in this area over the next three years (CBI 2011). As the wind sector experiences rapid growth, these shortages are set to increase at certain 'pinch points', for example when the sector is expected to scale up activity from 2013 onwards and when other sectors, such as nuclear, are also expected to grow, further shrinking the available skilled labour.

UK wind sector: future workforce

As a high proportion of the workforce for 2020 is already in work, much of the higher-level skills delivery will need to take place at work (HM government 2009). The wind industry currently employs about 5,000 people in the UK and, as this rises to 40,000 by 2021 as projected by the BWEA, a large number of new recruits to the sector will need training. The sector estimates that 80 percent of these new recruits will be mature candidates (Renewable 2011b). Specialist training for mature entrants is therefore a vital priority and here further education colleges working with employers will have an important role to play.

However, this cannot be relied on as a strategy over the longer term. Over the next few decades replacement demand will be high in sectors where engineering is a core skill, such as in renewable and nuclear power generation, where a large percentage of their workforce will be retiring over the next 10-15 years (BIS 2011). It is essential that there is a strong flow of young people into the workforce to replace retiring workers.

While the overall number of engineering graduates is falling and the increase in STEM graduates has been modest, interest in the renewable energy sector appears high. Evidence from stakeholder interviews conducted by the UKCES in a recent report on the off-shore wind sector found that many of the over 50 specialist courses in the renewable sector – ranging from postgraduate qualifications awarded by universities to part-time short courses run by private training providers – are currently oversubscribed (UKCES 2011).

Apprenticeship programmes are also seen as an important source of skilled labour for the wind industry (Renewable 2011). However without certainty about future development, it can be difficult for employers in this sector to invest in apprenticeships where the lead-time for people to become fully trained is between four and five years. Investing significant amounts of time in training up new entrants can also be difficult for the many small start-up companies that form the sector – 70 percent of organisations employ fewer than 24 FTEs (Renewable 2011b).

To meet the demand for labour, the industry has several options. It can attract workers from similar sectors including off-shore oil and gas and the automotive and aerospace sectors; however it may need to offer financial and other incentives to compete with salaries and benefits in these sectors. It can also source labour internationally: the BWEA has suggested it may have to 'off-shore' design and manufacturing jobs to European competitors and similarly to bring in European contractors to install, operate and maintain UK facilities (Renewable 2011b). Alternatively it can recruit and train new entrants to the sector. With skills shortages across the sector as a whole and an ageing workforce requiring high replacement rates, ensuring a strong flow of young people into the sector is key.

UK low-carbon vehicles sector

The revival of the UK automotive sector is one of the biggest success stories in British industry. Despite a highly challenging period overall for UK design and manufacturing, the shift to lower carbon vehicles is creating important growth opportunities for the UK's automotive sector, supporting the rebalancing of the economy and securing high-tech jobs.

The UK is leading Europe in the manufacture and development of low-carbon vehicles. The last few years have seen significant investment in the UK by Ford, Nissan, Toyota and others, with over £1.5 billion invested annually in automotive R&D in the UK. The UK is the location for European production of the Toyota Auris hybrid and Nissan is investing £420m in its Sunderland facility for the production of the 100 percent electric Nissan LEAF from 2013. Nissan's fuel efficient Qashqai model has been designed, engineered and built in Britain at the company's Sunderland manufacturing facility since 2006, with the company recently announcing that it will invest £192million in UK production of the next version of the car.

The automotive industry is a significant part of the UK's manufacturing sector, adding value of £8.5bn to the UK economy and employing over 700,000 people across the design, development, manufacturing, retail and service and repair sectors (SMMT 2011). The industry has also been successful in bouncing back from the recession, achieving growth of 4.4 percent over the first eight months of 2011.

The UK has a number of other global strengths including a motorsport cluster, an automotive design engineering sector, a 30 percent share of European internal combustion engine production and a No. 2 world ranking for premium car production (NAIGT 2009). The UK has the fourth largest retail automotive market in the world and is the only advanced country to grow strongly this decade. Confirming that it could play a vital role in the UK's rebalancing strategy, the automotive sector is the UK's biggest manufacturing export sector[6].

[6]See SMMT website: http://www.smmt.co.uk/2012/03/smmt-puts-uk-automotive-in-the-spotlight-ahead-of-geneva/

Growth in the sector, which is currently being driven by the development of low-carbon vehicles, is vital not just to create more jobs, but also to safeguard the hundreds of thousands of jobs which could be at risk through the low-carbon transition.

Table 9 below shows how the UK's competitive advantage in the low-carbon vehicles sector has been achieved in part through innovation driven by collaboration between industry, government and higher education institutions. This has also helped to match supply and demand, recognising the importance for employers of industrial experience in degree programmes.

Table 9: Higher education, innovation and the UK's automotive sector

Innovation lies at the heart of growth and the UK's recent success in the development of low carbon vehicles is due in part to a number of innovative government-backed organisations, research institutions and companies, many of which are clustered around higher education institutions. These include:

- Cenex (based at Loughborough University), the Technology Strategy Board and the Low-Carbon Vehicle Partnership are working at various stages of the low-carbon vehicle innovation chain
- Imperial College London is developing battery technologies, with companies such as Nexeon and EVO Electric spinning off.
- Jaguar Land Rover has two engineering and design facilities in the UK and is working with WMG, a Warwick University spin-off, to develop efficient technologies. It has also recently announced it is to build a new engine plant near Wolverhampton in which up to 750 employees will manufacture its new hybrid power trains.

The close working relationship between academic institutions and industry in the UK is seen as a strength internationally. Ten or more UK universities have a leading edge in relevant technology, such as advanced lithium-ion batteries or lightweight materials. This provides the foundations of an innovative automotive industry and, crucially, it has been supported by collaboration between government agencies, academic institutions and the private sector.

The UK needs to develop a package of policies to consolidate and accelerate UK technological innovation and bring British-originated products to market. Indeed innovation, in terms of R&D spend, has been falling as a percentage of the industry's added value. This is largely due to the fact that while seven large, global manufacturers have significant productive capacity in the UK, most conduct R&D activities in their home markets. Ford and Jaguar Land Rover are the exceptions to this, spending close to £1 billion in Britain annually, which is around 80 percent of the UK's total expenditure on automotive R&D (NAIGT 2009).

This requires ensuring that the UK and Europe have the tightest feasible regulations in place to 'lock-in' the technological trajectory. The industry-led New Automotive Innovation and Growth Team (NAIGT) has warned that: 'at present the UK industrial landscape features a limited scope for battery, hybrid, fuel-cell and hydrogen power trains, compared to countries like Germany or Japan.' The industry would also benefit from 'capturing' specialist skills – using its advantage as a global leader to develop a highly advanced skills base to allow it to build on the UK's expertise and enterprise.

Source: Pendleton and Bradley, IPPR 2011

Employment projections, skills demands and shortages

Of the 384,000 directly employed by the automotive sector in the supply chain, motor retail and general service sectors, 330,000 jobs are potentially at risk from the threat of off-shoring to Central and Eastern Europe where labour is less expensive (NAIGT 2009).

Employment demand is expected to hold steady up to 2016 in manufacturing within the automotive industry which is the sector expected to create the highest demand for higher level skills. Projected net requirement for 27,000 people (3,900 per annum) across all occupations is expected to cover retirements within the sector (SEMTA 2010). The picture is therefore one of changing skills demands rather than rapid employment growth, however more up-to-date research taking into account the recent achievements driven by developments in low-carbon technology in the automotive sector could be expected to present a different account of future employment demand.

Currently 24 percent of companies in the manufacturing sector within the auto industry report skills gaps, which is higher than the UK average. Automotive employers face skills gaps among operators, craftspersons and technicians, and these occupations have the most significant impact on their business. The main impacts of hard-to-fill vacancies on productivity and competitiveness of the employer were: increased workload; difficulties meeting customer services objectives; increased operating costs; delays in developing new products and services, and loss of business (SEMTA 2010).

Technical engineering skills gaps are highlighted by the industry as the most important. The industry is currently experiencing skills shortages in body engineers and electrical engineers among other technical roles. The Europe-wide demand for these skills means there is significant competition for skilled workers with many moving between companies to secure higher salaries.

Overall, it is likely that actual demand for skills is not fully reflected in the official picture, as only 56 percent of companies formally assess employee skills gaps (SEMTA 2010). The sector skills body for the industry SEMTA has also suggested that some employers may not fully appreciate the skills levels required to maintain or increase market share and that the skills gap may as a result be greater than employers suggest.

The growth in the low-carbon vehicles sector is creating a new set of skills demands for the automotive industry. Five new and developing areas of technology are central to future innovation and growth in the UK automotive industry:

- internal combustion engine
- lightweight materials
- electronic machines
- intelligent mobility
- energy storage.

The supply of STEM graduates will continue to be critical in the research and development, design and engineering elements of the supply chain. A skilled manufacturing and maintenance workforce will be needed to produce and work with key components of the vehicles. *Table 10* below summarises four new and growing areas of demand[7].

[7]Based on interviews with employers

Table 10: New and growing areas of demand

Electrical engineers	To work in areas like IT solutions, navigation, audio, body control modules and in high voltage work
Skills in designing and manufacturing advanced new materials	Specialist skills will be needed to develop and design advanced new materials such as lightweight materials as well as developing and designing new components and maintaining new vehicles
Chemical engineers	Energy storage, such as fuel cells and battery cells, is a key technology for low-carbon vehicles resulting in a significant demand in the sector for chemical engineers. Though demand has always been there, mass production requires a different skills set
Management skills	Management skills will be needed to oversee and embed these developments and to improve overall efficiency and sustainability

There is no available data projecting skills demand due specifically to the increased use of fuel-efficient and low-carbon technologies in the automotive sector. This makes it difficult to estimate the extent to which changing skills demands in this area could impact on growth. However experience suggests that significant skills gaps could lead to increased operating costs, difficulties introducing new working practices and in meeting the ambitious plans that have been set out by the New Automotive Innovation and Growth Team to develop areas of competitive advantage for the UK (NAIGT 2009).

UK low-carbon vehicles sector: future workforce

Re-skilling existing workers can help to meet some of the changing skills demands in the automotive sector, but due to the new and specialist nature of the skills required, vehicle manufacturers will need graduates with the right grounding in the academic disciplines required. The demographic profile of the automotive workforce is currently similar to that within engineering and manufacturing more generally, with nine percent aged 16-24 years, 48 percent aged 25-44 years and 43 percent aged 45 years plus. Not enough young people are coming into engineering and there are difficulties recruiting skilled people, requiring the sector to actively market itself to under-represented groups.

Within the automotive supply chain, the percentage of the total workforce that are graduates has doubled from five percent to 10 percent in recent years and in the 1990s a doubling of the percentage graduate employment in the supply chain was accompanied by big productivity gains (SEMTA 2006).

Within the supply chain, nearly 50 percent of the managerial/technical/professional group are graduates. Replacement demand within the managerial/professional/ technical group is most likely to be filled by graduates in the future.

However the overall proportion of employees in the automotive sector with higher qualifications is still relatively low. The UK automotive sector is reliant on intermediate level skills, and 30 percent of employees are qualified to GCE A-level or equivalent compared to 21 percent of employees having a higher education or degree or equivalent qualification. SEMTA, the sector skills body for the automotive sector has expressed concerns that the lower proportions of employees with a higher education, degree or equivalent qualification could constrain future automotive R&D activity as a result (SEMTA 2010).

Further and higher education provision in the automotive sector

The auto industry might be expected to attract a good quality graduate intake because of its blue-chip graduate schemes which often provide two years of training along with a decent starting salary. However such is the demand for engineering skills and the lack of students going into engineering, the industry is concerned about its ability to attract enough skilled labour to continue to grow at its current pace[8].

In 2011 Nissan managed to attract 37 out of the 38 graduates needed for its graduate training scheme. This is a record number for recruitment to Nissan's graduate scheme, which recruited just 10 the previous year, indicating the current health of the industry. So Nissan doesn't currently have difficulty recruiting the number of graduates needed and the quality of graduates compares well with those recruited by the company in Japan.

However Nissan does have concerns that current numbers may not be sufficient for the company to scale up its production in innovative growth areas such as low-carbon vehicles. Nissan's Vice President for Vehicle Design and Development Jerry Hardcastle has warned:

'In India they are churning out hundreds of thousands of graduates and we are churning out a small number and that will restrict our ability to expand. We can't have any shrinking of mechanical engineering graduates – we need more engineering graduates. If they're not available here, the jobs will move to India, Brazil and China.'

It is clear that the industry and higher education providers need to work together to determine how the increasing annual output of graduates can be better matched to the industry's needs for intermediate level skills and to fill intermediate level jobs with industrial experience. However these findings suggest that quantity as well as quality of skills provision in this area is a critical issue if the UK is to compete on a global stage.

Rather than relying on level 2 skills and graduates for competitiveness, it is also clear that the industry should re-examine the role of intermediate level engineering education provided through apprenticeships. Nissan for example are looking at re-introducing apprenticeships as one way of tackling the skills shortage, especially with many young people rejecting a university education due to the perceived higher expense. They are interested in taking 18 year olds on as technicians and then taking them through a degree in partnership with university or college in the way that some companies sponsor people through university. However they have suggested that incentives from government such as tax breaks or changes to employment law would be needed to encourage this.

Policy implications

These examples of promising growth sectors show that in order to realise the potential of the UK's most successful low-carbon industries it will be vital to ensure there are as few barriers to growth as possible. High-quality research infrastructure and skilled workers are essential for the development and scaling up of production in innovative growth areas.

Failing to tackle skills shortages in these low-carbon growth sectors could result in the loss of investment and jobs, as well as hampering growth. As well as compromising the

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[8] Channel Four News http://www.channel4.com/news/the-great-british-luxury-car-boom

UK's ability to meet its targets to reduce carbon emissions, this would have important implications for the UK economy.

The findings equally highlight the importance for employers of accurately forecasting changing skills demands. For the low-carbon vehicles sector, one of Britain's most important emerging growth sectors, there was little data available on how expansion of the low-carbon vehicles market could affect skills demands.

Our analysis shows the boost to the economy from educating an individual to degree-level compared to A-level is approximately £180,000, and to A-level compared to GCSEs is approximately £47,000. In general terms, this suggests increasing the numbers of students in higher education and further education will produce significant benefits to the economy. But clearly this is only the case if there is additional marginal demand in the labour market for these students.

We cannot predict the future with any degree of accuracy but one sector where it is reasonable to expect there will be growing demand for employees at all levels of qualification is in the low-carbon and environmental goods and services sector. This sector is forecast to grow by five to six percent a year over the next five years. The number of people employed in this sector increased between 2007/08 and 2009/10 despite the recession and is expected to continue to increase at a rate of 1.5 percent a year for next five years. This is equivalent to approximately 14,000 additional jobs every year (BIS 2009).

Bird and Lawton (2009) show how occupational structures vary between firms engaged in different industries within the overall 'low-carbon and environmental goods and services' sector, and also between firms within the same industry. It is, therefore, impossible to be precise about the level of skills and education that will be required from the people filling these 14,000 additional jobs. But Bird and Lawton also show that there are more high-skilled jobs in some key sectors within LCEGS, such as utilities. It is not unreasonable, therefore, to assume that the proportion of the 14,000 new jobs created each year in LCEGS that go to graduates and to those with A-levels will at least match the current proportions of jobs within the overall labour market.

Data from the Annual Population Survey show that in 2010, 31 percent of the UK labour force had qualifications at NVQ level 4 and above (equivalent to a first degree), and a further 20 percent had qualifications at NVQ level 3 (equivalent to two A-levels). Using these proportions, 4,340 of the additional jobs in LCEGS are likely to require a degree, and a further 2,800 A-level qualifications.

Meeting this demand for skilled workers will result in a boost to the economy of £900 million a year. At a time when the economy has slumped back into recession and only weak growth is predicted up to 2014 for the UK, it is vital that everything possible is done to secure the opportunity presented by growth in the low-carbon and environmental goods and services sector.

This should be seen in the context of wider labour market trends which have resulted in an expansion in high-wage, analytical, non-routine jobs and manual, lower-wage jobs at the expense of routine, middle-wage jobs, creating a more polarised labour market.

Previous research by IPPR has shown that if the trend of the last decade continues, by 2020 around 35 percent of the UK's workforce will be in high-skilled jobs requiring at least an undergraduate degree. For the first time there will be more high-skilled jobs than either mid- or low-skilled jobs. Demand for young people with degrees will, therefore, probably increase (Dolphin et al 2011). Of course, there is no straight link between having a degree and working in a high-skilled job. Some people without a degree will have high-skilled jobs; some people with a degree will have mid- or low-skilled jobs. However this evidence suggests that maintaining and even expanding the numbers of young people educated to degree level whilst enabling progression routes from intermediate-level occupations is essential if the UK is to meet the future needs of the economy and to remain internationally competitive.

4 Conclusion and recommendations

The UK economy has been weak for some time with real GDP falling in four of the last six quarters and increasing by just 0.4 percent since the Coalition government took office in the second quarter of 2010. This is a result of a number of factors, including rising global energy prices, which are outside the control of the government. However, there is little doubt that if the UK is to avoid a further worsening in the economic outlook and ever higher levels of unemployment, measures to boost growth will be needed.

The UK's future economic prosperity depends on identifying and cultivating sectors in which the UK is likely to develop a future competitive advantage. Low-carbon sectors such as the low-carbon vehicles and off-shore wind sectors are key examples of high growth areas which also hold the potential to support the Coalition government's rebalancing agenda, both sectorally and spatially.

An active industrial strategy is needed to support industry to identify and address skills and financing gaps specific to individual sectors, as well as infrastructure needs. Through our case studies we have identified two central areas of importance for any industrial strategy to secure expansion in these sectors: creating the conditions for innovation and skilled labour.

Universities and colleges have a central role to play in both of these areas. Colleges contribute to the development of enterprise and open access to learning, reaching out to disadvantaged, hard-to-reach groups within communities and addressing the UK's low skills culture. Universities have been central to the processes of technical invention, the development of a wider innovation ecosystem and the resulting growth in the two sectors examined above. Innovation in both sectors examined was driven in part by collaboration between industry, government and higher education institutions. More collaborations of this kind will be needed if the UK is to develop areas of competitive advantage and to compete effectively on the global stage.

The case studies also demonstrate that there will be significant increased demand for high-value, design-rich jobs as a result of the low-carbon transition. This reflects the overall growth in the proportion of high-skilled jobs projected in the economy over the next five years, with the increase in occupations with high levels of graduates expected to outstrip all other categories in 2020 (University Alliance 2012).

Recommendations

We have seen that the attainment of higher- and intermediate-level qualifications provides a significant boost to the UK economy and to individuals, justifying in financial terms alone the investment in further and higher education. We have also seen that higher education is highly effective at generating GDP per capita, with a contribution exceeding that of many other sectors of the economy.

At the last spending review higher education institutions were protected from spending cuts by a rise in tuition fees. This option will not be available at the next spending review.

As tough strategic decisions are made about where to invest state funds in the lead-up to the next spending review, it is imperative that government and policymakers consider the contribution of tertiary education to creating growth in the context of an uncertain economic outlook and an increasingly competitive global economy.

Our recommendations focus on the role of tertiary education in creating the conditions needed for innovation, and a skilled workforce needed for stronger economic growth in the UK.

1. Ensuring a skilled workforce

If the UK is to excel in establishing comparative advantage in new growth sectors, it needs to ensure that it can meet industry needs for skilled workers. Failure to do so could have serious implications for the UK economy. Yet at a time when the proportion of graduates in emerging economies such as Brazil, China and India is increasing rapidly, the outlook for the number of graduates graduating from UK universities is uncertain.

As the proportion of jobs requiring higher-level skills increases, maintaining and even expanding the number of graduates entering the workforce should be a priority across all subject areas, including the arts, social sciences and humanities.

For the employers interviewed for this research the most concerning skills gaps were in STEM subjects. In the short term it may be possible to tackle STEM skills gaps in key low-carbon occupations by recruiting skilled workers from similar sectors, such as the oil and gas industry, aerospace, rail, steel, chemical and defence industries and providing them with the necessary training. Businesses are already considering greater recruitment from overseas to meet gaps (Aldersgate Group 2009), yet given the Coalition's restrictions on immigration, even this option may be limited.

Over the medium to long-term, the twin challenges of an ageing workforce and an insufficient cohort of graduates leaving university with science, technology and maths related skills and entering into STEM occupations, need to be tackled if the UK is not to miss its opportunity to develop comparative advantage. The current share of new graduates with the skills to enter high-demand occupations in low-carbon sectors may not support the growth demands of these industries.

The number of undergraduates studying for STEM subjects in the UK is increasing. Yet in engineering, manufacturing and construction, the UK is still far behind the OECD average and employers interviewed have spoken of their concerns for UK competitiveness as the supply of skilled graduates in emerging economies is fast increasing. The UKCES has shown that despite improvements, employers in specific sub-sectors still report challenges in recruiting graduates with the appropriate STEM skills (UKCES 2011).

However the issue is not simply one of supply. Measures are also needed to improve the rates of STEM graduates entering into and staying in STEM occupations.

- The government must tackle STEM skills shortages which threaten to hamper growth in key low-carbon sectors by promoting maths and science in schools; safeguarding the higher education STEM teaching budget, and supporting STEM-related apprenticeship programmes.

- In order to improve the number of graduates entering and staying in STEM occupations, business also has a role to play in offering STEM-related work experience and information, and universities should ensure the continual development of STEM degrees to ensure they meet employer needs.
- The government should reconsider its 'cap' or quota on skilled migrants including overseas students from outside the EU, which could help tackle skills gaps in key sectors in the short-term.

2. Creating the conditions for innovation

Despite an excellent research base, the UK has historically had a poor record on research development and deployment, particularly in creating profitable commercial products (HM Government 2009). This has in turn constrained growth. Improving this record could make a significant contribution to producing a stronger economic growth rate in the UK.

The government has introduced various small-scale and piecemeal efforts to promote business and innovation across the UK – such as enterprise zones (EZs) and technology and innovation centres. These should be reconfigured into more ambitious 'innovation zones'. Rather than relying heavily on tax breaks (as is the case with Enterprise Zones), these should offer greater government support for R&D activity and start-ups in key sectors and an environment that fosters intensive cross-industry collaboration. Successful zones would focus on developing close working relationships between businesses and local universities, technical colleges and business service providers (Lent and Nash 2011).

University start-ups are more likely to be successful in accessing venture capital and to grow if they are 'business-ready': that is, they must have business planning and management know-how, and knowledge of patenting and links to patent attorneys (Clifton et al 2009).

- The government should look to centre 'innovation zones' near local universities, to encourage closer relationships with existing employers and new employers through proximity to the best academic talent, new graduates and technical resources. While innovation zones centred on universities will aid local businesses, universities will also benefit from their links to business.

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Appendix: Evaluating the value of pursuing higher education

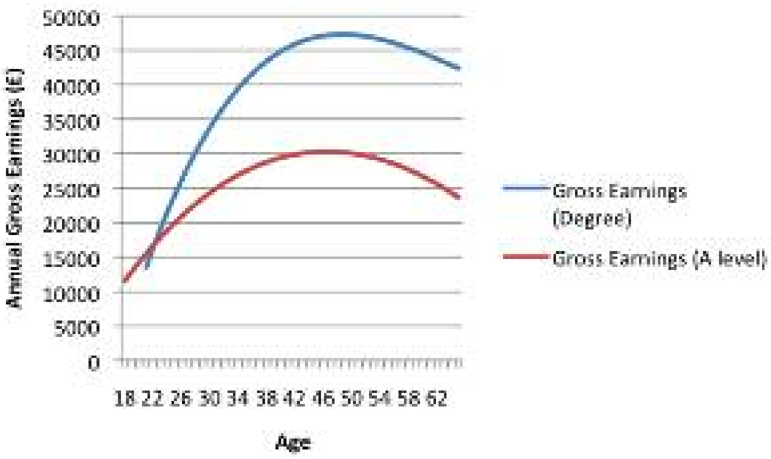
A. Returns to the wider economy from higher education

For returns to the wider economy from education the benefits and costs differ slightly to the private returns to the individual.

Benefits

1. For returns to the wider economy it is the additional gross earnings (exclude tax and NI contributions) attained by those holding a degree versus A-level qualifications we are interested in assessing. Note for this calculation we use gross earnings as a proxy to capture how much a person's work effort is worth to society ie it captures the benefits to wider society from higher earnings and therefore higher taxes and NI.

Table 11: Gross earnings for degree and A-level qualifications



Source: Labour Force Survey 2010-2011

Costs

2. Costs to the wider economy include the cost associated with sending an average student through university. Here we use HEFCE-funded higher education institutions' teaching costs to capture the costs associated with an average year of university. (Source: HEFCE 2011). The teaching costs are given as an aggregate figure which is then divided by the number of students attending a higher education institution (Source: HESA 1011).The average degree length is 3.305 years given that 73% of students attend university for three years, 23.5% attend for four years and 3.5% attend for five years. The costs are adjusted for inflation after the first year by 2% per annum (expenditure starts at £5,583.11). Overall the cost of sending the average student is £18,864.011. Source: HEFCE, HESA

3. Costs also capture the average student's foregone earnings over the 3.305 years they are in universtiy and not participating in the workforce.

Cost-benefit analysis

To get an estimate of the value of benefits and costs to the wider economy, the final step was to discount net benefit at each age by 3.5% to get the discounted net benefit per year.

Returns to the wider economy from higher education

The net present value of attaining a degree compared to an A-level degree over an individual's working lifetime is approximately £180,000.

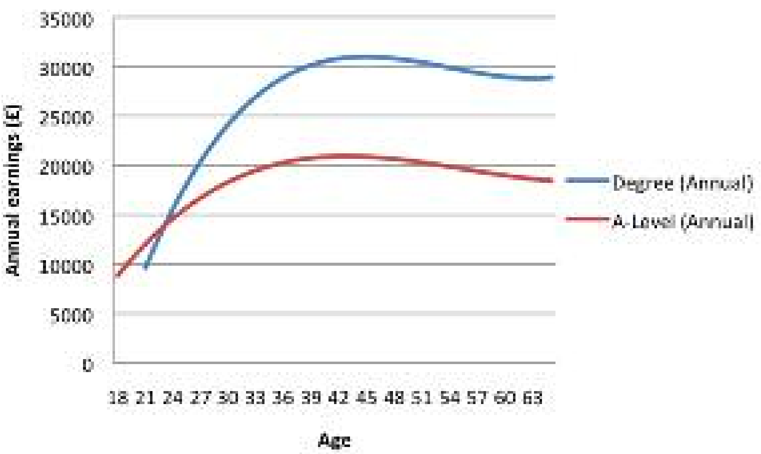
B. Private returns to education

A cost-benefit analysis was used to estimate the value of the benefits and costs to the wider economy and to the individual of attaining a degree. The private returns of attaining a degree are calculated for three different tuition fee scenarios. For private returns the costs and benefits are as follows:

Benefits

1. Benefits from investment in higher education include the additional earnings attained by degree holders versus A-level graduates. This is the difference between net annual earnings (exclude tax and NI contributions) of degree holders and A-level graduates ie net annual earnings of graduate – net annual earnings of A-level graduate. The earnings data is based on current earnings.

Table 12: Net earnings for degree and A-level qualifications



Source: Labour Force Survey 2010-2011

Costs

2. Costs to the individual include the cost of tuition fees to obtain an average degree. The average degree length is 3.305 years given that 73% of students attend university for three years, 23.5% attend for four years and 3.5% attend for five years. The tuition fees are adjusted for inflation, after the first year, by 2% per annum. The average total cost is £11,116 – given a fee of £3,290 per year in the first year. (Source: BIS 2011 The Returns to Higher Education Qualifications)

3. Costs captured include the foregone earnings an individual incurs over 3.305 years by opting out of the workforce.

Calculating the cost-benefit analysis

To get an estimate of the value of benefits and costs to the individual in present value figures, the net benefit at each age is discounted by 3.5% (Source: HMT)

Private returns to individual

The net present value of attaining a degree compared to an A-level over an individual's working lifetime is £98,000[9].

Scenarios

Given the introduction of higher tuition fees for degrees from 2012, there are additional calculations for the private return to individuals. The cost-benefit analysis was run according to two scenarios: with fees being set at £7000 and £9000. The net present value for these scenarios is approximately £86,000 (£85,970) and £79,500 (£79,480) respectively.

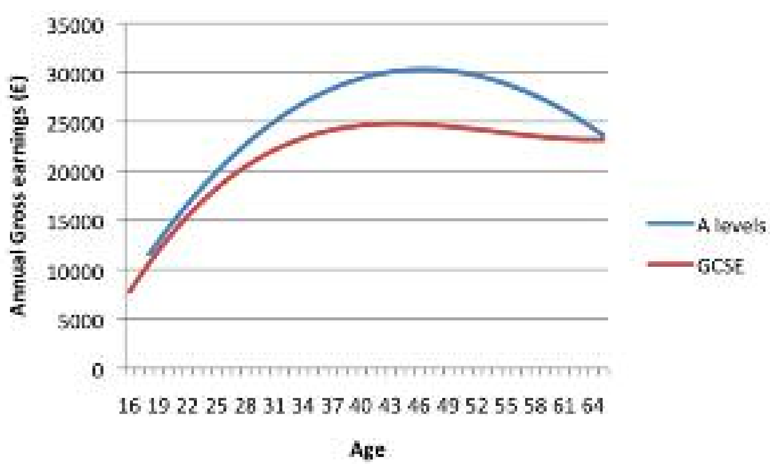
C. Returns to the wider economy for A-level qualifications

For returns to the wider economy for A-level qualifications the benefits and costs differ slightly to the private returns to the individual again as we include gross earnings and include the teaching costs associated with A-level graduates.

Benefits

1. Benefits are similar to private returns but here it is the additional gross earnings (include tax and NI contributions) attained by those holding A-level qualifications we are interested in, ie gross annual earnings of A-level – gross annual earnings of GSCE graduate. Note for social returns we use gross returns to capture the benefits to wider society from higher taxes.

Table 13: Gross earnings for A-levels and GCSE qualifications



Source: Labour Force Survey 2010-2011

[9]To note these are average returns, and the calculations do not account for changes in employment rates. There are possible greater returns if degree-level graduates have higher employment rates, but this is not included in the model. An additional assumption is that those who go to university presumably have better A-level results, on average, than those who do not, and might therefore be expected to earn more than the average A-level leavers. This results in a slightly exaggerated earnings gap. We also do not account for individuals who drop out of their degree, which could result in a deadweight cost that brings the down the average. These caveats hold throughout the paper.

Costs

2. Costs to the wider economy cover all costs associated with an average student completing A-levels. Here we use teaching costs as a proxy for the cost borne by the wider economy; this is derived from the combined Skills Funding Agency and Young People's Learning Agency of college finance records for the year ending 31 July 2010. The teaching costs are given as an aggregate figure which is then divided by the number of students attending sixth form colleges (Source: Skill Funding Agency and Young People's Learning Agency). The average course length is assumed to be two years. The costs are adjusted for inflation after the first year by 2% per annum (expenditure starts at £2,400).

3. Costs also include the foregone earnings of individual over the two years they are-out of the workforce.

Cost-benefit analysis

To get an estimate of the value of benefits and costs to the wider economy, the final step was to discount net benefit at each age by 3.5% to get the discounted net benefit per year.

Returns to the wider economy an A-level qualification

The net present value of attaining an A-level over a working lifetime is approsimately £47,000 (£46,961).

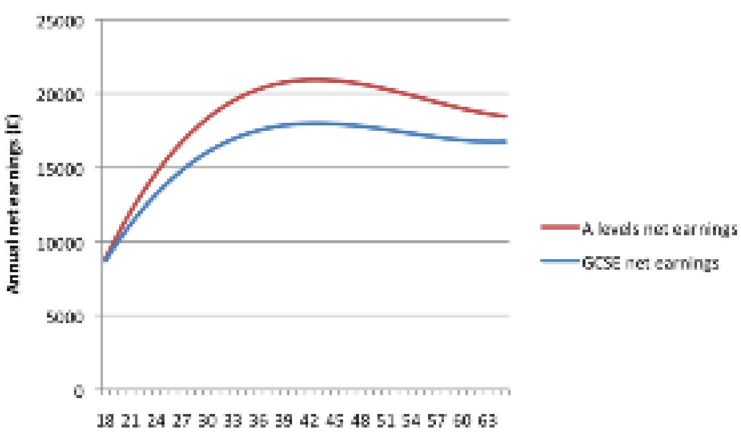
D. Private returns to education

For this report we assess the value of pursuing an A-level qualification versus GCSEs. Further education offers a range of educational options beyond A-level. However given the data limitations, the model assesses the returns to A-level. The labour force survey earnings data is estimated in qualification bands (A-level, degree, GCSE etc) and not the type of institution attended. Again, here both the private returns and returns to the wider economy are estimated. For private returns the costs and benefits are:

Benefits

1. Benefits included in the value of pursuing an A-level are the additional earnings attained by A-level graduates versus GCSE holders. This is the difference between net annual earnings (exclude tax and NI contributions) of A-level graduates and GSCE graduates. Source: Labour Force Survey 2010-2011.

Table 14: Net earnings for A-levels and GCSE qualifications



Source: Labour Force Survey 2010-2011

Costs

2. Costs also include the individual’s foregone earnings over the two years where we assume they are out of the workforce and in education. This is calculated in our model as equivalent to the salary of 16- and 17-year-old GCSE graduates. Unlike the cost-benefit analysis of degree graduates, for the purposes of our model here we assume there are no individual costs associated with undertaking an A-level degree.

Cost-benefit analysis

To get an estimate of the value of benefits and costs to the wider economy, the final step was to discount net benefit at each age by 3.5% to get the discounted net benefit per year. The net present value of attaining an A-level is approximately £45,300 (£45,340).

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