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BIG INNOVATION CENTRE

The Next Wave of Innovation

Five areas that could pull the UK clear of recession

Andrew Sissons

The Big Innovation Centre is an initiative of The Work Foundation and Lancaster University. Launched in September 2011, it brings together a range of companies, trusts, universities and public bodies to research and propose practical reforms with the ambition of making the UK a global open innovation hub as part of the urgent task of rebalancing and growing the UK economy, and with the vision of building a world-class innovation and investment ecosystem by 2025.

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Executive summary

Britain needs a new economic model to pull it clear of a decade of stagnation. The forces that have driven growth in the past – consumer spending, freely available credit and the widespread adoption of computers – are unlikely to return. Until we find new forces to ignite the economy, the UK will be locked into a cycle of sluggish growth, volatility and high unemployment that will leave it vulnerable to the vagaries of a turbulent world economy. In short, Britain desperately needs a new wave of innovation. We need to exploit emerging ideas and technologies, turn them into viable business models and sell them to the world. Without developing new, world class industries, and creating new types of job, the UK economy will not emerge from the ruins of the financial crisis.

But innovation does not happen in a vacuum. Inventors, businesses and entrepreneurs don't develop groundbreaking ideas out of thin air; still less can they turn their ideas into cash on their own. Innovation has to come from somewhere, and we need to understand where it comes from if we want to promote it. Innovation is the product of a complex system, made up of many different types of business, of banks, universities, and public institutions, and shaped by laws and market regulations. If we want Britain to return to the forefront of the global economy, we need to make these innovation systems work as effectively as possible, to support entrepreneurs and drive innovation.

At the same time, innovation is concentrated in certain areas of the economy, and it will look different in different industries. There is no point in trying to drive growth in every part of the economy; some areas will inevitably decline, just as others will undergo rapid growth. Over the last 30 years, innovation in the UK has come from a complex mix of business services and public sector employment, driven in part by a boom in consumption. Contrary to popular perception, not all of this innovation has been illusory; much of it has been a productive response to changes in the global economy. But the UK's economic model of the last 30 years has left us with some severe structural problems, most notably a gaping strategic trade gap and a stifling legacy of debt.

Key insights from the research

This paper contains a number of findings on the nature of innovation in the UK economy:

- Innovation and economic growth do not just come from individual businesses. Instead, growth is concentrated among networks of interdependent businesses, which interact with one another in a range of ways. This reflects the growing complexity of the economy, and partly explains why a systems approach to innovation is so important;

- Although growth in demand has largely been driven by consumer spending, the majority of new jobs have been created in industries that sell things to other businesses, and not directly to consumers. This is a consequence of the increasingly networked nature of the economy;
- Innovation and long-run economic growth are not always tied directly to productivity growth. Some parts of the UK economy, most notably manufacturing, have experienced rapid productivity growth coupled with falling output. This suggests that the demand-side needs to be considered more prominently within studies of innovation;
- There are three key elements that drive innovation within particular parts of the economy: technology; applications and business models; and demand. Technological progress alone is not enough to drive growth; it must be turned into useful products and services, and generate sufficient customer demand. These three elements increasingly interact with one another, partly enabled by improved communication technology.

Five areas with the potential to undergo rapid innovation

Britain's new wave of innovation must build on existing economic strengths, while taking advantage of emerging opportunities. These opportunities could come from a wide range of new ideas and technologies, many of which cannot be predicted with confidence. At any rate, the government should not be aiming to pre-empt the future, but should rather focus on putting in place the conditions that enable Britain to adapt and respond to emerging economic opportunities.

This report identifies five parts of the economy that have the greatest potential to undergo rapid innovation between now and 2025. The aim of doing this is not to provide a narrow focus for government policy, but to highlight the different types of policy that government can introduce to drive growth in different parts of the economy. Each of these economic drivers is supported by a subtly different innovation system, and government policy must take account of these variations, without lapsing into crude industrial policy. The five potential high-innovation areas are:

1. **Healthcare:** The ageing of the UK population, combined with advances in life sciences and service models, should lead to significant innovation and growth in healthcare;

2. **The low resource economy:** As natural resources become strained by a growing world population, innovative products and services that use resources more efficiently, while reducing carbon emissions, should be fertile ground for economic growth;

3. **The experience economy:** Rising incomes and sophisticated consumers increasingly demand complete experiences rather than products. This is enabling retailers, personal services and manu-service firms to create new value by designing innovative new service models;

4. **The digital economy:** The rise of powerful online networks has created a burgeoning market for content and information, which has enabled a range of new business models for creative companies as well as traditional manufacturers and retailers, and will continue to grow rapidly; and

5. **Business services:** Britain's success story of the last 20 years, business services will continue to grow in response to the growing needs of UK firms for knowledge assets, expertise and professional support.

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Chapter 1 Introduction

Innovation can come from anywhere. It might be the result of years of research, or serendipitous, accidental changes. It can happen in any part of the economy, from high-tech, knowledge-intensive sectors to basic service industries. But there are certain parts of the economy that are more innovative, and grow more quickly than others. These innovative branches of the economy are crucial, because they create the majority of new jobs, and help to drive growth across the rest of the economy.

These high-innovation branches are determined by technological change and market forces, rather than by government intervention. Despite this, the state has a major role in creating the right conditions for innovation to take place. While some of these conditions – such as finance, confidence and infrastructure – apply to all parts of the economy, many of them are unique to specific markets. As a result, knowing which parts of the economy have the potential to undergo rapid innovation is extremely important for government. Without this understanding, it is impossible to design coherent innovation policies for the future, from skills and technological infrastructure to investment priorities and market regulations.

The debate over innovation policy often becomes polarised between those who advocate a sectoral approach – sometimes characterised as 'picking winners' – and those who support a sector-blind approach that focuses on putting in place the broad conditions for economic growth. But this dichotomy is both misleading and unhelpful. Effective innovation policy can put in place the broad conditions needed to support innovation in all parts of the economy, while taking into account challenges and opportunities that are specific to some markets. Indeed, a truly systematic approach to innovation policy cannot coherently be sector-blind, since the innovation system varies between different parts of the economy.

The aim of this paper is to shed light on why certain parts of the economy create most economic growth and new jobs. Understanding the drivers and conditions that cause innovation in certain areas can help us to predict where growth and innovation might come from in the future. To this end, we have set out five parts of the economy that have the potential to experience rapid innovation over the coming decades, given the right policies and external conditions. The ultimate goal, though, is not to plan and project the exact future of the UK economy, but to move towards a sensible and flexible approach to innovation policy that can drive growth in the places where it is most likely to occur.

How do we measure innovation within a branch of the economy?

One of the biggest challenges in thinking about innovation is defining exactly what it means. There is a wide-ranging body of literature on the topic, which has led to a plethora of different definitions and distinctions being drawn; distinctions between radical and incremental innovation and product and process innovation have been among the most commonly used.

For all these different definitions, there is a pretty clear consensus on why innovation matters: it is the primary source of lasting economic growth in a developed economy. At its heart, innovation is about doing something new and better. In an economic context, innovation refers to any change that raises the national output in the long term. Innovation may involve creating an entirely new product or service, raising productivity, or finding new ways to sell existing products; quite often, it involves a combination of all three. Innovation matters because it is the only way the economy can grow and create new jobs in the long-term. Short-term increases in economic output that do not involve doing something new and better are generally short-lived; the pre-recession booms in financial services and the housing market bear testimony to this.

But measuring innovation at its source is extremely difficult. We may be able to work out how many inventions have been registered – by looking at data on patents and other intellectual property – but it is much harder to work out how much each invention is worth to the economy. Further, many types of innovation – particularly those involving new services or business models – are often not captured formally, and yet they make up a significant proportion of economic growth. This makes it extremely difficult to measure the value of specific innovations.

For the purposes of this paper, which looks at the UK economy as a whole rather than specific firms or industries, it makes sense to use growth as a proxy for innovation. Since most growth in a knowledge economy like the UK ultimately comes from innovation[1], it is reasonable to assume that fast-growing parts of the economy are undergoing more rapid innovation. Of course, growth alone does not prove that part of the economy is particularly innovative, so it is important to complement this view by looking at other key indicators of competitiveness:

- **Exports and trade balance:** Competitive and innovative sectors will often have a strong trade performance. Growth in exports and positive trade balances usually indicate that the UK has a competitive advantage in that area; and

1 This idea is implicit in both exogenous growth theory (see Solow (1956) A Contribution to the Theory of Economic Growth) and endogenous growth theory (associated with the work of Paul Romer)

- **Productivity growth:** Innovation is usually associated with improvements in output per worker; however, this must be treated with some caution, since rapid productivity growth in a sector is not always associated with growth output.

So while this paper focuses on innovation in different parts of the economy, the key measures available to us are growth in output and productivity and international competitiveness.

The purpose of this paper

The purpose of this paper is threefold. First, it seeks to draw on the UK's past experience of growth and innovation, to understand what has driven growth, and what makes certain parts of the economy grow rapidly. Second, it sets out the five areas that appear most likely to grow rapidly over the next decade or so, and thus represent Britain's best chance of moving past the recession. And third, it argues that a systematic approach to innovation and economic policy cannot be sector-blind. Different parts of the economy have different needs and characteristics, and government policy must take account of this, without reverting to old-fashioned industrial policy.

Chapter 2 Where has innovation come from in the past?

If we are to understand which parts of the UK economy are most likely to grow in the future, it is important to identify where innovation has come from in the past. This section looks at which parts of the economy have grown in the past, and examines the drivers behind these changes, looking at growth in both demand and supply.

Looking into where growth has come from presents a somewhat confusing picture. The UK has consistently run a large trade deficit, manufacturing output has been stagnant at best (fuelling the myth that Britain doesn't 'make' anything anymore), and most of the new jobs have been created in the supposedly 'unproductive' service sector. But despite this, Britain's economic growth has been comparable with many other leading economies since 1979, even allowing for the effects of the financial crisis.

Innovation and growth in the UK economy has been heavily concentrated in a few areas, particularly business services and health. However, when it comes to explaining what has caused this growth, the evidence throws up a number of apparent paradoxes, including:

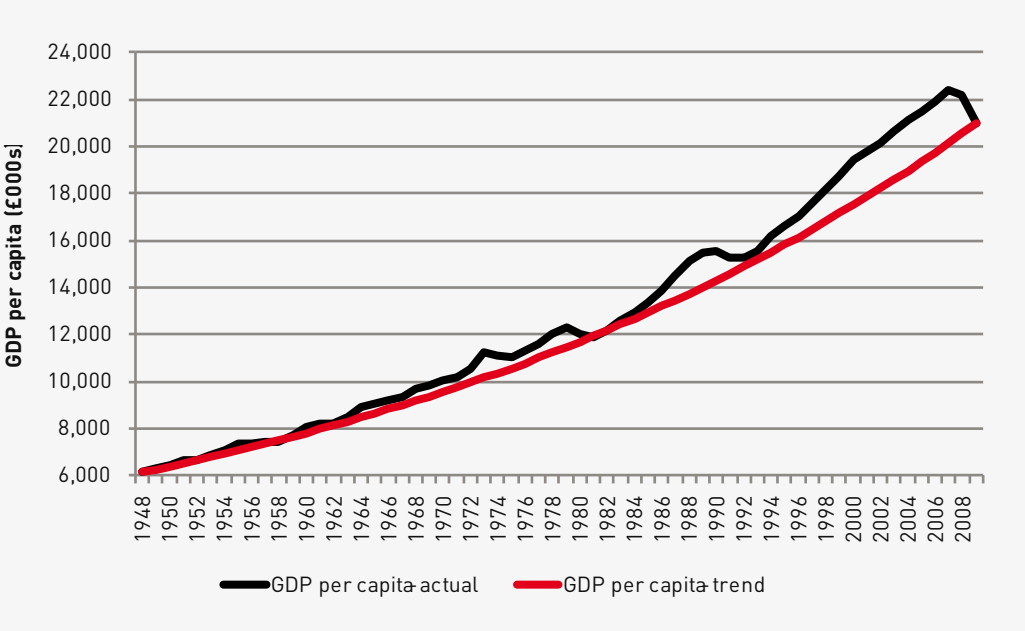
- Demand growth since 1979 has been driven by a consumption boom, and yet most economic growth has been concentrated in industries that primarily sell things to other businesses, not to consumers;
- In many parts of the UK economy, especially manufacturing, periods of productivity growth have been accompanied by stagnant or falling output;
- Growth in jobs has been largely concentrated in a minority of high-growth firms, and yet these firms are evenly distributed across all parts of the economy, whether they are shrinking or growing; and
- The UK's long term growth rate appears to have remained roughly constant at around 2.25 per cent per year since the second world war, despite significant changes in economic policy over that period.

These apparent paradoxes all make it harder to interpret the nature of the UK economy, but they can all be explained by changes in the structure of our economy. This section provides an overview of where growth has come from in the UK economy over recent decades, and provides an explanation for each of these confusing aspects of the UK's recent economic history.

How has the UK's growth rate varied over time?

Since 1948, the UK's economy has grown at a long-term rate of around 2.25 per cent a year – this figure is around 2 per cent when controlling for population growth. As **Figure 1** shows, the short-term growth rate has fluctuated considerably around this figure since 1980, with a sustained boom between 1994 and 2007 leading to a recession that returned output to its long-term trend.

Figure 1: UK GDP per capita since 1948



Source: ONS Blue Book, GDP per capita figures

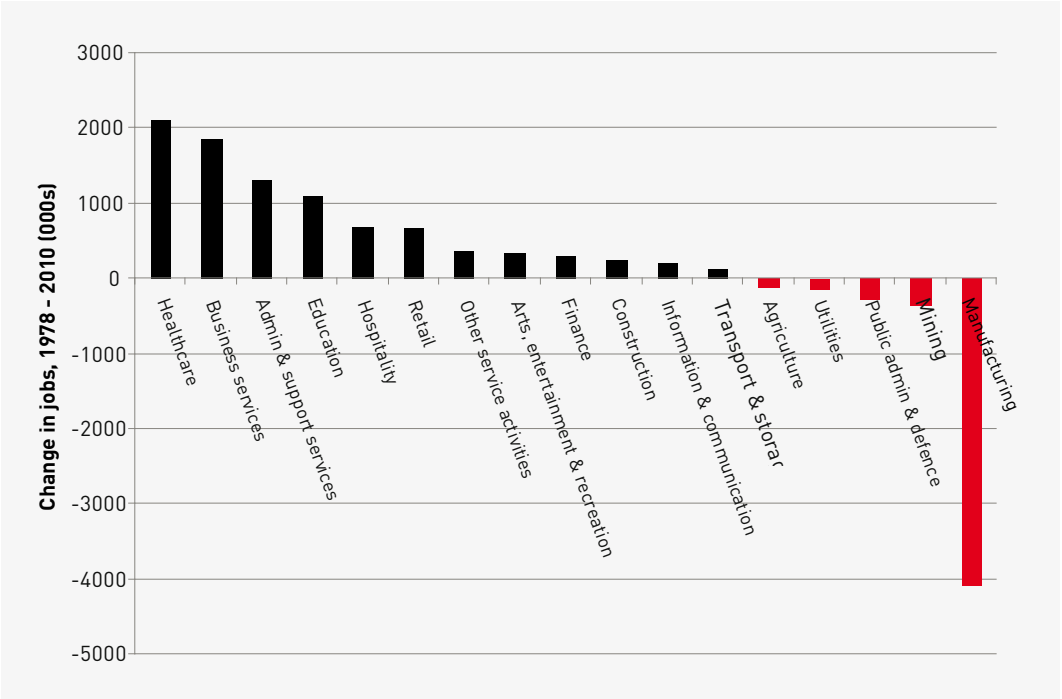
Note: Trend growth rate has been calculated as a constant annual percentage change from 1948 to 2009. The trend curve represents a constant rate of GDP growth of 2.04 per cent per annum; it slopes upwards because 2 per cent represents a larger amount of GDP as GDP increases. This does not mean that the trend growth rate has accelerated over time.

This long-run per capita growth rate of 2 per cent broadly reflects Britain's long-run rate of innovation. The fact that it does not appear to have changed significantly in the post-war period suggests that the various different economic policies pursued since 1948 have not significantly altered the UK economy's underlying capacity for innovation. This is a surprising finding, especially given the significant shift in Britain's economic policies after 1979, but it does not preclude the UK increasing its rate of innovation in the future.

Where has the growth come from over the last three decades?

Since the late 1970s, growth in GDP and employment has overwhelmingly been concentrated in a few key parts of the economy, most notably business services, healthcare and education. In the private sector, the business services sector has created 1.8m jobs since 1978, along with an additional 1.3m jobs created in administrative and support services. Meanwhile, the public sector areas of education and healthcare have created over 3.2m jobs combined (1.1m and 2.1m respectively). At the same time, over 4m manufacturing jobs have been lost. **Figure 2** gives a full breakdown of how employment has changed in each part of the UK economy since 1978.

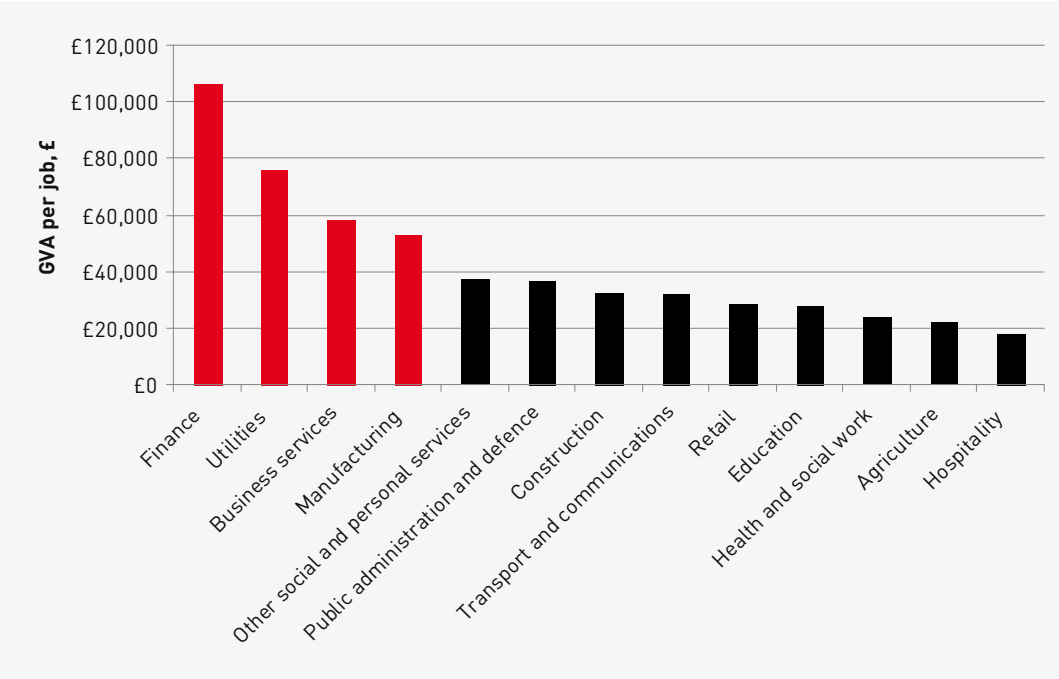
Figure 2: Change in jobs by industry, 1978 - 2010



Source: ONS Workforce Jobs survey

These changes in employment do not tell the full story. The UK economy has three main productive anchors: manufacturing, business services and finance. These three activities have the highest levels of productivity (along with utilities), as shown in **Figure 3**.

Figure 3: GVA per job in main sectors of the UK economy



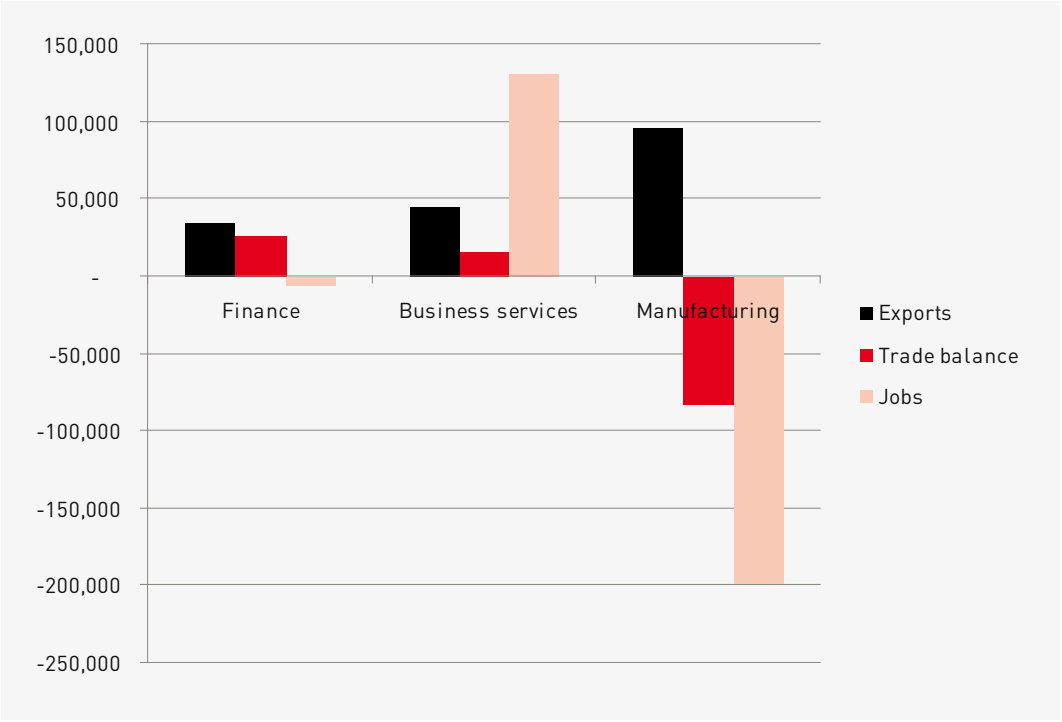
Source: ONS Blue Book and Workforce Jobs survey. GVA values in 2009 prices

Note: Mining has been excluded from this chart. Due to data constraints, 'Business Services' includes both knowledge-based business services and administrative and support services in this chart. It is likely that GVA per job in knowledge-based business services is significantly higher than £60,000, while the figure for administrative and support services is expected to be considerably lower.

These sectors are both highly innovative, and extremely important to the UK economy, since they generate much of the value that stimulates demand for other activities. They also account for over 80 per cent of UK exports.[2] Despite this, they have experienced differing fortunes over recent decades. As **Figure 3** shows, financial services has seen its trade performance improve markedly since 1991, without creating many new jobs. Manufacturing has seen its trade balance deteriorate and has shed jobs en masse, but it has increased exports. Meanwhile, business services, the UK's best performing sector, has both created large numbers of jobs and vastly improved its export performance. This analysis suggests that business services have been the most innovative part of the UK economy over the last 20 years, with financial services.

2 ONS Balance of Payments Quarterly First Release

Figure 4: Changes in trade performance and jobs in the UK's key productive anchors, 1991 – 2010



Source: ONS Balance of Payments Quarterly First Release and Workforce Jobs Survey

Note: Figures represent absolute changes between 1991 and 2010. Exports and trade balance values are shown in £m in 2010 prices (deflated using HMT deflators), while jobs figures represent 10s of jobs (i.e., manufacturing lost almost 2m jobs, which displays as 200,000 on the chart).

What has driven the growth of the UK economy?

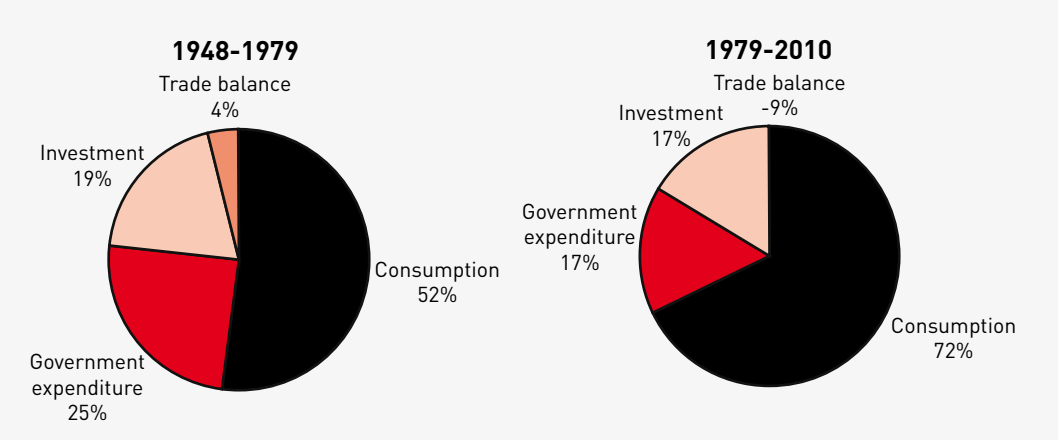
To understand why growth has been concentrated in certain areas of the economy, we need to consider the underlying drivers of growth in aggregate demand and supply in the UK. Industries can only grow if someone wants to buy their products, and if they can increase their ability to supply them, so it is worth looking at underlying changes in demand and supply for clues as to what has driven the growth of the UK economy.

Demand and consumption

Over the last 30 years, growth in demand has been driven primarily by a boom in consumer spending; consumption accounted for over 70 per cent of all growth in demand between 1979 and 2010. At the same time, Britain's trade deficit has acted as a serious drag on growth, which must be reversed as part of any sustained economic recovery.

As **Figure 5** shows, this picture differs significantly from the 30 years previously, where growth in demand was more balanced, and relied less on consumption and more on government spending and trade.

Figure 5: Contribution to growth in aggregate demand, 1948-1979 and 1979-2010 compared

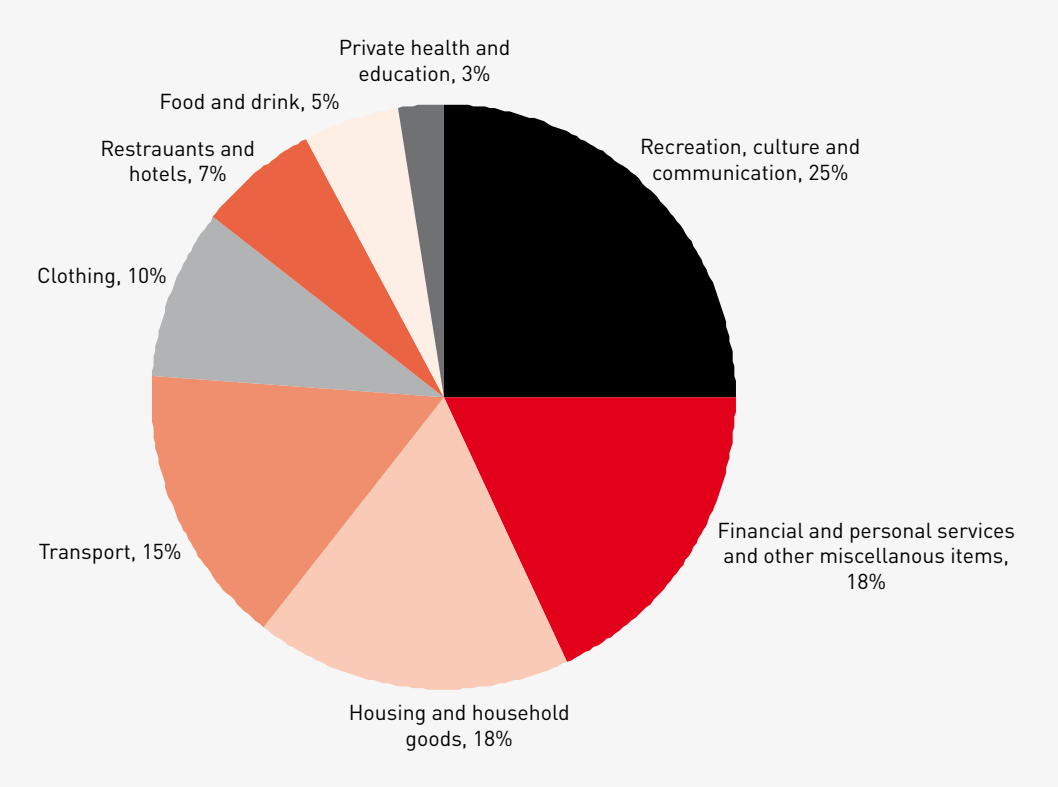


Source: United Kingdom Economic Accounts

This growth in consumption has largely been the result of increased spending on recreational items and new technologies, as **Figure 6** shows. The fastest growing area of consumption has been recreation, culture and communication, which includes computers, electronic equipment and various hobbies and cultural services. Other major areas in which consumption has increased include transport, financial services, clothing and housing-related products. Meanwhile, consumption growth has been far more modest in areas such as food, alcohol and even restaurants and hotels.

Consumer spending is evenly split between goods and services, with goods accounting for just under £400bn of spending, and services just over £420m (although the services figure is boosted significantly by the inclusion of housing, at around £160m). Since 1979, goods have accounted for 53 per cent of consumer spending growth, with housing contributing 10 per cent and other services around 37 per cent of growth.

Figure 6: Contribution to growth in consumer spending, 1979 to 2010



Source: ONS Consumer Trends data. All figures in 2006 prices.

The supply side – productivity growth

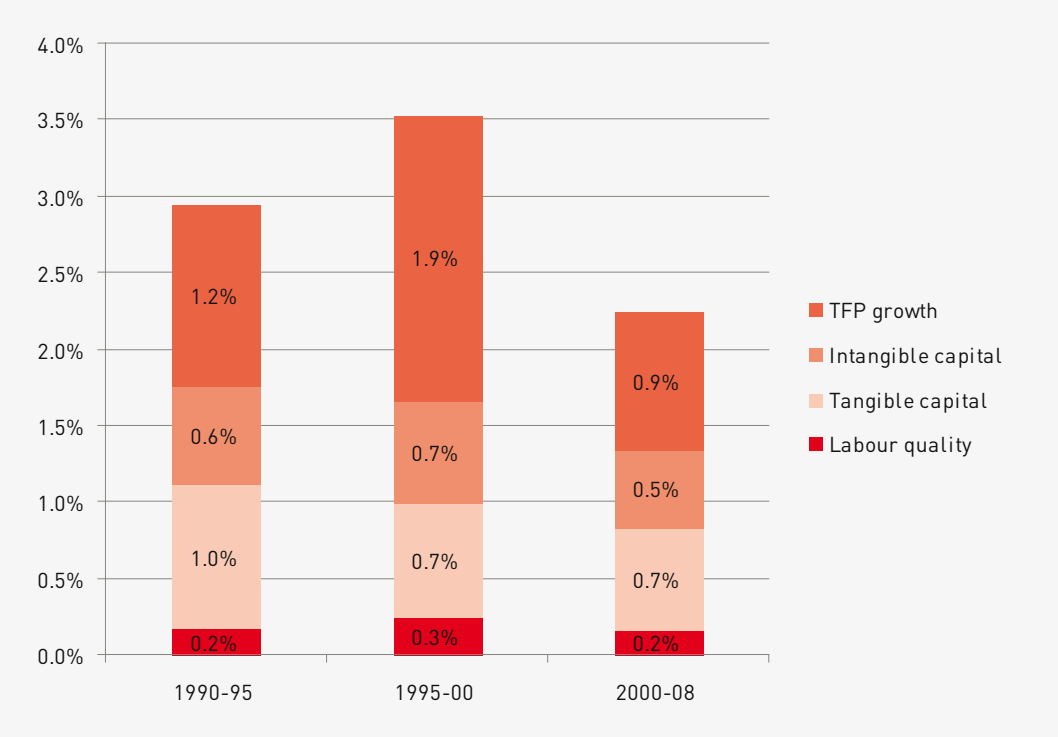
On the other side of the growth equation, economic growth must also be sustained by growth in productivity. Over the last 20 years, the UK's private sector productivity growth has been driven primarily by innovation and investment in knowledge assets by businesses. According to data from NESTA[3], labour productivity grew by an average of roughly 2.8 per cent a year between 1990 and 2008. Of this growth, between 25 per cent and 30 per cent was the result of investment in knowledge assets and higher skill levels, while another 45 per cent came from knowledge spillovers and other sources of

3 NESTA (2011) Driving Economic Growth

serendipitous innovation[4]. By contrast, less than 20 per cent of productivity growth came from investment in physical capital, such as machinery and computers.

As **Figure 7** shows, there has been significant variation in the rate of productivity growth during different periods over the last 20 years or so. According to NESTA, productivity grew much more rapidly, by around 3.5 per cent a year, between 1995 and 2000, before slowing considerably to 2.3 per cent a year between 2000 and 2008. This rapid increase during the late 1990s can partly be explained by a boom in software investment.

Figure 7: The role of innovation in labour productivity growth since 1990



Source: NESTA

However, this data suggests that productivity in the market sector grew much faster than did the UK economy overall. Annual GDP growth in the UK between 1990 and 2008 averaged around 2.4 per cent[5], considerably lower than the 2.8 per cent growth in

4 This 45 per cent represents modelling of Total Factor Productivity (TFP), which measures growth in productivity that cannot be explained by increases in inputs (such as investment in tangible capital, knowledge assets or labour quality). This TFP value is calculated as a residual – so it is not directly observed – but it is assumed to come from spillovers and serendipitous interactions

5 United Kingdom Economic Accounts

productivity. This gap may partly be explained by slow productivity growth in the public sector, but it is a surprising finding, especially given that employment increased by more than 2.5m over the period.[6]

Can demand and supply fully explain the growth of the UK economy?

While these demand and supply factors provide an insight into what has driven the growth of the UK economy, they cannot fully explain many important trends that have shaped the economy. Some of these apparent paradoxes are highlighted below.

Productivity growth and economic growth are not always linked

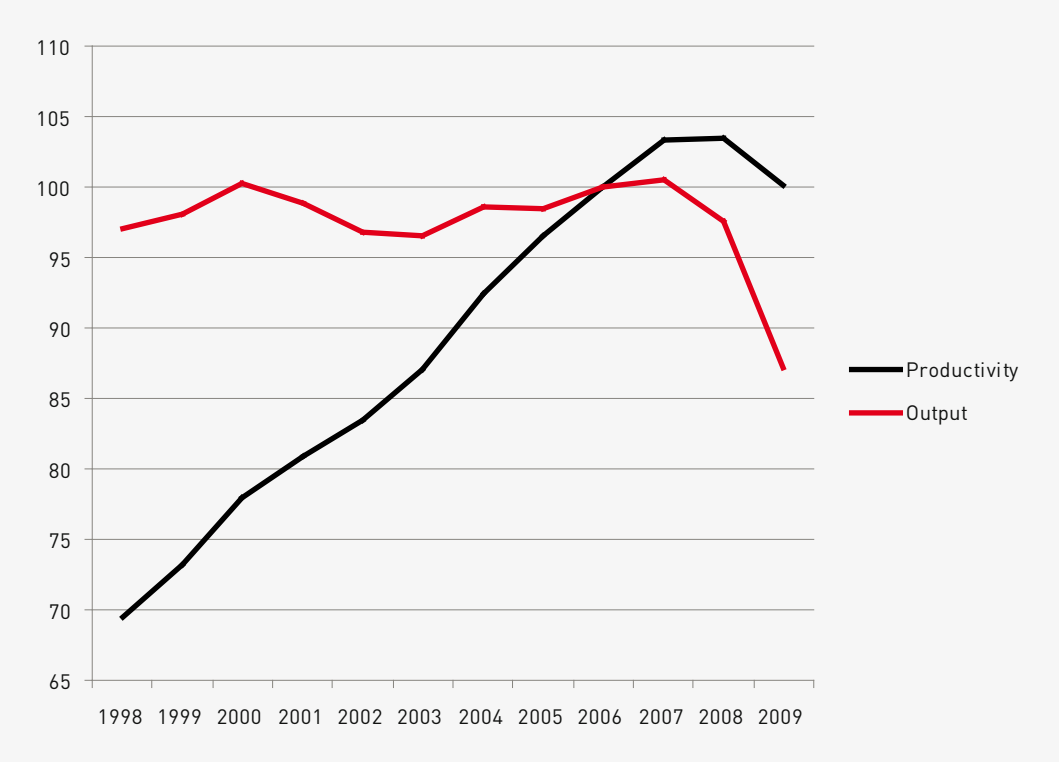
The fact that the economy has grown more slowly than productivity highlights an important point that is often overlooked: productivity growth and economic growth do not always go hand in hand. While productivity is clearly an important driver of growth, we should be cautious about equating the long-term rate of productivity growth with total economic growth (as tends to be the standard in theories of long-term economic growth).

This point applies equally to different parts of the economy as to a national economy as a whole. Between 1998 and 2009, productivity in the manufacturing industry grew by 44 per cent (more than twice as quickly as in the economy overall), and yet manufacturing output declined by 10 per cent over the same period. This occurred despite the export-facing nature of manufacturing, and a significant increase in domestic consumption of goods in the UK. **Figure 8** illustrates this divergence between productivity and output growth in the manufacturing sector.

This divergence between productivity and output growth, both at a national and sectoral level, is hard to explain. It may be due to mismatches between demand and supply, so that firms are more productive, but do not have sufficiently strong demand for their products to translate this into higher output. The share of UK output captured in wages has fallen from 60 per cent in 1980 to 53 per cent in 2007[7], which may have prevented some of these productivity gains feeding back into consumption (with any increase in investment deterred by constraints on growth in demand). Whatever the explanation, it is clear that innovation and long-run growth are about more than productivity alone; it is essential to take the demand-side of the economy into account.

6 ONS Labour Market Statistics
7 TUC, Lansley (2011) Unfair to middling

Figure 8: Divergence between productivity and output growth in manufacturing



Source: ONS time series data on GDP and productivity

Consumption-led growth has led to a rise in business-to-business trade

These increases in productivity – driven primarily by innovation and knowledge assets – helps to explain why so much of the UK's growth has been concentrated in business services. Business services are the activities that sell knowledge and support innovation in other businesses, so increased investment in this area has driven the growth of that sector, leading it to create 1.8m jobs over the last 30 years.[8]

But this growth in business services also leads to one of our apparent paradoxes: growth in demand has been driven primarily by consumer spending, and yet most new jobs are in areas that sell very little directly to consumers. Equally, consumer spending on goods is equivalent to around a third of GDP, and yet the UK manufacturing sector accounts for 12 per cent of GDP and 8 per cent of all jobs.

8 See Sissons, A. (2011) Britain's Quiet Success Story: Business services in the knowledge economy. London: The Work Foundation

These apparently conflicting trends can be partly explained by Britain's growing dependence on imported goods, particularly raw materials and basic manufactures. But the main reason for this shift has been a radical change in how businesses, and Britain's economy as a whole, create value in today's economy. Today's businesses rely more and more on a network of supporting services, which help to develop new outputs, raise productivity and improve their branding. These business services play a crucial role in supporting innovation and investment, and are also Britain's biggest economic strength. So although demand has been driven by an increase in consumption, businesses have responded by investing more in knowledge, technology and innovation, thereby creating jobs in IT and business services.

Rapid growth in branches of the economy is not driven by individual firms alone

It is clear from the analysis presented in this section that innovation and growth are unevenly distributed within different parts of the UK economy. Intuitively, we would expect this innovation to be driven by individual firms, with fast growing sectors populated by a high proportion of innovative, fast growing firms. It is true that high-growth firms tend to be more innovative[9]; however, with one significant exception, high-growth firms are not heavily concentrated in fast growing sectors. **Figure 9** shows that the UK's high-growth firms are roughly evenly distributed in different parts of the economy; however, business services – the fastest growing branch of the economy – has a slightly higher proportion of high growth firms than its share of employment.

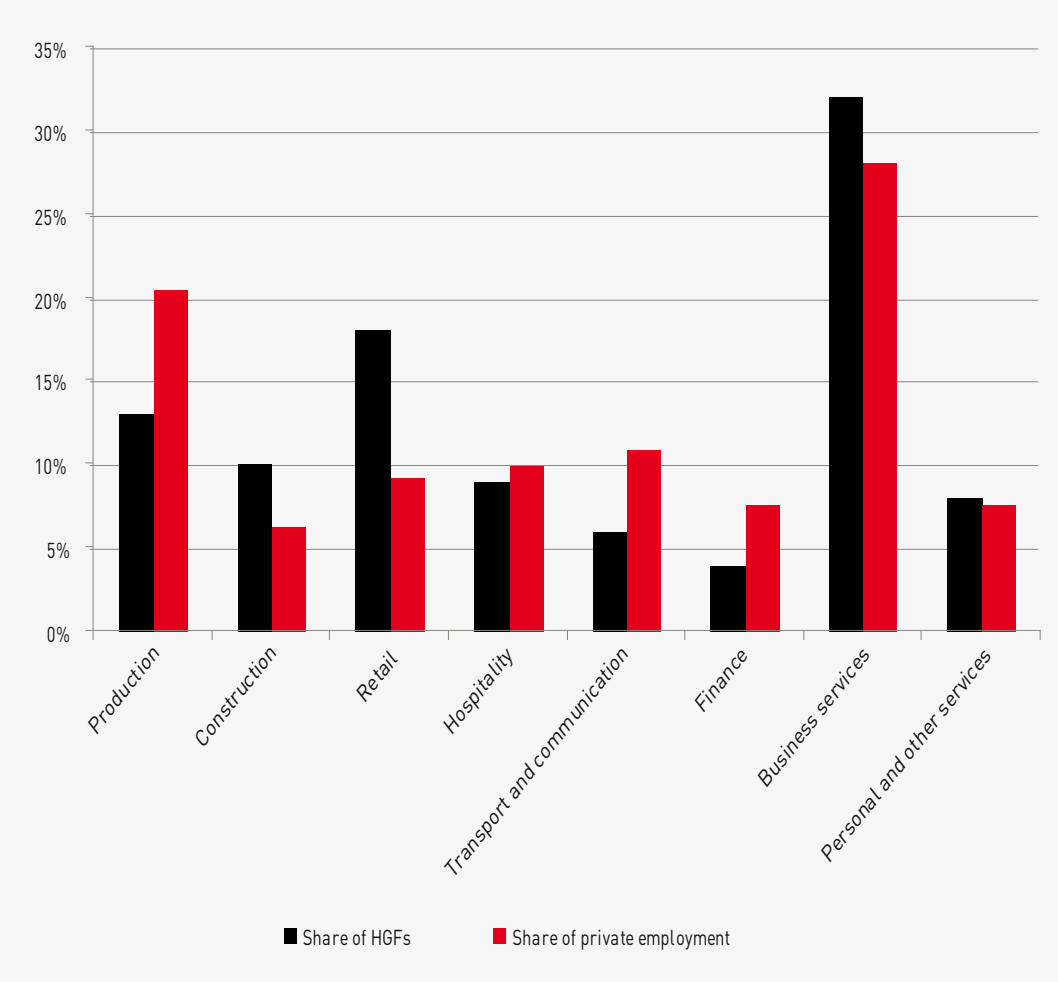
This suggests that innovation and growth within a particular part of the economy are not driven by individual firms alone, but also by wider economic conditions. Of course, high growth firms are still vital to job creation, but this evidence suggests that innovation and growth is about more than just individual firms.

The rise of the innovation network

These two surprising findings – that a consumption boom has created jobs in business-to-business trade, and that the uneven distribution of innovation cannot be explained by the activities of individual firms – point to an important change in the UK economy: the rise of the innovation network. In today's economy, firms do not work in isolation; they interact with and rely on complex ecosystems of partners and suppliers.

9 NESTA (2009) The vital 6 per cent. NESTA's econometric analysis suggested that firms that introduced a product innovation between 2002 and 2004 had an average employment growth rate of 4.4 per cent between 2004 and 2007, compared to 2 per cent among non-innovators

Figure 9: Sectoral distribution of the UK's high-growth firms compared with share of private sector employment



Source: NESTA (2009) *The vital 6 per cent*; and ONS Workforce Jobs survey. All figures are for 2008

These two surprising findings tell us a lot about the nature of an innovative economy. Innovation is not done by firms in isolation, but involves whole networks of businesses and institutions, which feed off one another. No firm in today's economy can work completely independently; it relies on a network of partners, suppliers and key infrastructure that enable it to run smoothly, and to innovate effectively. These networks are often built around particular technological platforms, or areas of demand, and can feature firms of many different types, both large and small. Inter-firm networks are also hard to trace and analyse, since they are complex, and can take many different forms. But thinking and policy on innovation must take account of these networks if it is to work at the right level. A large amount of innovation comes from knowledge spillovers

between firms within networks, so that ideas generated by one organisation can benefit many others. This is why it is so important to consider innovation in the context of a system, rather than as a series of separate outputs.

Summary – a complex economy

The analysis presented in this section makes one thing abundantly clear: the UK economy is extremely complex. With consumption booms driving growth in business-to-business trade, with an apparent decoupling of productivity and growth, and with innovation not just taking place within individual firms, it has become increasingly difficult to work out where growth comes from in the UK economy. This provides a headache for economists, but it could actually benefit Britain's businesses.

The UK economy is clearly in a delicate position; our problems are both short- and long-term. At the present moment, Britain is struggling to come to terms with the aftermath of the financial crisis. Economic growth is sluggish, held back by the slow process of recovering from the burden of debt accumulated over the last decade. But these short-term problems are compounded by long-term, structural imbalances in the UK economy. Most pressingly, Britain has developed a strategic trade gap[10], which drains the economy and creates severe imbalances; this gap can only be closed by significantly expanding exports in areas of British economic strength.

But contrary to some suggestions, the UK economy still has a lot of underlying strength. Britain has made the transition to a knowledge economy as quickly as any country in the world, and remains an open, flexible and competitive economy. And Britain is well placed to take advantage of the growing complexity of the global economy, through its world-leading business services sector. Firms and consumers increasingly need support to help them adjust to the pace of economic change, to find solutions to major challenges, and to drive innovation. It is in these areas that Britain appears to excel. If the UK can get better at exporting these solutions to an increasingly needy world, it can put itself back on a sustainable trajectory: in other words, we must become a global innovation hub.

10 See Coutts and Rowthorn (2009) Prospects for the UK Balance of Payments

Chapter 3 What makes a branch of the economy highly innovative?

The rise of innovation networks means that we need a more sophisticated understanding of what makes some parts of the economy highly innovative. Fast growing networks often spring up around new technologies, but they cannot be explained by technology alone. Innovation is not just a function of technological progress, of investment in R&D, or of any other individual measures. Rather, it involves a more complex interaction between technology, customer demand, and the business models that link these two. This section sets out a more complete picture of what drives innovation in some parts of the economy, and sets out a framework for thinking about where innovation will happen in the future.

The three elements of innovation

Innovation is driven by the interplay of three key factors:

1. **Technology:** New technologies can have a transformative effect on large parts of the economy. Technology is primarily an enabler; it can open up new types of product, provide new platforms for exchanges, and raise productivity.

2. **Applications and new business models:** In order to be useful, new ideas and technologies must be turned into something useful. This can involve combining different technologies in novel ways, developing different services or adopting new business models; and

3. **Demand:** New products and services cannot be successful unless someone is willing to buy them. Businesses and customers undergo a dynamic interaction, in which firms can shape demand and customers can influence innovation.

Academic literature and policy on innovation tends to focus disproportionately on the role of technology and research spending in driving innovation, to the detriment of the latter two factors. In turn, this often leads the debate around innovation to focus on areas such as manufacturing and 'high-tech' industries[11], which depend on technological innovation and protecting intellectual property. However, the vast majority of the UK economy is concentrated in the service sector, in which innovation in business models and customer interaction play a far greater role. To focus solely on technology and patents is akin to ignoring the role of innovation in the service sector; and it would be wholly unrealistic to consider building a sustainable UK economy without rapid innovation in services.

11 This label is often vaguely applied to industries related to computers, software, internet activities and other electronic goods

In reality, each of these three factors interacts closely with one another; a firm (or part of the economy) is unlikely to innovate successfully if any of these factors are missing. A new technology or idea (such as mapping the human genome) will not create much economic value until businesses can find useful applications for it. Equally, new products and services, however good, will generate little benefit unless there are customers willing to buy them.

At the same time, market demand can influence the development of new technologies, and their application into new products and services. Business increasingly use data on customer preferences to shape their products and services around their needs, and in some cases customers are directly involved in developing new products, through techniques such as personalisation[12] and crowd-sourcing.[13]

Technology and new ideas

New technologies can have a transformative effect on the economy in a number of different ways:

- **Creating new products:** Much of the growth in consumption over the last 30 years has been driven by technologically advanced products, such as mobile phones and computers. New technologies can create or enable brand new products, providing scope for increased sales and economic output;
- **Creating new platforms for products and services:** Some new technologies – particularly those associated with the digital economy – create new platforms for products and services. For example, the invention of the television spawned a broadcasting industry, while the internet provides a new platform for a range of creative activities;
- **Raising productivity:** New technologies often raise productivity, either by complementing workers or automating jobs altogether. This productivity growth is a key driver of long-run economic growth; and
- **Bringing people closer together:** Technologies that make it quicker and cheaper for goods, people and information to move around the world (such as air travel and the internet) can create new markets, and make a greater range of beneficial economic transactions possible.

12 Personalisation involves allowing customers to specify bespoke variations to a mass produced product. For an overview, see Kumar (2008) From mass customisation to mass personalization

13 Crowd-sourcing involves taking contributions from the general public to solve problems or develop new products

Waves of technological progress are often built around the development of key general purpose technologies, which are widely applicable to many different parts of the economy. These technologies – such as steam engines, computers and the internet – tend to trigger waves of innovation, as businesses rush to exploit the benefits of these technologies. More radical technological breakthroughs such as these are generally accompanied by more incremental improvements in technology, which work to develop and exploit these broader technologies.

The development of new technologies is primarily driven by investment in research, both by the private sector and by universities and public research bodies. However, this does not mean that there is a linear relationship between research spending and technological progress; other factors, including collaboration and serendipity, can play a significant role. This means that government policy must focus on more than just the level of investment in research, and also look at this research spending as part of an integrated system.

Box 1: General purpose technologies

Within the arena of technological progress, certain technologies stand out as being particularly important to economic growth. These so-called 'general purpose' technologies – from steam power to the internet – affect all parts of the economy, and can have a transformative effect on productivity and the range of products and services that are made possible. This makes general purpose technologies a particularly important focus on for innovation policy.

It is not easy, even with hindsight, to determine which technologies have a sufficiently broad economic impact to be considered general purpose. We know that computers, software and the internet have had a transformative effect on the whole economy, but it is hard to say whether these are separate technologies, or all aspects of a single technological advance. At the same time, it is hard to predict with any certainty which technologies will be most important in the future. Future technological breakthroughs may build on the internet revolution, or they may lie in different fields entirely.

Just as important as the development of new general purpose technologies is the application and diffusion of these technologies around the economy. The benefits from breakthrough technologies – especially those that raise productivity – depend on them being widely used across a range of activities in the economy.

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This diffusion is a complex process – it requires translational research to apply technologies to different sectors, new skills to use technologies effectively, and considerable investment by firms.

Because general purpose technologies are hard to predict, policy should focus on the frameworks and conditions that can speed up this technological diffusion. These conditions range from the enabling infrastructure and skills, to the knowledge hubs and business services that enable firms to incorporate general purpose technologies effectively.

Applications and business models

While technology tends to drive transformational changes in the economy, it is primarily an enabler rather than a source of value in its own right. If it is to generate economic growth, technology needs to be turned into something useful, and businesses need to find a way of getting people to pay for it. This process of applying technology to create new products and services can take many forms, including:

- **Using existing technologies to create new products:** Businesses have significant scope to develop new products using existing technologies, by developing new concepts and improving designs;
- **Developing new services:** Businesses can develop a range of new services to meet the needs of their customers. For example, digital firms such as Groupon and LinkedIn use existing internet technology to provide a different type of service to customers. These innovative services may also be combined with manufactured goods, as part of 'manu-service' packages[14];
- **Improving business processes:** Technology may be a great aid in boosting productivity, but it needs to be accompanied by changes in processes to make the most of the technology. UK businesses invest more heavily in this type of organisational capital than in any other type of intangible asset[15];

14 For an introduction to manu-services, see Sissons, A. (2011) More than making things: the future of manufacturing in a service economy. London: The Work Foundation

15 According to NESTA (2011) Driving Economic Growth, 'organisational capital' accounts for 23 per cent (around £32bn in 2008 prices) of investment in intangible assets by UK businesses

- **Adopting new business models:** Businesses often innovate by adopting a different business model to sell their products and services. For example, retailers may adopt an online business model, while creative industries may develop new ways of getting customers to pay for content; and
- **Combining different technologies in novel ways:** Entrepreneurs and companies can often develop innovative new products by combining existing technologies in different ways. The overlap between different technologies is likely to become more important as more and more technologies become available in future.

The application of technologies and development of new products and services is a complicated process, and is difficult to measure accurately. However, it is hugely important; the rate of economic growth depends just as much on how quickly new ideas are turned into greater economic output as it does on the creation of new ideas themselves. Despite this, applications and business models are largely ignored by government policy; it is largely left to businesses themselves.

However, the exploitation of new ideas and technologies depends on a range of institutions within the innovation system. In order to develop new products, services and business models, businesses need access to a workforce that has the right blend of skills. Universities can play a role in disseminating best practice, while entrepreneurship is also hugely important. At the same time, the multitude of business service firms in the UK play a vital role in helping businesses to exploit new ideas.

Demand

Consumer demand plays a vital – and often overlooked – role in supporting innovation. Innovation cannot succeed unless someone is willing to pay for newly developed goods and services. Raising productivity will have little impact (apart from destroying jobs) if it does not translate into increased output. For a business, persuading the customer of the merits of its product is just as important as developing a superior product in the first place. The reason for this is quite simple – in a market economy, the value of something is largely determined by what people are willing to pay for it, rather than by what it producer deems it should be worth.[16]

16 In a paper on shifting approaches to marketing, Vargo and Lusch argue that firms can only 'value propositions' to customers, rather than defining the value of their outputs by how much they cost to make. See Vargo and Lusch (2004) Evolving to a New Dominant Logic for Marketing

The relationship between innovative businesses and customers involves a dynamic, two-way interaction. Businesses actively seek to shape and manipulate demand for their products, while they can also use customers to help improve their products. This interaction can take many forms, some using traditional methods, some making innovative use of digital technology.

When introducing new products or services, businesses have always sought to reflect the desires and needs of their customers. Companies invest significantly in market research to gather information about consumer preferences, and generally seek to reflect customer needs as far as possible when developing new products.

But businesses also use a variety of tools – and invest a significant amount of money – to shape demand. Many radical new products are not demanded by customers, because their habits are slow to change, or just because customers don't realise that they exist. New products, such as the iPhone or the Kindle, become must-have products partly because they alter the way customers think about their needs. This effect does not just apply to newly invented products; the famous De Beers marketing campaign that allegedly boosted demand for diamond rings suggests that old products can still be used to shape demand.[17]

The methods available to businesses to shape demand for their products include:

- **Brand and reputation:** Most successful companies possess a brand that persuades customers to pay more for their products, and differentiates themselves within their markets. Brands can be a powerful economic asset, and make up a significant proportion of many businesses' values. UK businesses invested over £15bn (more than 1 per cent of GDP) in brand equity in 2008[18];
- **Relationship management:** Many companies – especially those involved in business-to-business trade – develop relationships with their clients to boost their sales. This so-called shift to 'relational marketing'[19] allows companies to appreciate their client's needs better, but also to lock themselves into markets and sell additional products and services; and

17 In 1939, the diamond distributor De Beers used the advertising slogan 'A diamond is forever' to popularise the use of diamonds for engagement rings. This is widely believed to have led to a rapid increase in demand for diamond engagement rings (although Brining (1990) Rings and Promises offers an interesting alternative explanation)

18 NESTA (2011) Driving Economic Growth

19 See Howells (2003) Innovation, Consumption and Knowledge: Services and Encapsulation

- **Providing information:** Besides cultivating their brand and image, businesses also seek to make customers aware of their products. Increasing customer information about products can help to make markets work more efficiently, provided the information is accurate, by causing more exchanges to take place. Businesses do this through a range of activities, ranging from traditional advertising to search engine optimisation.

At the same time, businesses can also use demand to shape their products and services. This is particularly true for services (and manu-services), which are often customised around the user's needs. Methods of using customers to shape products include:

- **Traditional market research and development:** All firms develop products and services with the potential users in mind. This often involves investing in market research to understand customer preferences, and trial testing prototype products. More recently, firms have begun exploiting data on consumer behaviour to improve their products and services[20];
- **Bespoke products and services:** Many firms offer bespoke products and services, so that customers can specify particular features to meet their needs. This concept is not new (for instance, tailors and hairdressers have always offered bespoke services), but the use of the internet has greatly increased the potential for mass customisation;
- **Direct user-interaction:** In some cases, firms can use customers to directly improve the quality of their products and services. The use of crowdsourcing allows firms to receive ideas and input from their customer base en masse, sometimes in actually designing or developing products. In other cases, computer programmes are developed in 'beta' mode, allowing them to be trialed and to incorporate customer feedback.

Summary – a broader view of innovation

This section provides one key lesson: innovation is about more than just technology. Technological progress clearly plays an enormous, and highly visible role in economic growth, but it is not enough in itself to drive innovation. Successful innovation comes from the interplay of technology with new business models and changing consumer demand. Often one of these factors can play a leading role, but it must be supported by the other two elements. While the rise of the computer was clearly a technology-led

20 See Mckinsey Global Institute (2011) Big data: The next frontier for innovation, competition and productivity

innovation, the advent of social networks and online intermediaries owes much more to innovation in business models and customer behaviour, with technology playing an enabling role. Failure to address any one of these three elements will severely constrain innovation in a particular market.

This broader view of innovation must be reflected in Britain's economic policy. We need a systematic approach to innovation that covers the whole economy; it must not be focused on a few sectors, like manufacturing, or on technological development. It is for this reason that we must focus on the conditions and frameworks that support innovation, and not on specific innovations themselves. But it is also helpful to know where innovation might come from in the future, a task to which the next section addresses itself.

Chapter 4 Where is innovation going to happen in the future?

While it isn't too hard to identify the factors that make a branch of the economy grow quickly, predicting where innovation is going to happen in the future is much more difficult. It is impossible to predict with exact certainty the path of future technological development, or of trends in business behaviour or customer demand. However, there are certain areas of the UK economy that have the potential to experience rapid innovation and grow quickly. This section provides an outline of the UK economy's best prospects, the areas that are most likely to see innovation and growth over the coming decade.

Healthcare

As the UK population ages, demand for healthcare and care for the elderly will grow, placing an increasing strain on the available resources. This demographic change poses a significant challenge, with productivity having stagnated within healthcare over the past decade, but it will also provide numerous opportunities for innovation. By combining new, more cost effective technology with well-designed approaches to care, both the public sector and innovative private businesses should be able to greatly increase productivity, output and quality within the health and care industries.

What is it?

Healthcare in Britain is dominated by the NHS, but there is much more to health than hospitals and primary care. When considered in broader context, it also includes pharmaceuticals and life sciences, residential care for the elderly, and non-residential care for the infirm and elderly, besides a series of other public and private services. When looking at innovation in health and care, it makes sense to consider this broader perspective; innovation will involve advanced research into new treatment methods, and broader measures such as improving preventative treatments and streamlining care processes.

Why could it grow?

The health and care industries are almost certain to grow over the next decade, because of the continued increases in demand. As Britain's population continues to grow older, the proportion of GDP devoted to treating and caring for a more elderly population will continue to rise. The Office for Budget Responsibility (OBR) projects that government spending on health and long-term care will increase from around 9.5 per cent of GDP

in 2011 to almost 12 per cent of GDP by 2060.[21] This trend is common to most other developed nations[22] (and perhaps also some emerging countries), which means there is potential for healthcare to become an important export market.

Spending on healthcare has more than doubled as a share of GDP since 1960[23], while over 2m new jobs have been created in the health and social care sector since 1978. Official statistics suggest that this growth has been driven primarily by increased government spending on the NHS and community services, since domestic consumption of pharmaceuticals and private healthcare has not grown significantly since 1990.[24]

So it is clear that increasing demand for healthcare – both at home and overseas – will drive growth in healthcare. But this increase in demand may act as a drain on other parts of the economy as much as a driver of growth. In order to derive genuine economic benefit from the rising demand for healthcare, Britain needs to greatly increase productivity in this area, and to make healthcare jobs more highly valued. Over the last decade, productivity in the NHS has stagnated, despite a big increase in investment.[25] Innovation in the healthcare sector will be key to raising productivity, improving jobs prospects and turning healthcare into a major export sector.

What type of innovation might happen?

Innovation in healthcare will be focused on raising productivity, on achieving better outcomes with fewer people. This innovation will be driven by a combination of new technologies, new models for care provision and new ways of taking the needs of patients into account. On the technological side, developments in life sciences and bio-technology have the potential to radically improve treatment, while systems that improve the monitoring of patients and allow resources to be allocated more efficiently could have a big impact. These technologies may be complemented by new, more efficient approaches to care, as well as improved preventative measures to reduce the need for acute treatment.

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21 OBR (July 2011) Fiscal Sustainability Report

22 According to OECD figures, Britain's demographic shift will be less severe than other countries, such as Japan and Germany. The UK's dependency ratio (i.e., the number of working people per retirement-age person) should reach 2.4 by 2050, compared with 1.2 in Japan and 1.6 in Germany

23 OECD stats. UK spending on healthcare was equivalent to 3.9 per cent in 1960, growing to 9.8 per cent by 2009

24 According to ONS Consumer Trends data for Q1 2011, consumer spending on pharmaceuticals and private healthcare has grown from £10.3bn in 1990 to £13.1bn in 2010. Both figures are in 2006 prices. The growth of the UK pharmaceuticals industry can partly be explained by its success as an exporter

25 See Levy, C. (2011) Making the most of public services: A systems approach to public innovation. London: The Work Foundation

What types of jobs are likely to be created?

The healthcare sector employs a large degree of knowledge workers (just under 50 per cent have degree level[26]), but also has a significant number of jobs in more elementary care roles. A decade of rapid innovation in healthcare would see many of these elementary roles become more highly valued and highly skilled (and correspondingly more productive).

The low-resource economy

The growing world population and advancing industrialisation of emerging nations has not just resulted in climate change; it has also increased pressures on the world's natural resources. As oil and commodity prices continue to rise, there is likely to be growing demand for new solutions that allow consumers and businesses to use resources more efficiently, in effect substituting knowledge for natural resources.

Part of this challenge – that presented by climate change – has already emerged as one of the key opportunities for the world economy over the coming decades. But there are other important parts of a low-resource economy that are likely to grow in importance in the future

What is it?

The low-resource economy is a broad group of economic activities that respond to the challenges posed by increasing pressure on the world's environment and natural resources. As the world population continues to grow, and the stock of some natural resources – including oil – remains limited, increasing scarcity should drive up the real cost of natural resources in the long term. At the same time, pressure on both global and local environments is being increased by population growth and increasing industrialisation throughout the world. In the long term, these challenges can only be addressed by finding innovative solutions that reduce resource usage and protect environments while sustaining our standard of living. The low-resource economy will be driven by this innovation.

The low-resource economy consists of a number of different but closely related economic activities:

26 Labour Force Survey

- **The low carbon economy:** The desire to reduce carbon emissions in all parts of the economy has already given rise to a significant driver of economic growth. This applies particularly to carbon-intensive areas such as energy, transport and construction, but has spawned new technologies and services across the economy[27];
- **Smart infrastructure:** Businesses and households depend on a network of infrastructure to provide power, water, transport and protection against dangers such as flooding. This infrastructure plays a major role in supporting business and protecting the environment, but it is also a major consumer of resources. Making this infrastructure more efficient and less resource-intensive will require significant innovation from both the public and private sectors;
- **Efficient consumption:** The average Briton produces almost 450kg of waste each year[28], and businesses also generate waste in producing the products we consume. The raw materials that go into this consumption are likely to become more expensive as the world population grows over the next few decades. While this cost pressure may only influence consumption patterns gradually, it creates an opportunity for innovative products and services that reduce resource consumption in all parts of the economy.

Some of these innovative activities, such as renewable energy, fall into fairly specific economic sectors, while others represent much broader cross-cutting economic trends.

Why could it grow?

Demand is likely to be the key driver of growth in the low-resource economy. The scale of the challenge associated with climate change, environmental pressures and rising raw material prices should drive continually increasing demand for solutions. This demand may be partly stimulated by government policies, such as carbon pricing.

Many technological solutions already exist in principle – such as electric cars and wind turbines – but they will need to be refined and turned into viable business models. As the prices of raw materials continue to rise, this should help more and more low-resource solutions become economic viable, and make it rational to substitute knowledge for natural resources.

27 See Levy, C. (2010) A 2020 low carbon economy. London: The Work Foundation
28 DEFRA Local Authority collected waste for England – Quarterly Statistics

What type of innovation might happen?

The low-resource economy will depend on innovation in all three key areas: technology; business models and customer demand.

Many of the technologies already exist, but their efficiency will need increasing to improve their viability. Many of the technological innovations in this area are likely to be small scale, helping to reduce resource usage in specific activities.

The application of these technologies, and adoption of new service and business models will be a key driver of the low-resource economy. New technologies need to be installed, maintained and adapted to specific problems. Meanwhile, many resources are used up in transferring products between producer and consumer (e.g., food packaging). Services which can overcome these challenges effectively, while making low-resource solutions economically viable, are likely to be key to innovation in this area.

Finally, the nature of customer demand will play an important role in the low-resource economy. For the low-resource economy to grow, customers need to alter their consumption habits in favour of new lower-resource products. Businesses and government will have a role in shaping these consumption habits, while changes in the costs of natural resources should also have a significant cost effect.

What types of jobs are likely to be created?

The low-resource economy is likely to create a wide variety of jobs. Many of the technical solutions will create jobs in advanced engineering, manufacturing and maintenance. Meanwhile, the majority of jobs are likely to be created in services, with activities such as consultancy, customer service and delivery likely to be especially important.

The experience economy

As customers become more affluent and more sophisticated, they do not just demand better goods and services; they also seek better packages and better experiences from firms. This presents firms with a big opportunity: they can make money not just by developing better products, but also by selling complementary services to improve the customer's experience.

This experience economy, and the opportunities it creates, have touched many parts of the economy. It is particularly important in areas such as retail, tourism and hospitality, where providing a good customer experience is integral to the activities of many businesses. But it has become increasingly important in other areas, notably manufacturing, where companies seek to move beyond mass produced products

and sell personalised packages to customers. This experience economy matters because it opens up a whole new area of innovation and growth for firms, but also because it changes the way many firms operate. Rather than focusing on products, internal procedures and standardisation, businesses are having to focus more on their customers. Managing customers tends to be a labour-intensive process – although it is made easier by the rise of a truly interactive internet – and this offers the opportunity to create new types of middle-ranking job within the economy.

What is it?

The experience economy has been talked about in many different guises. The concept of 'experiential services', which involve a journey with multiple touch points between business and customer, has been widely analysed.[29] Equally, the concept of 'manu-services'[30] – or the 'servitization' of manufacturing – draws heavily on the idea that manufacturing firms cease to sell individual products, and instead provide experiences or solutions.

While this experience economy can take different forms, it is characterised by a few key trends:

- The package or outcome replacing the product or service as the key unit of trade;
- Mass production being replaced by products or services that are designed around the needs of individual customers; and
- A shift from 'transactional marketing' – which is based around price and quality – to relational marketing, which places a much greater emphasis on establishing lasting connections with customers.

The experience economy cannot in any way be thought of as a sector; it is a driver of change that cuts across the whole economy. While it is likely to have greatest influence in areas such as retail, hospitality and manu-services, it influences all parts of the economy, including the public sector.

Why could it grow?

As consumers become wealthier and more sophisticated over time (as they should if the economy keeps growing), they are able to spend a greater share of their money on

29 See Voss and Zommerdijk (2007) Innovation in Experiential Services – An Empirical View

30 See, Sissons, A. (2011) More than making things: A new future for manufacturing in a service economy. London: The Work Foundation

experiential services, rather than on more basic goods and services. This gives firms a new way to make money; besides investing in their core products and services, they can generate additional value by focusing on the experiences they provide. Provided firms can carry out this experiential innovation successfully – and develop packages that customers are genuinely willing to pay more for – they should be able to find demand for their innovations.

Technological development – and particularly the rise of the internet – has greatly enhanced the ability of firms to manage customer experiences. The web provides a new forum through which businesses can interact with customers, and reflect their preferences more closely. This provides broad scope to develop new, innovative business models, that both improve the customer experience and allow firms to become more productive in how they deal with customers.

A key trend that has been enabled by the internet and computer technology is the large-scale analysis of customer data – so-called 'Big Data'.[31] An increasing number of companies – from Google to Tesco to Rolls Royce – collect enormous amounts of data about their customers, and about how their products are performing. This can enable them to manage their products and services, almost in real time, to meet the needs of customers and to maximise efficiency. It also means that they can develop a better understanding of consumer behaviour and preferences, and fit the services they offer around those preferences wherever possible. In some ways, this data has become a new factor of production; but tellingly, it is primarily concerned with customer demand, emphasising the central role of demand in innovation.

What type of innovation might happen?

Innovation in the experience economy is all about business models and customer interaction. Technology plays an important enabling role in the experience economy, but it is more a case of applying and diffusing existing general purpose technologies, rather than developing new ones. Of course, the shift from transactions to experiences will be applicable to many technology-intensive industries; the point is that the experience economy offers a supplementary area of largely non-technological innovation to firms.

The challenge for firms is to improve the customer experience in ways that customers genuinely value, and are willing to pay for. This can be hard for firms to judge – Voss and Zommerdijk argue that this can lead to under- or over-investment in improving customer experiences.[32]

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31 See McKinsey Global Institute (2011) Big Data: The next frontier for innovation, competition and productivity
32 See Voss and Zommerdijk (2007) Innovation in Experiential Services – An Empirical View

There are two other areas of innovation that are closely linked to customer experiences: providing access to larger networks; and offering complementary products.[33] Neither of these principles are new, but improvements in communication technology have greatly enhanced the ability of firms to link their products and services with others. Many products become more valuable because they connect with other products (e.g., a messaging service is more valuable if you can speak to more of your friends), or because they are bundled together with other complementary products. This enables firms to innovate by building links between their products and others. It also provides an incentive for firms to form the types of networks and strategic partnerships that have become so important to the modern economy.

What types of jobs are likely to be created?

The experience economy should create a wide range of jobs, covering many skill sets and various parts of the economy. High-skilled jobs are likely to include data analysts, marketing and relationship managers and designers of service processes. Meanwhile, many jobs in personal and customer service should become more high-value, as the process of interacting with the customer becomes more valuable and more important. This should have a particularly strong impact in retail, hospitality and tourism.

Meanwhile, the associated rise of manu-services will create an increasing demand for workers who can combine technical skills with strong personal and customer service skills. Those involved in services will require a degree of knowledge of the manufacturing processes they deal with; this will place new demands on the UK's science and engineering skills system.

The digital economy

An increasing share of economic activity takes place completely online, with some companies offering access to a range of creative content, and others acting as sophisticated intermediaries between creator and consumer. At present, this economy is in large part fuelled by advertising revenue, but finding new ways of getting customers to pay for the digital economy could open up new opportunities for innovation.

The digital economy has been the most innovative part of the world economy over the past decade. Firms such as Google and Facebook have emerged as among the largest in the world, while the number of internet users globally has increased from under 400m

33 These factors are both identified by Amit and Zott (2001) Value Creation in E-business

to over 2bn since 2000.[34] This digital economy marks one of the key drivers of the UK economy at present, and it should continue over the coming decade.

What is it?

The digital economy is all about the exchange of content and information online. Some parts of the digital economy interact with the physical world – many websites are used to order shopping or book holidays – but much of it takes place solely online. Large amounts of content, including newspapers, books and television programmes, can now be exchanged solely online, which has fundamentally changed business models among traditional creative industries. At the same time, the distinction between producer and consumer has been eroded, with people able to upload and share content – whether they are a few hundred characters of text or feature length films en masse on the web.

One of the key developments on the internet has been the rise of the online intermediary. Firms such as Google, Facebook and Twitter have transformed the digital economy, by making it far easier for people to find information and access the content they want to see. They have also enabled a range of new business models, particularly by streamlining advertising revenues, and turning people's attention into revenue. This combination of factors has created vast scope for firms to develop new business models, and for content providers to reach huge audiences.

Why could it grow?

The digital economy is already undergoing rapid innovation and growth. A report by Boston Consulting Group[35] describes the UK as a 'power user of the internet', and estimates that the internet accounted for 7.2 per cent of GDP in 2009.[36] The same report estimates that the digital economy will grow by around 10 per cent a year for the next four years, to reach 10 per cent of GDP by 2015.

This growth of the digital economy is driven by a host of factors. The spread of increasingly fast broadband connections and cheaper server space, along with advances in software and algorithms, provides a rapidly improving technological platform for the digital economy. This technology gives users access to a wider range of content, that they can find more easily, and it enables firms to process data about their customers

34 Internet World Stats, www.internetworldstats.com. Data accessed on 25 August 2011

35 Boston Consulting Group (2010) The Connected Kingdom: How the internet is transforming the UK economy. This research was commissioned by Google

36 This figure does not take into account the wider benefits of the internet (according to Boston Consulting Group), such as e-commerce between businesses and free content consumed online

– and their own processes – far more rapidly. These advances greatly improve the efficiency of online markets – they are reducing the information failures that beset all markets – and in doing so they make a much wider range of transactions possible.

These technological advances have enabled firms to develop a wide range of new business models. Some of these business models involve intermediary services – they meet people's needs by connecting them to other people, or by helping them to find exactly what they want. Other business models involve providing new forms of creative content, sometimes linked to a service or a physical product.

At the same time, the number of people with access to the internet – and thus the demand for online content and services – is increasing. This should enable the digital economy to continue growing for some time yet. And it is not just the number of internet users, but the extent to which they use the internet. The internet is an interactive environment, with firms far more able to develop new ideas or customise services according to customer preferences. This close link between consumers and firms should enable strong positive feedback, so that strong demand stimulates further innovation.

What type of innovation might happen?

Innovation in the digital economy in recent years has centred around two key areas: the development of different mobile platforms (including smartphones and tablets); and the development of new business models.

The development of new types of device – from laptop and mobile phone to tablet and smartphone – has driven innovation in two ways. First, firms have been able to benefit from increased demand for the physical products, helping to drive economic growth. Second, diversity of devices has stimulated innovation in the content and services that digital companies can provide. Innovations in types of device has provided a platform for innovation in software and content – this has been most visible through the growth of mobile 'apps'. Finding new ways for consumers to access digital content will be key to continued growth in this area.

At the same time, digital companies of all types have adapted traditional business models for the digital economy. The challenge for businesses in the digital economy is two-fold. First, they must create something that users value; this relies not only on good content and services, but also on how well it links to other parts of the internet. Second, they must find a way to generate revenue from their users, which can be difficult in an online world that is dominated by free content. There are many ways that businesses can go about solving this, from cultivating advertising revenue to using content to sell

other goods and services. Online business models should continue to be a major area of innovation in the digital economy, with the process of creative destruction operating far more rapidly than usual.

What types of jobs are likely to be created?

Most of the jobs created in the digital economy will require highly skilled workers. Key skills that stand out include IT engineers, programmes, data analysts, as well as creative content producers.

Business services

Business services are a diverse group of services that sell advice, expertise and knowledge to other companies.[37] In many ways, business service firms, from law and accountancy firms to computer consultants, act as the infrastructure of today's knowledge economy. They play a key role in carrying knowledge around the economy, in hastening the diffusion of technologies, and in boosting productivity and driving innovation in other firms.

Although business services tend to have a low profile, they are the largest and fastest growing part of the UK economy. They tend to be conflated with financial services, but this is misleading; they employ far more people than financial services, and provide a more lasting type of innovation. Business services exist to exploit knowledge and drive innovation, and as long the UK's economic growth depends on innovation, this sector will continue to grow.

What are they?

The business services sector is comprised of two closely related types of service: networked and intermediary services. Networked services, which include lawyers, architects, management consultants and engineering services, provide expertise directly to businesses. They benefit businesses by improving their efficiency and productivity, and by helping them to develop and market new products.

Intermediary services, by contrast, add value by bringing together buyers and sellers. By making it easier for companies to access what they need, they reduce transaction costs and make markets work much more efficiently. Examples of intermediary services include estate agents, recruitment agents and advertisers.

37 For a full assessment of the role of business services in the UK economy, see Sisson, A. (2011) Britain's Quiet Success Story: Business services in the knowledge economy. London: The Work Foundation

Why could they grow?

Business services should continue growing as long as the UK's economy continues to become more knowledge-intensive. British firms invest more and more in intangible assets – such as design, branding and software – to drive innovation, and it is business services that sell the bulk of these assets. The growing complexity of the economy, and the growing importance of inter-dependent networks of firms, have also driven the growth of business services. Companies increasingly rely on business service firms to help deal with specific challenges, and often outsource non-core business functions where they can be provided more efficiently by outsiders.

What type of jobs will be created?

A very high proportion of employees in business services are graduates, due to the highly skilled nature of the work. Jobs created in this area will overwhelmingly require people with strong degrees and high skill levels.

Summary – the difficulty of predicting innovation

The five potential growth areas set out in this section reflect our best estimate of where growth is going to come, based on what we know about how technology, business models and demand may evolve in the future. But it is extremely likely that new, transformative technologies will emerge, and be put to uses that cannot at present be foreseen. It is for this reason that the Big Innovation Centre focuses overwhelmingly on the conditions and frameworks that support innovation, rather than on any specific innovations themselves. However, there are various technologies that may have the potential to trigger rapid innovation, including bio-technology and nano-technology, and it is essential that government policy is able to adapt to such breakthroughs.[38]

Our aim in setting out these five areas is not to provide a narrow focus for government policy, but to highlight the fact that innovation will be concentrated in certain areas. Each of these areas has slightly different needs, and government policy must respond to these needs as they arise, rather than trying either to pre-empt or ignore them.

38 For an overview of emerging technologies that may have a wide impact on the economy, see Foresight (2010) Technology and Innovation Futures: UK Growth Opportunities for the 2020s

Chapter 5 What is the role of policy in promoting innovative branches of the economy?

Britain's economy has changed profoundly over the last 30 years, and government policy needs to adapt to these changes. Today's economy is far more complex, more inter-linked and more dependent on innovation than is commonly recognised. Individual businesses themselves are no longer the sole drivers of innovation and growth; many new jobs are, in effect, created by networks that span many firms, and include public institutions.

In the light of this change, the government must adopt a more systematic approach to innovation and economic growth. Policy can no longer treat public institutions, such as universities, and intellectual property as separate and independent; they are part of a broader system, and their success depends on their working effectively as part of that system.

The Big Innovation Centre exists to examine what the UK's innovation system looks like, and how it can be brought into line with the needs of a 21st century economy. The Centre's ambition – to make the UK into a global innovation hub, thereby pulling it clear of economic stagnation – can only be achieved if this systematic approach is developed in a coherent way.

This systems approach offers an alternative both to large-scale industrial policy, and to free market fundamentalism. It does not involve picking winners, trade protectionism or expanding the state dramatically. At the same time, it does not accept that innovation and growth can be left to unchecked markets, with the potentially disastrous consequences that were seen during the financial crisis. It recognises that markets are key to innovation, but also that the state plays a role in creating, supporting and shaping these markets.

The UK's innovation system works on two levels. At one level, there are a set of conditions and institutions that support innovation in all parts of the economy, and across the country. These institutions, and the way they interact, will be the core focus of most of the Big Innovation Centre's work. They include:

- The financial sector, which must allocate funding effectively and enable the most innovative firms to grow;
- Universities and public research institutions, which must become more effective as interactive partners in the economy;
- Intellectual property law, which helps to create a market for inventions, ideas and creative content, but can also act as a drag on innovation;

- Regulation and other public action, which must be designed to ensure that markets work as effectively as possible, and maximise the scope for innovation;
- The skills system, which must meet the growing skill demands of the UK economy, while being flexible enough to adapt to changes in the economy;
- The basics of economic development, such as planning policies, transport and communications infrastructure, which are required to make towns and cities conducive to business.

This national innovation system must be able to support individual firms, especially those with the potential to grow quickly. Policy must be able to both attract inward investment from around the world, while promoting the growth of indigenous businesses in the UK. But it must also be able to look beyond the needs of individual firms, and be able to foster and support the markets and networks of firms that often create jobs and drive innovation.

But a national innovation system in itself is not enough. Beneath this national level, the different parts of the UK economy work in different ways, and have different drivers of growth. A truly systematic approach to innovation cannot ignore these differences, or it will fail to embrace the firms and networks that are so integral to an innovation system. If policy does not acknowledge this, for fear of distorting markets, then it will become incoherent.

Each of the potential areas for growth identified in this paper have their own unique characteristics and needs. Many of these needs centre on the structure of their markets, the technological and infrastructural platforms they operate on, and the legal regulations that support them. This paper does not contain detailed policy recommendations for each of these areas, but we can set out an overview of the unique features they each have.

Healthcare

The healthcare market is prone to a number of pervasive market failures, mainly stemming from information failures, that make it hard to create the right incentives for innovation. Partly because of these market failures, the UK healthcare system is dominated by the NHS, which also has a profound impact on its innovation system. Key policy areas in the healthcare market include:

- **Improving the NHS' investment in intangible assets and innovation:** The NHS has missed out on much of the innovation that has been undertaken by the private sector, most notably by failing to fully exploit the emergence of IT.

Frequent reorganisations of the NHS' structure have often distracted from the organisation's most pressing needs; to invest in innovation, and to raise productivity[39];

- **Streamlining the NHS' procurement process:** The NHS' large procurement budget has a huge impact on the UK economy, as it funds a range of related industries. However, it is difficult even to estimate the size of the procurement budget, let alone assess how well it supports innovation in the private sector;
- **Ethics and regulation:** The healthcare market requires careful regulation of both private and public providers, to ensure the highest standards are met. This regulation needs to be done in a way that encourages innovation without taking risks or compromising standards. At the same time, there are a number of ethical issues around emerging technologies that influence research priorities in life sciences. The government must provide consistency and clarity on these issues, to ensure firms have the confidence to invest in development.

The low-resource economy

There are two key issues that stand out in the low-resource economy: creating stable markets that provide firms with the confidence to invest, and influencing customer behaviour:

- **Providing platforms for long-term investment:** Developing innovative solutions in the low-resource economy typically requires large, upfront capital investment. At the same time, markets for energy and commodities are often extremely volatile, which makes it hard for businesses to have the confidence to make long-term investments. The state can help to overcome some of this uncertainty by shaping markets, and by allocating funding through an effective Green Investment Bank[40];
- **Behavioural change:** Consumer behaviour will play a huge role in the low-resource economy. In order for innovative low-resource solutions to succeed, customers must alter their habits and accept them. The state has a major role to play in making this happen, through regulation, financial incentives, educational programmes and behavioural change methods such as nudge.

39 See, Levy, C. (2011) Making the most of public services: A systems approach to public innovation. London: The Work Foundation

40 See, Levy, C. (2010) A 2020 Low Carbon Economy. London: The Work Foundation

The experience economy

Adapting to an experiential business model often poses an acute challenge for firms. This challenge is made more serious by the lack of public research and advice available in the field of business models. Innovation in services and business models receives far less attention than science and technology research. Key considerations include:

- **Centres of excellence for experiential business models:** The UK needs more resources that businesses can draw on to help them make the move to an experiential business model. Adapting to the experience economy is a significant challenge for firms, and they would benefit enormously from being able to draw on best practice from universities;
- **Specialised vocational training for experience economy:** If the experience economy is to raise productivity and create better jobs in personal service occupations, it needs to be accompanied by increases in skill levels. These skills are likely to be targeted, and would be best delivered in collaboration with employers.

The digital economy

The digital economy follows a completely different set of rules to most of the rest of the economy. Transaction costs are much lower, exchanges of content and information are much easier, and a lot of online content has some of the characteristics of public goods. At the same time, large online networks are particularly prevalent in the digital economy, which can lead to different relationships between different companies. Key policy areas for consideration include:

- **Clear policies on privacy and information sharing:** Internet users provide vast amounts of data on the web – much of this data is collected by companies, and can be useful to both users and firms. However, there are likely to be concerns about data gathering, and its implications for security and privacy. The government must balance the benefits of data gathering against these risks, and it must do so on a clear and consistent basis;
- **Cyber-security:** Attacks on virtual networks are becoming more serious, and can have a serious impact on businesses and on sensitive data. The government has made cyber security a high priority, and must continue to adapt this policy to emerging threats;

Creating new markets wherever possible: Some online markets work better than others; for instance, companies that develop content for smartphones find it easier to get paid than content providers whose content is consumed through PC browsers. The government should seek to create and support new, efficiently working markets in the digital economy wherever possible[41];

Competition policy: Enforcing competition policy and preventing monopoly powers can be much more difficult in the digital economy than in other industries. The competition authorities must adapt quickly to the different characteristics of the digital economy, and adopt a sensible approach to regulation; in some situations, concentrations of market power may make the internet work more effectively.

Business services

The UK's business services sector is already thriving, but its contribution to the overall health of the economy could be further increased. As long as UK businesses continue to innovate and invest in their knowledge bases, business services should continue to grow. But at the same time, we should be striving to boost exports of business services, leveraging our greatest economic strength to close our strategic trade gap. Key policy considerations include[42]:

- **Investing in the UK's knowledge base:** Business services depend on continued investment in knowledge, and government must continue doing everything it can to sustain this investment. The state plays a key role in promoting this investment, both through incentives (such as the patent box) and its major role as a buyer of knowledge services. It is vital that the UK adopts the most effective mechanisms for promoting investment in knowledge assets;
- **Turning business services into a mass export sector:** The UK already has the best trade performance in the world in business services, but the sector has significant scope for increasing exports. Key steps to enable this include pushing for greater liberalisation of international trade in services, and helping UK firms to develop networks in overseas markets;
- **Increasing the pool of highly skilled workers:** Business services overwhelmingly require highly skilled, graduate workers. If the UK is to sustain expansion in this area, it must have a continuing increase in the number and quality of graduates.

41 Sissons, A. (2011) The Big Digital Dilemma. London: The Work Foundation

42 For a more comprehensive analysis of the needs of the business services sector, see Sissons, A. (2011) Britain's Quiet Success Story. Business services in the knowledge economy. London: The Work Foundation

None of these points constitute definitive policy recommendations; the Big Innovation Centre will work to develop policy frameworks for all of these parts of the economy in future. All of these issues need to be considered within the wider context of the national innovation system.

What is clear, though, is that different parts of the economy have specific needs – not in terms of direct government support, but in terms of the frameworks and conditions created by government. An innovation policy that denies these differences will be incoherent; it will fail to address the issues that influence these sectors. As a result, we need a more sensible approach to government economic policy, that transcends both blind adherence to free markets and crude industrial policy that creates an unlevel playing field for different firms. It is clear that, by looking closely at what drives economic growth, the state can catalyse growth and innovation without resorting to heavy handed intervention. It is policies that follow this approach that can pull Britain clear of recession, and usher in a new wave of innovation.

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Contact details

Big Innovation Centre
The Work Foundation
21 Palmer Street
London SW1H 0AD

info@biginnovationcentre.com
www.biginnovationcentre.com
www.theworkfoundation.com

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