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EMPLOYMENT AND SKILLS

# The Future of Work: Jobs and skills in 2030

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# **The Future of Work Jobs and Skills in 2030**

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## Foreword

What will jobs look like in 2030 and what skills will be in greatest demand? Gazing into the future may seem speculative, or even whimsical, because experience tells us that predictions about what the world will look like years from now are destined to be inaccurate.

But what if, backed with extensive and robust research, an assessment of the labour market of the future could serve as a basis for a debate around the challenges and opportunities individuals and businesses are likely to face?

This kind of exercise has never been more relevant as we seek to make sense of the future in a landscape of rapid and profound change. For example, the potential disruptive impact on jobs of advances in robotics, artificial intelligence and 3-D printing is a focus for fierce debate. We may also face the paradox where the emergence of a networked global talent pool seems to promise ever more intense competition for opportunities at all levels of the UK workforce, and at the same time we are also likely to face skills “vacuums” where we are not fast enough at developing skills for newly emerging business fields.

Technology is already transforming our homes in ways we could not have dreamed of only a few years ago, and these same technologies are also re-shaping the workplace and how we work and interact. This will have major implications for underlying business models and the way in which work is organised.

It is in this context that individuals and employers, as part of their career and business development, will make decisions about investment in skills. These decisions are critical, with skills playing a fundamental role in determining individual employability and earnings potential, contributing to the productivity of business and attracting mobile foreign investment.

And, at a national level the central question of the UK’s ability to rebalance its economy and deliver sustainable prosperity for all is strongly dependent on creating an “agile, demand led” skills engine that can respond rapidly to this transformational agenda.

This study presents an authoritative assessment of future challenges and opportunities in the labour market and the implications for jobs and skills. It is based on expert input from key groups including business, trade unions and academia, as well as a detailed and comprehensive review of the literature.

Foresight studies are plentiful, but this one adds distinctive value through its specific focus on labour market issues, and by examining the impact of global trends through the lens of UK conditions.

Although a study of this kind can never provide definitive answers, it serves to provoke reflection and debate as part of the process of preparing for the challenges and opportunities presented by the labour market of the future.

The UK Commission looks forward to engaging with you on the pertinent areas of action that will prepare our businesses and UK workforce for tomorrow's world of work.

**Toby Peyton-Jones**

**Director of HR Siemens UK and North West Europe**

**UKCES Commissioner**

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## Executive Summary

**It is not possible to predict the future. 20 years ago, there was widespread belief among commentators that the defining feature of the future UK labour market would be radically reduced working hours and increased leisure time.**

**Fast forward to 2014, the year in which mobile is set to overtake desktop to access the internet, and work and leisure hours have become blurred by our increasingly 'mobile' lives (The Economist, 2012). Jobs are being done on the move, at any time of day, in almost any location.**

This example highlights the difficulties involved in forecasting change. Yet, the way we think about tomorrow influences what we do today. We do not have definitive answers about what is around the corner but we can try to systematically make sense of the direction of travel in the labour market and assess the key uncertainties that we know exist. By analysing developments in the UK labour market now, we can start to position ourselves for the work needs and opportunities of the future.

As we see welcome signs of a strengthening UK economy, it is an opportune time to take a detailed look at the medium to long-term prospects for the world of work. At the UK Commission for Employment and Skills, our mission is to transform approaches to skills investment to drive enterprise, jobs and growth.

This report presents the results of *The Future of Work* study which looks ahead to the labour market of 2030. It analyses stable trends that are already shaping the future of UK jobs and skills, and forecasts the most likely disruptions to those trends. It then plots four anticipated scenarios of what the UK's work landscape might look like in 2030, and importantly, the skills that will be required under these conditions.

The purpose of this report is to trigger debate about investment in skills and inform the decisions facing employers, individuals, policy makers and education providers.

At a time when economic optimism is building, we can do more than merely react to developments – we can proactively work towards a positive outcome. Our aim is not to predict a specific future, rather to influence and challenge thinking in a constructive, creative way.

## **Why look to the future?**

What will be the characteristics of the UK's job landscape in 2030? Which will be the skills needed to drive the competitiveness of UK businesses and push the employability of the UK's working age population?

Even though we live in a dynamic and turbulent world dominated by constant, rapid change, having a long-term perspective remains indispensable. The business community needs to take the long view when developing new strategies and business models to compete in tomorrow's markets, just as investments in innovations and new growth fields have to be based on a solid understanding of long-term developments. Market success increasingly depends on an internationally competitive skills base, and this makes skills development a key long-term issue.

Education and training providers need to be aware of the potential future requirements of the labour market to make sure that they offer individuals the training they require to be competitive in the future. An individual's decision about the skill level they aim to achieve and their subject specialisation has a major impact on their career path throughout their working lives.

Today, in the face of increasingly volatile markets and global change, many decision makers are asking whether the tried-and-tested forms of strategy development are still appropriate. In many sectors global change has called into question not just a company's portfolio, but its entire business model. The upheavals and crises of the last decade have made it clear that companies, sectors and economies cannot assume the maintenance of a stable, long-term environment.

Predictions of future developments, based on an analysis of historical patterns, are unlikely to be appropriate within rapidly changing systems. Hence, taking into account uncertainties and possible disruptions in the marketplace requires decision makers to think of potential alternatives. For many companies and UK institutions, scenario-based strategic management is already an established approach for doing so.

A strategic dialogue linked with scenarios can help decision makers to understand and manage complexity better, to identify courses of action, and to build the longer term into today's decisions.

## ***The Future of Work* study**

This foresight study looks ahead to 2030 by analysing both the stable trends which shape the future of UK jobs and skills and potential disruptions. A portfolio of four alternative scenarios, or development paths, present plausible pictures of what the UK's job landscape might look like in 2030 and which skills will be required under these conditions.

The picture of future jobs and skills is based on a robust evidence-based approach. Key elements include a comprehensive literature review, expert interviews, high-level workshop discussions and a full analysis of trends and disruptions.

The four scenarios were developed systematically and implications for jobs and skills, plus associated action needs, were then drawn from this analysis.

### **Trends shaping the future of jobs and skills**

A trend is an empirically documented development which lasts for several years. Trends are usually relatively stable and less likely to be affected by cyclical changes and fluctuations, nor are they subject to sudden reversals or dramatic increases. In general, trends have a clear direction and a robust course. When extended into the future, they describe a “business-as-usual” continuation of events.

It is possible to identify a number of local and global trends today which point towards forthcoming changes in business and society. Their long-term impact on UK jobs and skills will be significant. For instance:

- Emerging economies are acquiring stronger representation in global production chains;
- Demographic change and migration are changing the face of the workforce;
- Technological developments are slowly dissolving the boundaries between sectors and are changing traditional modes of working;
- Organisational structures in business are evolving and becoming more flexible and more networked.

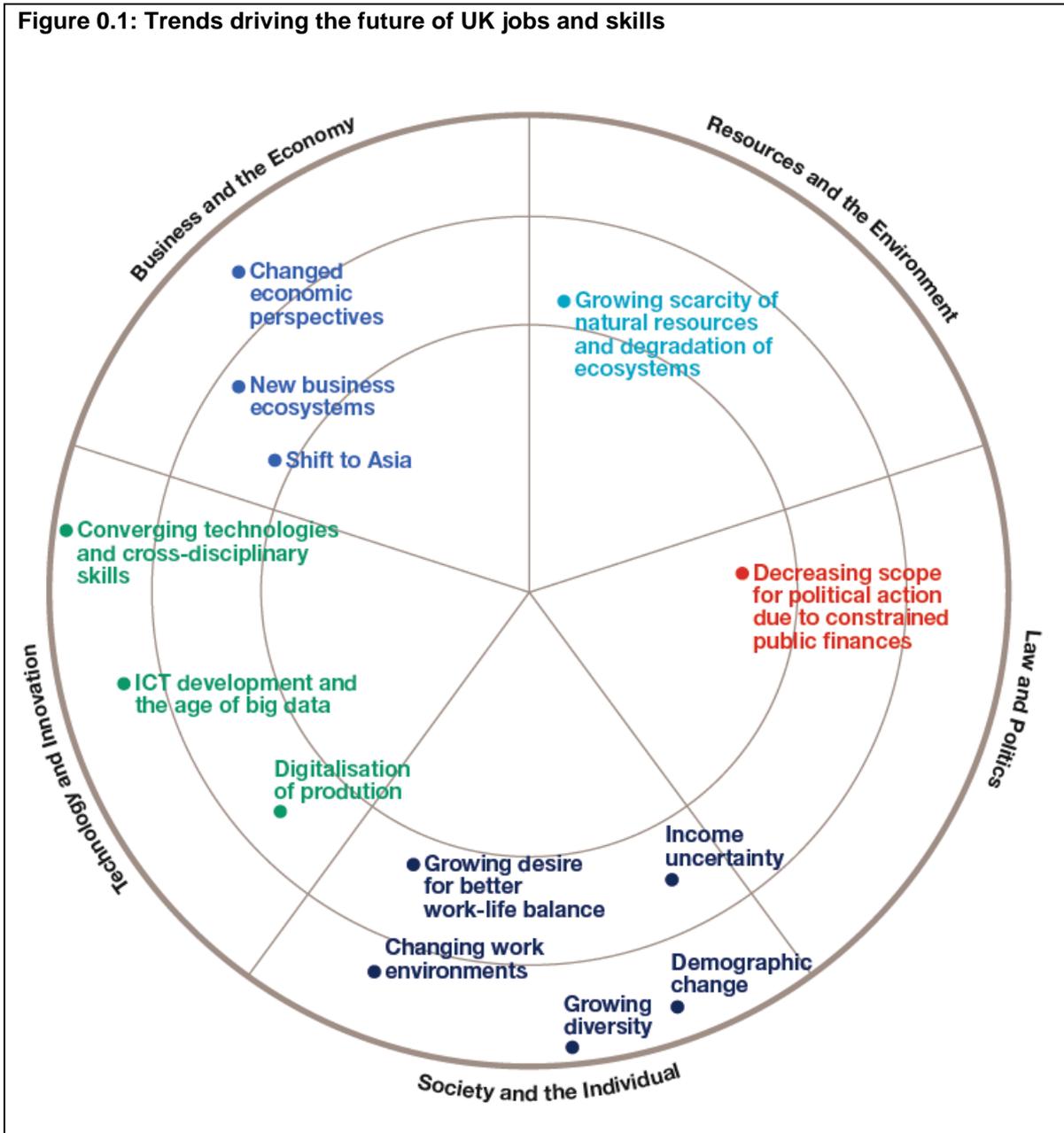
These rapid, complex shifts are affecting labour markets around the world, constantly challenging the balance of supply and demand, and labour market and education policies.

This study adopted a 360° view; looking at societal, technological, economic, ecological and political factors to identify the 13 most influential and plausible trends impacting the jobs and skills landscape in the UK to 2030 (Figure 0.1):

- Demographic change, especially an ageing population.
- Growing diversity, increasing representation of gender and ethnic groups in the labour force.
- Growing household income uncertainty and regional inequalities.
- Growing desire for a better work-life balance.
- Changing work environments shaped by Information and communications technology (ICT), outsourcing, internationalisation and the need for greater flexibility.
- Converging technologies and cross-disciplinary skills, particularly the combination of biotechnology, information and communications technology, nanotechnology and cognitive science.
- Digitalisation of production: automated and additive manufacturing processes, involving 3D printing.
- ICT development and the age of big data, the power of digital devices and the potential to capture and use vast amounts of data.
- Changed economic perspectives due to globalisation and technological change, particularly volatility and uncertainty in the period post the 2008 crash.
- Shift to Asia, growing economic power and influence of countries in the East.
- New business ecosystems leading companies to be increasingly defined as 'network orchestrators.'
- Growing scarcity of natural resources and degradation of ecosystems: finite environmental resources leading to higher extraction costs and environmental decline.
- Decreasing scope for political action due to constrained public finances, as well as greater levels of social transfers for the aging population, limits resources for education and skills initiatives.

The 13 trends were selected from an initial longer list which included trends deemed to have less potential impact on the labour market of 2030, including changing household and family structures, increasing borderless risks, such as global crime, and the growing importance of social enterprise.

Figure 0.1: Trends driving the future of UK jobs and skills



### Disruptions that could radically change the future of work

While the changes that result from trends can, to a significant degree, be foreseen - assessing the impact of disruptions on the UK labour market, employment and skills in the year 2030 is far more complex, and impossible to calculate with accuracy.

Nevertheless, addressing disruptions is important in challenging ways of thinking - to go beyond 'business-as-usual'.

New technologies, changing market structures, and innovative employment models are emerging. Disturbances affecting the labour market are not only conceivable but also likely; in the digital age, knowledge and technology are markedly fluid. If disruptions become virulent, they pose a significant risk for destabilising economic markets and thus employment.

Economic theory often refers to periods of disruption caused by technological innovation as ‘creative destruction’ (using Schumpeter’s phrase) – new industries, jobs and economic value are created whilst old industries decline. Businesses that recognise changes early are well positioned to take advantage of the potential opportunities that emerge from disruptive influences.

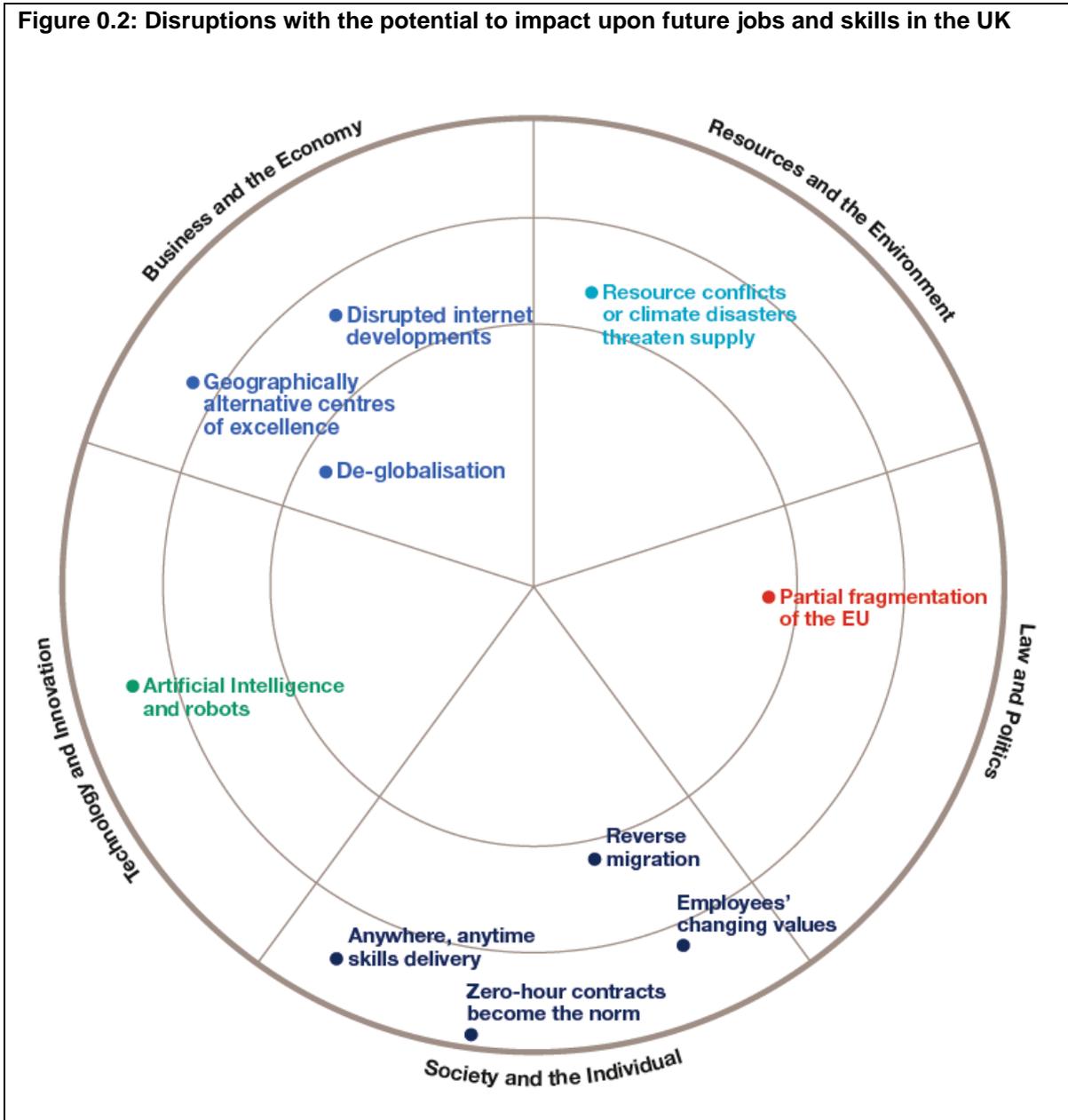
Although at a commercial level it is entrepreneurial and innovative companies that grasp these opportunities, individuals, policy-makers and education and training providers need to be vigilant and prepared for new employment and skills needs arising for such disruptions.

Ten key disruptions were selected for this study. These are based on conceptual plausibility and severity of impact on the future of jobs and skills in the UK if they were to occur. The ten disruptions would all most probably lead to significant deviations from the path of “business-as-usual” as laid out in the trends above (Figure 0.2).

- Reverse migration
- Changing values of employees’, where workers select employers on the basis of alignment with their own values
- Zero-hour contracts, and similar flexible arrangements, become the norm
- Anytime, anywhere skills delivery, enabled by virtual and peer-to-peer learning
- Artificial intelligence (AI) and robots, penetration of AI and automation into highly skilled occupations
- De-globalisation
- Geographically alternative centres of excellence, the UK’s leading position in key economic sectors is lost to high growth economies
- Disrupted Internet developments due to cyber crime
- Resource conflicts or climate disasters threaten supply
- Partial fragmentation of the EU.

The disruptions were selected from a longer list that included possibilities such as climate change catastrophe, automated healthcare for the elderly and rapid growth in the informal economy<sup>1</sup>.

**Figure 0.2: Disruptions with the potential to impact upon future jobs and skills in the UK**



<sup>1</sup> For example, the emergence of shale gas as a major new source of energy through the use of hydraulic fracturing (fracking) and other techniques was considered as a disruptive development, in view of its impact on the US economy. This did not make the final list of disruptions because it was judged that other developments had more potential to impact on UK jobs and skills in 2030. UK shale gas reserves are believed to be substantial but not “game changing”, whilst environmental concerns are likely to limit its exploitation to a greater extent than has been the case in the US.

## **The four scenarios**

Scenarios are a method of identifying and describing complex and consistent visions of the future. Exploratory scenarios involve the extrapolation of challenges, trends, and other influencing factors. They also serve the central purpose of exploring disruptive development paths that deviate from the “business-as-usual” of today’s trends.

The study explored four different development paths, or scenarios, for the UK labour market leading to 2030. The first scenario outlines how a ‘business-as-usual’ landscape might develop. In contrast, the remaining three feature more disruptive developments.

The scenarios describe four alternative paths and outcomes, but are not mutually exclusive. They are all driven by strong common developments including further globalisation, an ageing workforce, and digitalisation of work and everyday life.

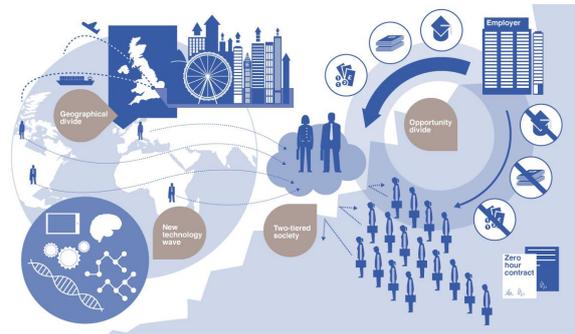
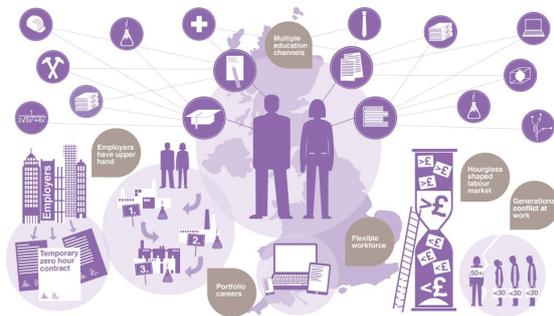
While this study is robust, comprehensive and compiled from detailed analysis, there are, of course, countless alternatives in reality. The scenarios are not intended to be normative or to convey a ‘preferred’ future. Rather they seek to create coherent, plausible stories from complex socio-economic and technological ingredients.

To enrich and illustrate the differences and qualitative shifts presented in the scenarios, creative vignettes for seven economic sectors and/or related occupations are provided<sup>2</sup>. General/cross-sectoral and scenario specific implications for these sectors are also drawn out.

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<sup>2</sup> The seven sectors are: manufacturing, creative and digital, professional and business services, retail and logistics, health and social care, education, and construction.

## The scenarios at a glance

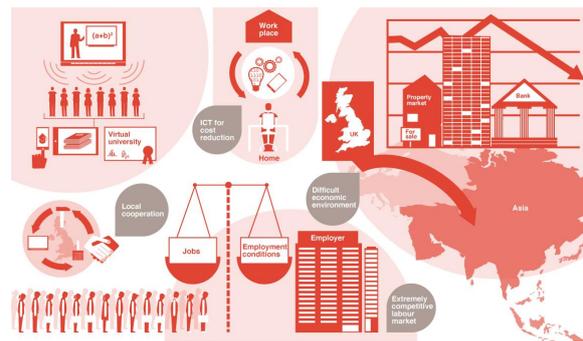
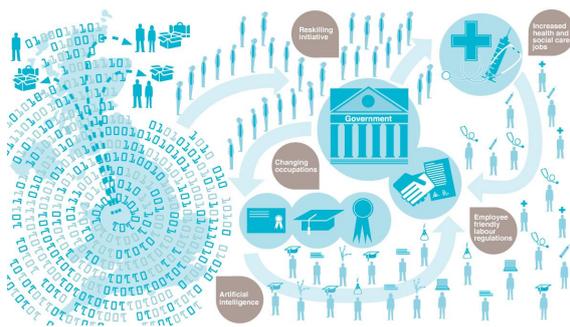


### Forced Flexibility (business-as-usual)

*Greater business flexibility and incremental innovation lead to moderate growth in the economy, but this flexibility often results in fewer opportunities and weakened job security for the low skilled*

### The Great Divide

*Despite robust growth driven by strong high-tech industries, a two-tiered, divided society has emerged, reinforcing the economic position of the 'haves' and 'have nots'*



### Skills Activism

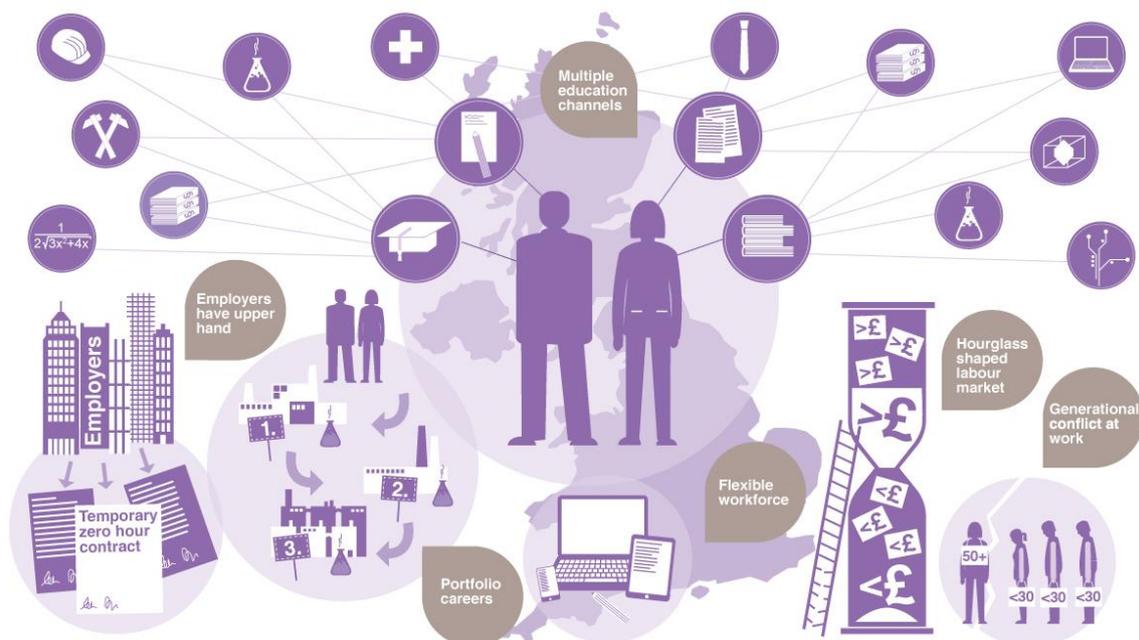
*Technological innovation drives the automation of white-collar work and brings large-scale job losses and political pressure, leading to an extensive government-led skills programme*

### Innovation Adaptation

*In a stagnant economy, improved productivity is achieved through a rigorous implementation of Information and Communications Technology (ICT) solutions*

## Scenario 1: Forced Flexibility (business-as-usual)

*Greater business flexibility and incremental innovation lead to modest growth in the economy - but this flexibility often results in less opportunity and weakened job security for the low skilled*



**Situation:** The recovery process after the global financial crisis of 2008/9 affected the UK economy well into the second half of the 2010s. Fiscal restraint continued to define the landscape but, overall, work by government throughout the 2020s to balance the budget and deleverage was successful. By 2030, after focusing on increasing business flexibility and championing innovation in almost all UK sectors, the nation is achieving moderate economic growth, averaging 2.2 per cent per annum, but is subject to elevated volatility in world markets. Within the workforce, there is a widening income gap and low-skilled workers are the most vulnerable experiencing fewer opportunities and weakened job security. An easing of employment regulation, to promote job creation, strengthens the hand of employers but often at the expense of the low-skilled.

**Employers** offer premiums and incentives for high-skilled talent and top employees. In-house efficiency monitoring systems are frequently used to collect data to allocate required skills to work tasks. Market volatility drives increased flexibility in work arrangements, and temporary or zero hour employment contracts are the rule in many organisations.

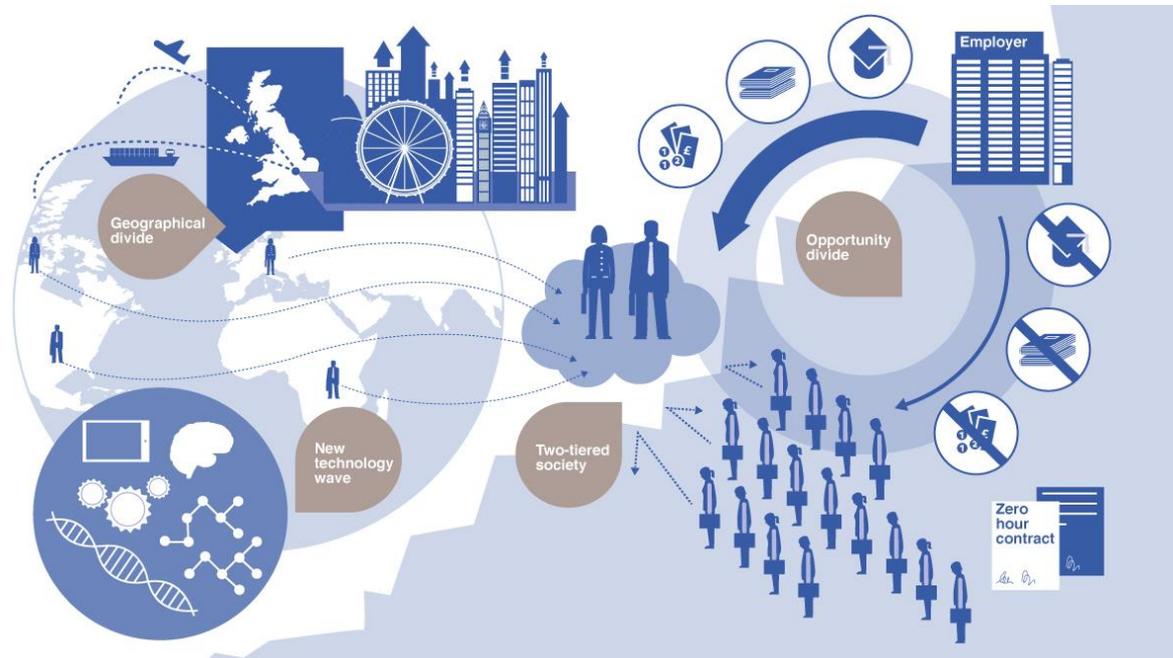
**Employees** find themselves in an hourglass-shaped labour market. For highly skilled individuals, a progressive work environment allows for greater autonomy and a better balancing of work and family life. While the “squeezed middle” of the workforce sees jobs disappearing, low-skilled workers compete ferociously for positions (across all sectors). Security of employment is highly important for individuals - especially the low-skilled. Intergenerational differences need careful management in the work place, since many young people are trapped in low-level entry positions, as older people stay in employment longer.

**Education and training providers** are more commercially focused and responsive to employer needs, offering a variety of avenues for qualifications. Technological advancements have fuelled developments in online learning, especially in work-based skills, but qualifications acquired through these avenues have yet to be widely recognised. The same holds true for other non-traditional learning methods such as peer-to-peer learning.

**Policy makers** have limited influence, mainly as a result of reduced budgets. Public funding for education and skills policy remains constrained due to deficit reduction.

## Scenario 2: The Great Divide

*Despite robust growth driven by strong high-tech industries, a two-tiered, divided society has emerged, reinforcing the divergence in the economic position of the 'haves' and 'have nots'.*



**Situation:** By 2030, the UK has seen over a decade of strong economic growth, close to the pre-recession rate, fuelled by globalised trade and the emergence of high-tech businesses. Innovative companies in life and material sciences are the flag-bearers of this new economy – and are among the main drivers of industrial growth. But inequality is at an all-time high. The income and opportunity gap between regions and individuals is stark. It is boom time for London and the South East of England. The low-skilled everywhere face limited opportunity.

**Employers** market themselves to prospective employees, both domestically and globally, by promoting their brand, values, options for flexible working, and pathways for personal development. In many multinational companies work is executed through virtual collaboration platforms across various time zones.

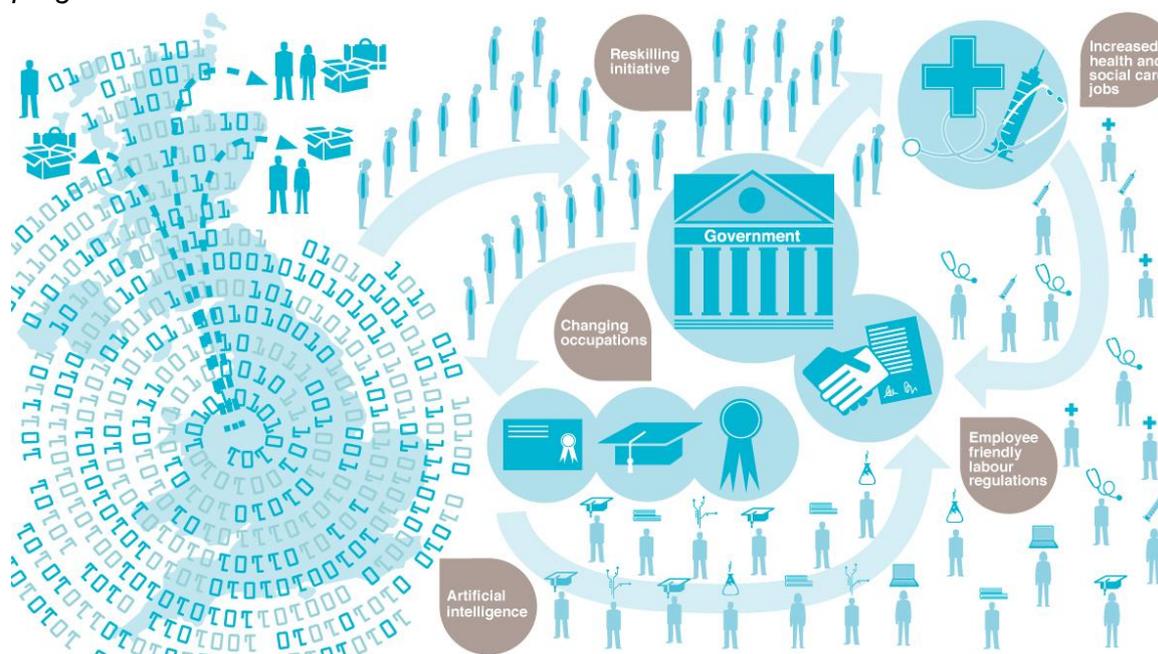
**Employees** experience new job opportunities due to the growth of companies providing high-tech goods. New jobs are also created in the higher value business and professional service industries that are linked to these new technologies. Positions for highly skilled workers come with a high degree of autonomy. Among the medium and low-skilled there is intense competition for poorly paid temporary positions, with limited career prospects, and a continued drop in demand for medium and low-skilled workers in manufacturing. Generation Y shapes organisational values and practices. Flexibility, transparency and employee engagement are widely adopted by business, but their application is effectively limited to the highly-skilled.

**Education and training providers** see cuts in public funding, which lead to the disappearance of a wide range of public education institutions and the privatisation of many higher education institutions. The marketisation of skills delivery increases the direct cost of education and limits access to training opportunities for the less affluent, which restricts upward social mobility.

**Policy makers** focus on developing a supportive environment for a diversified, knowledge-based economy, including liberal labour regulations and tax credits for intellectual property, whilst limited attention is given to vocational skills and employment promotion initiatives.

### Scenario 3: Skills Activism

*Technological innovation drives the automation of professional work, leading to large-scale job losses and political pressure prompting an extensive government-led skills programme*



**Situation:** In the late 2010s and early 2020s, applications entered the market that drew on smart algorithms to replicate the judgment and experience of human workers. Once their accuracy and resultant productivity gains had been confirmed, a sharp leap forward in IT innovation led to significant disruption for traditional professions. Medium to upper-income groups were the hardest hit. Accountancy services felt the change first, followed by the insurance industry and legal professions. Professional service firms shed a significant percentage of their workforce. The resulting rapid growth in unemployment posed a serious threat to economic stability. Government policies (including an increase in the education budget to support a re-skilling drive) played a significant role in pulling the UK economy back from the brink of crisis in the mid-2020s. In 2030, the economy is back on a relatively low growth path of 1 per cent to 1.5 per cent annually. For those with the right skills, the labour market delivers opportunities. However, for many, competition for jobs is tough. The low-skilled find employment in lower paid opportunities, which are mostly in the services sector.

**Employers** often find it challenging to find employees with the right skill set to fill vacancies due to a mismatch between skills of displaced workers and the requirements of their available opportunities. This is a key reason why employers' involvement in skills development has significantly increased – evident for example in increased apprenticeships and work placements.

**Employees** face long periods of unemployment, in particular those professionals made redundant by IT automation. Work is mainly project-based, with a high turnover of jobs, which can make the development of new skills more challenging.

**Education and training providers**, with government support, expand access to higher education to include students from a wider range of socio-economic backgrounds. The steady reform of the education system, to allow a better combination of academic and vocational training, and better meet employers' needs, continues. Education and training providers increasingly work in partnership with employers to deliver this dual model.

**Policy makers** actively promote employment in the health and social care sectors via publicly funded incentives and marketing campaigns. The education budget is at an all time high and labour regulation is strictly enforced. Government also focuses on increasing local and regional autonomy as a way of fostering jobs growth and skills development.

## Scenario 4: Innovation Adaptation

*In a stagnant economy, productivity is improved through a systematic implementation of ICT solutions.*



**Situation:** Against a backdrop of a chaotic global economy with faltering trade, the UK has experienced a decade of minimal growth prior to 2030. A key problem is that the financial sector is struggling to compete internationally. As the economy falters, ICT technology is essential to business survival. By systematically integrating cost-efficient technologies into business and work processes, productivity gains are realised and at least some companies are able to remain internationally competitive. However, employment is falling and wages remain static. Income inequality levels have decreased as higher earners have lost more relative to others. Nevertheless the struggle to make ends meet has become a lot harder for low-income households.

**Employers** reduce the size of their workforce to a minimum. Carefully orchestrated virtual workforces complete tasks highly efficiently which used to be handled entirely in-house. Limited project and zero-hour contracts are commonly used to transfer financial risks to employees. At the regional level, small companies are coming together to set up co-operative ventures to combine capital and increase their bargaining power. Co-operatives are developing a relatively strong position in re-localising some economic activities.

**Employees** face relative insecurity of employment, many being forced to develop ongoing portfolios of project-based assignments with a variety of employers. Company-specific qualifications are often demanded as an entry ticket to jobs.

Among **Education and training providers**, online platforms have become the channel of choice for delivering education and training, as they offer the most cost-effective option for essential on-the-job-training and for keeping individuals' skills up-to-date. Bite-sized training opportunities are easily integrated into corporate processes and are regularly used by most medium-sized and large companies.

**Policy makers'** efforts are limited by the lack of funds; however, the government is committed to supporting skills development despite the pressure on public finances. Together, policy makers and training providers are working towards developing a new 'compact', by re-engineering courses (materials, subjects) and delivery models (online and blended learning) to better meet employer and employee needs.

## Implications for Key Sectors

The 2030 scenarios provide compelling ‘macro’ narratives through which it is possible to discern broad opportunities and challenges for jobs and skills across the economy. It is also valuable to explore what such changes might mean for different sectors, each with a distinct profile, and with different demands for jobs and skills.

Seven sectors were selected to provide this granularity of focus. The main criteria for selecting these sectors were: their current (and anticipated) future significance in terms of employment (numbers of people employed within these sectors); their expected role in driving future economic growth; and their importance in meeting societal demand.

Between them, the seven sectors account for a large proportion of jobs and economic output in the UK. The implications presented for the sectors appear to be the most plausible across the 2030 scenarios, posing challenges but also offering opportunities for jobs and skills.

The caveat, which applies to the study as a whole, is worth repeating here: that these are not predictions but plausible implications that emerge from the changed conditions within the scenarios (the combined impacts of key trends and disruptions).

A summary of plausible, selected implications for seven key sectors, arising from the scenarios, are shown in Table 0.1.

**Table 0.1: Implications for key sectors**

| Key Sectors                               | Implications   |
|---|--|
| Health and Social Care                    | It is anticipated that there will be a significant increase in the number of jobs in health and social care due to demographic factors (ageing population), social trends (working parents requiring childcare), and opportunities that will emerge with investment in medical research and innovation. It is anticipated that the increase in job opportunities will attract a range of individuals (from those entering the labour market for the first time to those transferring from other sectors). The adoption of technological innovations within the health and care sectors is expected to change the profile of many jobs. Migrant workers are expected to fill high- and low-skilled job gaps. In these sectors, there is an anticipated tension between an increase in demand for social and healthcare services, and constraints on public spending. Technological innovation and new business/delivery models provide opportunities to address these challenges. For example, the introduction of personal healthcare budgets would enable people to select preferred healthcare options and services. |
| Professional and Business Services Sector | Developments in the professional and business services sector are likely to be linked closely to globalisation and internationally traded services (growth in the East, for example, creates demand for this   |

sector with new customers and potentially new products), the adoption of technological innovation, and providing solutions to new or increased social demands (such as an ageing population). One of the major influences is likely to be the automation of professional jobs and the impact of ICT using smart algorithms. Undergoing constant change, the structure, management and strategies of businesses in this sector, and supported by this sector, are likely to become increasingly flexible, diverse and global.

Retail and Logistics

It is anticipated that jobs and skills in the retail and logistics sector will be impacted by the increased use of ICT in work processes (both back office and customer facing), the continued impact of the Internet in multi-channel retailing, and social consumption patterns (including satisfying 'green' consumer choices). Overall, a growing population will probably drive growth in the demand for both low- and high-skilled jobs within the retail and logistics sector. Data and technology enable new service models for retailers, allowing for increasing sophistication in segmentation and customisation through customer profiling.

Education

The development of market-based and employer focused education is expected to become an increasingly important driver for the sector. Social trends and enabling technologies create a need for increasingly personalised modes (in structure and content) for learners. This is particularly the case for Further Education and Higher Education, where higher fees focus the minds of learners on employability questions and return on investment. Online and blended learning techniques will become more widespread and sophisticated to match the expectations of fee-paying learners. It is anticipated that there will be an increase in demand for work-based learning, which offers the flexibility required by employers and individuals. With increasing competition and public spending constraints on core funding in the Higher Education sector, new entrants (private providers) may find it easier to adapt to the new environment, with a different business model, a lower cost base and a very focused curriculum.

Manufacturing

Global competition, technology adoption and international trade levels will have a formative influence on the manufacturing sector in the UK to 2030. Whilst a full rebalancing of the economy (where manufacturing re-assumes a larger proportion of the economy) is less likely, a stabilisation in manufacturing employment levels is plausible. Within a globalised production environment, the demand for low-skilled labour in UK manufacturing will continue to decrease. One of the major uncertainties facing the sector is the degree to which additive manufacturing or 3D printing will revolutionise production and supply chains. The manufacturing sector in the UK will be challenged to upgrade its innovation capacity – and move beyond achieving efficiency (through lean methods). Increasing concern over resilience of supply chains is likely to drive business strategies and may stimulate near-shoring and re-shoring of manufacturing activity to the UK.

Creative and Digital Sector

Changes in technology are expected to drive productivity and the development of new business models in the Creative and Digital Sector. The sector will have a significant impact on other sectors as digital and creative solutions are applied in different business processes and fields. It is anticipated that a growth in virtual collaboration and outsourcing, together with the increasing need for flexible project management, will also shape the work environment

in the Creative and Digital Sector. It is anticipated that there will be an increase in demand for digital tools that engage with customers, suppliers and companies' own employees. Alongside expected improvements in productivity that come with the application of ICT tools, companies will seek to incorporate digital platforms as a core part of their innovation processes (for example, in open innovation platforms).

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#### Construction

Construction is often regarded as a bellwether for the economy as a whole, sensitive to changes that come with growth and recession. Whilst it is plausible that the sector will continue to experience the (cyclical) impacts of the economy as a whole to 2030, there are several key drivers that are likely to shape employment and skills demands. The growing population of the UK will sustain demand for construction jobs although the building of new housing relies on an enabling regulatory environment. Resource efficiency is another key driving factor for the sector – both in the creation of new housing stock and in improving existing stock. Offsite construction with on-site assembly and final construction are anticipated to offer cost-effective and flexible means for meeting some of the increased future demand. Whilst some of the sector will continue with established techniques and approaches, new technologies (for example, energy and materials) will change work needs for both construction, maintenance and repair.

### **Key messages**

The future is unknowable, but the trends, disruptions and scenarios outlined in this study provide clues to help us start to develop a plausible picture of what the world of work could look like in 2030.

### **Technological growth and expansion**

As digitalisation grows, we can expect a significant impact on employment and skills in the decades ahead, at all levels and in all sectors. In the health sector, for example, we could see care workers assisting with home-based diagnostic and monitoring devices, as well as teams of clinicians, engineers and programming specialists working on the next wave of personalised patient treatments. In the construction sector, increasingly sophisticated building technologies, such as home automation, will demand new installation, maintenance and repair skills, while architects and building managers use cradle-to-grave digital modelling in their projects, to both design and build physical structures.

As almost every job becomes increasingly technology-related, there will be winners and losers. As demonstrated by Mark Zuckerberg and Facebook – new businesses with limited capital and experience but that exploit opportunities created by technological development can succeed on a grand scale.

Technological growth, and the accompanying changes in business models, make the continuous adaptation of skill sets absolutely fundamental for successful participation in the labour market. More so than ever before, individuals that are not willing or able to do this will face being left behind.

***“Individuals must acquire special skills to stay competitive, as even a high-end skill set is becoming more and more available elsewhere in the world”*** (Global senior business leader)

### **Interconnectivity and collaboration**

Work in the future will be more interconnected and network-oriented. Employees (and employers) will require the competencies to work across different disciplines, to collaborate virtually, and to demonstrate cultural sensitivity.

If location-based (for instance from a specific office) and time-based (for instance 9am-5pm) work becomes eroded, organisations will need to develop new HR and contractual mechanisms to manage performance, address issues of trust and transparency, and invest in keeping the skills of a largely virtual workforce up-to-date.

In this context, the imperative on businesses to collaborate around skills development grows. Action by employers to ensure (and protect) their supply of workforce skills and talent will be critical in servicing a more global supply chain. This will also challenge organisations to manage internal staff alongside orchestrating relationships with external actors to create the right skill sets.

***“Your quality (as a business) is dictated by the quality of your supply stream. Jobs will also stretch across borders”*** (UK senior business leader)

### **Convergence of innovation**

We can expect more and more innovations to take place at the borders of disciplines and sectors. Successful solutions may be found through combining established disciplines with novel developments, for instance with material sciences and nano-technologies.

The spread of disciplines and jobs across sectors will also stimulate the hybridisation of skills which will provide some individuals with a strong position to compete within an increasingly demanding workplace.

As companies become increasingly open in their innovation activities, cross-sectoral and cross-discipline collaboration with customers, suppliers, experts and others becomes even more prevalent in developing products and services that can be brought to market.

***“Big innovations today come from people who are capable of translating one paradigm of a discipline to a paradigm of another discipline”*** (Global thought leader)

### **Increased individual responsibility**

International competition and technological development is likely to continue to increase the flexibility that employers demand from their employees.

As the world of work becomes more flexible, employees are expected to shoulder more and more responsibility for skills development. Self-management, alongside core business skills, such as project management expertise, and the ability to promote your personal brand, will become increasingly vital.

Personal agility and resilience, such as the ability to adapt to or embrace change is important within this context. Particularly for young people who will be competing for jobs with those that stay in employment longer.

The hierarchical structures of companies are changing towards leaner management with more responsibility for tasks and processes. The responsibility to uphold the organisation’s brand when dealing with customers rests more and more on the shoulders of individuals. New work modes like telework (work wherever and whenever) further drive this.

***“Workers will need to constantly gain new skills throughout their work life”*** (Global thought leader)

### **The shrinking middle**

The shrinking middle will challenge the workforce. The high-skilled minority (characterised by their creativity, analytical and problem solving capabilities and communication skills) will have strong bargaining power in the labour market, whilst the low-skilled will bear the brunt of the drive for flexibility and cost reduction, resulting in growing inequality.

Jobs which have traditionally occupied the middle of the skills hierarchy and earnings range, such as white collar administrative roles and skilled / semi-skilled blue collar roles, are declining at a significant rate due to changes in work organisation driven by technology and globalisation. There is evidence that new types of jobs are emerging to fill the middle ground but these have markedly different entry routes and skill requirements.

***“People moving in and out of learning will continue. In particular, when people develop portfolio careers, they need to be able to convert their qualifications or build upon the ones they have. Education has to come up with the right package to solve these new demands”*** (Education and training provider)

### **The four-generational workplace**

The future workplace will be multi-generational, with four generations working side-by-side. Traditional notions of hierarchy and seniority will become less important. The skills for leading and managing the four-generational workforce, and for facilitating collaboration across multiple generations and their values, will be in increasing demand.

The complex values of this multi-generational workforce will impact upon employers' ability to attract talent, at all skill levels. Attitudes to corporate social responsibility, or expectations of flexible working conditions, will alter the ways employers recruit. Cross-generational skills acquisition will be important.

While the speed of technological change may place younger cohorts at a perceived advantage, especially those who have grown up entirely in a digital age, all age cohorts will need to invest in continual up-skilling to keep pace with accelerating development. Workers in older age groups will need to embrace technology fully in order to compete in the labour market.

By 2020, over 50 per cent of the workforce are expected to be Generation Y members who have grown up connected, collaborative and mobile.

***“Different generations have to understand each other. Fostering intergenerational solidarity in the workplace is extremely important to future business performance”***  
(UK thought leader)

### **Action for future skills**

Each of the scenarios highlights distinctive implications for the UK jobs and skills landscape in 2030 - but there are also implications, and therefore action needs, that are common to all four. To prepare for tomorrow's world of work, the study indicates key areas for consideration by employers, individuals, education providers and policy makers. These are not to be seen as definitive solutions to the opportunities and challenges presented by the analysis, but as a starting point for further thinking and debate.

## **Employers**

- Take leadership and responsibility for developing the skills needed for business success to create resilience and the capacity to innovate in the face of intensifying competitive pressures and market volatility. Industry-wide collaboration by business is needed to address key skills challenges as an intrinsic part of sectoral growth strategies. The ability to attract, develop and retain world class talent will increase in importance as a differentiating factor in global markets.
- Develop capability to manage skills and talent across global business networks and supply chains, to adapt to open business models and more fluid employment arrangements.
- Collaborate with government to develop sustainable career and learning pathways for young people in a challenging labour market.
- Prepare for increasing diversity in the workforce, both culturally and generationally, by supporting a greater range of flexible working arrangements and adapting organisational values to create meaning and value to work.
- Intensify collaboration with the education and training sector to access critical skills as the capacity to innovate becomes paramount.

## **Individuals**

- Change mind-set regarding the nature of work, as it becomes less location-specific, more network oriented, project based and increasingly technology-intensive.
- Take greater personal responsibility for acquiring and continuously updating skills for progression and success in the face of limited investment from employers and government and increasing division between low and high-skill jobs. Keep in touch with relevant labour market developments and include skills and training opportunities as part of contract negotiations with employers.
- Be open to and take advantage of new and different approaches to learning, for instance self-directed, bite-sized learning, peer-to-peer learning and technology enabled training opportunities.

- Be willing to jump across specialist knowledge boundaries as technologies and disciplines converge, developing a blend of technical training and ‘softer,’ collaborative skills.
- Focus on development of key skills and attributes that will be at a premium in future, including resilience, adaptability, resourcefulness, enterprise, cognitive skills (such as problem solving), and the core business skills for project based employment.

### **Education and Training Providers**

- Collaborate closely with employers to support them in achieving their business and skills objectives to ensure provision is responsive to their needs and forward-looking in a competitive learning market.
- Be prepared to adapt to the continuing disruption of established income streams and business models arising out of the marketisation of learning.
- Invest continuously in new modes and content of provision. Keep abreast of developments and understand the impact of technology on learning delivery.
- Put in place systems to offer clear information on success measures of learning to inform investment decisions by learners and employers.
- Adapt learning programmes to reflect the critical importance of an interdisciplinary approach to innovation in the workplace and the all-pervasive influence of technology.
- Understand the increasingly diverse demands people place on modes of education and training and develop flexible learning pathways and bite-sized opportunities to reflect the changing employment landscape.

### **Policy makers**

- Foster a flexible and dynamic skills investment environment which enables people and businesses to build their capacity to innovate and compete. Government’s role will be increasingly to ensure an effective alignment of public and private investment with a view to maximising outcomes that contribute to jobs and growth.
- Encourage employers to take a greater degree of leadership and control of the education and training system. Foster strategic relationships between business and the education and training sector to ensure agility and cost effectiveness in developing the skills needed for a rapidly changing environment.
- Empower individuals through access to high quality careers and training information and advice, and facilitate access to finance to support individual investment in skills.

- Put in place domestic labour market regulation that prevents a ‘race to the bottom’ in labour standards as the balance of power shifts increasingly to employers. Support discussions around the facilitation of labour market regulation on a global scale.
- Develop a coherent and comprehensive long-term strategy for ensuring that the low-skilled can respond to the challenge of a radically shifting labour market.
- Mitigate growing spatial disparities in jobs and skills, by enabling labour mobility and /or supporting local economic development.

# 1. Introduction

This study looks ahead to 2030 by analysing stable trends that are already shaping the future of UK jobs and skills; potential disruptions to those trends; plus a portfolio of four scenarios of what the UK's job landscape might look like in 2030 and the skills that will be required under these conditions.

The aim is to creatively influence and constructively challenge patterns of thinking, while stimulating informed debate on the actions that could be taken today to prepare for the labour market of 2030. The purpose of this report is to trigger debate about investment in skills and inform the decisions facing employers, individuals, policy makers and education providers.

Through its *Working Futures* research, The UK Commission for Employment and Skills has generated detailed projections of quantitative changes in the labour market and occupational structure, including growth in employment in the private services sector, and the anticipated employment growth in higher skilled occupations<sup>3</sup>.

*The Future of Work* study offers a distinct but complementary approach in analysing and better understanding the underlying drivers and factors (including disruptive and discontinuous factors) that shape the future demand for skills in the UK<sup>4</sup>.

There is a need both to respond to and to anticipate changes. The act of anticipation, assessing trends and potential future changes, reveals new potential and strategic choices in the present. Foresight methods and concepts offer a framework for structuring analysis and discussion on the future of jobs and skills. The methodological approach is set out in more detail in Section Two.

The study consisted of three main phases: (1) analysis of key trends, potential disruptions, and the underlying key factors (driving forces); (2) development of four anticipated scenarios of what the UK's work landscape might look like in 2030, with implications for key stakeholders and economic sectors; and (3) drawing from analysis, the identification of action needs.

## Research aims and objectives

The overall aim of the study is to “enable key groups in the UK labour market to position themselves effectively by building their understanding of key emerging trends and the implications for the future of jobs and skills for the medium to the long term (up to 2030).”

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<sup>3</sup> For more information, including detailed projections of UK employment, labour supply and skills: [www.ukces.org.uk/ourwork/working-futures](http://www.ukces.org.uk/ourwork/working-futures)

<sup>4</sup> More information on the range of outputs of the study are available at: [www.ukces.org.uk/thefutureofwork](http://www.ukces.org.uk/thefutureofwork)

Core questions that the study aimed to answer included:

- What are the main assumptions regarding the future global economic development and performance of UK jobs and skills?
- What are the potential future disruptions?
- Which key factors are driving the development of jobs and skills in the UK? Which uncertainties do they feature?
- What are possible and plausible pictures of the future of UK jobs and skills, and how might they develop?
- What are the scenarios' implications for the key actors in the field of UK jobs and skills?
- What could these actors' strategies look like? How robust are the strategies when applied to different futures?

### **Key trends shaping future jobs and skills**

13 trends are identified as being the most influential and plausible impacting on the jobs and skills landscape in the UK to 2030. These are discussed in detail in Section Three:

- Demographic change, especially an ageing population.
- Growing diversity, increasing representation of gender and ethnic groups in the labour force.
- Growing household income uncertainty and regional inequalities.
- Growing desire for a better work-life balance.
- Changing work environments shaped by Information and communications technology (ICT), outsourcing, internationalisation and the need for greater flexibility.
- Converging technologies and cross-disciplinary skills, particularly the combination of biotechnology, information and communications technology, nanotechnology and cognitive science.
- Digitalisation of production: automated and additive manufacturing processes, involving 3D printing.
- ICT development and the age of big data, the power of digital devices and the potential to capture and use vast amounts of data.
- Changed economic perspectives due to globalisation and technological change, particularly volatility and uncertainty in the period post the 2008 crash.
- Shift to Asia, growing economic power and influence of countries in the East.

- New business ecosystems leading companies to be increasingly defined as ‘network orchestrators.’
- Growing scarcity of natural resources and degradation of ecosystems: finite environmental resources leading to higher extraction costs and environmental decline.
- Decreasing scope for political action due to constrained public finances, as well as greater levels of social transfers for the aging population, limits resources for education and skills initiatives.

### **Potential disruptions that could radically change the future of work**

Ten key disruptions have been chosen on the basis of their conceptual plausibility to the UK context in 2030. These are discussed in detail in Section Four. These represent a potential divergence (or a marked acceleration) from current trends or expected development:

- Reverse migration
- Changing values of employees’, where workers select employers on the basis of alignment with their own values
- Zero-hour contracts, and similar flexible arrangements, become the norm
- Anytime, anywhere skills delivery, enabled by virtual and peer-to-peer learning
- Artificial intelligence (AI) and robots, penetration of AI and automation into highly skilled occupations
- De-globalisation
- Geographically alternative centres of excellence, the UK’s leading position in key economic sectors is lost to high growth economies
- Disrupted Internet developments due to cyber crime
- Resource conflicts or climate disasters threaten supply
- Partial fragmentation of the EU.

### **Four scenarios for UK jobs and skills in 2030**

This study explored four different development paths, or scenarios, for the UK labour market leading to 2030. The first scenario outlines how a ‘business-as-usual’ landscape might develop. In contrast, the remaining three feature more disruptive developments. The scenarios describe four alternative paths and outcomes, but are not mutually exclusive. They are all driven by strong common developments including further globalisation, an ageing workforce, and digitalisation of work and everyday life.

While this study is robust, comprehensive and compiled from detailed analysis, there are, of course, countless alternatives in reality. The scenarios are not intended to be normative or to convey a 'preferred' future. Rather they seek to create coherent, plausible stories from complex socio-economic and technological ingredients.

The four scenarios are:

- 1) **Forced Flexibility (the 'business-as-usual' scenario):** Greater business flexibility and incremental innovation lead to modest growth in the economy, but this flexibility often results in fewer opportunities and weakened job security for the low-skilled.
- 2) **The Great Divide:** Despite robust growth driven by strong high-tech industries, a two-tiered, divided society has emerged, reinforcing the divergence in the economic positions of the 'haves' and 'have nots.'
- 3) **Skills Activism:** Technological innovation drives the automation of white-collar work and brings large-scale job losses and political pressure, leading to an extensive government-led skills programme
- 4) **Innovation Adaptation:** In a stagnant economy, improved productivity is achieved through a rigorous implementation of Information and Communications Technology (ICT) solutions.

***“People will look for jobs that give them the diversity of experience and skills that will enhance their personal mobility and opportunities rather than a conventional ‘career ladder’ set of skills”*** (UK policy maker)

This report is structured as follows:

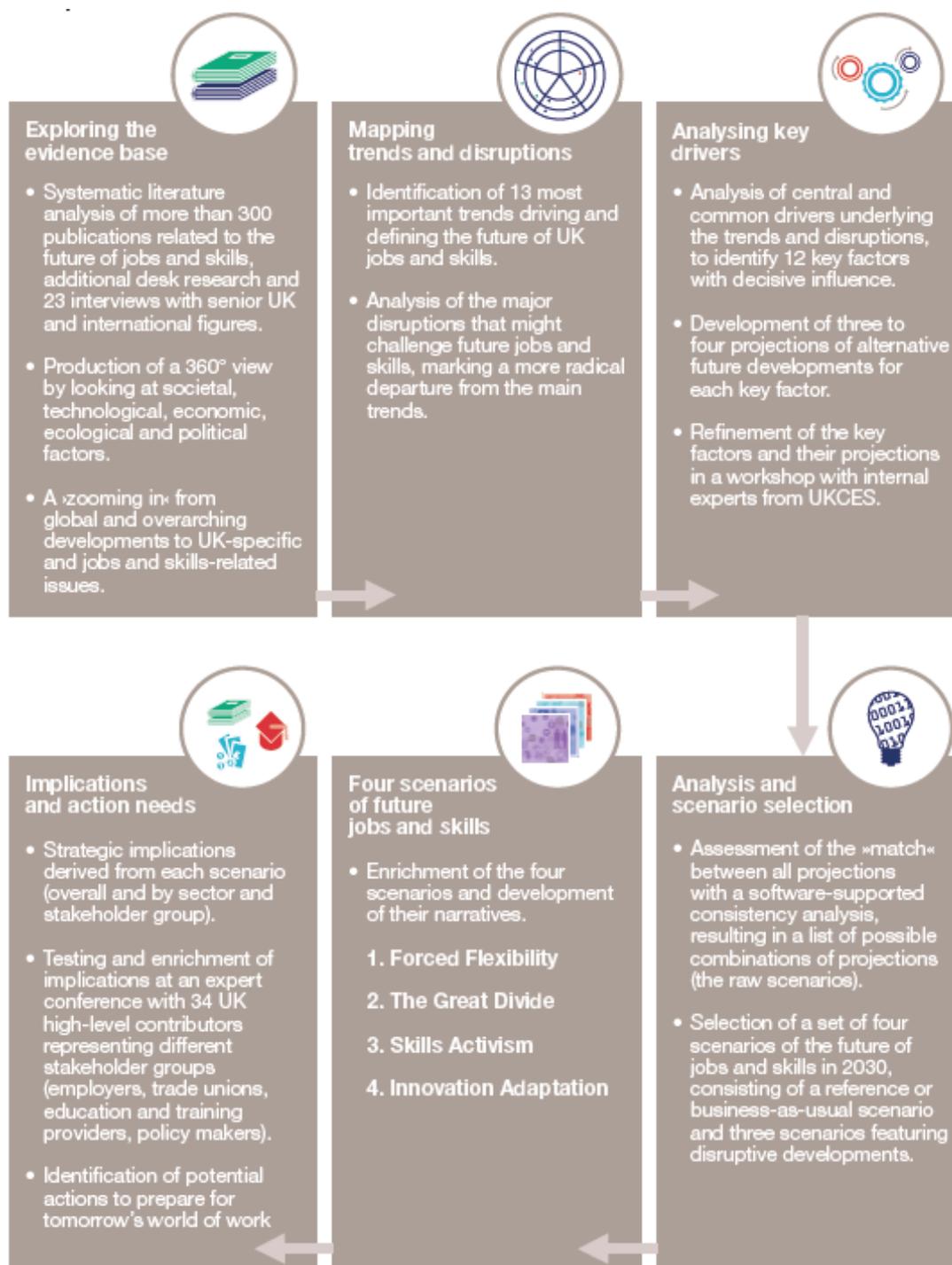
- Section Two describes the methodology used in the project, the mixture of methods used, and the way in which the study engaged with employment and skills experts.
- Section Three, analyses some of the principal trends shaping employment and skills in the UK – reviewing the evidence and assessing the prospects for the period to 2030.
- Section Four discusses the more uncertain, disruptive factors that could have radical impacts on the future of work.
- Section Five presents the four scenarios for the jobs and skills landscape in 2030. To enrich and illustrate the differences and qualitative shifts present in the scenarios, creative vignettes for seven economic sectors (manufacturing, creative and digital, professional and business services, retail and logistics, health and social care, education, and construction) are provided.
- Section Six draws out generic, scenario-specific and cross-scenario implications for jobs and skills for each of the seven sectors above.

- Section Seven concludes with key messages arising from the study.
- Appendices A – F detail the expert interviews, future of jobs and skills conference, analytical results, key factor report, set of raw scenarios and their projections, and provides the full trend and disruption report, which contributes a greater level of detail on top of the analysis presented in Sections Three and Four.

## 2. Methodology

The picture of future jobs and skills in this study is based on a robust, evidence-based approach. This includes literature reviews, expert interviews and high-level workshop discussions. Trends and disruptions were analysed and a set of four scenarios setting out alternative pictures of the future was developed in a systematic and analytical way. Implications for jobs and skills plus associated action needs were then drawn from this analysis. The chart below summarises the research process.

**Figure 2.1: Research process**



## **From trends to scenarios**

The future may be unknowable, but signals of future developments can be identified and analysed. These are existing developments, or manifestations of change, that can already be identified and be projected reasonably well into the future. The evidence-based developments, that allow for a relatively confident assessment of their future states, are called trends.

They range from comprehensive “megatrends” (or great overarching processes of change) that have already been visible for at least 10-15 years (e.g. globalisation, digitalisation, increasing importance of health issues) to more issue-, sector- or region-specific trends which are stable over a shorter timeframe of several years. Trend-based projections of specific topics are an important element in developing foresight knowledge.

However, there are also many uncertainties regarding future developments. Long-term processes of change are always at the mercy of disruptive developments. Such signals of change are already evident today, but remain limited to niches.

Thinking in terms of disruptions and their potential to change the world of work, as we know it today, is crucial when preparing for the uncertainties of the future. Trends and disruptions, however, are relatively linear approaches to gaining foresight knowledge.

This study takes a broader approach, using a systemic scenario analysis.

When identifying and describing complex and consistent visions of the future, scenarios are used to create and explore alternative pictures of the future which can be compared with each other. The scenario technique enables:

- the extension of alternative developments into the future;
- increasing awareness for possible changes in the strategic environment;
- identifying and clarifying implications and action needs; and
- increased knowledge for decision-makers.

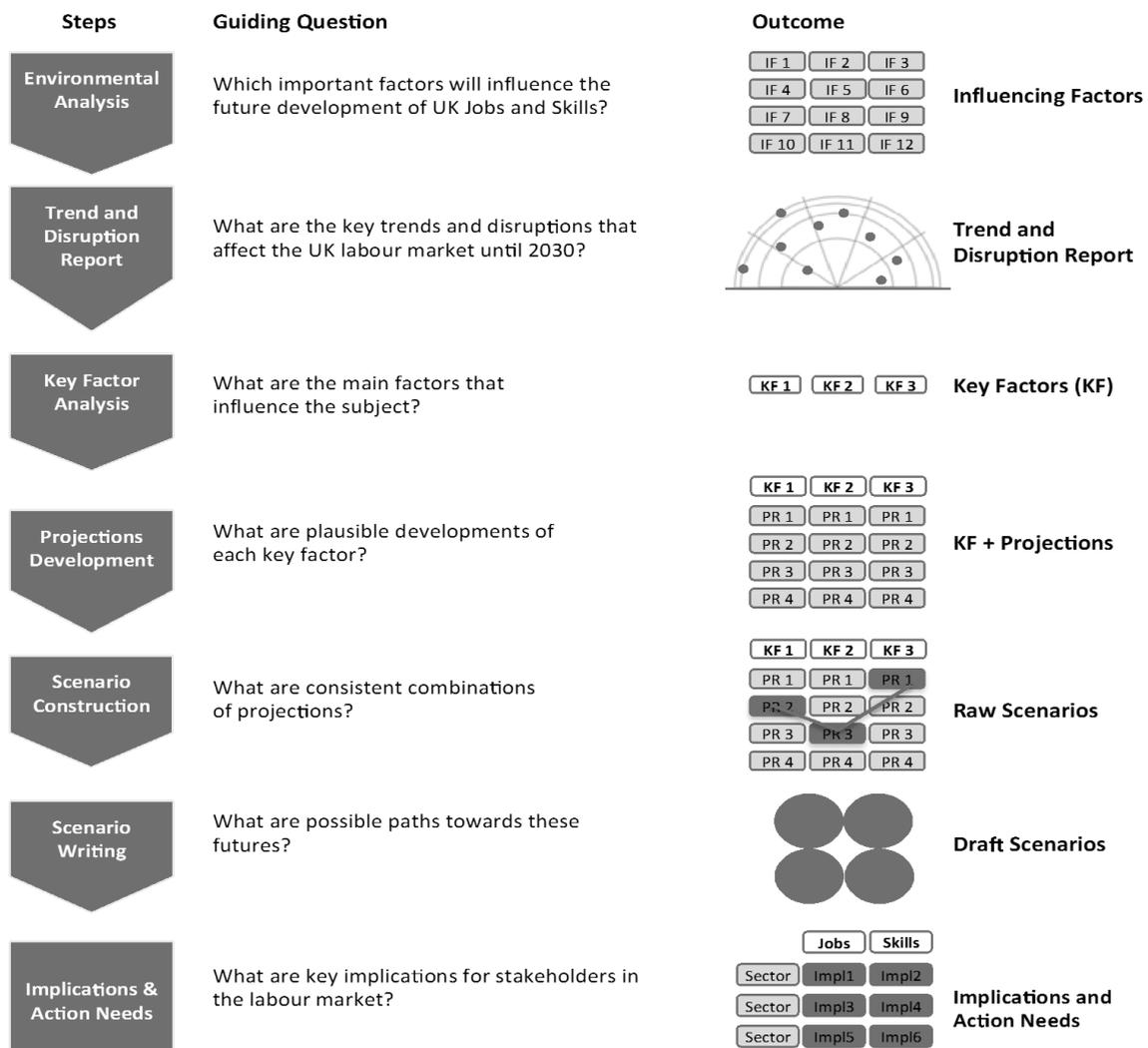
Exploratory scenarios involve the extrapolation of challenges, trends, and other influencing factors. They also have the crucial purpose of exploring disruptive development paths that deviate from the “business-as-usual” of merely continuing today’s trends. Inconsistencies or conflicts between individual trends are identified and addressed using interdependency methods, including the morphological box, cross impact analysis, and consistency analysis (see below and Appendix C).

## Using scenarios

As a rule, all scenarios have both positive and negative aspects, even those describing a more adverse vision of the future. They provide food for thought on challenges and opportunities, options, and action needs. Viewed from this angle, they prepare the ground for reflections on long-term oriented decisions. The focus is on the conclusions taken from the scenarios: “How could, how should we act?”

Scenario processes are based on key factors, i.e. factors that have a significant influence on the issue examined and its future development. The concept of key factors is used to reduce complexity by examining a large number of parameters (actors, challenges, trends, etc.) and then selecting those which are the most relevant. This process often begins with environmental scanning, in which numerous parameters determining trends in the environment are identified, systematised, and classified. Figure 2.2 below provides an overview of all process steps and their outcomes.

**Figure 2.2: Analytical process**



The following sections set out the methodological steps used in this study in more detail.

### **Exploring the evidence base: Analysing trends and disruptions**

This research is based on a robust, evidence-based approach including an analysis of more than 300 publications related to the future of jobs and skills and additional desk research. In addition, interviews with 23 UK and international experts (see Appendix A) validated and enriched the collection of trends and descriptions and shared their expectations and future perspectives from their field from a bottom-up approach. The interviewees were senior experts from different sectors who hold a varied range of outlooks: thought leaders, senior business leaders, trade union representatives, education and training providers, representatives from voluntary organisations, and policy makers.

To select the trends and disruptions, a 360° view on the topic of UK jobs and skills was used, taking into consideration all possible influencing trends according to the STEEP framework: social, technological, economic, ecological and political factors. The analysis followed a “zooming in” approach, looking first at the more distant environment, e.g. global economic developments and climate change, and then zooming in to factors more specific to job and skills in the UK.

This scanning process resulted in the identification of 13 major trends which drive and describe the future of UK jobs and skills (set out in Section Three). Also, ten major disruptions were analysed that could challenge the future of UK jobs and skills beyond the trend developments (set out in Section Four, additionally a standalone more detailed trend and disruption report is provided in Appendix F)<sup>5</sup>.

### **Key factors analysis**

Focusing exclusively on trends and disruptions will not provide a systemic picture of the future of work that is required for an in depth analysis of the future of jobs and skills.

Specific and comprehensive scenarios of the future of jobs and skills are developed from the main underlying drivers of change (so called ‘key factors’). The trends and disruptions are combined to generate consistent and plausible scenarios.

By analysing the identified trends and disruptions for central and common drivers, a long-list of 25 influencing factors was compiled (see Appendix C).

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<sup>5</sup> Available at [www.ukces.org.uk/thefutureofwork](http://www.ukces.org.uk/thefutureofwork)

Key factors ‘bundle’ parameters that significantly determine possible future developments. Forecasts are always uncertain, in particular over timeframes of more than 15 years, but the degree of uncertainty of individual factors may differ.

With the exception of migration, demographic trends, for example, are characterised by comparatively low forecast uncertainties; usually, they involve only a single crucial parameter. Economic factors, by contrast, are often subject to considerable uncertainties.

Hence, it is necessary to distinguish two categories of influencing factors: Those with low uncertainty, where only one parameter has to be considered in the scenario construction, and those with considerable uncertainty, where several parameters have to be considered.

A two-step approach was taken to achieve the goal of reducing the number of factors for further analysis while keeping those with the greatest influence on the future of UK jobs and skills.

Most relevant for the development of alternative scenarios or development paths are those factors with high impact and high uncertainty, these are candidates for the ‘key factor set’.

The criteria for selecting the most influential factors were strength of impact, degree of uncertainty and also the degree of influence on other factors. To achieve this, an Uncertainty-Impact-Analysis was undertaken.

### **Uncertainty-Impact-Analysis**

The Uncertainty-Impact-Analysis evaluates two aspects:

- How certain or uncertain is the development of a factor?
- How strong is its impact on the field under investigation?

The main objective of this method is to single out the factors that are neither important nor uncertain. The identified disruptions were used to make valid assumptions on the degree of uncertainty. Appendix C set outs the results of the analysis plotted in an uncertainty-impact matrix.

### **Givens**

The process identified seven factors with low relative uncertainty, yet high impact for the future environment – referred to as “givens”, which shape future developments similarly across all scenarios. These “givens” are:

- Climate conditions;
- Globalisation of business activities;
- Resource availability;
- Digital infrastructure (internet);
- The specialisation of work;
- The division of labour;
- Digitalisation and big data opportunities, and;
- The age structure of the workforce.

Appendix D provides more information on these givens. During the process of building scenarios, givens play a similar role across all scenarios, whereas key factors take different forms/projections.

### **Cross-Impact Analysis**

The remaining set of influencing factors was reduced even further by evaluating their mutual impacts in a Cross-Impact Analysis (see Appendix C). The objective of this analysis was to single out factors that are neither actively influencing other factors, nor passively influenced by a large number of other factors. Simultaneously, this analysis identifies major drivers (highly 'active' factors) and output factors (influenced by many other factors).

### **Active-Passive Matrix**

The level of activity and passivity of each factor was plotted in an Active-Passive Matrix (see Appendix C). The most active drivers were then selected as scenario key factors. Drivers with a medium level of activity<sup>6</sup> were selected based on the issue at hand.

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<sup>6</sup> *Workforce Diversity* is excluded, as it is strongly influenced by the remaining factor *Workforce Mobility* and the increasing role of women in the workforce is already present as a given. *Economic Conditions in the World* is strongly driven or represented by the included factors *Global Trade Conditions* and *Structure of the UK Economy*. *Employment and Labour Regulation* is also represented in parts in *UK Contract Conditions* and *Access to... Education* and overall in *Scope of Government*. This factor is also a strong output factor and is discussed in the action needs at the end of the process.

## Developing projections

Once the final list of key factors had been identified, their possible future developments (projections) with respect to the project's time horizon of 2030 were sketched out. This included developing three to four projections of alternative future developments for each key factor. This step was also informed by the insights gathered during the literature analysis and expert interviews set out above and validated and enriched in a workshop with UKCES experts. Appendix D provides detailed descriptions of the key factor projections. The projections then served as the basis of the scenario construction.

**Figure 2.3: Key factors and projections**

|  |  |  |  |  |
|--|--|--|--|--|
| Condition of Global Trade                  | Between Tension and Cooperation                  | Continuing Liberalisation                                    | A more National Perspective              | Sluggish Global Trade                                      |
| Economic Condition of the UK               | Shaky Recovery, New Foothold for Growth          | Sturdy Recovery, Robust Growth                               | Prolonged Crisis, Threat of Stagnation   | Economic Vicious Cycle                                     |
| Structure of the UK Economy                | Maintaining the Balance                          | Slow Re-industrialisation                                    | Financial Sector Blues                   |  |
| Public Funding for Skills Delivery         | Reduced Funding and Priority for Skills Delivery | Focus on Skills Delivery, Despite Funding Restrictions       | Priority for Skills Delivery             | Market-Driven Education and Employment Conditions          |
| Employment and Promotion Measures          | Austerity Driven Restraint                       | Focus on Social Markets and Healthcare                       | Focus on High-Tech Industries            |  |
| Uptake of Innovation in UK Businesses      | Accelerated Incremental Innovation               | Focus ICT: Accelerated, Networked, Disruptive Innovation     | Entering a New Kondratieff Cycle         | Stagnation of Innovation in UK Relative to Other Economies |
| Work Environment                           | The Flexible and Smart Workplace                 | The Cyber Workforce  | The Individual Workplace                 | The Stagnating Work Environment                            |
| Employment Contract Conditions in the UK   | Limited Employment Regulation Benefits Employers | Employees hold Balance of Power (Despite Limited Regulation) | Regulation Strengthens Employees' Rights | Employers Side-Step Regulation                             |
| Workforce Mobility                         | The Semi-Mobile Workforce                        | The Global Workforce   | The Virtual Workforce                    | The Static Workforce                                       |
| Access to and Forms and Modes of Education | Multiple and Accessible Skills Delivery Models   | Online Education Trumps Other Modes                          | Elite (Offline) Education                | Traditional Institutions Train the Workforce               |
| Income Distribution within UK Workforce    | Widening Income Gap                              | Income Stratification  | Inequality Restraints                    |  |
| Employees' Values                          | New Values vs. Old Values                        | Struggle for Survival  | Shaped by Generation Y                   |  |

## Checking consistency and building the scenarios

A consistency check identified possible conflicts and synergies between the projections. Each set of projections of different key factors forms the basic structure of a scenario (also called a raw scenario or projection bundle).

However, not all possible raw scenarios are consistent and plausible. A consistency check is necessary at this stage because projections of different key factors occasionally dovetail, but may also violently clash. Also, with the multitude of possible raw scenarios resulting from the numerous combinations of different key factor projections reducing complexity is crucial.

A comprehensive software-supported consistency analysis was conducted to identify consistent and plausible “matches” between projections<sup>7</sup>. A **Consistency Analysis** assesses the “match” between all projections, based on the question “Could projection X coexist with projection Y?” In this relatively complex process, all pairs of projections of different key factors are given ‘consistency values’ which describe their compatibility<sup>8</sup>. The result was a list of all possible and plausible combinations of projections.

Using software to calculate which of the projections’ combinations achieve the highest consistency scores and clustering based on similarities, four sufficiently differentiated clusters emerged. These raw scenarios were then further developed, with one scenario representing a trend-based “business-as-usual” scenario and three scenarios featuring disruptive developments.

To arrive at a full scenario story, raw scenarios have to be enriched. This is achieved by making more detailed assumptions about the causalities or underlying ‘logics’ of a scenario and explaining possible paths leading to the scenario’s future.

Often, a back-casting approach is used, i.e. developments are viewed in reverse, starting from the future state in 2030 defined by the raw scenario rather than from the present. Construction of these logical development chains has to be rooted in a thorough understanding of the jobs and skills systems and economic, societal, technical and ecological interactions. The development chains are inspired by cause-effect relationships of real-world impacts and based on the insights gained from the literature review and expert interviews.

Section Five sets out the four scenarios.

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<sup>7</sup> This approach is contrasted with the 2x2 matrix scenario approach which is commonly used in scenario studies.

<sup>8</sup> Parmenides EIDOS<sup>®</sup> software uses a scale of -3 (highly inconsistent) to 3 (highly consistent), with 0 defining a non-existent relationship between the two projections

### 3. Trends shaping the future of jobs and skills

There are many local and global trends that are already visible today that point towards forthcoming changes in business and society. These will have significant impact on UK jobs and skills over the long-term. These include:

- Emerging economies acquiring shares in global production chains;
- Demographic change and migration changing the face of the workforce;
- Technological developments weakening the once clear differentiation of sectors and traditional modes of working;
- The structure of businesses evolving and developing into more flexible and networked models;
- Employees becoming more mobile (through preference or necessity) leading to higher job turnover rates.

These rapid, complex shifts are affecting labour markets around the world, constantly challenging the balance of supply and demand, and labour market and education policies.

A trend is a development lasting several years that is empirically documented. Trends usually run a steady course, and cyclical changes and fluctuations do not affect them, nor are they subject to changes in course or sharp rises. As a rule trends follow a clear direction and their course is robust. Trends describe a continuation of events according to the principle of established patterns or “business-as-usual”.

This section sets out the 13 trends that were considered to have both the highest plausibility of occurrence and to be the strongest drivers of future jobs and skills in the UK. To cover this broad base, the trends are inter-sectorally relevant and stable over the long-term.

Appendix F provides a standalone ‘trends and disruptions’ report that includes further data and more detailed implications for jobs and skills<sup>9</sup>.

#### **Selection of the 13 trends**

The selection of trends for the long-term future of UK jobs and skills is based on a broad literature review of more than 300 global and UK specific foresight studies published from 2010 onwards<sup>10</sup>.

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<sup>9</sup> Available at [www.ukces.org.uk/thefutureofwork](http://www.ukces.org.uk/thefutureofwork)

The trends were initially selected by taking a comprehensive view of their long-term impact on UK jobs and skills.

Secondly, the plausibility of the trends were considered. For the trends, plausibility is taken to mean certainty about their occurrence and the expected developments generally apply across the UK labour market, but may vary for different sectors and occupations<sup>11</sup>.

The initial longer list included trends deemed to have less potential for impact on the labour market of 2030, such as a growing informal economic sector, demand for more personalised goods and services, and increasing borderless risks such as natural disasters and global crime.

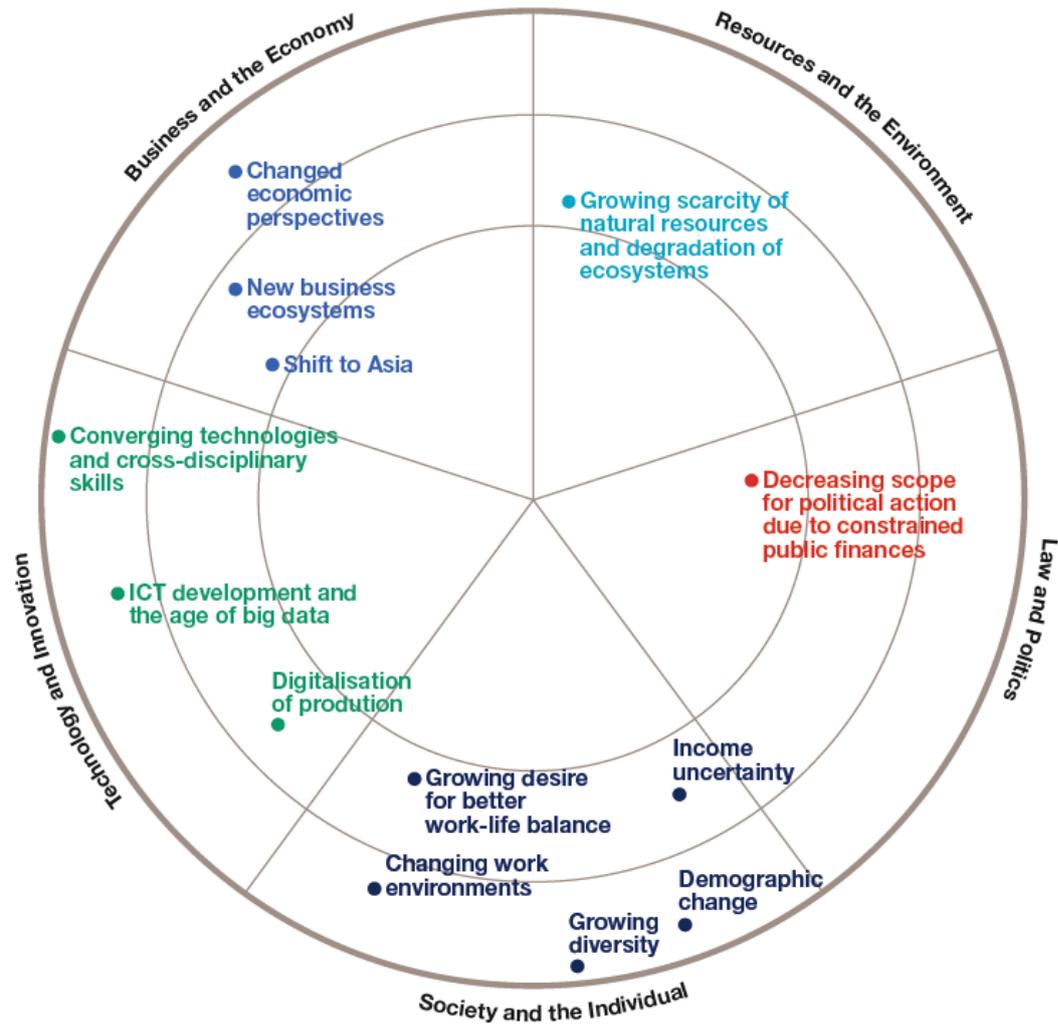
The sub-sections below present the 13 trends. Recent evidence is provided, together with extrapolations of their future development. Also included is a list of their implications for UK jobs and skills. As jobs and skills are strongly interconnected, these implications are also strongly interlinked. These trends are evidence based and references are provided from the literature analysis.

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<sup>10</sup> The literature base was supplemented by *Z\_punkt Megatrends Update*, a compilation of the twenty most important megatrends that are on the strategic radar of many international companies; as well as the *Z\_punkt Trendradar 2020*, which includes descriptions of more than 170 trends.

<sup>11</sup> A more detailed analysis of the impacts of the scenarios on selected sectors and occupations can be found in Section Six.

Figure 3.1: Trends driving the future of UK jobs and skills



### 3.1 Demographic change

**Description** The UK's population and labour force are experiencing a marked aging process as the "baby boom" generation reaches state pension age and older people participate in the labour market for longer. While, as in other industrialised nations, the population and workforce are aging, migration is helping to remedy skill shortages.

**Expected future developments**

- By 2030 the UK's population is projected to reach 71.4 million (ONS, 2011a). The continued ageing of the UK's population is projected to shift the median age from 39.7 years in 2010, to 39.9 years in 2020, and to 42.2 years by 2030 (ONS, 2011a).
- With the average age of the UK's labour force increasing over the coming decade, today's largest age band of workers is set to shift from 44-46 to 54-56 by 2020 (Duckworth *et al.*, 2010).
- London is projected to become the UK's first megacity in around 2025 when the population is expected to reach 10.3 million, an increase of almost 26 per cent from 8.2 million in 2011 (ONS, 2012a; UNDESA, 2011).

**Implications for Jobs**

- The growing population will lead to increased consumption within the UK, this will create additional jobs e.g. in the construction sector, but also in retail and energy. Ageing of the population will lead to a continued increase in care occupations including those that assist the sick and elderly.
- As employees work into their later years job compensation and 'phasing out' options may need to be considered in order to address declining productivity and physical capacity.

**Implications for Skills**

- As people live and work longer, they will require lifelong learning and training. Consideration and emphasis may need to be placed on ensuring the availability of age appropriate work, including training for new tasks, managing job transitions and leadership challenges. Additionally, skills for leading multi-generational workforces and collaboration within multi-generational groups will become an important success factor.
- As high-skilled workers from the baby-boomer generation reach retirement age it is likely to lead to large skill gaps in many occupations, especially in the STEM (science, technology, engineering and mathematics) professions (Business Europe, 2011; Intel, 2012).

### 3.2 Growing diversity

**Description** As women around the world continue to seek equal rights within society, the workplace and at home, traditional gender roles are increasingly challenged. The role of women in the UK labour market will continue to grow in scale and importance. Rising global mobility of workers and new technologies are bringing together different and sometimes conflicting cultures, religions, races and languages.

- Expected future developments**
- An increasing number of women will enter the workforce over the coming two decades – 56 per cent of the net increase in jobs between 2010 and 2020 are expected to be filled by women (Wilson *et al.*, 2012), a tendency which will continue until 2030. Further, the skills level gap between the genders is widening until 2020 with 46 per cent (2010: 35 per cent) of females higher skilled compared to 42 per cent (2010: 33 per cent) of males (Bosworth, 2012). Consequently, it is expected that women's roles and ranks within the workplace will increase.
  - As increased policy efforts focus on assisting the successful integration of migrants into the UK's social fabric, it can be expected that foreign-born workers will continue to rise up the ladders of the UK workforce (Rolfe *et al.*, 2013).
  - Cross-country collaboration will increase further in multi-national companies, driven by outsourcing and global supply chains. Also day-to-day virtual teamwork requires intercultural competences and respect to diversity issues (Hay Group, 2011).
- Implications for Jobs**
- Occupations and working arrangements that facilitate a successful balance between employees' careers and their private lives are expected to rise, leading to a rise in social care jobs (SFH and LMI Team, 2011).
  - Companies will increasingly need to cater to the needs of different ethnic markets, both nationally as well as internationally, in order to remain profitable. New occupations, increased need for translation services, language teaching etc. and an increasingly globalised workforce will develop as a result (People 1st, 2010; PwC, 2010a).
- Implications for Skills**
- Increasing migration encourages a rise in multi-cultural social and communication skills within the workforce. This is particularly important for those in managerial roles (EGFSN, 2013).
  - There is a growing need to recognise and understand foreign qualifications (certificates, diplomas, degrees) and the competencies they signal, as well as to provide UK-specific training courses to cover any knowledge gaps.

### 3.3 Income uncertainty

**Description** Households in the UK face growing income uncertainty due to low economic growth, fleeting job security and expected increases in taxes. Against this backdrop, income and wealth inequality in and between UK regions is becoming more important.

- Expected future developments**
- Pressure on household net income (pension plans, etc.) is forecast to continue to rise owing to, amongst other things, changes in employment structures, the UK's current tax and benefit policy, and the projected increases in high and low-paid jobs (at the expense of middle-income jobs; Brewer *et al.*, 2012). In terms of employment structures, the rise in temporary employment and self-employment in the UK leads to an accompanying rise in associated negative social impacts such as lower average wages, less employment protection, and reduced social security provisions (Brewer *et al.*, 2012).
  - Without effective policies in place inequality of income between groups within the workforce is expected to continue to rise. If recent trends continue in the UK, by 2030 the highest 0.1 per cent who currently receive 5 per cent of the national income will see this rise to 14 per cent (HPC, 2011).
- Implications for Jobs**
- As the power balance shifts more towards employers, who also face increasing cost pressures, there is likely to be a subsequent rise in temporary employment contracts. Such contracts adversely affect lower-end jobs, while high-end jobs sometimes benefit (e.g. micropreneurs; Lansley and Reed, 2013).
  - With increasing pressure on consumers' income, there is a push for lower-priced products and services leading to downward pressure on wages for associated jobs. A shift towards low-cost products and services will lead to a rise in associated jobs, such as in the retail sector or household related services.
- Implications for Skills**
- As inequality increases, those in lower socio-economic groups may require additional support and training in soft skills. For example, job acquisition expertise will need to improve as people find it increasingly necessary to master the required practices to obtain employment (i.e. job interview skills, networking strategies, etc.; Campbell *et al.*, 2010; Hackett *et al.*, 2012).

### 3.4 Growing desire for a better work-life balance

**Description** Better work-life balance is becoming increasingly important. More flexible working arrangements, that enable family friendly work patterns, are on the rise. Successful flexibility arrangements address both personal and company goals. As organisations seek to hire and retain strong performers, there is a growing understanding of the need to offer soft benefits in addition to traditional incentives.

- Expected future developments**
- As flexibility continues to be a decisive factor when choosing a job, the rise in limited project contracts, freelancing and part time employment is expected to continue (Andre *et al.*, 2013; EC, 2012a).
  - There is expected to be a continued rise in the need to offer future employees non-traditional incentives as employers compete on a global stage for the most talented employees. Generation Y<sup>12</sup>, who since the 2010s are entering the workforce in large numbers, will further drive this trend: 92 per cent of them place flexibility as a top priority when selecting workplaces (Adachi *et al.*, 2013).
- Implications for Jobs**
- There will be a continued rise in job sharing, part-time employment, flexitime (etc.), and contract based work as well as new and innovative employment models (Gratton, 2010).
  - HR departments will be required to cover more tasks and demands: they will need to be well versed in new employment policies and legislation relating to flexible employment rights and options (CIPD, 2013a). Additionally, they will need to care for the wellbeing of employees, including health and personal issues, to ensure a happy and productive workforce in a more comprehensive way than before. As a result of these demands, precautionary health services will be a growing job market.
- Implications for Skills**
- Employees will need to be able to show strong self-organisation and multi-tasking skills. Employees, especially those who are contracted on a project by project basis, will need to have a greater breadth of skills to draw upon and will need to rely increasingly on further education and lifelong learning initiatives to upgrade their existing talents (e-skills UK, 2009; SES, 2012).
  - Leadership skills in reintegrating employees after periods of parental leave as well as in the efficient re- and up skilling of returnees to work where skill requirements have changed over their period of absence will become increasingly necessary (Duckworth *et al.*, 2010).

<sup>12</sup> Generation Y are commonly referred to as those people born between 1982 and 2000.

### 3.5 Changing work environments

**Description** Work places and working modes are under pressure to increase flexibility and to adapt to business volatility. Outsourcing and the increasing internationalisation of business are leading to a rise in project and teamwork with external collaborators. As a result, decision-making is occurring more broadly in companies across those with various levels of responsibility. Additionally continuous digital training becomes necessary.

- Expected future developments**
- In the knowledge sector, future companies will operate from a slimmed-down pool of employees, backed up by colleagues from branches in other countries and external consultants for specific projects. Knoll Workplace Research forecasts that by 2020 employers will provide opportunities for flexible working hours to the majority of UK knowledge workers (Ouye, 2011).
  - With over 50 per cent of the workforce in 2020 expected to be Generation Y members, who have grown up connected, collaborative and mobile, organisations must ensure they are able to easily and effectively adapt to rapid social and technological change (Morgan, 2013).
  - Effective policies to manage more mobile workers will become increasingly necessary, with organisations needing to place strategic emphasis on management, scheduling and technology guidance (Citrix, 2012; Thompson *et al.*, 2013).
- Implications for Jobs**
- Jobs and organisations will become increasingly more fluid as people move from project to project. It will become even more necessary to focus on creating a positive work based culture and to foster team building (Intel, 2012).
  - Managers and organisations will need to place additional focus on developing individual packages for employees as well as finding effective ways of switching from time based monitoring to results based monitoring.
- Implications for Skills**
- The key qualities for success in the future workplace will be: the ability to quickly adapt to changes in the working environment, to excel in collaborative working modes and strong analytical skills to assess problems and make decisions.
  - With the rise in project based skill requirements and as people change jobs more frequently and thus need a varied portfolio of skills, higher education providers will increasingly need to provide new methods of cross-crediting, accumulation and transfer of skill units.

### 3.6 Converging technologies and cross-disciplinary skills

**Description** The boundaries between disciplines, such as natural sciences and informatics, are becoming increasingly blurred. As the disciplines converge, so do the technologies. This convergence, particularly at the intersection between nanotechnology, biotechnology, information technology and cognitive science, disrupts existing business models, but also creates completely new markets and novel application fields.

- Expected future developments**
- Networking and the cooperation of industry and research institutions, both inside the UK as well as internationally, will continue to be increasingly important in enabling cross-disciplinary innovation potential (IBLF, 2013).
  - Besides R&D, innovative products and processes will considerably impact on the fields in which they are applied. For example, developments in bioscience, pharmaceuticals and technology will improve services and outcomes for patients on the one hand, but change the work of doctors, nurses and carers on the other.
  - Research and development activities are becoming more internationally mobile. The increasing relocation of R&D activities from western European countries to eastern European or Asian countries is likely to have an impact on domestic research and development activities (Gomory and Baumol, 2013).
- Implications for Jobs**
- There will be strong demand for high skilled labour especially professional scientists and engineers due to rapid technological change, and innovation, research and development in the biotechnology and life sciences sectors (Hogarth *et al.*, 2010).
  - With a host of new knowledge being generated in ever more specialised fields of study, there will be increasing demand for specialists at the intersection of the sciences and for business to turn insights gained into successful business ideas.
- Implications for Skills**
- The convergence of technologies and disciplines is intensifying the need for multi-disciplinary teams with highly qualified individuals such as engineers, bio-scientists, bio-engineers, and ICT specialists. Good communication skills are necessary in order to ensure smooth operation and collaboration in such multi-disciplinary teams (Hogarth *et al.*, 2010).
  - The growth of sectors and business activities based on converging technologies is also likely to create demand for knowledge intensive services and skills, including legal services for intellectual property and other issues, marketing and strategic management consulting.

### 3.7 Digitalisation of production

**Description** The digitalisation of production processes is driving a new era of industrialisation. With real time data exchange between machines, materials, and products-in-the-making, increasingly autonomous production systems and factories become possible. Moreover, additive manufacturing techniques (also known as 3D printing) enable new forms of decentralised, yet complex production processes.

- Expected future developments**
- Developments in sensor and RFID (Radio-frequency identification) technology are beginning to allow for real-time track and trace in logistics and are seen as the basis for the emergence of an “Internet of Things” in which by 2020 an estimated 50bn items will be connected to each other (Cisco, 2011).
  - Additive manufacturing will most likely only diffuse slowly into the broader production environment. But a number of prominent examples of the use of 3D printing in critical areas are promising signals for such a development. Tests of 3D-printed rocket parts at NASA, for example, have shown that such parts are as durable as those traditionally manufactured, but are produced at a 70 per cent reduction in costs (NASA, 2013).
- Implications for Jobs**
- Automation and productivity gains due to new technologies are the major reason for the continuing reduction in employment, particularly in routine jobs. However industrial and technological change is increasing demand for high- and medium-skilled workers (Cedefop, 2010; EGFSN, 2013; Wilson and Homenidou, 2012).
- Implications for Skills**
- With continuing automation, the core value that labour can add is in non-routine processes, in uniquely human, analytical or interactive contributions that result in discovery, innovation, teaming, leading, selling and learning (Austin, 2010).
  - In a semi-autonomous manufacturing environment, the remaining shop floor workers will have more responsibilities that require control, maintenance and problem-solving skills. Also, with small numbers of employees on the shop floor and flat hierarchies, communication skills will become increasingly important.
  - The technical profile of trades and crafts jobs will increase. The increased use of automation within buildings, for example, requires changes in construction work as well as in installation, maintenance and repair.

### 3.8 ICT development and the age of big data

**Description** The development of ICT continues to be characterised by performance increases, miniaturisation, and nanotechnology. The increasing number of smart mobile devices combined with faster mobile Internet access allows for ubiquitous communication and access to information and media. Effective data management is becoming of critical importance as the amount of data collected and stored, as well as the ability to analyse this data, increases.

- Expected future developments**
- Over the coming 15-20 years, ICT hardware, software, and connectivity will continue to experience massive growth in capability and complexity as well as more widespread diffusion (NIC, 2012).
  - It is projected that by 2017, the annual amount of data traversing the global networks will exceed the accumulated amount of data from 1984 to 2012 (Cisco, 2013). Much of this data will need to be stored, analysed or will be waiting for analysis (Bamford, 2012).
- Implications for Jobs**
- While many lower skilled jobs (e.g. secretarial and clerical work) will continue to be replaced through developments in ICT, information technology also creates new markets such as design and programming of websites or ‘apps’, as well as disruptive business ideas like the platform airb’n'b<sup>13</sup>. These new businesses often generate jobs of a professional, associate professional and managerial nature (Wilson and Homenidou, 2012).
  - The demand for ICT specialists will grow within companies and in business consulting services. According to Hollingworth and Harvey-Price (2013), the ICT sector in the UK requires nearly 300,000 recruits until 2020 at professional, manager and associate professional level.
- Implications for Skills**
- Programmers, software development professionals, data security experts, web design and web development professionals represent the crucial skills (EUSP, 2012). While big data skills<sup>14</sup> are of crucial importance, in particular, knowing how to turn data into insights that increase the efficiency of existing business and generate ideas for new business opportunities will be highly valued (McKinsey, 2011; Avanade, 2012).
  - For the general population increased levels of digital competence and the ability to continually adapt and learn new competences are increasingly becoming a requirement (EUPS, 2013).

<sup>13</sup> airb’n'b provides a platform for collective consumption and sharing of rooms and flats, thus challenging traditional business models in the tourism sector.

<sup>14</sup> The ability to interpret the huge amount of data collected around the world, and around the clock

### 3.9 Changed economic perspectives

**Description** Due to globalisation and technological change, the economy and financial system are increasing in complexity. This is compounded by challenges arising out of greater global volatility and low economic growth within established economies. As the innovation necessary for continuing expansion of the economy is requiring increasingly higher levels of economic and financial complexity, there is also a growing business awareness of the need for more resilient value chains that are safeguarded by risk management policies and strategies.

**Expected future developments**

- Growing levels of economic and financial complexity<sup>15</sup> are necessary in order to achieve the degree of innovation that is needed for continuous economic growth in developed economies (Cowen, 2011; Hausmann *et al.*, 2013). However, this will also lead to a higher risk of economic shocks at a crisis level and will probably lead to greater volatility of economic development (NIC, 2012).

- As businesses are facing increased uncertainty, they are adapting their processes to allow greater flexibility, while many also realise the need to integrate resilience into their management of business structures and processes.

**Implications for Jobs**

- Slow economic recovery could amplify the underuse of human capital caused by the recession. Those with higher skills compete for jobs that, in better times, would be filled by the less skilled, and the result is the displacement of the latter.<sup>16</sup>

- In order to gain more flexibility companies are striving to shift a part of their economic risks to their employees, e.g. through changing work time agreements and job benefits or through using more flexible work contracts such as zero-hour contracts. Already in 2013, over 1 million people or 3.1 per cent of the UK workforce are employed under zero-hour contracts with 38 per cent of them wanting to work more (CIPD, 2013b).

**Implications for Skills**

- For businesses facing increased uncertainty, the need for risk management skills and the ability to manage complexity become of critical importance. These skills will need to become a significant part of business-oriented higher education.

<sup>15</sup> Technological innovation often requires considerable investment of financial resources and a variety of rare materials and intermediate products. To increase the options for investments and financing, increasingly complex financial tools are developed that create unclear interlinkages between the real economy and the financial sector. Also, supply chains grow in length and are spread out all over the world so that when looking upstream it is often unclear how many and which suppliers are present in the supply chain.

<sup>16</sup> The slow recovery could also amplify the “hysteresis” phenomenon, a decline in the employability of those losing their jobs, because long-term unemployment leads to an erosion of skills, detrimental effects of detachment from working life and the loss of a network of contacts that would facilitate in job searching (Mortensen and Vilella-Vila, 2012).

### 3.10 Shift to Asia

**Description** Economic power is shifting towards emerging countries, parallel to the relative loss of importance of the G7 economies. The markets of emerging countries promise high growth and profitable investment opportunities.

- Expected future developments**
- Income levels are rising in Asia alongside economic growth. By 2030, Asia is projected to account for 66 per cent of the global middle-class and for 59 per cent of middle-class consumption, compared to 28 per cent and 23 per cent in 2009 (Pezzini, 2012).
  - China is projected to overtake the U.S. as the largest economy in the second half of the 2020s (NIC, 2012), effectively doubling its GDP compared to 2011<sup>17</sup> (PwC, 2013a). While India's economy is expected to remain the third largest economy in 2030, its GDP triple that of 2011 (PwC, 2013a).
- Implications for Jobs**
- In the UK, it is likely that low-skilled labour will find it increasingly difficult to acquire decent employment outside of the service sector, particularly if the number of low-skilled manufacturing jobs continues to decrease due to further relocation of production (NIC, 2012).
  - Moreover, international competition will also put increasing pressure on wages in high-skilled jobs, as a growing high-skilled workforce in emerging countries will soon be able to offer results similar to their counterparts in the developed economies (Duckworth *et al.*, 2010).
- Implications for Skills**
- With increasing educational levels of the workforce in Asia the international competition between workers will increasingly begin to affect intermediate and high skill workers in the UK (EGFSN, 2013; PwC, 2011; Duckworth *et al.*, 2010).
  - Further, with the growing number of attractive employment opportunities in Asia, the supply of migrant labour at all skills levels may decline in the future (Belt *et al.*, 2010), while outward migration of UK nationals to Asia may increase.
  - As international competition for innovation continues to increase, focusing on techniques for innovation in education and training will be of great importance, especially for (engineering) jobs in manufacturing and R&D, but also across all sectors (EGFSN, 2013).

<sup>17</sup> In purchasing power parity terms.

### 3.11 New business ecosystems

**Description** A new organisational paradigm sees companies increasingly defined as ‘network orchestrators’. The skills and resources they can connect to, through activities like crowdsourcing, become more important than the skills and resources they own. Collaboration in value creation networks is enabled by the virtualisation of business processes, fuelled by the rise of the digital economy.

- Expected future developments**
- The nature of the firm will be progressively defined by its role as ‘network orchestrator’ (see Fung *et al.*, 2008) as opposed to being defined by its product related core competences<sup>18</sup>. Firms are likely to be successful when they manage a network of partners that are integrated into the value creation process.
  - The highly networked companies tend to be smaller ones. SMEs are growing and booming, while large multi-business companies tend to stagnate or shrink. As company’s core competences are more fluid the turnover rate of companies is likely to increase.
- Implications for Jobs**
- The value of an organisation will increasingly be held in its ‘social capital’, that is, the value of the networks and relationships held within businesses, across businesses and into the wider community and ecosystems.
  - Teamwork in virtual teams, across businesses, functions and organisations, will grow in importance (Gratton, 2010). At the same time, the jobs responsible for running processes and infrastructures that enable multi-actor cooperation are gaining in importance (Fjeldstad *et al.*, 2012).
  - Innovation and other functions of value creation will be increasingly carried out in an open manner (like in open innovation). As hierarchies are increasingly flattened, power and decision making is shifted at least partly, to the teams.
- Implications for Skills**
- Orchestrating the partnership network by managing communication and organising knowledge networks are the key skills for the future. Interdisciplinary competences, i.e. profound understanding of the interfaces and differences between sectors will grow in importance.
  - Skilled experts may face increasing competition from an equally skilled global workforce for day-wage tasks. Thus, self-marketing skills will be crucial. Owning certifications for skills may become important in order to guarantee qualification for in-demand tasks.

<sup>18</sup> This will not affect all companies in the same way, but at the least, many functions of a firm will be shifted to the network and need to be *orchestrated*.

### 3.12 Growing scarcity of natural resources and degradation of ecosystems

**Description** Global economic growth is leading to a growing worldwide demand for natural resources and raw materials. Over exploitation implies higher extraction costs and degradation of ecosystems. The prices of these resources will become more volatile.

- Expected future developments**
- In the period to 2035, global primary energy consumption is expected to rise from 12,700 million tonnes of oil equivalent (Mtoe) in 2010 to 17,200 Mtoe (IEA, 2012). In the UK, the renewables share in gross final energy consumption is expected to rise from about 4 per cent in 2011 to 15 per cent by 2020, according to the UK renewable energy target, and by 2030, the renewables share should reach 30 per cent to 45 per cent share (CCC, 2011).
  - By 2030, global resource extraction will increase to about 100 gigatonne (Gt), and could increase further up to 140bn tons in 2050 (in comparison to 49-60 Gt in 2000; Fischer-Kowalski *et al.*, 2011; SERI, 2009).
  - Globally, there is a risk of food shortages over the next decade due to rising population and climate change impacts.<sup>19</sup>
  - If current trends were allowed to continue, water scarcity will increase. In a dry year in the 2020s the gap between water supply and demand in the UK could be nearly as large as the total current agricultural abstraction of 120bn litres per year (CCC, 2013).
- Implications for Jobs**
- The renewable energies sector promises future growth both in manufacturing and in installation and maintenance services, generating new jobs across different sectors from manufacturing to construction. Trade and craftsmen, in particular, tend to profit from the need to install and maintain technical solutions locally.
  - Water-intensive industries such as thermal power generation, pulp, textile, chemistry or steel may need to invest in water efficient solutions, generating jobs, particularly in manufacturing and engineering.
- Implications for Skills**
- Increased focus on reducing carbon emissions and energy consumption will lead to growing demand for skills in material and resource efficiency, particularly in engineering and design, but also in most occupations across all sectors (EGFSN, 2013).
  - Resources could become a new arena for the UK financial industry, in turn requiring particular skills, like mathematics in combination with an in-depth understanding of the global resource market, and strategies to responsibly deal in these products.

<sup>19</sup> An Oxfam study predicts a climate change induced increase of rice, wheat and maize prices of between 110% and 180% between 2010 and 2030 (Carty, 2012).

### 3.13 Decreasing scope for political action due to constrained public finances

|                              |  |
|------------------------------|--|
| Description                  | Government scope to invest in employment and education initiatives is increasingly challenged by the competing fiscal pressures of growing social transfer payments, pension burdens and public debt.  |
| Expected future developments | <ul style="list-style-type: none"> <li>• Despite comparatively strong forecasted economic growth – 1.8 per cent for 2012-2017, 2.6 per cent for 2018-2020 (highest among all G7 economies; OECD, 2013a) – the OECD expects the UK to be the only G7 country unable to reduce its debt level by 2020. Instead, a growth of debt levels up to 117 per cent of GDP is expected by 2020, followed by a reduction to approximately 100 per cent by 2030 (OECD, 2013a).</li> <li>• In the event of higher interest rates, high debt levels could become a serious concern for the UK budget, curtailing the scope for political decision making in the future. Further, the age structure of the UK population indicates that the UK will face growing burdens in the future (CIA, 2013). Retirement payments will increase, tax revenues could be negatively affected due to the shrinking workforce, and the potential of growing unemployment could increase social transfer payments.</li> </ul> |
| Implications for Jobs        | <ul style="list-style-type: none"> <li>• Public funding for measures for the promotion of job creation, and generally any labour market measures, are hard to implement when faced with severe budget constraints. There will be fierce competition for public money and workforce under the different political action fields.</li> <li>• Financial consulting could be a beneficiary of persistently low interest rates or rising tax rates. Savings in individual pension funds will need to rise to counteract potentially decreasing state pension claims.</li> <li>• According to the Office for Budget Responsibility, public sector employment will fall drastically in the future. According to current estimates, this will lead to around 1 million people needing to search for new jobs (Emmerson <i>et al.</i>, 2013).</li> </ul>  |
| Implications for Skills      | <ul style="list-style-type: none"> <li>• There will be a much greater onus on the individual to invest in skills if both government and business become unwilling or unable to maintain their level of investment in human capital.</li> <li>• Public sector workers need to invest in up-skilling to be able to integrate in the private sector labour market.</li> </ul>   |

## 4. Disruptions that could radically change the future of work

Whereas trends lead to more or less clearly foreseeable changes, the impact of disruptions on the UK labour market, employment and skills to 2030 is complex and less amenable to prediction.

Despite these uncertainties, opportunities and risks can be surveyed and assessed. New technologies, changing market structures, and innovative employment models are emerging. Bottlenecks affecting labour markets are not only conceivable but also probable; in the digital age, knowledge and technology are decidedly fluid.

If disruptions become virulent, they pose a significant risk for destabilising economic markets and thus employment. Economic theory often refers to periods of disruption caused by technological innovation as ‘creative destruction’ (using Schumpeter’s phrase) – new industries, jobs and economic value are created whilst old industries decline.

Businesses that recognise changes early are well positioned to take advantage of the potential opportunities that emerge from disruptive influences. Although at a commercial level it is entrepreneurial and innovative companies that grasp these opportunities, individuals, policy-makers and education and training providers also need to be vigilant and prepared for new employment and skills needs arising for such disruptions.

Ten disruptions were selected based on their conceptual plausibility under certain conditions, and the severity of their impact on the future of jobs and skills in the UK if they were to occur<sup>20</sup>. An initial longer list included disruptions such as climate change catastrophe, automated healthcare for the elderly and rapid growth in the informal economy. They were not included in the selection due to the criteria mentioned above<sup>21</sup>.

All of the ten selected disruptions would most probably lead to significant deviations from the business-as-usual development as laid out in the trends. In particular, eight disruptions can be clearly related to seven trends (see Table 4.1). Two disruptions touch upon further topics<sup>22</sup>.

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<sup>20</sup> The selection is based on the literature base and expert interviews. This is complemented by the *iKnow* database *WiWe Bank* with more than 800 emerging issues, wild cards and weak signals, available: [wiwe.ikonowfutures.eu](http://wiwe.ikonowfutures.eu)

<sup>21</sup> For example, the emergence of shale gas as a major new source of energy through the use of hydraulic fracturing (fracking) and other techniques was considered as a disruptive development, in view of its impact on the US economy. This did not make the final list of disruptions because it was judged that other developments had more potential to impact on UK jobs and skills in 2030. UK shale gas reserves are believed to be substantial but not “game changing”, whilst environmental concerns are likely to limit its exploitation to a greater extent than has been the case in the US. The potential for energy-intensive industries to migrate to the US is currently unclear.

<sup>22</sup> These are “Anywhere, Anytime Skills Delivery” and “Partial Fragmentation of the EU”.

**Table 4.1: Trend and disruption relationship**

| Trend   | Related Disruption<br>Radical deviation from trend assumptions |
|---|--|
| Demographic change                            | Reverse migration  |
| Growing desire for a better work-life balance | Employees' changing values                                     |
| Income uncertainty                            | Zero-hour contracts become the norm                            |
| Digitalisation of production                  | Artificial intelligence and robots                             |
| Shift to Asia                                 | Geographically alternative centres of excellence               |
|   | De-globalisation   |
| ICT development and big data                  | Disrupted internet developments                                |
| Scarcity of resources                         | Resource conflicts or climate disasters threaten supply        |

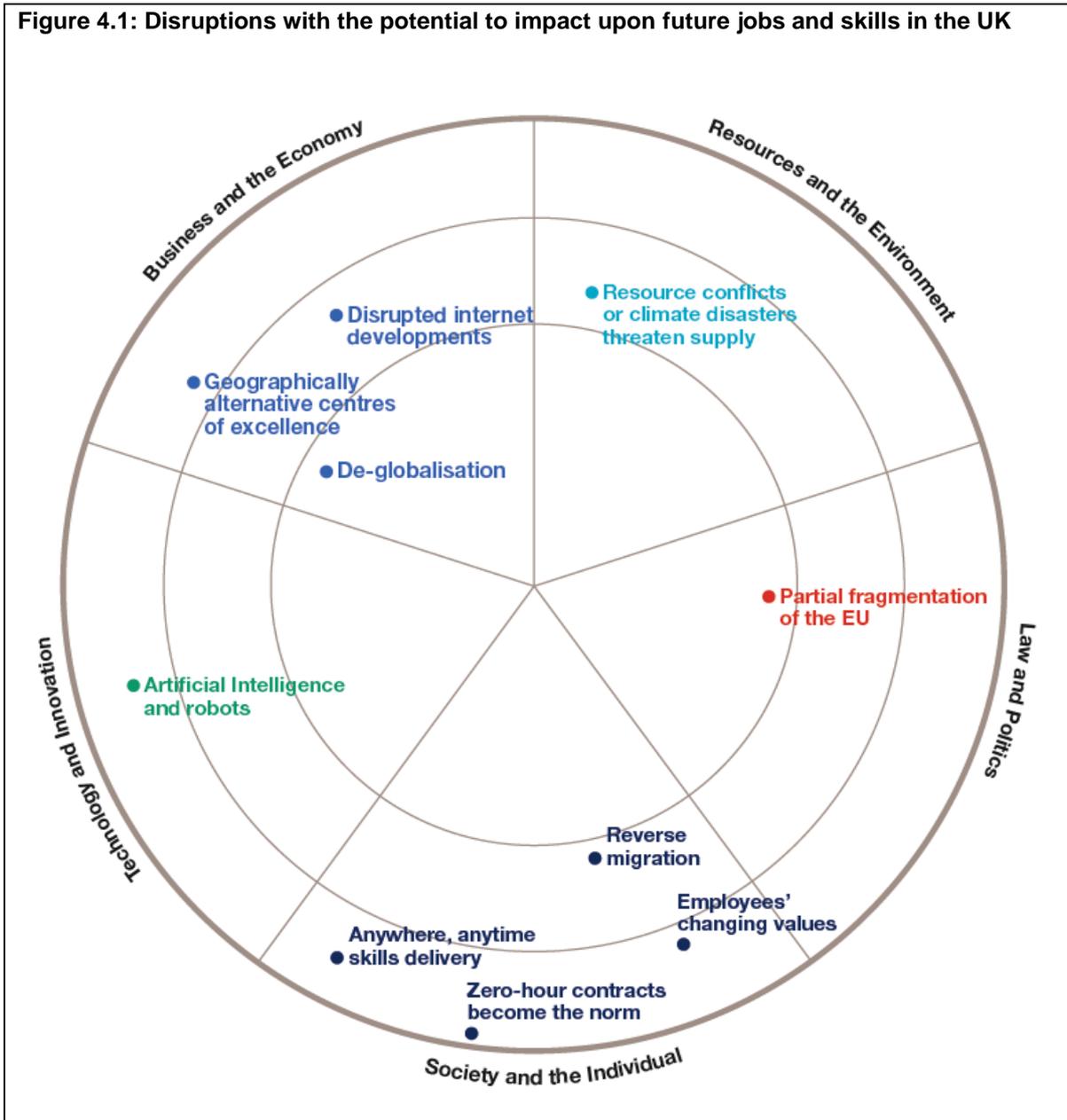
The disruptions are set out in more detail below. In the 'recent development' section of each disruption, it is not a long visible development that is documented, but rather weak signals indicating a potential new development.

The probability of the developments shown in the 'future development' section is much lower than the corresponding section in the trend descriptions. The future assumptions shown are those that should, in particular, aid us in imagining the potential of these disruptions to alter the future UK jobs and skills landscape.

Appendix F provides a standalone 'trends and disruptions' report that includes further data and more detailed implications for jobs and skills<sup>23</sup>.

<sup>23</sup> Available at [www.ukces.org.uk/thefutureofwork](http://www.ukces.org.uk/thefutureofwork)

Figure 4.1: Disruptions with the potential to impact upon future jobs and skills in the UK



## 4.1 Reverse migration

**Description** With continued low economic growth rates in Western countries, global migration patterns may reverse. Immigrants in industrialised nations could migrate back to their country of origin (particularly to emerging economies) in search of work and prosperity.

- Recent developments**
- Job markets in emerging countries have been growing rapidly for some time, while job opportunities in Western countries like the UK are limited, due to the economic crisis. In 2010, 30,000 people left the UK to make a life in India (BBC, 2012; Vaidyanathan, 2012). Countries like India are also actively attracting their “diaspora” by offering them lifelong visas (“Overseas Citizen of India”) that allows for keeping their British (or other) passport. While until now, permanent migrants mostly migrated back at the end of their working life; in contrast reverse migrants are relatively younger people, of working age.
- Potential future developments**
- While the Office for National Statistics estimates a 4 million increase in population due to net migration until 2030 (out of an overall 9 million population increase to 2030; ONS, 2011a, 2013a), this number may be greatly reduced if the developments described above accelerate.
  - An active search by foreign companies for a “diaspora” workforce with language and cultural skills might push the reverse migration phenomenon, as would a UK job market with low prospects and high entry barriers.
- Implications for jobs**
- The loss of a significant proportion of the high-skilled workforce could lead to skill-shortage vacancies. The labour force shortage would be felt particularly strongly in sectors that have high levels of immigrant labour, such as social care.
  - Positive impacts may also arise in terms of better connected and intensified international business relations: reverse migrants are able to retain their professional networks and relationships and fall back on UK suppliers in their new work places abroad or even build a bridgehead for the UK company in the home country, e.g. opening a sales agency.
- Implications for skills**
- If well-educated workers (especially younger workers) leave the UK for better prospects in foreign labour markets, it could reduce the number of eligible candidates for high-skill jobs, like IT specialists or engineers, leading to a potential jobs-skills mismatch.
  - National or company skills retention is becoming more important, as well as skills acquisition by the lower skilled workforce to fill the gap left by reverse migrants.

## 4.2 Employees' changing values

**Description** More people are living their personal values and wanting to realise them in a meaningful way in the workplace both in high and low skilled positions. Individuals may increasingly look to select potential employers based on their value priorities, disrupting the traditional employers' market. Hence, organisational cultures are forced to adapt their corporate values and policies.

**Recent developments**

- A report by Net Impact (2012) outlines students' and workers' high preference for working at a company that acts in a socially and environmentally responsible manner. Studies have shown that Generation Y<sup>24</sup> members put a premium on work-life balance (rather than making career sacrifices), want greater flexibility, and are more globally minded than previous generations, and in general want more from their jobs than just financial reward (PwC, 2013b; Deloitte, 2011).

**Potential future developments**

- By 2030, Generation Y members will make up about 50 per cent of the working population in the UK (ONS, 2011a). The general focus of Generation Y members on corporate social responsibility, work-life balance, and greater mobility could force corporations to act ethically if they want to attract employees.

**Implications for jobs**

- In recruitment, it is likely that corporate values will become the most important hiring tool, making it difficult for 'unpopular' industries (e.g. defence industry) to attract the necessary talent.
- With Generation Y members being much more mobile (Deloitte, 2011) and more likely to change jobs (e.g. for Germany, see IAB, 2011), talent retention will become much more competitive.
- The shift to sustainable consumption espoused by Generation Y members could result in reduced expenditure on imported consumer goods and higher spending on services, boosting green job growth.

**Implications for skills**

- Generation Y's 'positive competition' attitude, pro-diversity, eager to learn, is a boost to skill development in organisations. Leaders have to recognise that skills are understood differently and processes have to be adapted: autonomy, recognition of individual needs, and collaboration are valued much more highly than before.
- The lack of job security and the fact that Generation Y members are more mobile (e.g. more willing to emigrate) leads to a short-term focus, which has to be recognised by businesses.

<sup>24</sup> The role of Generation Y - the designation 'Generation Y' is used to cover those born between (approx.) 1980 and 2000 that grew up almost entirely in the digital age, primarily in developed countries - is discussed here exemplarily for people with a high appreciation of values. Currently, 12 million people over the age of 18 fall into the Generation Y age range in the UK (ONS, 2011a).

### 4.3 Zero-hour contracts become the norm

**Description** With individuals facing such high competition in the job market, employers are able to structure employment conditions to meet their specific needs. It is evident in a rise in the practice of zero-hour contracts, and similar flexible arrangements, coupled with the decline of investment (by employers) in up-skilling individuals.

- Recent developments**
- Persistent and rising un- and underemployment<sup>25</sup> are shifting the balance of power in the job market. Individuals are under a much greater pressure to accept contracts that benefit employers much more than they do workers, particularly when competing for low-skilled jobs, however, underemployment is also on the rise among graduates in the UK (Mosca and Wright, 2013).
  - One prominent example of these lopsided contracts are zero-hour contracts.<sup>26</sup> CIPD (2013b) reports that in 2013 just over 1 million people or 3.1 per cent of the UK workforce are employed under zero-hour contracts, 38 per cent would like to work more hours.
- Potential future developments**
- Future use of zero-hour contracts or similar contractual designs will depend greatly on the development of the regulatory landscape and on a persistent labour surplus. Should legislation and the current growth trend remain unchanged, there would be some 25 million people on zero-hour contracts in the UK by 2020 (Cross, 2013; Neville, 2013; Butler, 2013) of an overall workforce numbering some 30 million. Even less aggressive growth would see at least 50 per cent of the workforce employed in zero-hour contracts by 2030<sup>27</sup>.
- Implications for jobs**
- A possible outcome is a highly polarised labour market, with low- to medium-skilled workers in constant competition for more hours – either in zero-hour contracts (low and unskilled) or as freelancers – offering employers low wage bills and utmost flexibility. Full-hour contracts would be limited to a small minority of core staff in executive positions, similar to, e.g., Sport Direct today (only 10 per cent of all staff were on regular contracts as of 2013; Neville, 2013).
- Implications for skills**
- Companies' investment in skills might be tightly concentrated on job-specific requirements. In addition, uncertainty about one's personal income situation reduces the incentive to pay for one's own training, hurting overall skill levels.

<sup>25</sup> Willingness of workers to work more hours than employers demand, or to work below their skill level; Bell and Blanchflower, 2013

<sup>26</sup> Zero-hour contracts offer employers the flexibility to meet fluctuating demands, yet under which people are not guaranteed a specific number of hours or times of work, or may have to work varied or extended longer hours from time to time

<sup>27</sup> Own calculation, assuming that three quarters of the workforce are employed in zero-hour contracts in the sectors: health and social care, retail, transport, accommodation and food service activities, education.

## 4.4 Anywhere, anytime skills delivery

**Description** Traditional education and training providers are being challenged by the broad variety of non-traditional learning opportunities. New models of skills delivery are resulting from a rise in online educational opportunities, open universities and peer-to-peer learning.

- Recent developments**
- In recent years, the costs of traditional education have increased considerably.<sup>28</sup> At the same time, non-standard education and training have become more widely recognised, e.g. by the EU's ECVET<sup>29</sup> scheme (ECCTIS, 2013).
  - Technology has enabled a revolution in distance learning: free or fee-based Massive Open Online Courses (MOOCs), which provide students with online teaching materials and interactive forums, have seen a rapid rise in recent years (in the US, enrolment rose 100-fold between March 2012 and March 2013; Waldrop, 2013). The use of MOOCs in further training is also growing rapidly in the corporate environment (Meister, 2013).
- Potential future developments**
- MOOCs are expected to continue their expansion, with an estimated 120 million students enrolled worldwide in 2020 (Yuan *et al.*, 2013), roughly 50 per cent of overall participation in tertiary education (Uvalić-Trumbić, 2011).
  - The tendency of Generation Y to favour gamified and experiential approaches could overturn traditional didactic models. This would also entail new ways of validating and accrediting learning.
- Implications for jobs**
- As technological development is likely to lead to rapid changes in necessary competences and skills - easy 'up skilling' would help to maintain employees' and businesses' competitive position.
  - Expensive universities and training providers need to adapt their business models and core services to compete against low cost MOOCs. Life-long learning will open new markets that can be developed by established and new players alike.
- Implications for skills**
- In corporate on-the-job training and up skilling, MOOCs and similar models make it much easier to reach and involve (in particular older) workers. Bite-sized learning offers a route to developing skills to precisely fit the task, providing ready-to-use new knowledge.
  - Teamwork, social skills, and presentation fluency, etc., are more conducive to being taught in a traditional environment and resultantly may suffer in an overwhelmingly online learning environment.

<sup>28</sup> In the UK, average tuition fees more than trebled between 1998 and 2010, and have since risen again steeply (Bolton, 2013).

<sup>29</sup> European Credit System for Vocational Education and Training

## 4.5 Artificial intelligence and robots

**Description** Further advancements in the fields of robotics, algorithms and Artificial Intelligence may make it possible to automate processes and services that are presently provided by high-wage experts (e.g. surgery, diagnostics, legal advice).

- Recent developments**
- Today, robots are not only employed in manufacturing (i.e. industrial robotics), but have also found use in health care (supporting or conducting surgery, and more recently, as service robots in hospitals; Hay, 2012) or in agriculture and various other fields with routine tasks.
  - Over the past decade, Artificial Intelligence (AI) applications have matured in many areas, most prominently in stock trading (using textual analysis to predict the development of stocks; Mims, 2010), but also in medical diagnosis (lowering costs and improving outcomes; IU, 2013), education (one-to-one teaching of maths; Williams, 2011), and computer games (guiding the actions of computer opponents; Lane, 2013), among others. In general, AI is increasingly used to facilitate capturing, structuring, and analysing big data (O’Leary, 2013).
- Potential future developments**
- Robots will begin to enter occupations previously thought to be limited to humans, among them nursing (in particular in ageing societies; SD, 2013) or the transportation of passengers and goods in autonomous vehicles (Shankland, 2012).
  - Many tasks on the stock market are already handled by AI applications. In the future AI applications could take over stock and financial markets completely, almost entirely foregoing human input.
- Implications for jobs**
- A greater role for both AI and robotics as described above would bring about a further decoupling of productivity from employment, leading to the loss of medium and high skilled jobs in analysis and management.
  - Resulting productivity gains may be used to improve service quality, leading to the creation of new jobs in the area of personal training and assistance. This could even lead to an upheaval in wage structures, where e.g. non-replaceable social jobs may become much better paid.
- Implications for skills**
- Many jobs will be ‘de-skilled’, i.e. stripped of routine, complex technical tasks; leading to a new focus on interpersonal skills in formerly purely technical and other occupations (in health care, e.g. a shift from medical diagnosis to working with patients).
  - As personalised, AI-supported training and education reduce the cost and efforts necessary for acquiring skills, more workers could gain additional qualifications, leading to a higher skilled workforce.

## 4.6 De-globalisation

|                               |   |
|-------------------------------|---|
| Description                   | Increasing protectionist and nationalist tendencies, due to the persistent global economic crisis, may counteract international cooperation and trade.  |
| Recent developments           | <ul style="list-style-type: none"> <li>• Governments worldwide are increasingly using protectionist measures to support their national companies, with more than 400 measures taken globally since the autumn of 2012 (Evenett, 2013). Rather than using traditional trade barriers, protectionist measures include restricting migration and providing export subsidies and guarantees, or financial aid.</li> <li>• Increasingly, jobs and manufacturing processes that had been exported to emerging nations are 're-shored' (Economist, 2013), as rapid reaction to market changes and access to talent is becoming more important than lower wages, a development also expected for the UK (Groom, 2013). One study suggests optimistically that 200,000 jobs will be created over the next 10 years as a result of this process (BusinessBirmingham, 2013).</li> <li>• In the financial services sector cross-border lending has fallen sharply and major banks have scaled back their international ventures, also as a response to new regulatory requirements (Davies, 2012).</li> </ul> |
| Potential future developments | <ul style="list-style-type: none"> <li>• The current mood towards more protectionism could result in a trade barrier war, with reciprocal retaliations in the form of new trade barriers. Regional trade agreements could take the place of intercontinental multilateral agreements, leading to the rise of several regional trade blocks with little trade between each other by 2030. Intra-regional trade within the EU would absorb much of the negative impact on the UK, as in 2013 8 out of 10 of the UK's significant import and export partner countries were within the EU (ONS, 2013b).</li> </ul>  |
| Implications for jobs         | <ul style="list-style-type: none"> <li>• The UK has much to lose from a revival of 'regionalism'. International trade, i.e. exports plus imports, accounts for 65 per cent of GDP (BIS, 2013). Financial and business services, e.g. insurance, finance, or consultancy, would be hard hit by a loss of export markets. Many UK utilities and manufacturing companies are foreign-owned; a withdrawal of capital would mean the loss of many jobs.</li> </ul>   |
| Implications for skills       | <ul style="list-style-type: none"> <li>• Re-shoring would require large-scale retraining efforts to regain the skills lost in, e.g., manufacturing. Skills necessary in global sectors, like the financial industry, will be demanded at a lower scale.</li> </ul>  |

## 4.7 Geographically alternative centres of excellence

**Description** As emerging countries develop the infrastructure necessary to push them to the next level of development, a new wave of cities, like Shanghai, Hong Kong or Singapore in the case of the financial industry, are taking the competitive lead in specific production and innovation fields. Supportive government (e.g. subsidies and tax incentives), large working age population, and cheaper production and labour costs encourage foreign investors and an increasing amount of business start-ups.

- Recent developments**
- Governments in emerging nations are more willing to adapt local laws (weakening labour laws or environmental legislation) to develop local centres of excellence, e.g. China's special administrative regions (Ren, 2008). China has also used significant state subsidies to enable private actors to form industry clusters in which a specific future-tech sector dominates (e.g. photovoltaic; ASM, 2011; Weiwei and Rui, 2011).
  - Asian financial capitals, particularly Shanghai, Hong Kong or Singapore are challenging the dominance of today's leading financial centres (e.g. London, New York and Tokyo). Two-thirds of British investment bankers surveyed in 2012 expect that in 2022 the top global finance centre will be in Asia, due to a low tax and bank friendly environment (Jeff, 2012).
- Potential future developments**
- In combination with aggressively active governments, emerging market leaders will become a disruptive force in the global competitive landscape (as in, e.g., the destruction of the German Photovoltaic industry). The new clusters will be much closer to the growth markets (countries with growing populations and/or increasing affluence), giving them an edge over the clusters in the 'old' industrial nations of the West. This could lead to an exodus of talent to these clusters, further weakening the position of the old clusters. PwC predicts that six of the world's ten largest industry clusters will be located in today's emerging markets by 2040 (PwC, 2010c).
- Implications for jobs**
- Due to the factors described above, the UK risks losing its competitive advantage in different sectors. A real risk of job losses might exist in tertiary education and future tech research.
  - The indirect effects of an exodus of key industries could be much higher than the direct loss of jobs, as consumption and the national income suffers.
- Implications for skills**
- In order to compete with the new centres of excellence, top talent is needed, necessitating easier immigration.

## 4.8 Disrupted internet developments

**Description** The ‘smooth’ development of the future Internet may be blocked as corporatisation and privacy issues dominate the online space. Incidents of cyber crime are rising: targeting internet structures, organisations and individuals.

- |                               |   |
|-------------------------------|---|
| Recent developments           | <ul style="list-style-type: none"> <li>• In recent years, cyber crime has grown steadily and become more sophisticated, with e.g. eight per cent of the UK adult population reporting to have lost money to online computer fraud in 2012 (UoK, 2013; a 2011 report put the overall cost of cyber crime to the UK economy at £27bn; Detica, 2011).</li> <li>• In many countries, public investment in broadband infrastructure is also lacking (for the UK see Shah, 2013), raising the threat that many regions will be unable to access the bandwidth necessary for expected future uses.</li> <li>• In some countries, most notably the US and the UK, Internet service providers (ISP) have introduced bandwidth caps, ostensibly a reaction to growth in the absolute number of users and the amount of content shared, but more likely a way to increase revenue (Masnick, 2013). Similar to plans to end net neutrality (e.g. for the EU; see RT, 2013), these caps have stoked fears of a corporatisation of the Internet.</li> </ul> |
| Potential future developments | <ul style="list-style-type: none"> <li>• Cyber attacks and espionage are expected to pose a much greater threat in 2030, up to and including attacks on networked transport infrastructure (NIC, 2012).</li> <li>• Until 2020, bandwidth usage is expected to grow more than ten-fold (mostly through increased use of mobile devices), raising fears – in view of a lack of investment – of widespread network congestion, in particular in rural areas (Brodkin, 2012).</li> </ul>  |
| Implications for jobs         | <ul style="list-style-type: none"> <li>• The UK’s broadband penetration rate growth could remain comparatively limited (OECD, 2013b), severely reducing future job growth potential in rural areas.</li> <li>• The UK’s financial services industry depends on a stable, secure, and freely accessible high-speed Internet, the developments described above would lead to job losses. In contrast there would be a rise in IT security jobs: efforts to increase cyber security in businesses and organisations would lead to job growth in this area.</li> </ul>  |
| Implications for skills       | <ul style="list-style-type: none"> <li>• Basic cyber security knowledge in the workforce would need to be expanded vastly. Currently, the talent for improving online security is not widely available. Here, a national training effort to increase the number of highly skilled workers would be necessary.</li> </ul>  |

## 4.9 Resource conflicts or climate disasters threaten supply

**Description** As global resource requirements increase in line with global population growth, disputes surrounding the use of strategic resources may arise. Conservation and efficiency efforts do little to quell fears. Resource supply may become a crucial strategic focus for countries and organisations.

|                                      |   |
|--------------------------------------|---|
| <b>Recent developments</b>           | <ul style="list-style-type: none"> <li>• Natural deposits of many resources are slowly nearing exhaustion, or at least are getting harder and more expensive to exploit. At the same time, consumption continues to increase as the world's population grows and the living standards of more people improve (Tamminen, 2013). As supplies become limited (in particular water supplies), access to resources may cause conflicts (water wars; Klare, 2013). Current strategies for dealing with supply bottlenecks include land grabbing and stockpiling (Brown, 2013; Lasley, 2013).</li> <li>• Other options are the exploitation of substitute resources, for instance natural gas obtained through fracking in replacement of oil, which in some instances drove down, and in others, kept stable the price of oil (BBC, 2013b; shale oil could have a similar impact; PwC, 2013c).</li> </ul> |
| <b>Potential future developments</b> | <ul style="list-style-type: none"> <li>• Radical legislation could be used to limit the consumption of scarce materials (e.g. enforcing stringent recycling or efficiency criteria, introducing resource quotas for businesses, etc.).</li> <li>• As resource prices rise, substitutes may become economically attractive (e.g. synthetic fuels), reducing bottlenecks and thus keeping prices/economic growth stable.</li> </ul>   |
| <b>Implications for jobs</b>         | <ul style="list-style-type: none"> <li>• The renewable energies sector, key to reducing import dependency, promises growth in manufacturing, installation and maintenance.<sup>30</sup></li> <li>• Material efficient production and consumption could generate 50,000 new jobs with a investment of £10bn, boosting the GDP by £3bn according to an Environmental Services Association (2013) report. The jobs will be created in the waste and resources industry, design, manufacturing, retailing and consumption as well as logistics.</li> </ul>  |
| <b>Implications for skills</b>       | <ul style="list-style-type: none"> <li>• As a 'resource-poor' country, the UK would need to grow its innovation capabilities to find substitutes, re-design products without using critical materials, etc., necessitating a science offensive and vast (re-)training efforts (repair rather than replace).</li> <li>• Executives may have to constantly re-scale and adapt production to meet company needs through available materials, necessitating highly developed organisational skills.</li> </ul>  |

<sup>30</sup> For example, increased demand is anticipated in the UK offshore wind industry in engineering, technical, managerial and other skills over the next decade (BIS and DECC, 2013).

## 4.10 Partial fragmentation of the EU

|                               |   |
|-------------------------------|---|
| Description                   | The United Kingdom may leave the European Union, as may several peripheral countries. This could result in the emergence of a core Eurozone single market plus a detached United Kingdom.   |
| Recent developments           | <ul style="list-style-type: none"> <li>• Great economic disparities continue to exist in the EU (Ciurea and Miu, 2010), leading to major differences in regard to preferable economic policies. In addition, anti-EU sentiment has increased throughout Europe among the general public. In the UK, in particular, euro scepticism has always played a major role. The current government has proposed a referendum on whether Britain should leave the EU, which at the moment a majority of Britons might support (Boffey and Helm, 2012).</li> </ul>   |
| Potential future developments | <ul style="list-style-type: none"> <li>• Public anti-EU sentiment could lead to a fragmented explosion in which member states leave individually after holding public referenda, a development which the UK would most likely spearhead.</li> <li>• Should the inequalities between nations persist, one outcome is a two-tier EU, in which the economically powerful nations collaborate closely, while the weaker nations become far less integrated and do not share the other's common policies. Here, the UK would probably withdraw from the inner circle, leaving it without power in the EU's decision-making, yet still influenced by the results of the latter in regard to common market regulations, etc. (see Ditchley, 2012).</li> <li>• The Euro crisis could also lead to a much stronger political and economic integration, based on the recognition that stronger European political control and representation offers much better means to solve calamities such as this. Should the UK opt out of this development, the consequences would be much more negative than in the other scenarios.</li> </ul> |
| Implications for jobs         | <ul style="list-style-type: none"> <li>• Should the UK lose its current free-trade status with the EU, exports would suffer, leading to a loss of jobs. Only 18 per cent of UK businesses surveyed believe that a withdrawal from the UK could have a positive impact (Vina, 2013).</li> <li>• The loss of the current freedom of movement of EU nationals to the UK would mean a considerably smaller talent pool for UK businesses.</li> </ul>  |
| Implications for skills       | <ul style="list-style-type: none"> <li>• A loss of unhindered access to Europe's talent would render vast retraining and up skilling efforts necessary. Skills retention would become more important; competition for limited talent would increase.</li> <li>• It would become harder for Britons to study or train in continental Europe, reducing the number of top national talents.</li> </ul>   |

## 5. Scenarios of future jobs and skills in the UK

### 5.1 Introduction

Scenarios are specialised foresight tools to construct and explore alternative images of the future. Through a creative but structured process of imagining disruptive but plausible and consistent futures, scenarios are used primarily to identify strategic needs, options and implications for decision-making in the present. These are not merely philosophical questions – they are practical and meaningful for how organisations and individuals take decisions.

Within this study, as set out in Sections Two to Four, trends, disruptions and key factors are analysed as important phenomena that shape or structure broad conditions for economy and society, with a particular focus on jobs and skills. However, these should not be considered in a deterministic or passive way – that we simply wait for these technological, economic and social impacts to happen.

Rather, it is a process of devising potential, alternative future states that help to inform decision-making in the present. Above all, the scenarios presented are intended to heighten awareness of potential changes, and to elicit strategic choices and action needs that improve the jobs and skills prospects of employers and individuals in the UK.

Foresight scenarios are rich narratives that reflect the relative importance of key factors and disruptions in future states. They are not intended to be normative or to convey a ‘preferred’ future. They seek to create coherent, plausible stories from complex socio-economic and technological ingredients.

The four scenarios chosen for the purpose of the study describe alternative development paths for UK jobs and skills in 2030, but are not mutually exclusive.

These scenarios are a starting point for strategic discussions for organisations and industries. As emphasised above, the scenarios provide a creative, accessible means for challenging thinking and clarifying strategic implications and action needs.

Within this section, for each scenario, the key implications for jobs and skills at a general/cross-sectoral level are drawn out. In addition, implications for seven key sectors for the UK are provided. These sectors are: health and social care, manufacturing, professional and business services, creative and digital, education, construction, and retail and logistics<sup>31</sup>.

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<sup>31</sup> The main criteria for selecting these sectors were: their current (and anticipated) future significance in terms of employment (numbers of people employed within these sectors); their expected role in driving future economic growth; and

Other experience and evidence points to the value of complementary creative tools, ‘creative fictional prototypes,’ in bringing foresight scenarios alive (Rhisiart, 2013). Therefore, for each of the seven sectors analysed, a vignette has been developed – as a form of creative fictional prototype<sup>32</sup>. These are designed to illustrate potential changes in employment and occupations in 2030. Again, these are creative illustrations rather than predictions.

### **What does the future of work look like in alternative scenarios for the UK?**

As set out in Section Two, the future is shaped by a set of drivers that are relevant across all scenarios as their development is relatively certain – so called ‘givens’.

All scenarios have commonalities, as some future developments within them are relatively certain. In all the scenarios:

- The globalisation of business activities remains a key feature but varies in intensity;
- Older workers are more prominent in the labour force;
- The specialisation of work will continue;
- Digital infrastructure will be increasingly improved in bandwidth and performance;
- Digitalisation is more pervasive in work and everyday life;
- Climate change will lead to an increase in extreme events like droughts, floods and storms and:
- The rising global demand on resources will lead to volatility in prices.

Appendix D provides a full list of the givens and their definitions.

The identified key factors driving the different futures of work scenarios in this study are listed below. They have a higher degree of uncertainty which leads to alternative plausible developments. Appendix D also provides more information on the key factors and their projections.

- Condition of Global Trade
- Economic Condition of the UK
- Structure of the UK Economy
- Public Funding for Skills Delivery

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their importance in meeting societal demand. Between them, the seven sectors account for a large proportion of jobs and economic output in the UK

<sup>32</sup> Vignettes are forms of creative fictional prototypes to explore the possible environment for work in the analysed sectors within the scenario contexts. Vignettes are visionary but without normative preferences and enable creative discussions around the future of jobs and skills (Rhisiart, 2013)

- Employment Promotion Measures
- Uptake of Innovation in UK Business
- Work Environment
- Employment Contract Conditions in the UK
- Workforce Mobility
- Access to and Forms and Modes of Education
- Income Distribution within UK Workforce
- Employees' Values.

In the scenario analysis, as described in Section Two, the key factor projections are combined to consistent and plausible raw scenarios. These combinations build the backbone for the identification of four engaging scenario pictures on the future of work. This combination is represented in the morphological box in Appendix E.

#### **The four scenarios of the future of work**

- 1) **Forced Flexibility (business-as-usual)** Scenario: greater business flexibility and incremental innovation lead to modest growth in the economy, but this flexibility often results in fewer opportunities and weakened job security for the low skilled.
- 2) **The Great Divide** Scenario: despite robust growth driven by strong high-tech industries, a two-tiered, divided society has emerged, reinforcing the economic position of the 'haves' and 'have nots'.
- 3) **Skills Activism** Scenario: technological innovation drives the automation of white-collar work and brings large-scale job losses and political pressure, leading to an extensive government-led skills programme.
- 4) **Innovation Adaptation** Scenario: in a stagnant economy, improved productivity is achieved through a rigorous implementation of ICT solutions.

For a comprehensive overview on the scenario stories, please see Table 5.1 below. This table focuses on the most decisive characteristics of the scenarios and explains their variety of future assumptions. It consolidates the key factors.

**Table 5.1: Scenario summary**

|                                       | <b>Forced Flexibility</b>  | <b>The Great Divide</b>   | <b>Skills Activism</b>  | <b>Innovation Adaptation</b>  |
|---------------------------------------|--|---|---|---|
| <b>Economic conditions</b>            | Moderate economic growth in context of a volatile world economy  | Sturdy UK recovery fuelled by high-tech and innovative business   | Slow recovery following prolonged crisis  | Stagnant economy within a turbulent international environment   |
| <b>Social conditions</b>              | Widening income gap, low skilled workers are the most vulnerable   | Two-tiered society with deep division between the economic 'haves' and 'have-nots'  | Automation of professional work has hit medium to upper income groups hard  | Decrease in income gap as financial sector struggles to compete internationally   |
| <b>Labour market context</b>          | Hourglass shaped - ferocious competition for low-skilled positions and a hollowing out of the middle of the workforce  | Competitive and attractive marketplace for high-skilled jobs, poor opportunities for the low- skilled   | Significant disruption to medium and highly skilled work. Jobs are mainly project-based with high turnover  | Growing virtual workforces as a strategy for productivity in a low growth environment. Increased work intensity                                       |
| <b>Policy context</b>                 | Easing of employment regulation and focus on job quantity rather than quality. Reduced public funding available for training and skills due to fiscal restraints | Liberal immigration policies and labour regulation create a supportive environment for business. Minimal public funding available for training and skills | Extensive government-driven skills programme and investment to facilitate re-skilling, supportive employment regulation strengthens employee position | Commitment to skills development despite deficit reduction, government drive to re-engineer training and skills content and delivery to best fit need |
| <b>Uptake of innovation</b>           | Focus on incremental innovation in UK businesses, across almost all UK sectors   | Radical innovation in life and material sciences driving economic growth  | Disruptive IT automation restructures professional tasks  | Wide integration of cost-efficient ICT technologies to enable business survival   |
| <b>Education and training context</b> | Greater commercial focus and responsiveness to employer needs, although fees are higher  | Highly competitive and efficient, but also expensive which reduces access   | Reform of system and expansion of access to all socio-economic backgrounds  | Significant increase in online provision as a cost-effective option   |

## The disruptions driving the scenarios

“Forced Flexibility”, is the business-as-usual or reference scenario. It assumes disruptions will not occur and instead presents the results of the trend analysis in a systemic and interlinked perspective.

The three other scenarios are disruptive scenarios:

- Scenario “The Great Divide” is driven by the disruption “Employees’ Changing Values” for the “haves” but not the “have nots”. The upper hand in bargaining between employees and employers is strongly on the side of the employees for the high skilled, while in contrast it is on the side of the employers for the low skilled. The “have nots” have to deal with “Zero-hour Contracts becoming the Norm” a development which also occurs in other scenarios.
- Scenario “Skills Activism” is dominated by the disruption “Artificial Intelligence and Robots” which changes the job situation for those in routine jobs, even at the high skilled level. New forms of online and distance learning (as described in “Anywhere, Anytime Skills Delivery”) are one important component in the “Skills Activism”.
- Scenario “Innovation Adaptation” is driven by “Geographically Alternative Centres of Excellence” which is leading to losses in economically relevant sectors, such as the financial sector. It is also driven by “Anywhere, Anytime Skills Delivery” that allows an efficient way of individualised up-skilling and “Reverse Migration”.

For more details on the disruptive developments assumed in the scenarios, please see Appendix F<sup>33</sup>.

The following sections set out each scenario in detail. They include:

- A morphological box describing the basic assumptions of the scenario;
- A scenario narrative describing the scenario conditions in more detail;
- Illustrative scenario vignettes that present the scenario story from the point of view of a particular sector;
- Implications for jobs and skills for seven sectors (health and social care, professional and business services, retail and logistics, education, manufacturing, creative and digital, construction).

Appendix E shows the condensed setup of the four scenarios by the use of alternative key factor projections.

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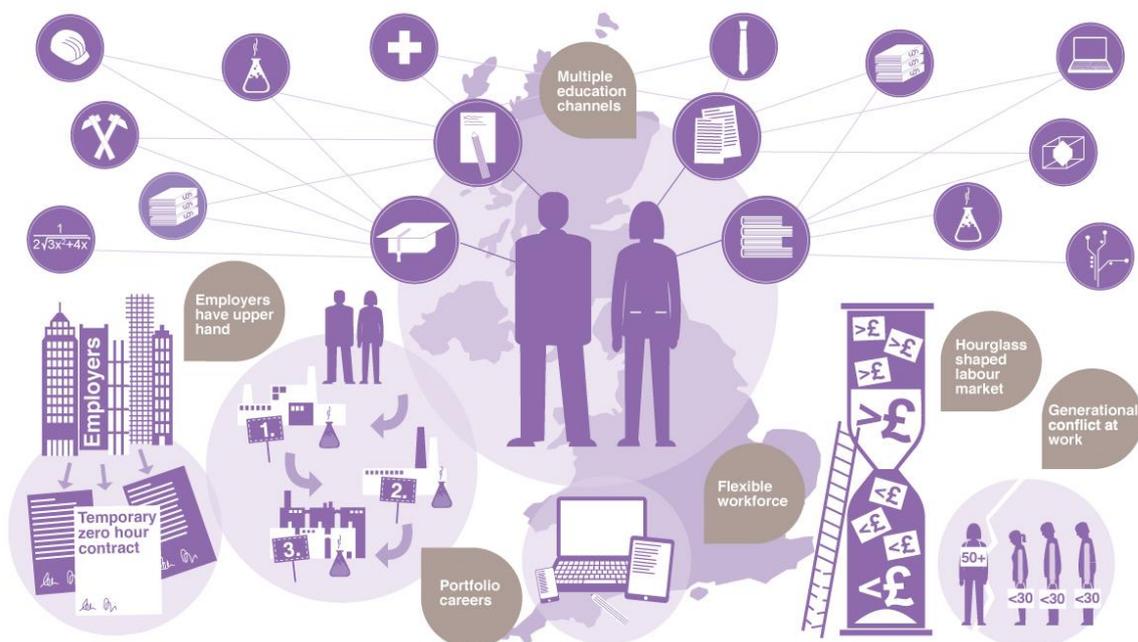
<sup>33</sup> Available at [www.ukces.org.uk/thefutureofwork](http://www.ukces.org.uk/thefutureofwork)

## 5.2 Forced Flexibility – the business-as-usual scenario

### The morphological box

|   |  |  |  |  |
|---|--|--|--|--|
| <b>Condition of Global Trade</b>                  | Between Tension and Cooperation                  | Continuing Liberalisation                                    | A more National Perspective              | Sluggish Global Trade                                      |
| <b>Economic Condition of the UK</b>               | Shaky Recovery, New Foothold for Growth          | Sturdy Recovery, Robust Growth                               | Prolonged Crisis, Threat of Stagnation   | Economic Vicious Cycle                                     |
| <b>Structure of the UK Economy</b>                | Maintaining the Balance                          | Slow Re-industrialisation                                    | Financial Sector Blues                   |  |
| <b>Public Funding for Skills Delivery</b>         | Reduced Funding and Priority for Skills Delivery | Focus on Skills Delivery, Despite Funding Restrictions       | Priority for Skills Delivery             | Market-Driven Education and Employment Conditions          |
| <b>Employment and Promotion Measures</b>          | Austerity Driven Restraint                       | Focus on Social Markets and Healthcare                       | Focus on High-Tech Industries            |  |
| <b>Uptake of Innovation in UK Businesses</b>      | Accelerated Incremental Innovation               | Focus ICT: Accelerated, Networked, Disruptive Innovation     | Entering a New Kondratieff Cycle         | Stagnation of Innovation in UK Relative to Other Economies |
| <b>Work Environment</b>                           | The Flexible and Smart Workplace                 | The Cyber Workforce  | The Individual Workplace                 | The Stagnating Work Environment                            |
| <b>Employment Contract Conditions in the UK</b>   | Limited Employment Regulation Benefits Employers | Employees hold Balance of Power (Despite Limited Regulation) | Regulation Strengthens Employees' Rights | Employers Side-Step Regulation                             |
| <b>Workforce Mobility</b>                         | The Semi-Mobile Workforce                        | The Global Workforce   | The Virtual Workforce                    | The Static Workforce                                       |
| <b>Access to and Forms and Modes of Education</b> | Multiple and Accessible Skills Delivery Models   | Online Education Trumps                                      | Elite (Offline) Education                | Traditional Institutions Train the Workforce               |
| <b>Income Distribution within UK Workforce</b>    | Widening Income Gap                              | Income Stratification  | Inequality Restraints                    |  |
| <b>Employees' Values</b>                          | New Values vs. Old Values                        | Struggle for Survival  | Shaped by Generation Y                   |  |

## Scenario visual



**Greater business flexibility and incremental innovation lead to modest growth in the economy, but this flexibility often results in fewer opportunities and weakened job security for the low skilled.**

- Volatile world economy after emerging from a difficult financial recovery process between 2010s to mid 2020s
- Higher flexibility of work and employment contracts due to the necessity to adapt to market volatility
- Hourglass shaped labour market - increasing competition faced by low skilled workers, and the hollowing out of the middle of the workforce
- Security of employment remains highly important for individuals - but work life balance and autonomy are gaining importance
- Wide variety of education and training channels to choose from to update skills - for those that can afford it, or are backed by employer financing

The UK economy has emerged from a decade-long, slow and challenging economic recovery process. Austerity continued to define the landscape throughout much of the 2020s, due to the UK's lingering high public debt level. But a focus on increased flexibility and the championing of innovation helped steer the economy toward an upward growth trajectory. In 2030, the UK is achieving modest economic growth averaging 2.2 per cent per annum, but is subject to elevated volatility in world markets.

On-going incremental improvements in innovation are occurring in almost all UK sectors. Manufacturing is particularly benefiting from this, with employment in the sector close to stabilising following previous periods of gradual decline – but the continued economic success of the sector remains uncertain. In contrast, the successful financial sector, located almost solely in London and the South East, reliably and consistently outperforms all other UK sectors.

In the 2020s the education and training sector underwent restructuring and rationalisation as a result of reductions in public funding. As a response, education institutions are now more commercially focused and responsive to employer needs – and fees are higher. Those at the lower end of the skills ladder are impacted most by the increased economic barriers to training. In many companies, in-house monitoring systems are providing employers with data that enable flexible responses to skills provision.

The direct partnerships between employers and the education sector have strengthened the hand of employers in contract negotiations. An increase in temporary, part-time and zero hour contracts gives employers higher flexibility, while collective agreements play a minor role; but this flexibility is often gained at the expense of the low skilled. The job turnover rate continues to increase across all skill levels.

The term ‘individuals’ best describes UK employees in 2030 because each worker faces a unique set of employment conditions and opportunities. Lower skilled workers are primarily concerned with wage security. In contrast, a more progressive work environment for high skilled individuals allows for greater autonomy and work life balance.

## **Stakeholder perspectives**

### Employers

- Employers are aware that to adapt to market volatility and the needs of their workforce they must offer their high skilled employees flexible working options.
- Employers actively recruit from an international pool of labour, particularly for very high skilled individuals such as top-level management and technical specialists.
- Employers still offer premiums for high skilled talent, with many willing to make a significant investment in top employees’ skills.
- Employment legislation is limited, giving employers negotiating power when filling low skill positions.

## Employees

- Low skilled workers face intense competition for positions (across all sectors), and are more vulnerable to unfavourable employment conditions. The updating of skills and up-skilling is mainly an individual's own (expensive) responsibility.
- Many younger people entering the workplace face a large disconnect between their employment expectations and the workforce reality – with older cohorts remaining in employment longer, career advancement opportunities for younger employees have narrowed. Intergenerational conflicts are common in the work place.
- Vocational and workplace training and learning has become a widely embraced alternative to college education.

## Policy-makers

- Policy makers have limited influence on jobs and skills within the UK, due mainly to reduced budgets; education and training policies rest low on the priority ladder.
- Employment regulations have been eased to promote job creation, with the focus on quantity of jobs not quality.

## Education and training providers

- Rising co-investment from businesses and individuals is absorbing some of the funding cuts to education and training providers, although some institutions are disappearing as a result of rationalisation.
- Most education and training programmes are expensive. As a result, those of higher socio economic status enjoy a favourable position with regard to opportunities and the possibility of securing employer financing.
- Education and training providers are more responsive to employer needs and offer a variety of avenues for qualification programmes. Technological advancements have fuelled developments in online learning especially in regard to on-the-job skills development, but qualifications gained through these avenues are not yet universally recognised. The same is true for non-traditional learning methods such as peer-to-peer learning. It is those employees with qualifications from traditional tertiary institutions that are best placed to gain significant wage premiums.

### **Illustrative vignette: Potential future of retail**

Under this business-as-usual scenario, the retail sector will become increasingly automated and personalised, using a greater variety of technology-enabled channels to meet their customers.

#### ***Data enabled shopping experience: The future of showrooming (case study of retail manager, 2030)***

*Sector: Retail*

*Occupational focus/role: Retail manager/assistant and customer*

Sarah Jones is happy with her job as a retail manager in London's Covent Garden. Omni-channel shopping had been standard for years. Online retail had taken large shares of the retail market but people still like to peruse a brick-and-mortar shop for the experience. Yet, in Sarah's opinion, the usual run-of-the-mill showroom makes only poor use of the possibilities that digital technology has to offer. By focusing on the seamless and unobtrusive integration of the advantages of the digital and the real world in her showroom, she has created an information-enhanced, yet very personal and entertaining showroom and shopping experience.

In her office, Sarah is not only able to analyse real-time data on sales and the performance of her retail assistants, but also most importantly the data on almost every customer currently in the store.

As Sarah looks at her screens an alert goes off: some of the recently upgraded sensors detected that a regular customer, Mr Lambard has entered the shop. The alert, which is automatically sent to Mr Lambard's favourite retail assistant, Bradley, enables him to immediately look at Mr Lambard's customer profile via his bionic contact lenses. This provides him with data on Mr Lambard's past purchases, clothing size, average price range, general preferences and recommendations. Bradley approaches Mr Lambard, who expects his personal fashion guru to present him the latest trends aligned to his taste.

Bradley is an expert in men's clothing and besides counselling Mr Lambard, he also offers his expertise on a couple of online platforms and blogs to gain extra money.

Back in the store, Sarah observes Bradley and Mr Lambard who was one of the first to install an app that tracks his activity related to clothing (purchases, online views, Facebook likes etc.) and lets retailers access this information to get more personalised

offers. Seeing Mr Lambard buying a new rain jacket by his favourite brand, Sarah is satisfied that the measures she has implemented since her first day - the up-skilling of her retail assistants in the use of advanced augmented reality technology, the constant technological upgrades and the occasional use of consulting services by freelancing data analysts - have proven valuable. Particularly, as many of her peers are now running logistic centres or hosting online shops.

## Implications for jobs and skills

|                          | Jobs   | Skills  |
|--------------------------|--|---|
| General / Cross-sectoral | <ul style="list-style-type: none"> <li>• Individuals seeking more flexibility follow more entrepreneurial approaches that look at earnings potential (e.g. leveraging assets such as property) rather than a job or in addition to an existing job. Paid employment/jobs could become one means of generating income amongst several – and they are likely to co-exist at the same time. This is driven by more lifestyle entrepreneurship and demographic factors, such as family care responsibilities for younger and older people, and a search for a better work life balance.</li> <li>• Portfolio careers become more mainstream – with people increasingly changing jobs and moving between sectors</li> <li>• The links between the global economy (global supply chains) and the regional economy (sub-national level) become more significant than national-regional links in shaping employment patterns in places across the UK, i.e. the national level becomes less significant in influencing regional outcomes. These patterns suggest very different outcomes between local areas even in the same region (relative proximity of hotspots and struggling areas in the same region).</li> </ul> | <ul style="list-style-type: none"> <li>• Due to the ubiquity of big data – and the means to analyse it – the ability to interpret large amounts of data is likely to be a key generic skill. This is not from a technical ICT perspective but rather the key skill is ‘data literacy’ to interrogate, interpret and spot patterns to be able to make decisions effectively.</li> <li>• The movement between careers and sectors stimulates the hybridisation of skills.</li> <li>• The focus on flexibility could mean insufficient time for personal development and acquiring appropriate skills and competences. This potentially undermines productivity i.e. there is a trade off between flexibility and productivity (sufficient time to develop competence).</li> <li>• As organisations increasingly manage multiple generations (four generations) within the workplace, softer skills are needed to manage (inter-) generational equity issues, and resolve conflicts that may arise.</li> <li>• With increasing project-based employment (decline of traditional, permanent employment contracts), fundamental business skills are needed more widely (organising, marketing, contract negotiation and management, project management).</li> <li>• Up-skilling (technology and business skills) becomes ever more important. Those that don’t continue to up-skill become marginalised in the labour market (especially from lower socio-economic groups and those that don’t embrace technology).</li> <li>• Personal agility becomes more important – such as ability to adapt or embrace change and the acquisition/combination of new competences and learning. The ability to acquire new skills and competencies (quickly) becomes more important.</li> <li>• Growth in collaborative business models require skillsets that include risk management and ability to manage across networks</li> </ul> |

|   | Jobs  | Skills  |
|---|---|---|
| Professional and business services sector | <ul style="list-style-type: none"> <li>• A reduction of management positions due to more people working in project teams without a traditional supervisor or team leader.</li> <li>• Undergoing constant change, the structure, management and strategies of businesses become increasingly flexible, diverse and global.</li> <li>• Internationalisation: increasing global marketplace and growth of the East creates new customers for the sector</li> <li>• Much of the growth in high-value jobs continues to happen in London and South East England, although employment in mid-level back office professional services functions is created in conurbations away from London, where rents are lower and there is a good supply of well-qualified, flexible labour.</li> <li>• Ageing workforce in sub-sectors (especially Real Estate and Facilities Management) – where there is increasing use of flexible work environments and use of migrant workers to fill posts.</li> </ul> | <ul style="list-style-type: none"> <li>• Employees in this sector face a business environment defined by increasing uncertainty and huge amounts of data. Thus, the skills to manage complexity and risk, as well as the ability to analyse and translate vast amounts of data to inform decision-making, are required.</li> <li>• As smart machines take over some of the routine jobs, there is increasing demand for the skills that are (as yet) irreplaceable by machines, such as creative and critical thinking.</li> <li>• Other important future skills for individuals in the professional and business sector include the ability to work across different disciplines, collaborate virtually, cultural sensitivity and design skills.</li> <li>• New models of developing professional skills (providing advice and guidance) need to be developed where automation has removed much of the formative experiences of traditional professional careers.</li> <li>• Globalisation in Finance sub-sectors is leading to the development of new international markets – need for managing innovation and cultural awareness to create products that can be adapted to these new markets.</li> </ul> |
| Creative and digital sector               | <ul style="list-style-type: none"> <li>• New forms of mobile and home-working arrangements will develop or increase.</li> <li>• Workers in the creative sector will experience more job opportunities as more companies outsource their innovation processes to crowdsourcing platforms. Thus, many individuals will have to deal with short-term, project-by-project employment across a variety of employers.</li> <li>• Increased use of ICT and digital technologies in Design (e.g. simulated environments)</li> </ul>   | <ul style="list-style-type: none"> <li>• Increased inter-disciplinary thinking will be demanded from workers to enable them to better understand the user experience and the market – demand for ethnographic skills – and to apply this knowledge to their product design.</li> <li>• Growing need for more entrepreneurial and self-organisation skills as structures shift from traditional permanent employment contracts to a more flexible, project-based employment.</li> </ul>  |

|                      | Jobs   | Skills  |
|----------------------|--|---|
| Retail and Logistics | <ul style="list-style-type: none"> <li>• Decrease in demand for traditional sales people due to the automation of checkout processes and the continuing shift to online retailing.</li> <li>• Increase in demand for programmers and data analysts in the online retail business and IT-specialists for warehousing and transport logistics.</li> <li>• Increasing uptake of Internet retail channels creates more demand for local logistics solutions</li> <li>• Large retailers generally absorb new technologies and deploy them successfully. Small retailers run risk of failure and obsolescence unless they implement new technologies.</li> </ul> | <ul style="list-style-type: none"> <li>• As most jobs at all levels - from retail assistant up - involve some use of technology, there is a general need for medium to high technology literacy throughout the sector. Individuals in higher positions need to be able to combine their technical or e-skills with their business skills.</li> <li>• The ability to analyse and use vast amounts of data (collected by an increased usage of electronic tags for consumer products) becomes an increasingly important skill, particularly for managerial positions in the sector.</li> <li>• Increasing need for investment in skills that support sophisticated customer engagement e.g. building brand loyalty rather than mechanistic selling skills; managing customers across multiple channels.</li> <li>• Data and technology enable new service models for retailers; increasing sophistication in segmentation and customisation with customer profiling.</li> </ul> |
| Education            | <ul style="list-style-type: none"> <li>• Reduced funding and priority for skills delivery leads to a reduction of employment opportunities in this sector.</li> <li>• The introduction of ICT reduces traditional classroom-based teaching and increase time used for online learning or learning at home – the teaching profession will need to adapt accordingly.</li> <li>• Blended learning (face-to-face and online) is widely deployed.</li> </ul>   | <ul style="list-style-type: none"> <li>• Increased integration of ICT and technological equipment requires employees to gain skills in their use, including keeping in touch with students via new social platforms. Teachers and lecturers move away from communicating information in chunks, such as a one-hour lecture, towards guiding students to find, analyse, evaluate, and apply information by themselves.</li> <li>• Increased demand for intermediary skills in education and training – brokering relationships between employers, education and training providers and individuals (e.g. (digital) marketing, account management)</li> </ul>   |

|               | Jobs   | Skills   |
|---------------|--|--|
| Manufacturing | <ul style="list-style-type: none"> <li>• Job losses amongst the low skilled in the sector due to further digitalisation and, automation, as well as novel, lean-manufacturing techniques. However, there is continued need for (up-skilled) technicians to manage automated production systems.</li> <li>• Continued transformation of the manufacturing sector to a highly sophisticated industrial sector where high-skilled engineers are increasingly in demand.</li> </ul>  | <ul style="list-style-type: none"> <li>• The higher level of technology integration requires employees to have relevant skills, including skills in design, simulation and data analytics.</li> <li>• Core engineering skills are of great importance within the manufacturing sector, while a tailored qualification such as biomedical engineering is a plus.</li> <li>• Rise in multi-disciplinary teams leads to increasing requirements for high-level communication and collaboration skills.</li> <li>• Increased demand for individuals with multi-disciplinary technical, commercial and management skills.</li> <li>• Demand for innovation commercialisation skills.</li> </ul>   |
| Construction  | <ul style="list-style-type: none"> <li>• Concern around environmental sustainability and demand for adaption measures to increase the preparedness for extreme climate events result in a rise in 'green' jobs in the construction sector.</li> <li>• Increase in offsite construction - buildings being manufactured in factory environments offsite, perhaps by robots, before being fitted onsite by a small team of construction workers.</li> <li>• Increased interaction between roles within construction and manufacturing sectors.</li> </ul> | <ul style="list-style-type: none"> <li>• Site managers require skills to use new, innovative technological devices and smart systems assisting in the management of construction processes and workers.</li> <li>• Demand for skilled project managers to manage both offsite and onsite construction projects</li> <li>• Increased integration of technologies into residential and office buildings (e.g. home automation) requires workers to obtain new installation, maintenance and repair skills.</li> <li>• Demand for marketing skills – business-to-business and business-to-consumer – to explain new products and market them to customers.</li> <li>• A focus on energy-efficiency and environmental sustainability requires engineers and site managers to update their skills in compliance with new environmental standards and sustainability demands and focus on the 'whole-life' of structures.</li> <li>• Demand for new installation and maintenance skills, especially in renewable energy technologies.</li> <li>• Increased demand for ICT skills in building modelling and building management.</li> </ul> |

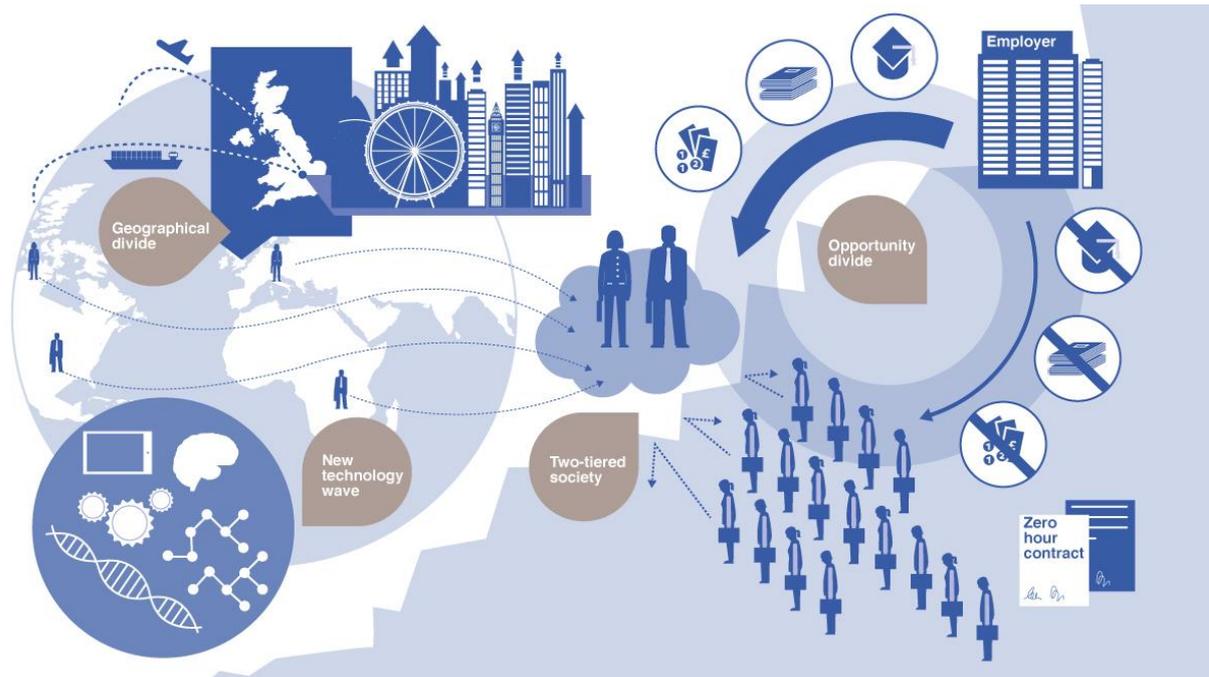
|                        | Jobs  | Skills  |
|------------------------|---|---|
| Health and social care | <ul style="list-style-type: none"> <li>• The rise in job opportunities in the health and social care sector (due to an increased ageing population in need of social care) attracts many job seekers and under-employed workers from other sectors and countries.</li> <li>• Demand for migrant workers to fill a large proportion of jobs (where there is a gap between demand and supply – some skills shortage vacancies).</li> <li>• New technology shifts the focus of the health care system towards prevention and the promotion of healthy lifestyles, leading to a rise in associated jobs (upstream rather than downstream focus). This partially redefines healthcare and healthcare jobs.</li> <li>• Increasing use of personal healthcare budgets leading to demand for jobs to support people in their healthcare choices.</li> <li>• An increase in the use of tele-care and tele-health enables location-independent care provision for a number of health care services, leading to a rise in health care positions outside of traditional institutions e.g. healthcare call centres.</li> <li>• Fiscal situation accelerates development of community models and social entrepreneurship (e.g. home-based care networks), based on principles of decentralisation.</li> </ul> | <ul style="list-style-type: none"> <li>• The need for workers to acquire more advanced ICT-skills. While younger generations might be familiar with the new technologies in place, older workers will have to update their skills to keep up with technological advancements.</li> <li>• By using new monitoring and self-diagnosing technologies, the amount of data on services and users increases tremendously. Workers in health and social care will have to acquire the skills to analyse, manage and translate this data (e.g. for choosing better treatment methods or communicating this to patients).</li> <li>• Rising requirement for managerial skills in facilitating health care remotely, including managing a diverse workforce.</li> <li>• Empathetic skills to care appropriately for diverse individuals in society.</li> <li>• Ability to work across professional boundaries in order to provide seamless care.</li> </ul> |

### 5.3 The Great Divide

#### The morphological box

|   |  |  |  |  |
|---|--|--|--|--|
| <b>Condition of Global Trade</b>                  | Between Tension and Cooperation                  | Continuing Liberalisation                                    | A more National Perspective              | Sluggish Global Trade                                      |
| <b>Economic Condition of the UK</b>               | Shaky Recovery, New Foothold for Growth          | Sturdy Recovery, Robust Growth                               | Prolonged Crisis, Threat of Stagnation   | Economic Vicious Cycle                                     |
| <b>Structure of the UK Economy</b>                | Maintaining the Balance                          | Slow Re-industrialisation                                    | Financial Sector Blues                   |  |
| <b>Public Funding for Skills Delivery</b>         | Reduced Funding and Priority for Skills Delivery | Focus on Skills Delivery, Despite Funding Restrictions       | Priority for Skills Delivery             | Market-Driven Education and Employment Conditions          |
| <b>Employment and Promotion Measures</b>          | Austerity Driven Restraint                       | Focus on Social Markets and Healthcare                       | Focus on High-Tech Industries            |  |
| <b>Uptake of Innovation in UK Businesses</b>      | Accelerated Incremental Innovation               | Focus ICT: Accelerated, Networked, Disruptive Innovation     | Entering a New Kondratieff Cycle         | Stagnation of Innovation in UK Relative to Other Economies |
| <b>Work Environment</b>                           | The Flexible and Smart Workplace                 | The Cyber Workforce  | The Individual Workplace                 | The Stagnating Work Environment                            |
| <b>Employment Contract Conditions in the UK</b>   | Limited Employment Regulation Benefits Employers | Employees hold Balance of Power (Despite Limited Regulation) | Regulation Strengthens Employees' Rights | Employers Side-Step Regulation                             |
| <b>Workforce Mobility</b>                         | The Semi-Mobile Workforce                        | The Global Workforce   | The Virtual Workforce                    | The Static Workforce                                       |
| <b>Access to and Forms and Modes of Education</b> | Multiple and Accessible Skills Delivery Models   | Online Education Trumps                                      | Elite (Offline) Education                | Traditional Institutions Train the Workforce               |
| <b>Income Distribution within UK Workforce</b>    | Widening Income Gap                              | Income Stratification  | Inequality Restraints                    |  |
| <b>Employees' Values</b>                          | New Values vs. Old Values                        | Struggle for Survival  | Shaped by Generation Y                   |  |

## Scenario visual



**Despite robust growth driven by strong high-tech industries, a two-tiered, divided society has emerged, reinforcing the divergence in the economic position of the ‘haves’ and ‘have nots’.**

- Innovative, high tech companies are the flag bearers of the new economy – and are redefining industrial growth
- It is boom time for London and South East England, other areas of the UK are trailing behind
- Growing inequality between workers – of earnings and opportunity
- Technology and liberalisation is opening up a more marketised approach to learning and skills delivery

In 2030, the overall picture looks good, at least superficially. The UK has seen over a decade of good economic growth fuelled by continuing globalised trade and the success of high-tech businesses in the life and materials sciences. These businesses embody an ‘innovation nation’ ethos that is at the heart of the Government’s Industrial policy. Science and technology advances in ICT, materials science and biology are providing good building blocks for economic growth. Although from the outside the picture looks rosy for the UK, there are deep divisions within UK society. The inequalities are obvious: between places, within places, and between people – and even more stark than two decades ago.

The gap between the core (London and South East England) and the periphery (the rest of the UK) continues to widen. Inequality between people in the same locality is at an all-time high. Social mobility has decreased and the socio-economic background of people largely determines their access to learning and job opportunities.

Liberal immigration policies and access to a global supply of graduates (especially from Asia) make the UK a competitive marketplace for jobs. Productivity improvements due to technology adoption add to this competitive environment – and downward pressure on wages in the UK due to international competition. With the growth of companies providing high-tech goods and services, demand for low- and medium-skilled workers continues to decrease in manufacturing, but is increasing in services.

The younger cohorts (the so-called Generation Y) who entered the labour market in the mid-2010s continue to help shape organisational values and practices: flexibility, transparency and employee engagement are very widely adopted. However this cohort, who are now approaching mid-career, are part of the two-tier society: the high skilled enjoy the autonomy and flexibility in their jobs that they hoped for, while the low skilled face frustration and limited opportunities.

## **Stakeholder perspectives**

### Employers

- Employers actively recruit both global and domestic talent. Organisations focus on marketing themselves to prospective employees by promoting their brand, values, flexibility options, and pathways for career progression.
- Work is no longer characterised by time or location constraints, but rather by the tasks that workers are expected to accomplish as part of project-based assignments. In many multinational companies work is executed through virtual collaboration platforms across various time zones.

### Employees

- There is an increasing divide between highly skilled workers and others.
- The highly skilled and well educated, in particular, have influence in shaping work conditions and employment contracts, pushing employers to introduce flexible, employee-friendly work arrangements by using new forms of self-organisation. Those nearing retirement age are calling for new models that allow them to work part-time or on a project-by-project basis.

- The medium- and low-skilled group are more diverse in profile but share a general characteristic – they find it increasingly difficult to fulfil their potential, and to progress within their careers. Here, workers compete for poorly paid temporary positions with poor career prospects. These individuals are taking up jobs in sectors such as healthcare, and in trades or occupational roles where automation has not yet replaced human labour.

#### Policy makers

- Government policy is focusing on developing a supportive environment for a diversified, knowledge-based economy (including liberal labour regulations, tax credits for intellectual property etc.).
- In contrast, spending on education and employment promotion initiatives is minimal. Substantial support for high-tech industry has made the economy much more diverse and robust. However, the newly emerging high-tech industry is yet to create jobs for medium- to low-skilled people.

#### Education and training providers

- The UK's post-16 education system is highly competitive and efficient, but also exclusive due to the high cost of most education and training programmes.
- The decreasing share of funding for education is resulting in the loss of a variety of public education institutions and the privatisation of many higher education institutions.
- The marketisation of skills-delivery is further contributing to inequality and restricting upward social mobility.

### **Illustrative vignettes: Potential futures for construction and the health care sector**

Under this disruptive scenario, the construction and health care sectors experience significant productivity gains through development and adoption of high-tech innovation, however the skill gap between lower and highly skilled workers widens.

***Building for the future. High-tech skills in the construction sector*** (learner profile in an FE College marketing brochure)

Sector: Construction

Occupational focus/role: Construction technician

Jamie Warren is studying Construction Technologies and Management at Broadway College. Although he has a few years of experience in the construction industry under his belt, the changing nature of skills needs in the sector led Jamie back to College. He is one of 10 employees from CODI Construction to enrol on our courses this year.

Jamie emphasised how valuable it was to upgrade his skills: *“The push to go green brought radical change to the sector, and we have to be fully familiar with the latest in technology and health and safety requirements. One example is solar nano materials for power generation now used by leading contractors in the industry. The nano materials module provided me with hands-on experience in several application techniques and I can now become certified to handle and install solar nano panels”*. Most of Jamie’s studies are undertaken off-campus – through our virtual learning environments. Every two weeks, Jamie comes in for an afternoon to focus on applying the techniques and skills in our construction labs. He is able to choose from a menu of options.

*“I’ve just started a module on project management and managing suppliers – that will be very helpful for progression in the industry. I’m also going to be studying automation systems in construction towards the end of the year”*.

You could say that Jamie is laying strong foundations for the future!

***Real-time healthcare solutions for the better-off –  
the future means of a dedicated doctor (case study of a private clinic physician)***

Sector: Health and Social Care

Occupational focus/role: Physician in private clinic

Patient 432: Mr Clayworth. Every time Suresh Khan (MD) comes across the name of this patient, it immediately reminds him of the pleasant immigration officer at the British Embassy in Mumbai, who approved his Visa application two years ago. Shortly after receiving his diploma from the Grent Medical College in Mumbai, he had landed a highly paid job in Manchester and decided to move there right away.

The holographic image in Suresh's home office shows a dying lung. Mr Clayworth, a marketing manager at a quantum computing company, hasn't been able to quit his addiction to Indonesian clove cigarettes ever since his international assignment ended.

As his private insurance covers almost anything, Suresh recommends an organ replacement and schedules a video chat appointment with the guys from the bio fabrication lab who will 3d-print an identical, but healthy, lung by using stem cell bio-ink modified with the patient's DNA. A nano robot treatment should further decrease the small traces of metastasis on Mr Clayworth's pulmonary blood vessels.

Suresh swipes to the next patient profile - Patient 953: Amanda Smith. During her morning routine, the health-tracking device in her bathroom detected something in her urine and immediately sends the data to her doctor, Suresh Khan. The good news: Amanda is pregnant. Suresh sends the standardised message to her and schedules an appointment with the genetic engineering department.

His additional expertise in nutritional physiology enables Suresh to further draw up the perfect pregnancy diet for Amanda who signed up for an expensive real-time diagnosis package at Suresh's clinic.

From time to time, the tremendous resources his employer is able to provide discomforts Suresh from an ethical perspective. During his studies in Mumbai, he offered his medical expertise via a UK based social organisation that provided medical diagnosis to low income families for a much cheaper price. Back then, a webcam, a broadband connection and his knowledge as a medical student were all the resources he had for his patients.

In his next appraisal interview, Suresh plans to ask that he spends 10 per cent of his time for low-income care and push the clinic to set up a scholarship scheme for families in need.

## Implications for jobs and skills

|                             | Jobs  | Skills   |
|-----------------------------|---|--|
| General / Cross-sectoral    | <ul style="list-style-type: none"> <li>• Fewer locational constraints on jobs: project-based assignments conducted across different time zones through virtual collaboration platforms.</li> <li>• Overall, demand increases for personalised services (for example, shopping, maintaining the home, at home care for the young and the elderly).</li> <li>• Knowledge spillovers from new industries – that combine life sciences, ICT, cognitive, and Nano technologies – benefit limited geographical areas (hotspots in London and the South East of England). Knowledge-intensive business services (e.g. Design, HR, Marketing, IP protection) in these regions thrive as they support the new economy.</li> </ul>  | <ul style="list-style-type: none"> <li>• Even in economically depressed areas a wide range of jobs and skills are required to maintain a functioning economy.</li> <li>• Core skills include data literacy (information management skills, ability to analyse and interpret data) – as well as traditional numeracy and literacy.</li> <li>• Core areas of knowledge in life sciences, ICT, cognitive and nano are crucial for product development across all sectors. Basic skills in these fields are also necessary for dealing and handling related products.</li> <li>• High demand for individuals with a blend of technical training and skills and softer collaborative skills.</li> <li>• The ability to collaborate in multi-disciplinary teams is crucial (for business opportunities that emerge from converging technologies).</li> </ul> |
| Creative and digital sector | <ul style="list-style-type: none"> <li>• Increased levels of investment in high tech industries leading to associated job growth. As investments in R&amp;D continue there will be a rise in demand for security specialists adept at protecting commercially sensitive information and intellectual property.</li> <li>• ICT developments and new businesses are generating jobs of a professional, associate professional and managerial nature.</li> <li>• Increasing virtualisation and ICT allows workers freedom of location, increasing competition between UK workers and others as the nature of many tasks allow international workers to compete for contracts.</li> <li>• Increasing numbers of workers within the sector are self-employed or employed under project based contracts.</li> </ul> | <ul style="list-style-type: none"> <li>• Creative and digital skills become more integrated in high-technology growth sectors – in life sciences, new materials science and artificial intelligence. Key skills in demand include design, design engineering and representation of complex data (e.g. through visualisation).</li> <li>• In the creative and digital sector more than any other, employees skills constantly require updating as new technologies enter the market.</li> <li>• Due to the fast paced nature of change within the industry, the large majority of necessary skill updates are acquired through online training programmes.</li> <li>• Increasing need for those with cyber security and digital forensic skills.</li> </ul>   |

|                        | Jobs  | Skills  |
|------------------------|---|---|
| Health and social care | <ul style="list-style-type: none"> <li>• Significant increase in number of jobs within the sector due to the ageing population, rising numbers of working parents requiring child care, and success in areas of medical research driving further investment.</li> <li>• Increased demand for self-employed health care workers working within the homes of the elderly and the young.</li> <li>• The proliferation of health and well-being technologies (e.g. personal medical devices) increases the number of data analysis jobs.</li> <li>• Contract conditions vary greatly between full-time permanent positions for some in traditional care institutions to zero-hour and part-time contracts for peripatetic care workers employed in the home.</li> <li>• Young migrant workers fill jobs gaps, in both high and low-skilled positions within health and social care positions.</li> <li>• Rising number of elderly requiring the provision of basic care services leads to rise in paraprofessional roles within health and social care.</li> <li>• Care responsibilities for family members (increasingly older cohorts but also children) require more flexible working arrangements.</li> <li>• ‘Top-up’ personalised care jobs are paid for/contracted by those that have the means – over and above the minimum, basic care levels offered by the public sector.</li> </ul> | <ul style="list-style-type: none"> <li>• With the diffusion of personalised medicine based on genetics into mainstream medical treatment there is increasing demand for new skill sets in areas of prevention, diagnosis and treatment.</li> <li>• Advances in life sciences in the UK are likely to lead to a greater demand for higher-skilled roles.</li> <li>• Technological advancements require ICT and data analysis skills, entailing continuing on-going replacement or update of existing skills.</li> <li>• Individuals qualified at postgraduate level are in high demand, especially those with inter-disciplinary skills.</li> <li>• The convergence of technologies and increasing skills-specialisation within the sector has heightened the need for multi-disciplinary teams.</li> <li>• Effective and high quality care services achieved through combining ICT skills with empathetic skills.</li> <li>• An overall reduction in employer funded skills development for workers in lower skilled positions is creating job skills mismatches; an increasing number of migrant workers are employed to fill these skill gaps.</li> </ul> |
| Construction           | <ul style="list-style-type: none"> <li>• The growing population pushes up demand for new construction ensuring job numbers remain steady.</li> <li>• Increased drive for building efficiency and other eco-friendly solutions such as water efficient measures drive employment in areas of installation and retrofitting.</li> <li>• Growth in productivity comes from increasing use of off-site construction but limits job growth.</li> <li>• Automation in the construction industry raises the bar for new entrants – and many don’t get in because they lack knowledge and skills.</li> </ul>  | <ul style="list-style-type: none"> <li>• Increased technical profile of trades and crafts jobs requires sufficient technical skills.</li> <li>• The increased use of automation within buildings requires workers to continually update their skills in installation, maintenance and repair; skills in interfacing between factory/automated environments and onsite construction environments.</li> <li>• Skills for assembly of building subsystems (modular, off-site building) rather than narrower functional building skills. Use and knowledge of lean smart systems becomes important.</li> </ul>  |

|   | Jobs  | Skills  |
|---|---|---|
| Professional and business services sector | <ul style="list-style-type: none"> <li>• Growth in business services and associated jobs supporting converging technologies i.e. knowledge intensive services and skills such as legal for intellectual property, strategic management consulting etc.</li> <li>• Increasing demand for financial services due to higher numbers of self-employed workers and the prolonged retirement age.</li> <li>• Increasing competition with high skill overseas workers as much of the professional and business services sector moves to online platforms, and continued off-shoring of back-office roles in sectors such as Finance. Associated rise in limited project based contracts.</li> <li>• Automation and software render many lower skilled customer service roles obsolete (e.g. use of mobile technology to monitor service quality online as means of maintaining effective customer relationship management).</li> </ul> | <ul style="list-style-type: none"> <li>• Converging technologies put a premium on ‘network orchestration’ skills – combining a sufficient knowledge of different technology areas, consortium-building, and coordination.</li> <li>• Converging knowledge-intensive business services create demand for legal and commercial due diligence services, and Intellectual Property services – to manage and protect novel products and services, and set contractual and governance boundaries for strategic alliances/joint ventures.</li> <li>• Focus on inter-personal, entrepreneurial and creative skills as competition within the industry rises. Alongside this is a decrease in the requirement for administrative skills as technology developments render many routine tasks obsolete.</li> <li>• As the sector increasingly offers new and innovative services to keep ahead of competition, employees require the ability to quickly acquire new skills.</li> <li>• The competitive nature of the sector encourages employers to invest in the skills development of their high performing employees.</li> </ul> |
| Retail and Logistics                      | <ul style="list-style-type: none"> <li>• Increased consumption due to the growing population is driving growth in the number of both low and high skilled jobs within the retail and logistics sector.</li> <li>• As rising numbers of retail outlets operate online there is an associated rise in ICT based occupations.</li> <li>• Rising demand for delivery solution and transport logistics to service Internet retailing.</li> <li>• Green consumption is impacting on retail jobs with increased demand for eco-friendly goods - leading to a rise in demand for staff to accredit products as eco-friendly.</li> </ul>   | <ul style="list-style-type: none"> <li>• With online outlets and an increasingly globalised economy the rise in international customers and sales requires employees to have high quality marketing, sales and inter-personal skills.</li> <li>• Lower skilled workers face a basic of choice of up-skilling – particularly in ICT inventory management and associated tools – or redundancy due to automation. The relatively strong growth of the economy provides resources for employers to support up-skilling programmes for lower to medium-skilled staff.</li> </ul>  |

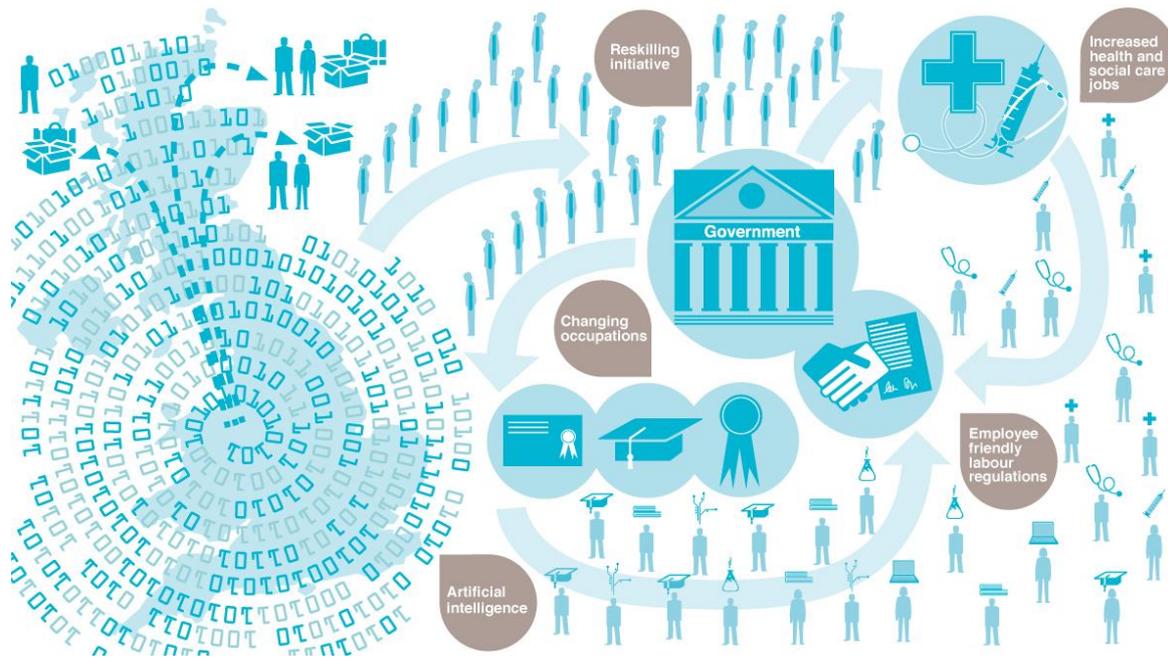
|               | Jobs   | Skills   |
|---------------|--|--|
| Education     | <ul style="list-style-type: none"> <li>• Loss of jobs in many public education institutions due to decreased share of government funding. In contrast there is a rise in private educational institutions when employees are rewarded based on students' achievement.</li> <li>• With the increasing focus on ICT education, education and training providers increasingly deploy technology in their daily work.</li> <li>• The growing need to provide new methods of cross-crediting, qualification and skills assessment leads to rise in associated jobs.</li> </ul>  | <ul style="list-style-type: none"> <li>• With privately funded high calibre skills delivery programmes in high demand e.g. creative and interdisciplinary, education and training providers need to stay ahead of demand by consistently updating their relevant skills.</li> <li>• Need for STEM skills to feed high-tech growth within the economy.</li> <li>• Private education institutions are willing to fund on-going teacher training to keep their staff's skills up to date and courses competitive.</li> <li>• Demand for commercial and management skills in education – management of education facilities – to compete in more marketised context.</li> </ul>  |
| Manufacturing | <ul style="list-style-type: none"> <li>• The success of the government's industrial strategy has led to a growth in the number of jobs within the manufacturing sector. However, automation and advancements in technology and are reducing demand for low-medium skilled workers.</li> <li>• Material sciences and biology, as major economic growth areas for the UK, drive demand in associated production and commercialisation jobs e.g. development and commercialisation of new materials, biotech and nanotech.</li> <li>• The majority of low-skilled workers are employed under temporary contract conditions, in contrast to the majority of high-skilled workers with flexible but permanent contracts.</li> </ul> | <ul style="list-style-type: none"> <li>• High demand for uniquely human, analytical or interactive skills (not easily replaceable by automation and developments in ICT) such as those associated with discovery, innovation, commercialisation, problem-solving and management and leadership of complex projects and supply chains.</li> <li>• Remaining shop floor workers have a greater number of responsibilities requiring control, maintenance and problem-solving skills.</li> <li>• Many high skilled workers receive on-going training investment from employers.</li> <li>• Lower skilled workers caught in vicious cycle: the introduction of automated technologies erodes employers' incentives to invest in skills. Without up-skilling, lower skilled workers face redundancy.</li> </ul> |

## 5.4 Skills Activism

### The morphological box

|   |  |  |  |  |
|---|--|--|--|--|
| <b>Condition of Global Trade</b>                  | Between Tension and Cooperation                  | Continuing Liberalisation                                    | A more National Perspective              | Sluggish Global Trade                                      |
| <b>Economic Condition of the UK</b>               | Shaky Recovery, New Foothold for Growth          | Sturdy Recovery, Robust Growth                               | Prolonged Crisis, Threat of Stagnation   | Economic Vicious Cycle                                     |
| <b>Structure of the UK Economy</b>                | Maintaining the Balance                          | Slow Re-industrialisation                                    | Financial Sector Blues                   |  |
| <b>Public Funding for Skills Delivery</b>         | Reduced Funding and Priority for Skills Delivery | Focus on Skills Delivery, Despite Funding Restrictions       | Priority for Skills Delivery             | Market-Driven Education and Employment Conditions          |
| <b>Employment and Promotion Measures</b>          | Austerity Driven Restraint                       | Focus on Social Markets and Healthcare                       | Focus on High-Tech Industries            |  |
| <b>Uptake of Innovation in UK Businesses</b>      | Accelerated Incremental Innovation               | Focus ICT: Accelerated, Networked, Disruptive Innovation     | Entering a New Kondratieff Cycle         | Stagnation of Innovation in UK Relative to Other Economies |
| <b>Work Environment</b>                           | The Flexible and Smart Workplace                 | The Cyber Workforce  | The Individual Workplace                 | The Stagnating Work Environment                            |
| <b>Employment Contract Conditions in the UK</b>   | Limited Employment Regulation Benefits Employers | Employees hold Balance of Power (Despite Limited Regulation) | Regulation Strengthens Employees' Rights | Employers Side-Step Regulation                             |
| <b>Workforce Mobility</b>                         | The Semi-Mobile Workforce                        | The Global Workforce   | The Virtual Workforce                    | The Static Workforce                                       |
| <b>Access to and Forms and Modes of Education</b> | Multiple and Accessible Skills Delivery Models   | Online Education Trumps                                      | Elite (Offline) Education                | Traditional Institutions Train the Workforce               |
| <b>Income Distribution within UK Workforce</b>    | Widening Income Gap                              | Income Stratification  | Inequality Restraints                    |  |
| <b>Employees' Values</b>                          | New Values vs. Old Values                        | Struggle for Survival  | Shaped by Generation Y                   |  |

## Scenario visual



**Technological innovation drives the automation of professional work, leading to large-scale job losses and political pressure prompting an extensive government-led skills programme.**

- A sharp leap forward in IT innovation automates medium and highly skilled (and well-paid) professional work leading to significant disruption to traditional professions
- Driven by necessity and government support, an active localism emerges as a response to the ‘IT revolution’
- Government proactively provides employment regulation and skills support – with the ‘battered middle’ in mind – but it’s a long, tough road
- A project-based economy develops; health and social sector and micropreneurism also offer good opportunities for job creation
- For the fortunate people with the right skill set the labour market offers many opportunities

In the late 2010s and early 2020s, smart algorithms became packaged in applications replicating the judgment and experience of professional workers. As their accuracy and productivity gains were verified, the momentum became unstoppable. Accountancy services, which had already been globalised to some extent, felt the change first. The shock was greater for insurance industry staff and the legal profession. Typically, law and accounting firms shed a significant percentage of their highly skilled workforces.

As a result, professional service firms have relatively few professionals with traditional skills working in them in 2030. The typical role in demand in such firms is 'meta-accountability' (a human audit and verification process – checking machine algorithms have been applied properly) and compliance with the updated regulatory regime. Medium to upper income groups have been the hardest hit.

The slow economic recovery of the 2010s exacerbated the impact of the IT revolution. By the early 2020s the effects of the wave of automation had been felt across most sectors of the economy and skills-mismatches were stark; as neither job market entrants nor the recently redundant were adequately qualified for the demands of the new labour market. The ensuing wave of growing unemployment posed a serious threat to economic stability.

With the economy on the brink of a crisis, there was sustained political pressure by the mobilised professional classes, government designed a package of policies aimed at tackling the challenges. As a result, there was an increase in the education budget to support a re-skilling drive. The 'social sector' jobs market (health and social care) was primed through sustained public funding.

While increasing local and regional autonomy, facilitated with government support, aimed to foster jobs growth and skills development as a way of offsetting the dislocation of the IT revolution. Local and regional skills development support groups sprang up, as individuals tried to find a new footing.

The crisis also created a wave of entrepreneurship, often small-scale businesses. Local entrepreneurial support networks provided assistance for new business owners, as did government support for founding a new business. Government also tried to strengthen the hand of employees through supportive employment regulation.

Now in 2030 the economy is back on a path of relatively meagre growth with unemployment slowly but steadily decreasing, thanks largely to the healthcare and social care sectors. Innovation has become the major solution for profitable survival. Firms that require human-based creative and problem-solving skills have prospered. The creative sector, which is primarily domestically driven, is one of the success stories. However, for many, competition is tough in an economy in which work is mostly project-based, with a high turnover of jobs.

## Stakeholder perspectives

### Employers

- Employers have a plentiful supply of labour available in many sectors, but often face the challenge of finding employees with the right skill-set to fill open positions; because of the digitalisation of production there are increasing numbers of skills shortages especially in manufacturing (a sector that has recovered reasonably well).
- The new wave of automation is leading to the restructuring of professional tasks across both the public and private sector.
- Driven by the public policies and initiatives, there is an increase in employers' involvement in skills development, rising significantly since the early 2010s, visible for example in the increased number of apprenticeships and work-placements during education and qualification programmes.

### Employees

- Employees in many sectors are still feeling the dislocation effects of disruptive IT automation – especially those involved in professional services.
- Long periods of unemployment are common for professionals that became redundant by IT automation – a new phenomenon on this scale.
- Skilled people are in high demand, particularly in IT, not only in the UK but also globally. But in general short-term job opportunities are making the practical uptake of new skills challenging.

### Policy makers

- In 2030 government takes a very active role in skills delivery.
- In recent budget reviews, education and training received the highest share of total government spending relative to historic norms.
- Policy changes aim to allow increased access to education opportunities regardless of age, former education or job history.
- Demographic changes continue to lead to an increasing number of jobs in the healthcare and social care sectors. Government is actively promoting employment in these sectors through incentives as well as commissioning marketing campaigns to improve the image of the sector – and its attractiveness to potential entrants.
- Strict enforcement of labour regulation deters employers from abusing their market power in the labour market.

## Education and training providers

- With government encouragement, education providers continue to seek to reduce the cost of tertiary education – often achieving this through more efficient skills delivery and the rationalisation of some courses. As a function of increasing government investment, access to traditional tertiary education is becoming more open to students from a broad range of socio economic backgrounds.
- IT skills are becoming core modules for many non-technical subjects (modules include vocation and industry-specific digital applications; while basic programming skills are also increasingly taught).
- While non-traditional further education alternatives are available (such as online and peer-to-peer learning), traditional institutions still provide the best educational results relative to their costs.
- The on-going steady reform of the system to allow the greater combination of academic and vocational training continues; education and training providers, in cooperation with employers, are increasingly adapting to a dual model of vocational training.

### **Illustrative Vignettes: The future of professional services and manufacturing**

Under this disruptive scenario, the professional services and manufacturing sectors are radically altered by the automation of medium and high-skilled professional work. However, both sectors take advantage of an increased focus on skills and training initiatives for workers.

***Meta-accountability quality assurance group meeting, MGPC, global professional services firm (excerpt from meeting transcript)***

Sector: Professional and business services – Accounting services

Occupational focus/role: Meta-accountability/quality assurance

Freya: Good morning and welcome everybody – I should say good evening to you, Chandra! Sorry, it feels as if you're in the room!

Chandra [via immersive 3D video-conference]: That's fine, Freya. Hello everybody from Bangalore!

Freya: OK, let's get started...as you know, the main purpose of this meeting is to discuss verification, regulatory and skills issues in light of the firm's implementation of the new SUPERSMART System that offers automated accounting services for companies and individuals. Just to remind you, this meeting is being recorded and automatically transcribed for quality assurance purposes. Chandra is here to represent the Global Technology Services Team that has developed SUPERSMART. It's been piloted in the EMEA Region before being rolled out across the firm's other global regional operations. Marco, do you want to give us an update on the verification process? Anna can then take us through the skills development and HR issues.

Marco: Yes, I have a report for Europe, the Middle East and Africa. I downloaded all real time data from country offices last night and ran programmes to cross-check this data. In addition, some of the Algo-Audit Qualified Practitioners in my team have done sample checks. Across all data, the error rate was 0.4 per cent. Most countries performed better than that. We did identify problems in two cases where the back office Client Support Division had not been running the most recent update of the System – and some of our customers' data had not been captured accurately.

Freya: Thanks, Marco. Next steps?

Marco: I will submit the report to the compliance unit of the Accounting and Auditing Regulatory Authority. Anna and I have discussed the roll out of the project in terms of skills and development needs.

Anna: Yes, the experience of the new implemented system has been relatively positive for our staff, which can be partly attributed to the development programme we've put in place over the last 18 months. 600 of our staff have received special up-skilling support on interpretation of data and smart algorithms. This has really helped us to develop a talent pool of Algo-Audit Qualified Practitioners that have been registered with the regulatory body. In fact, the latest cohort of 50 celebrated their successful registration last Friday.

Freya: Celebrated with video-networked Karaoke again?

Anna: It has become something of a company tradition for MGPC!

Freya: So what skills do we need to roll this out to other countries – and what lessons have we learnt?

Anna: We will implement a similar approach for Algo-Audit Qualified Practitioners – globally, we need to put 2,500 of our people through the programme in the roll out period. We'd also like to focus on our in-house skills programme. The relationship with AQ College has been good – and they've provided an important element of the virtual training to a good proportion of our staff. But we are now in a position to customise it for our own needs whilst fulfilling the requirements of the regulatory body.

Freya: I saw that on one of the Board papers recently – there's a proposal to acquire AQ College. Any other skills or development issues to note?

Anna: SUPERSMART and some of the systems that preceded it have taken over some of the routine accounting work that our employees used to do. The problem is that this has taken away a lot of the development opportunities – where people gained experience and built knowledge based on working with different clients. So we've come up with a solution – Chandra?

Chandra: We've been working on this over the last few months. It's a simulator programme that generates case scenarios randomly – so our staff get to work on 'as real' projects. We've called it SIMACCOUNT and the beta version is currently going through the last stages of testing. This will be even better than the old system, because the system will adjust the level of technical difficulty according to the individual's experience and competence, and it will generate more varied case scenarios than would have been possible using traditional development processes.

Freya: That's really exciting. I'm already looking forward to hearing more about the results when SIMACCOUNT has been fully implemented.

**Job opening for a senior production manager (example of an email exchange between HR manager and a skills sourcing service provider)**

Sector: Manufacturing – Assembly

Occupational focus/role: Autonomous production facilities/operation and maintenance

Title: **Job opening for a Senior Production Manager, Account HR.AssemblyFlex**

-----  
Date: 27.04.2030, 3.19pm

From: nancy.nielsen@assemblyflex.com

To: benjamin.poulsen@skillsmatch.co.uk

Dear Benjamin,

This is the third job opening today that we would like to use skillsmatch's services to fill. It is quite urgent we fill this one.

Here are the details:

Position: Senior Production Manager

Location: Middlesbrough

Profile we are looking for: Master or PhD in Mechatronics, Cyber Physical Systems, or a related field; at least ten years of experience in the operation of autonomous production facilities; demonstrable history of regular skills development activities; willing to relocate to Middlesbrough within 3 months

Job description: As Senior Production Manager in our largely autonomous production facility you will oversee the operations of one of four sub divisions of our production site. You coordinate the day-to-day operations of the automated production processes and lead the production systems maintenance team of two to three engineering specialists. It will also be your responsibility to coordinate the regular skills development activities within your sub division. We offer challenging but rewarding tasks in a highly modern production environment utilising cutting-edge production techniques. Our employees enjoy a benefits package ranging from a generous qualifications budget for employees and their family members, cooperation with top-notch training providers to the option of taking sabbaticals.

To be send out via skillsmatch.co.uk to relevant target groups.

How many possible candidates do your algorithms identify and how likely is it that we will be able to fill this position within three months?

Best wishes,

Nancy

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AssemblyFlex S.E.

The future of manufacturing today  
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Title: **RE: Job opening for a Senior Production Manager, Account HR.AssemblyFlex**

Date: 27.04.2030, 4.06pm

From: benjamin.poulsen@skillsmatch.co.uk

To: nancy.nielsen@assemblyflex.com

Dear Nancy,

Many thanks for your on-going trust in our services!

Our algorithms have identified 28 possible candidates in the UK. They indicate that eight of them are considering changing employers, but only three are showing a likelihood of higher than 70% for choosing your company as an employer and being comfortable with relocating to the area in which your production site is located. Two more fall into the 50%-60% likelihood bracket. Please find their profiles attached.

Should we go ahead and contact these five possible candidates?

Kind regards,

Benjamin

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skillsmatch.co.uk – Our algorithms fill your job openings!

Premium skills sourcing service provider since 2023

## Implications for jobs and skills

|                          | Jobs  | Skills  |
|--------------------------|---|---|
| General / Cross-sectoral | <ul style="list-style-type: none"> <li>• Although there will be widespread disruption and dislocation (across professional occupations), new types of jobs will be created as the system won't be entirely automated and self-regulated: these jobs are likely to focus on meta-accountability (human level verification, quality assurance); creation and maintenance of new business systems (professional services delivered through new business models) and creativity/problem solving.</li> <li>• New (professional) jobs will be created by displaced professional workers – new 'micropreneurism'.</li> </ul> | <ul style="list-style-type: none"> <li>• Increased need for 'micropreneur' skills (i.e. the skills to grow a job, working with and for a client, etc.) as displaced medium- and high-skilled workers set up own business ventures.</li> <li>• The ability to learn new skills quickly becomes critical in adapting to disruptive change.</li> <li>• Recombination of occupational/professional skills with technological literacy – which service the validation and meta-accountability needs/checks within automated systems.</li> <li>• Strong demand for data management, analysis and visualisation skills as the amount of data transferred, collected, and stored continues to increase exponentially.</li> </ul>  |
| Health and social care   | <ul style="list-style-type: none"> <li>• Considerable increase in jobs due to an ageing population, especially in social care, and supported by sustained public funding for health and social care.</li> <li>• Increased demand for therapeutic services such as physical therapy as the focus of the health care system shifts to prevention of disease and promotion of healthy life styles.</li> </ul>  | <ul style="list-style-type: none"> <li>• Social care workers will increasingly be required to handle advanced care technology, for example care robots. This productivity increasing technology may also allow for more time to be spent on the "soft" aspects of social care.</li> <li>• As technical innovations allow for increasing automation of diagnosis, using increasingly complex electronic and digital medical equipment becomes a central requirement for medical staff. This includes guiding patients through self-applied diagnosis / treatment.</li> <li>• Rising demand for inter-disciplinary skill-sets, especially the combination of medical knowledge and programming skills, as automated diagnosis tools become widely adopted.</li> <li>• As many people find employment in health and social care for the first time, either as their first time in employment or because they have been displaced from other sectors, there is strong demand for social/behavioural skills (empathy and service ethos) alongside new technical skills in operating technology effectively.</li> </ul> |

|   | Jobs  | Skills   |
|---|---|--|
| Professional and business services sector | <ul style="list-style-type: none"> <li>• Massive upheaval in the labour market for professional and administrative services that include high skilled but repetitive work processes as these activities are increasingly automated by smart (in some cases also self-learning) algorithms.</li> <li>• Increased demand for creative technological development and scientific research services, as innovation is a key focus of businesses.</li> </ul>  | <ul style="list-style-type: none"> <li>• Sharp decrease in the demand for routine professional skills, such as drafting contracts, accounting, fiscal advice, etc.</li> <li>• Increased demand for analytical, research and design skills.</li> <li>• Increased demand for non-routine professional services that foster the implementation of digital automation technologies and increase the productivity of the remaining white-collar work.</li> <li>• Increased need for more entrepreneurial and self-organisation skills as employment structures shift from permanent jobs to more flexible project-based employment.</li> <li>• Demand for IT specialists skilled in auditing and verification to ensure that machine algorithms have been correctly applied.</li> </ul> |
| Retail and Logistics                      | <ul style="list-style-type: none"> <li>• Decrease in demand for traditional sales people due to the automation of checkout processes and the continuing shift to online retailing.</li> <li>• Increase in demand for programmers and data analysts in the online retail business, and IT-specialists to manage warehousing and transport logistics.</li> <li>• Increase in the demand for distribution and logistics specialists and workers, especially for express city logistics, as same-day delivery becomes standard for e-tailing in urban areas.</li> </ul> | <ul style="list-style-type: none"> <li>• Data analysis and IT-skills (programming, digital visual presentation, etc.) are in high demand as the online share in the retail sector continues to grow and multi-channel retail approaches become ubiquitous.</li> <li>• Demand for technological and organisational skills that facilitate real-time 'track and trace' of products ordered online and higher flexibility in logistics, especially in the distribution to the end-consumer.</li> <li>• Increased demand for product curating skills and creative ideas for promoting a memorable shopping experience, as brick-and-mortar retail has to reposition itself in relation to online competition.</li> </ul>   |

|               | Jobs  | Skills  |
|---------------|---|---|
| Education     | <ul style="list-style-type: none"> <li>• Significant increase in demand for teachers, lecturers, facilitators, tutors and educational administrators due to the government driven skills initiative in schools, tertiary education, and apprenticeship programmes.</li> <li>• Demand for experts in online and digital based education is also increasing.</li> <li>• Increased demand for occupational guidance counsellors that assist individuals during the re-skilling process.</li> </ul> | <ul style="list-style-type: none"> <li>• Increasing demand for skills in restructuring traditional courses to fit the demands of jobs in a digitalised economy, nature of teaching skills more specialised regarding online courses.</li> <li>• The role of the teacher or lecturer will increasingly become more of a guiding, personal mentor for the students, helping them to educate themselves, while artificial intelligence takes over more teaching tasks. Teachers will have to acquire the adequate digital skills (e.g. managing MOOCs) as well as the necessary interpersonal skills that give them the ability to act as a mentor.</li> <li>• Brokering and intermediary skills (e.g. needs analysis, skills diagnostics, relationship management) are in high demand, as government requires an effective interface between employers, education and policy-makers to enable massive up-skilling programme.</li> </ul>   |
| Manufacturing | <ul style="list-style-type: none"> <li>• Demand for high- and medium-skilled production workers increases as the digitalisation of production leads to the re-shoring of some manufacturing facilities. Demand for low-skilled workers, however, continues to decrease.</li> <li>• Increased need for technical customer support (employed by equipment manufacturers) roles to guide and assist production workers in the use and operation of new technologies.</li> </ul>                    | <ul style="list-style-type: none"> <li>• The digitalisation of production increases the demand for engineers specialised in cyber-physical systems both for the development and the implementation of high-tech manufacturing.</li> <li>• In a semi-autonomous manufacturing environment, the remaining shop floor workers will have more responsibilities that require control, maintenance and problem-solving skills, as well as a general understanding of the work processes of the company.</li> <li>• In digital production (3D printing) factories, combined skillsets of design and production processes will be highly valued.</li> <li>• With small numbers of employees on the shop floor and flat hierarchies, communication skills will become increasingly important.</li> <li>• Demand for consultancy skill in advanced manufacturing will be in global demand (e.g. establishment of new manufacturing processes; technical and cost-benefit advice of relative merits and balance of additive manufacturing vs./and traditional manufacturing).</li> </ul> |

|                             | Jobs  | Skills  |
|-----------------------------|---|---|
| Creative and digital sector | <ul style="list-style-type: none"> <li>• Employment opportunities in the digital sector increase significantly as information technology drives a new wave of automation.</li> <li>• Employment and earning opportunities are shaped by heavy international competition as a global virtual labour market for creative services emerges.</li> </ul>   | <ul style="list-style-type: none"> <li>• Very high demand for cross-discipline skill-sets and the ability to apply rapidly evolving digital technologies in business and production processes.</li> <li>• High demand for data management, analysis and visualisation skills as the amount of data transferred, collected, and stored increases exponentially.</li> <li>• Demand for programming skills and IT specialists with the ability to facilitate the on-going production, monitoring and software updating of smart algorithms.</li> <li>• High demand for those with skills in data/cyber security</li> </ul>               |
| Construction                | <ul style="list-style-type: none"> <li>• Many jobs in construction are still defined by non-routine, manual tasks – although technological advancements replace some jobs for construction workers.</li> <li>• Increase in offsite construction with buildings being manufactured by robots offsite before being fitted onsite by a smaller team of construction workers.</li> <li>• In a struggling economic environment, however, the demand for construction and renovation/building upgrading activities is likely to experience only slow growth.</li> </ul> | <ul style="list-style-type: none"> <li>• The increasing integration of home automation and other technologies into office and residential buildings will require a wider range of skills for installation, maintenance, and repair.</li> <li>• The ability to manage off-site construction of modular buildings with on-site assembly and finishing becomes important for mid-level and higher skilled construction employees.</li> <li>• The emergence of more regionalised forms of cooperation (e.g.off-site manufacturing) creates demand for skills in establishing and managing consortia and new supplier networks.</li> </ul> |

## 5.5 Innovation Adaptation

### The morphological box

|   |  |  |  |  |
|---|--|--|--|--|
| <b>Condition of Global Trade</b>                  | Between Tension and Cooperation                  | Continuing Liberalisation                                    | A more National Perspective              | Sluggish Global Trade                                      |
| <b>Economic Condition of the UK</b>               | Shaky Recovery, New Foothold for Growth          | Sturdy Recovery, Robust Growth                               | Prolonged Crisis, Threat of Stagnation   | Economic Vicious Cycle                                     |
| <b>Structure of the UK Economy</b>                | Maintaining the Balance                          | Slow Re-industrialisation                                    | Financial Sector Blues                   |  |
| <b>Public Funding for Skills Delivery</b>         | Reduced Funding and Priority for Skills Delivery | Focus on Skills Delivery, Despite Funding Restrictions       | Priority for Skills Delivery             | Market-Driven Education and Employment Conditions          |
| <b>Employment and Promotion Measures</b>          | Austerity Driven Restraint                       | Focus on Social Markets and Healthcare                       | Focus on High-Tech Industries            |  |
| <b>Uptake of Innovation in UK Businesses</b>      | Accelerated Incremental Innovation               | Focus ICT: Accelerated, Networked, Disruptive Innovation     | Entering a New Kondratieff Cycle         | Stagnation of Innovation in UK Relative to Other Economies |
| <b>Work Environment</b>                           | The Flexible and Smart Workplace                 | The Cyber Workforce  | The Individual Workplace                 | The Stagnating Work Environment                            |
| <b>Employment Contract Conditions in the UK</b>   | Limited Employment Regulation Benefits Employers | Employees hold Balance of Power (Despite Limited Regulation) | Regulation Strengthens Employees' Rights | Employers Side-Step Regulation                             |
| <b>Workforce Mobility</b>                         | The Semi-Mobile Workforce                        | The Global Workforce   | The Virtual Workforce                    | The Static Workforce                                       |
| <b>Access to and Forms and Modes of Education</b> | Multiple and Accessible Skills Delivery Models   | Online Education Trumps                                      | Elite (Offline) Education                | Traditional Institutions Train the Workforce               |
| <b>Income Distribution within UK Workforce</b>    | Widening Income Gap                              | Income Stratification  | Inequality Restraints                    |  |
| <b>Employees' Values</b>                          | New Values vs. Old Values                        | Struggle for Survival  | Shaped by Generation Y                   |  |

## Scenario visual



**In a stagnant economy, productivity is improved through a systematic implementation of ICT solutions.**

- Turbulent international environment with faltering trade
- Domestic blues as the UK and Europe experience a decade of stagnant or, at best, low growth prior to 2030
- As the economy struggles, the pathway to progress is productive efficiency – through ICT implementation
- Mobile and virtual workers satisfy employers' skills needs – at the right price
- Significant increase in online education and skills provision

The stagnation years still cast a long shadow over economic life in 2030. After the double dip financial crisis of the late 2010s, the UK and most of Europe bumped along through a difficult decade. In the 2020s, global trade faltered and a vicious economic cycle began: low growth, political mobilisation in the developed world, and protectionist measures by concerned Western Governments. To make matters more complicated, the UK's financial sector has been struggling to compete with its international competitors. Within the tight economic environment the focus for organisations since has been to achieve more with less. The wide integration of cost-efficient ICT-technologies into business and work processes is enabling productivity gains and some companies are able to remain internationally competitive. However, low output growth combined with productivity improvements is leading to falling employment.

Wage increases have stalled and income inequality levels have decreased as higher earners lost more relative to others during the crisis. Wage difference between sectors is narrowing, partly as a result of economic decline in the financial sector. At the regional level, many small companies are coming together to set up cooperative ventures that combine their capital strength, reinforce their bargaining position with suppliers, and reduce their vulnerability to economic shocks. Cooperatives are developing a relatively strong position in re-localising/re-regionalising economic activities.

For most employees, job prospects are better now than they were in the middle of the stagnant years, although income levels are squeezed. Many are forced to look for second jobs. Increased work intensity and the growing virtual workforces made possible through ICT improvements are achieving productivity gains for some organisations. Many customer services formerly based on physical interactions have been replaced by web-based services occupied by “virtual” employees from all over the world. This is becoming increasingly necessary for productivity and economic survival reasons.

Online education options are experiencing an enrolment surge as they provide a cost effective option to keep one’s workforce’s skills up-to-date, and enable the provision of necessary on-the-job training despite meagre budgets. These bite-sized training opportunities (often offered in tandem between employers and government) are easily integrated into company processes and are regularly used by most medium and large companies.

## **Stakeholder perspectives**

### Employers

- Businesses are continuously searching for new and innovative measures to reduce costs and stay competitive, some of which include squeezing higher productivity from employees.
- Limited project and zero hour contracts are common because these transfer financial/economic risk to employees.
- Businesses limit the size of their workforces to a core of long-term employees.
- Work is often organised by orchestrating a huge virtual workforce, not just for knowledge workers but also for traditionally customer facing industries. Employees work from home via online platforms using intelligent systems that support them in accomplishing job assignments.

## Employees

- Relative insecurity of employment for a large proportion of the workforce, with many having to develop on-going portfolios of employers and project-based assignments. Often, company-specific certificates are needed as entry ticket to jobs.
- Income pressures are such that many seek supplementary income to primary job roles.
- Where the shift is feasible, those working in service industries are becoming increasingly accustomed to virtual customer service or hybrid customer service (physical/virtual).

## Policy-makers

- UK government policy is being driven largely by austerity measures, which concentrate on addressing the high public debt level and slow GDP growth.
- However government is focused on supporting skills development despite the fiscal squeeze.
- Together, policy-makers and training providers are working towards developing a new 'compact' – re-engineering courses (materials, subjects) and delivery models (online and blended learning). This is the main way in which Government feels it can provide learning opportunities for the majority that fit with employers' needs and their own budgetary constraints.

## Education and training providers

- Higher Education is increasingly dividing into two groups: the elite few that follow a primarily traditional model (with face-to-face delivery) and the pragmatic majority, the latter undergoing major re-engineering in their provision to adapt content and delivery methods to the reality of 2030.
- Online platforms are the main vehicle for delivering education and training. This shift has made a large proportion of University buildings and campus provision surplus to requirements. Instead, for the majority campus learning is yielding to home-based and work-based learning.

### **Illustrative vignettes: The future of the creative and digital and education sectors**

Under this disruptive scenario, the creative and digital and education sectors compete, mainly through the adoption of innovative ICT, to attract top talent and to remain economically competitive.

#### **Achieving results – by design (excerpt from an advertorial in a business magazine)**

Sector: creative and digital

60 seconds with Tom Breckon, CEO of DDB

Q: 'We've heard so much about the digital and creative economy. You are a business-to-business (b2b) provider of innovative services that boost productivity. What's your main business offer in this market?'

TB: 'Design+Digital+Business Process Engineering is our main business offer, our formula for unlocking potential and improving the efficiency of organisations. Design has always been a building block of the creative sector and digitalisation has provided platforms and tools for productivity gains. However, organisations have been looking for new services offers to deal with squeezed margins. 'Creative agencies' have become overtaken by agencies for creative, digital and business process professionals. DDB is an agency that provides integrated design, digital and business process re-engineering solutions'.

Q: 'What kind of added value do you deliver to clients?'

TB: 'It's a tough, competitive environment out there, and b2b providers really need to demonstrate bottom line impact. Most organisations have gone through various phases of adopting information systems and digital tools. Now they are looking for service packages that are tested and proven. Typically, we can deliver a 12-month return on investment for clients that purchase our services. Most people think that's impressive – and it is! The key to our success is combining skillsets, which we are continuously updating, to deliver real value for our clients. We worked with a consumer product company recently on branding and digital channels for its customers. We were also able to advise on how their back end service operation could be improved with these new services. The result: higher customer satisfaction and excellent savings. The project paid for itself in less than 4 months'.

### **The Classroom that never closes (advert)**

Sector: education

#### **Struggling to get your foot in the door? Join the classroom that never closes, and keep your qualifications current!**

More than 120 multidisciplinary courses, such as mechatronics, over 500 industry leaders available 24/7, expert tuition, and award winning online training modules – INTUS faculties offers qualifications\* which dovetail with the demands of today's project-based employment.

Bite-sized learning modules offer exceptional, up-to-date and varied insights that provide you with the tools you need to get your foot in any door you chose! With our gamified approach, learning has never been more fun. Try our virtual super-engineer tour for free.

→ Enrol today and take advantage of the government's 20 per cent course cost rebate.

\*Qualifications are co-developed with top employers across all sectors; INTUS courses are prerequisites for offers of employment from many UK businesses.

## Implications for jobs and skills

|                          | Jobs  | Skills   |
|--------------------------|---|--|
| General / Cross-sectoral | <ul style="list-style-type: none"> <li>• Only a small share of jobs take the form of permanent contracts as the companies are shrunk to their core.</li> <li>• Main task of the company employees is orchestrating the huge network of freelancers and short-term employees that are flexibly involved in projects.</li> <li>• Compelled to reduce overheads, jobs are often undertaken virtually and remotely through digital tools.</li> </ul>  | <ul style="list-style-type: none"> <li>• Demand for a portfolio of both hard and soft skills e.g. technical training with creative, collaborative skills.</li> <li>• Localised, co-operative business approaches require both technical expertise and business administration skills for building up and maintaining a small business.</li> <li>• Competences and skills for “orchestrating” the network of a huge fluid workforce.</li> <li>• Higher work intensity and an increasing technological component in (almost) all occupations require individuals to have high emotional resilience combined with good interpersonal skills under high pressure.</li> <li>• The freelance workforce needs certificated qualifications to guarantee their competences in fulfilling the project tasks they apply for.</li> <li>• Continuous up-skilling is key in order for freelancers to survive on the job market.</li> </ul> |
| Health and social care   | <ul style="list-style-type: none"> <li>• Increased demand for jobs in preventive and alternative medicine due to the strong push for cost-efficiency in the health care system.</li> <li>• Demand for management capability to handle drive towards cost efficiency</li> <li>• Rationalisation means increased focus on technology but also results in a higher level of work for most individuals working in the sector.</li> <li>• Increased demand for home care / tele care services, as the costs of nursing homes exceeds the financial capacities of many families due to the difficult economic environment.</li> </ul> | <ul style="list-style-type: none"> <li>• Increased use of digital and other medical technology will require health or social care workers to acquire relevant technological skills.</li> <li>• Increased demand for knowledge in preventive medicine and therapeutic treatments as the focus shifts from treatment to prevention.</li> <li>• Higher work intensity and an increasing technological component of care work will require even higher emotional resilience of individuals working in the sector, combined with good interpersonal skills under high pressure.</li> </ul>  |

|   | Jobs  | Skills  |
|---|---|---|
| Professional and business services sector | <ul style="list-style-type: none"> <li>• Labour demand is likely to decline drastically as rationalisation measures are implemented across all businesses and portions of the financial sector are off-shored to other global financial centres. Self-employment and working for a wide portfolio of employers become more common in this environment.</li> <li>• Advancements in ICT and cost-reduction measures lead to less use of traditional office spaces and more use of mobile and home offices.</li> </ul>   | <ul style="list-style-type: none"> <li>• Portfolio and client management skills are in high demand – as diversification enables service companies to survive in difficult times with smaller margins; providers become increasingly regionalised to offer benefits of scale and scope.</li> <li>• The demand for highly specialised skills will increase and continuous updating of skills becomes even more crucial in an extremely competitive labour market.</li> <li>• The ability to devise and market new professional and business services to individuals (that effectively become sole traders with a portfolio of projects) and organisations is valuable (e.g. indemnity, HR, insurance protection products).</li> </ul> |
| Retail and Logistics                      | <ul style="list-style-type: none"> <li>• The reduction in the global trade of goods will result in lower employment in international postal and courier services. Also, the demand for dockworkers in container terminals will be significantly reduced.</li> <li>• The shift to online-retail will reduce the demand for traditional sales personnel, increasing the demand for IT and ICT specialists.</li> <li>• The increase in goods delivery driven by online-shopping may be kept in check by the desire for more cost-efficiency, leading to increased use of picking up orders from a nearby interim storage rather than increasing the actual amount of individual deliveries.</li> <li>• Automation in warehousing leads to high seasonality of human work in peak times.</li> </ul> | <ul style="list-style-type: none"> <li>• A combination of entrepreneurial and technology skills will be crucial for individuals working in retail as the shift to online-retail continues. Programming and data analysis skills will be in especially high demand.</li> <li>• Brand values need to be the core of all customer contact points even the job is only temporary. Skills for quick brand value adoption are crucial.</li> </ul>   |

|               | Jobs   | Skills  |
|---------------|--|---|
| Education     | <ul style="list-style-type: none"> <li>• The number of traditional jobs in tertiary education, especially lecturers, are decreasing substantially as online education platforms allow skills delivery from one teacher to a much larger audience. Often companies are offering training and certificate courses themselves to train the freelance workforce.</li> <li>• Surge in online learning and skills acquisition leads to an increase in demand for specialised examiners, tutors and skills assessment personnel.</li> <li>• As the education system is moving online, the sector also creates new activity fields - though in moderate numbers. These include jobs for specialised online-lecturers, programmers, “edutainment” developers, etc.</li> <li>• Employment contracts for individuals working in this sector could change radically, with teachers and lecturers having to compete for student numbers on online platforms. Student participation could determine the salary paid by the online education institution.</li> <li>• Through offering expert knowledge online in an easily accessible manner, experts with no previous experience in the education sector compete with traditional educators.</li> <li>• The critical and explicit success criteria for education providers are employability, efficiency in working (with individuals and employers) and the track record of learners in gaining appropriate and good quality employment.</li> </ul> | <ul style="list-style-type: none"> <li>• The radical change in skills delivery and teaching methods will result in higher demand for educational skills that facilitate technology-driven but also cooperative and interactive learning,</li> <li>• It also includes the ability to gamify education to a certain degree.</li> <li>• ICT-related skills such as programming, information design; audio-visual editing, etc. will be in high demand as they will be at the heart of future skills delivery.</li> <li>• Psychological skills for personality and skills assessment become more important, because choosing the right education path early on increases the efficiency of the education system.</li> <li>• Demand for sales, marketing and promotion skills in competitive market – to ‘win’ students</li> <li>• Re-engineering of courses (content and delivery methods) creates need for value analysis/value engineering and marketing/new product development skills.</li> </ul> |
| Manufacturing | <ul style="list-style-type: none"> <li>• The digitalisation of production could favour a re-shoring of manufacturing activities and bolster advanced manufacturing in the UK, increasing the demand for highly skilled labour.</li> <li>• The introduction of small-scale additive manufacturing increases the demand for labour in localised production of low-tech goods.</li> <li>• In general, the demand for low-skilled labour in manufacturing continues to decrease.</li> </ul>  | <ul style="list-style-type: none"> <li>• The digitalisation of production will drive the demand for more specialised engineering and programming skills.</li> <li>• Localised additive manufacturing could also be part of co-operative business approaches that require not only the technical expertise but also the business administration skills for building up and maintaining a small business.</li> <li>• Skills for developing new manufacturing service models (servicisation/servitisation) are in high demand to deliver value for money and reduced risk for clients.</li> <li>• Third party manufacturing creates demand for business development and contract management skills.</li> </ul>   |

|                             | Jobs   | Skills   |
|-----------------------------|--|--|
| Creative and digital sector | <ul style="list-style-type: none"> <li>• Significant increase in demand for IT-specialists, programmers and (information) designers as the education sector is reformed and ICT is permeating all business activities.</li> <li>• Employment will be defined to a large degree by project-based temporary contracts, to the benefit of the highly skilled. Often, jobs can be carried out via a virtual workplace without requiring employees to be present in person.</li> </ul>  | <ul style="list-style-type: none"> <li>• Workers in ICT and design will have to be highly flexible, updating their skills constantly in harmony with the pace of technological innovations.</li> <li>• Interdisciplinary skills are crucial for the efficient application of information technology across all sectors and are therefore in high demand.</li> <li>• High-level software design and project management skills will be increasingly important as a large number of massive IT-projects have to be carried out efficiently during the transition to online-based tertiary education.</li> <li>• Data management and cyber security skills are in demand.</li> </ul> |
| Construction                | <ul style="list-style-type: none"> <li>• Individuals in the construction sector will face considerable challenges because of the unfavourable economic environment. A fall in employment opportunities is very likely.</li> <li>• Project-based employment and zero-hour contract like work arrangements will often be used to realise construction projects in a difficult economy.</li> <li>• A rise in micropreneurial endeavours will likely result from unemployed or underemployed workers in construction that try to offer or trade their skills via online market platforms or networks.</li> </ul> | <ul style="list-style-type: none"> <li>• Individuals in the construction sector will increasingly need a broader set of skills as the increasing implementation of ICT throughout the whole construction process demands up-skilling to the specific technological skills.</li> <li>• Increase in the use of self-build projects and rise in demand for associated construction skills needed, such as ability to handle and use new materials.</li> <li>• For 'micro' or small-scale builders, there is a need to develop knowledge and skills of the full construction process (from planning and development), marketing and accreditation.</li> </ul>                        |

## 6. The future of jobs and skills: A sectoral view

Whilst many of the implications associated with the scenarios described in Section Five are linked to the particular characteristics of those possible futures, some elements are common across the scenarios. This section outlines key implications for seven key sectors that emerged from analysis of the four scenarios<sup>34</sup>.

The main criteria for selecting the sectors were:

- Their current (and anticipated) future significance in terms of employment (numbers of people employed within these sectors);
- Their expected role in driving future economic growth; and
- Their importance in meeting societal demand.

The seven sectors account for a large proportion of both current and (anticipated) future jobs in the UK. They are also expected to be significant in driving economic growth in the period to 2030.

The implications presented for the sectors appear to be the most plausible, and potentially significant, across the study's four scenarios. The analysis below (as indeed analysis contained within this study as a whole) is not designed to be predictive. Rather, the focus is on those implications that are plausible and consistent with the impacts of key trends and disruptions. These are expected to present both valuable opportunities and challenges for future jobs and skills.

### 6.1 Health and social care

It is anticipated that there will be a significant increase in the number of jobs in health and social care due to demographic factors (ageing population), social trends (working parents requiring childcare), and opportunities that will emerge with investment in medical research and innovation.

The increase in job opportunities is expected to attract a range of individuals (from those entering the labour market for the first time to those transferring from other sectors). The adoption of technological innovations within the health and social care sector is anticipated to change the profile of many jobs.

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<sup>34</sup> The seven sectors are: health and social care, professional and business services, retail and logistics, education, manufacturing, creative and digital and construction.

Migrant workers are expected to fill high- and low-skilled job gaps. In these sectors, there is an anticipated tension between an increase in demand for social and healthcare services, and constraints on public spending. Technological innovation and new business and delivery models provide opportunities to address these challenges. For example, the introduction of personal healthcare budgets would enable people to select preferred healthcare options and services.

### **Implications for jobs**

- It is anticipated that there will be increased demand for home care and tele-care services, particularly for the elderly, as the high costs of nursing and residential care stimulates more home-based provision of services. 'Top-up' personalised care jobs are paid for/contracted by those that have the means – over and above the minimum care levels offered by the public sector. The rise in tele-services is expected to lead to a rise in health care positions outside of traditional institutions e.g. healthcare call centres.
- New technology partially shifts the focus of the health care system towards prevention and the promotion of healthy lifestyles, leading to a rise in associated jobs, for example, health and fitness trainers, and therapeutic services. The proliferation of health and well-being technologies (e.g. personal medical devices) increases the number of data analysis jobs.
- The fiscal situation is expected to accelerate the development of community models and social entrepreneurship (e.g. home-based care networks), based on principles of decentralisation.

### **Implications for skills**

- There is likely to be a demand for technological skills in both health and social care – in low-, medium- and high-skilled roles. On a broad level, there will be a need for workers to acquire more advanced ICT-skills. While younger generations might be familiar with the new ICT technologies in place, older workers will have to update their skills to keep up with technological advancements. Advances in life sciences in the UK are likely to lead to a greater demand for higher-skilled roles. Individuals qualified at postgraduate level will be in high demand, especially those with inter-disciplinary skills.

- As technical innovations allow for increasing automation of diagnosis, using increasingly complex electronic and digital medical equipment becomes a central requirement for medical staff. By using these approaches, the amount of data on users and services increases tremendously. Workers in health and social care will need to acquire the skills to analyse, manage and translate this data (e.g. for choosing better treatment methods or communicating this to patients).
- With the diffusion of personalised medicine based on genetics into mainstream medical treatment, there is likely to be increasing demand for new skill sets in areas of prevention, diagnosis and treatment.
- It is anticipated that there will be increased demand for managerial skills in facilitating health care remotely, including managing a diverse workforce.
- It is expected that social care workers will increasingly be required to handle advanced care technology, for example care robots. This productivity increasing technology may also allow for more time to be spent on the 'soft' aspects of social care.
- It is anticipated that there will be an increased demand for inter-disciplinary skill-sets, especially the combination of medical knowledge and programming skills, as automated diagnosis tools become widely adopted.
- As many people find employment in health and social care for the first time, either as their first job or because they have been displaced from other sectors, there is strong demand for social/behavioural skills (empathy and a customer service ethos) alongside new technical skills in operating technology effectively.

## **6.2 Professional and business services**

Developments in the professional and business services sector will be linked closely to globalisation and internationally traded services (growth in the East, for example, creates demand for this sector with new customers and potentially new products); the adoption of technological innovation, and in providing solutions in response to new or increased social demands (such as an ageing population).

One of the major influences will be the automation of professional jobs and the impact of ICT using smart algorithms. Undergoing constant change, the structure, management and strategies of businesses in this sector, and supported by this sector, are likely to become increasingly flexible, diverse and global.

## Implications for jobs

- Due to changes in the structure and organisation of professional work, a reduction in some management positions may ensue from flatter, more autonomous project teams that move away from more hierarchical management models.
- Much of the growth in high-value jobs is anticipated to take place in London and South East England, replicating established patterns, although there is significant growth potential for city-regions around the UK. For instance, it is anticipated that employment in mid-level back office professional services functions is created in conurbations away from London, where rents are lower and there is a good supply of well-qualified, flexible labour.
- There is anticipated to be growth in business services and associated jobs supporting converging technologies i.e. knowledge intensive services and skills such as legal for intellectual property or strategic management consulting. Together with an increasing demand for financial services due to higher numbers of self-employed workers and because of the prolonged retirement age.
- Increasing competition with high skill overseas workers, as much of the professional and business services sector moves to online platforms and continued off-shoring of back-office roles in sectors such as Finance is anticipated to lead to an associated rise in limited project based contracts.
- Automation and software could render many lower skilled customer service roles obsolete (e.g. use of mobile technology to monitor service quality online as means of maintaining effective customer relationship management).
- There will potentially be a massive upheaval in the labour market for professional and administrative services that include high skilled but repetitive work processes as these activities are increasingly automated by smart (in some cases also self-learning) algorithms. Whilst this may have negative effects for employment, depending on the extremity and impact of the scenario, there is also significant scope for innovation and new jobs in supporting this change.

## Implications for skills

- As smart machines take over some of the routine jobs, there is increasing demand for the skills that are (as yet) irreplaceable by machines, such as creative and critical thinking. The penetration of automation into professional work also calls for new models of developing professional skills (providing advice and guidance), i.e. where automation has removed much of the formative experiences of traditional professional careers. Even with a decrease in the demand for routine professional skills, such as drafting contracts, accounting, fiscal advice, etc, there is likely to be an increase in demand for analytical, research and design skills.
- Globalisation in Finance sub-sectors, such as Islamic financing, is leading to the development of new international markets, which results in the need for those with the skills to manage innovation and cultural awareness to create products that can be adapted to these new markets.
- An increasingly knowledge-intensive innovation economy creates demand for legal and commercial due diligence services, and Intellectual Property services and those with the skills to manage and protect novel products and services, and set contractual and governance boundaries (e.g. for strategic alliances/joint ventures/collaboration vehicles).
- Employees in this sector face a business environment defined by increasing uncertainty and huge amounts of data. Thus, the skills to manage complexity and risk, as well as the ability to analyse and translate vast amounts of data to inform decision-making, are required.

### 6.3 Retail and logistics

It is anticipated that future developments in jobs and skills in the retail and logistics sector will be linked to the penetration of ICT in work processes (both back office and customer facing); the continued impact of the Internet in multi-channel retailing; and social consumption patterns (including satisfying 'green' consumer choices).

Overall, a growing population will drive growth in the demand for both low- and high-skilled jobs within the retail and logistics sector. Data and technology enable new service models for retailers, allowing for increasing sophistication in segmentation and customisation with customer profiling.

## Implications for jobs

- A decrease in demand for 'traditional' sales people is expected due to the automation of checkout processes and the continuing shift to online retailing. Retail sales jobs are likely to focus increasingly on providing a personalised shopping experience, using a range of customer data and preferences.
- Internet retailing is expected to increase the demand for distribution and logistics specialists and workers. Especially, for instance, as same-day delivery becomes standard for e-tailing in urban areas.
- Across the sector, an increase is anticipated in the demand for programmers and data analysts (for online retail business) and IT-specialists (for warehousing and transport logistics).
- It is expected that larger retailers can generally absorb new technologies and will have the capacity to deploy these. Small retailers may run risk of failure and obsolescence unless they implement new technologies.
- Green consumption is expected to impact on retail jobs with increased demand for eco-friendly goods - leading to a rise in demand for staff to accredit products as eco-friendly new technologies.

## Implications for skills

- Data analysis and IT-skills (programming, digital visual presentation, etc.) will be in increasingly high demand as the online share of the retail sector continues to grow and multi-channel retail approaches become ubiquitous.
- As most jobs at all levels, from retail assistant up, involve some use of technology, there is a general need for medium to high technology literacy throughout the sector. The ability to analyse and use vast amounts of data (collected by an increased usage of electronic tags for consumer products) becomes an increasingly important skill, particularly for managerial positions in the sector.
- Lower skilled workers face a basic choice of up-skilling, particularly in ICT inventory management and associated tools, or redundancy due to automation.
- There is an increasing need for investment in skills that support sophisticated customer engagement e.g. building brand loyalty rather than mechanistic selling skills and managing customers across multiple channels. There is increased demand for product curating skills and creative ideas for promoting a memorable shopping experience, as brick-and-mortar retail has to reposition itself in relation to online competition.

## **6.4 Education**

The development of market-based and employer focused education becomes an increasingly important driver for the sector. Social trends and enabling technologies create a need for increasingly personalised modes (in structure and content) for learners. This is particularly the case for Further Education and Higher Education, where higher fees focus the minds of learners on employability questions and return on investment.

Online and blended learning techniques will become more widespread and sophisticated to match the expectations of fee-paying learners.

It is anticipated that there will be an increase in demand for work-based learning, which offers the flexibility required by employers and individuals. With increasing competition and public spending constraints on core funding in the Higher Education sector, new entrants (private providers) may find it easier to adapt to the new environment, with a different business model, a lower cost base and a very focused curriculum.

### **Implications for jobs**

- Reduced public funding linked to deficit reduction may lead to a rationalisation process in the HE sector, resulting in a reduction of employment opportunities. Technology is another driver for this rationalisation process as online education platforms allow skills delivery from one tutor to a much larger audience. However, employment growth is expected in private educational institutions.
- A surge in online learning would create demand for experts in online and digital based education. The growing need to provide new methods of cross-crediting, qualification and skills assessment leads to a rise in associated jobs.
- The critical and explicit success criteria for education providers are employability, efficiency in working (with individuals and employers) and the track record of learners in gaining appropriate and good quality employment.

### **Implications for skills**

- Increased integration of ICT and technological equipment requires employees to acquire necessary digital skills (e.g. managing MOOCs) whilst also developing necessary interpersonal skills that give them the ability to act as a mentor. Digital technologies and a cultural shift in pedagogy will see teachers and lecturers move away from communicating information in chunks, such as a one-hour lecture, towards guiding students to find, analyse, evaluate, and apply information by themselves.

- There is a strong need for STEM skills to sustain an innovative economy, and to meet societal needs in areas such as energy and environment.
- Brokering and intermediary skills (e.g. needs analysis, skills diagnostics, relationship management) are in demand, to ensure that employers become co-producers of a more effective skills system
- ICT-related skills such as programming, information design; audio-visual editing, etc. will be in high demand as they will be at the heart of future skills delivery.

## **6.5 Manufacturing**

Global competition, technology adoption and international trade levels will have a formative influence on the manufacturing sector in the UK to 2030. Whilst a full rebalancing of the economy (where manufacturing re-assumes a much larger proportion of the economy) is less likely, a stabilisation in manufacturing employment levels is plausible.

Within a globalised production environment, the demand for low-skilled labour in UK manufacturing will continue to decrease. One of the major uncertainties facing the sector is the degree to which additive manufacturing or 3D printing will revolutionise production and supply chains. The manufacturing sector in the UK will be challenged to upgrade its innovation capacity – and move beyond achieving efficiency (through lean methods).

Increasing concern over resilience of supply chains will drive business strategies and may stimulate near shoring and re-shoring of manufacturing activity to the UK.

### **Implications for jobs**

- Whilst job losses amongst the low skilled in the sector are likely to continue due to low-cost competition and automation, there will be continued need for (up-skilled) technicians to manage automated production systems.
- With a focus on upgrading innovation, there will be a continued transformation of manufacturing to a highly sophisticated industrial sector where high-skilled engineers are increasingly in demand.
- The digitalisation of production could favour a re-shoring of manufacturing activities and bolster advanced manufacturing in the UK, increasing the demand for highly skilled labour.
- Material sciences and biology, as major economic growth areas for the UK, drive demand in associated production and commercialisation jobs e.g. development and commercialisation of new materials, biotech and nanotech.

## Implications for skills

- Lower skilled workers could become caught in a vicious cycle. The introduction of automated technologies may erode employers' incentives to invest in skills. Without up-skilling, lower skilled workers face redundancy.
- Core engineering skills are of great importance within the manufacturing sector, while tailored qualifications (such as biomedical engineering) are likely to be highly sought after.
- In digital production (3D printing) factories, combined skillsets of design and production processes will be highly valued. The digitalisation of production increases the demand for engineers specialised in cyber-physical systems both for the development and the implementation of high-tech manufacturing. The higher level of technology integration requires employees to have relevant skills, including skills in design, simulation and data analytics.
- In a semi-autonomous manufacturing environment, the remaining shop floor workers will have more responsibilities that require control, maintenance and problem-solving skills, as well as a general understanding of the work processes of the company.
- It is anticipated that there will be increased demand for individuals with multi-disciplinary technical, commercial and management skills.
- Consultancy skills in advanced manufacturing will be in global demand. For instance, skills in the establishment of new manufacturing processes; technical and cost-benefit advice of relative merits and balance of additive manufacturing vs./and traditional manufacturing.
- Third party manufacturing is expected to create demand for business development and contract management skills.

## 6.6 Creative and digital

Changes in technology will drive productivity and the development of new business models in the creative and digital sector.

The sector will have a significant impact on other sectors as digital and creative solutions are applied in different business processes and fields.

It is anticipated that the growth of tools for virtual collaboration, outsourcing, and the associated need for flexible project management, will also shape the work environment in the creative and digital sector. For instance as a result of an increase in demand for digital tools that engage with customers, suppliers and companies' own employees – who are accustomed to digital business processes and virtual working.

Alongside expected improvements in productivity that come with the application of ICT tools, companies will seek to incorporate digital platforms as a core part of their innovation processes (for example, in open innovation platforms).

### **Implications for jobs**

- ICT developments and new businesses will continue to generate jobs of a professional, associate professional and managerial nature. In areas such as design, for example, new digital technologies will be used to generate simulated environments.
- Increasing virtualisation and ICT allows workers freedom of location. New forms of mobile and home-working arrangements will develop or increase. Virtualisation and ICT tools also increase competition between UK workers and others as the nature of many tasks allows international workers to compete for contracts.
- Increasing numbers of workers within the sector are likely to be self-employed or employed under project based contracts.

### **Implications for skills**

- There will be a growth in generic (for example, programming) and specialised skills across the creative and digital sector.
- High demand is expected for data management, analysis and visualisation skills as the amount of data transferred, collected, and stored increases exponentially.
- Creative and digital skills become more integrated in high-technology growth sectors – in life sciences, new materials science and artificial intelligence. Key skills in demand include design, design engineering and representation of complex data (e.g. through visualisation).
- There is an increasing need for those with cyber security and digital forensic skills.
- Increased inter-disciplinary thinking will be in demand to enable organisations to understand the user experience and customise products and services for the market. For example, this is expected to increase the demand for ethnographic, product design and innovation skills.

- There is a growing need for more entrepreneurial and self-organisation skills as structures shift from traditional permanent employment contracts to a more flexible, project-based employment.

## **6.7 Construction**

Construction is often regarded as a bellwether for the economy as a whole, sensitive to changes that come with growth and recession. Whilst it is plausible that the sector will continue to experience the (cyclical) impacts of the economy as a whole to 2030, there are several key drivers that are likely to shape employment and skills demands.

The growing population of the UK will sustain demand for construction jobs although the building of new housing relies on an enabling regulatory environment. Resource efficiency is another key driving factor for the sector – both in the creation of new housing stock and in improving existing stock.

Offsite construction with on-site assembly and final construction will offer cost-effective and flexible means for meeting some of the increased future demand. Whilst some of the sector will continue with established techniques and approaches, new technologies (for example, energy and materials) will change work needs for construction, maintenance and repair.

### **Implications for jobs**

- An increased demand for building efficiency and other eco-friendly solutions such as water efficient measures drive employment in areas of installation and retrofitting.
- An increase in the uptake of offsite construction (buildings being manufactured in factory environments offsite) could lead to changes in work within the sector. If automation accelerates offsite construction (for instance where building modules can be constructed by robots), smaller teams of individuals will be involved in the process and will instead focus on on-site construction and assembly. The impact on the quantity of new jobs is unclear. Whilst increased off-site construction is likely to lead to a growth in productivity, employment growth could be constrained.
- Overall, these developments will lead to increased interaction between roles within construction and manufacturing sectors.

## **Implications for skills**

- Across the sector, and across different roles, the increasingly technical demands of trade and crafts jobs require sufficient technical skills (for example in ICT, renewable energy technologies, and new materials).
- Increased integration of technologies into residential and office buildings (e.g. home automation) requires workers to obtain new installation, maintenance and repair skills.
- It is anticipated that there will be an increased demand for skilled project managers to manage both offsite and onsite construction projects.
- An increased demand for installation, repair and maintenance skills in the sector, is likely to be driven by increased automation (integration of technologies into residential and office buildings), and renewable energy technologies.
- An increased demand for ICT skills is expected in building modelling and building management.

## 7. Conclusions for the future of jobs and skills

The future is unknowable and making accurate predictions is therefore particularly difficult. Yet, the trends, disruptions and scenarios outlined in the research provide clues to help us develop a plausible picture of what the world of work could look like in 2030.

### 7.1 Key messages

#### Technological growth and expansion

As digitalisation grows, we can expect a significant impact on employment and skills in the decades ahead, at all levels and in all sectors. In the health sector, for example, we could see care workers assisting with home-based diagnostic and monitoring devices, as well as teams of clinicians, engineers and programming specialists working on the next wave of personalised patient treatments. In the construction sector, increasingly sophisticated building technologies, such as home automation, will demand new installation, maintenance and repair skills, while architects and building managers use cradle-to-grave digital modelling in their projects, to both design and build physical structures.

As almost every job becomes increasingly technology-related, there will be winners and losers. As demonstrated by Mark Zuckerberg and Facebook – new businesses with limited capital and experience but that exploit opportunities created by technological development can succeed on a grand scale.

Technological growth, and the accompanying changes in business models, make the continuous adaptation of skill sets absolutely fundamental for successful participation in the labour market. More so than ever before, individuals that are not willing or able to do this will face being left behind.

***“Individuals must acquire special skills to stay competitive, as even a high-end skill set is becoming more and more available elsewhere in the world” (Global senior business leader)***

#### Interconnectivity and collaboration

Work in the future will be more interconnected and network-oriented. Employees (and employers) will require the competencies to work across different disciplines, to collaborate virtually, and to demonstrate cultural sensitivity.

If location-based (for instance from a specific office) and time-based (for instance 9am-

5pm) work becomes eroded, organisations will need to develop new HR and contractual mechanisms to manage performance, address issues of trust and transparency, and invest in keeping the skills of a largely virtual workforce up-to-date.

In this context, the imperative on businesses to collaborate around skills development grows. Action by employers to ensure (and protect) their supply of workforce skills and talent will be critical in servicing a more global supply chain. This will also challenge organisations to manage internal staff alongside orchestrating relationships with external actors to create the right skill sets.

***“Your quality (as a business) is dictated by the quality of your supply stream. Jobs will also stretch across borders” (UK senior business leader)***

### **Convergence of innovation**

We can expect more and more innovations to take place at the borders of disciplines and sectors. Successful solutions may be found through combining established disciplines with novel developments, for instance with material sciences and nano-technologies.

The spread of disciplines and jobs across sectors will also stimulate the hybridisation of skills which will provide some individuals with a strong position to compete within an increasingly demanding workplace.

As companies become increasingly open in their innovation activities, cross-sectoral and cross-discipline collaboration with customers, suppliers, experts and others becomes even more prevalent in developing products and services that can be brought to market.

***“Big innovations today come from people who are capable of translating one paradigm of a discipline to a paradigm of another discipline” (Global thought leader)***

### **Increased individual responsibility**

International competition and technological development is likely to continue to increase the flexibility that employers demand from their employees.

As the world of work becomes more flexible, employees are expected to shoulder more and more responsibility for skills development. Self-management, alongside core business skills, such as project management expertise, and the ability to promote your personal brand, will become increasingly vital.

Personal agility and resilience, such as the ability to adapt to or embrace change is important within this context. Particularly for young people who will be competing for jobs with those that stay in employment longer.

The hierarchical structures of companies are changing towards leaner management with more responsibility for tasks and processes. The responsibility to uphold the organisation's brand when dealing with customers rests more and more on the shoulders of individuals. New work modes like telework (work wherever and whenever) further drive this.

***“Workers will need to constantly gain new skills throughout their work life”*** (Global thought leader)

### **The shrinking middle**

The shrinking middle will challenge the workforce. The high-skilled minority (characterised by their creativity, analytical and problem solving capabilities and communication skills) will have strong bargaining power in the labour market, whilst the low-skilled will bear the brunt of the drive for flexibility and cost reduction, resulting in growing inequality.

Jobs which have traditionally occupied the middle of the skills hierarchy and earnings range, such as white collar administrative roles and skilled / semi-skilled blue collar roles, are declining at a significant rate due to changes in work organisation driven by technology and globalisation. There is evidence that new types of jobs are emerging to fill the middle ground but these have markedly different entry routes and skill requirements.

***“People moving in and out of learning will continue. In particular, when people develop portfolio careers, they need to be able to convert their qualifications or build upon the ones they have. Education has to come up with the right package to solve these new demands”*** (Education and training provider)

### **The four-generational workplace**

The future workplace will be multi-generational, with four generations working side-by-side. Traditional notions of hierarchy and seniority will become less important. The skills for leading and managing the four-generational workforce, and for facilitating collaboration across multiple generations and their values, will be in increasing demand.

The complex values of this multi-generational workforce will impact upon employers' ability to attract talent, at all skill levels. Attitudes to corporate social responsibility, or expectations of flexible working conditions, will alter the ways employers recruit. Cross-generational skills acquisition will be important.

While the speed of technological change may place younger cohorts at a perceived advantage, especially those who have grown up entirely in a digital age, all age cohorts will need to invest in continual up-skilling to keep pace with accelerating development. Workers in older age groups will need to embrace technology fully in order to compete in the labour market.

By 2020, over 50 per cent of the workforce are expected to be Generation Y members who have grown up connected, collaborative and mobile.

***“Different generations have to understand each other. Fostering intergenerational solidarity in the workplace is extremely important to future business performance”***  
(UK thought leader)

## **7.2 Action for future skills**

Each of the scenarios highlights distinctive implications for the UK jobs and skills landscape in 2030 - but there are also implications, and therefore action needs, that are common to all four. To prepare for tomorrow's world of work, the study indicates key areas for consideration by employers, individuals, education providers and policy makers. These are not to be seen as definitive solutions to the opportunities and challenges presented by the analysis, but as a starting point for further thinking and debate.

### **Employers**

- Take leadership and responsibility for developing the skills needed for business success to create resilience and the capacity to innovate in the face of intensifying competitive pressures and market volatility. Industry-wide collaboration by business is needed to address key skills challenges as an intrinsic part of sectoral growth strategies. The ability to attract, develop and retain world class talent will increase in importance as a differentiating factor in global markets.
- Develop capability to manage skills and talent across global business networks and supply chains, to adapt to open business models and more fluid employment arrangements.

- Collaborate with government to develop sustainable career and learning pathways for young people in a challenging labour market.
- Prepare for increasing diversity in the workforce, both culturally and generationally, by supporting a greater range of flexible working arrangements and adapting organisational values to create meaning and value to work.
- Intensify collaboration with the education and training sector to access critical skills as the capacity to innovate becomes paramount.

### **Individuals**

- Change mind-set regarding the nature of work, as it becomes less location-specific, more network oriented, project based and increasingly technology-intensive.
- Take greater personal responsibility for acquiring and continuously updating skills for progression and success in the face of limited investment from employers and government and increasing division between low and high-skill jobs. Keep in touch with relevant labour market developments and include skills and training opportunities as part of contract negotiations with employers.
- Be open to and take advantage of new and different approaches to learning, for instance self-directed, bite-sized learning, peer-to-peer learning and technology enabled training opportunities.
- Be willing to jump across specialist knowledge boundaries as technologies and disciplines converge, developing a blend of technical training and 'softer,' collaborative skills.
- Focus on development of key skills and attributes that will be at a premium in future, including resilience, adaptability, resourcefulness, enterprise, cognitive skills (such as problem solving), and the core business skills for project based employment.

### **Education and Training Providers**

- Collaborate closely with employers to support them in achieving their business and skills objectives to ensure provision is responsive to their needs and forward-looking in a competitive learning market.
- Be prepared to adapt to the continuing disruption of established income streams and business models arising out of the marketisation of learning.
- Invest continuously in new modes and content of provision. Keep abreast of developments and understand the impact of technology on learning delivery.

- Put in place systems to offer clear information on success measures of learning to inform investment decisions by learners and employers.
- Adapt learning programmes to reflect the critical importance of an interdisciplinary approach to innovation in the workplace and the all-pervasive influence of technology.
- Understand the increasingly diverse demands people place on modes of education and training and develop flexible learning pathways and bite-sized opportunities to reflect the changing employment landscape.

### **Policy makers**

- Foster a flexible and dynamic skills investment environment which enables people and businesses to build their capacity to innovate and compete. Government's role will be increasingly to ensure an effective alignment of public and private investment with a view to maximising outcomes that contribute to jobs and growth.
- Encourage employers to take a greater degree of leadership and control of the education and training system. Foster strategic relationships between business and the education and training sector to ensure agility and cost effectiveness in developing the skills needed for a rapidly changing environment.
- Empower individuals through access to high quality careers and training information and advice, and facilitate access to finance to support individual investment in skills.
- Put in place domestic labour market regulation that prevents a 'race to the bottom' in labour standards as the balance of power shifts increasingly to employers. Support discussions around the facilitation of labour market regulation on a global scale.
- Develop a coherent and comprehensive long-term strategy for ensuring that the low-skilled can respond to the challenge of a radically shifting labour market.
- Mitigate growing spatial disparities in jobs and skills, by enabling labour mobility and /or supporting local economic development.

## Appendix A: Expert interviews

23 interviews were carried out in August and early September 2013. Each interview took about one hour. Ahead of interview, the interviewees were sent a preliminary list of trends and disruptions identified by an initial literature review as the most pertinent to the UK context. Interviewees were also invited to suggest other trends and disruptions.

### Interview topics

**Future trends:** What do you perceive to be the most important trends shaping UK jobs and skills until 2030?

**Future disruptions:** Beside the trends, which disruptions could have a dramatic impact on UK jobs and skills until 2030? (By disruptions, we mean potential radical developments that are today less visible or “strong” than trends, but that could become stronger and would have a strong impact)

**Implications and needs for action:** What are the main implications of these trends and disruptions for jobs and skills in the UK in 2030? What major needs for action do you see arising, and who could take this action?

**Table A.1: List of interviewees**

| Name   | Organisation  |
|--|---|
| <b>Global thought leaders (senior experts from abroad)</b> |   |
| David Finegold   | Chief Academic Officer, American Honours, Previously Professor at School of Management and Labour Relations, Rutgers.                                   |
| Michael Spence   | Professor Stern School of Business at New York University, Recipient of the 2001 Nobel Prize in Economic Sciences                                       |
| Andreas Schleicher   | OECD, Deputy Director for Education and Skills  |
| <b>UK thought leaders (senior experts from UK)</b>         |   |
| Will Hutton  | Chair, Big Innovation Centre The Work Foundation  |
| Paul Sparrow   | Director Centre for Performance Led HR  |
| Chris Warhust  | Professor of Labour Studies, University of Strathclyde and Professor of Work and Organisational Studies, University of Sydney, Australia                |
| Andy Green   | Director, LLAKES Centre for Learning and Life Chances in Knowledge Economies and Societies, London)   |
| Ben Hammersley   | Innovator in Residence at the Centre for Creative and Social Technologies at Goldsmiths, University of London; Prime Minister's ambassador to Tech City |
| <b>Global senior business leaders</b>                      |   |
| Michael Meyer  | Chief consultant advanced organizational development at Robert Bosch GmbH, Germany  |
| Tim Jones  | Director of the Future Agenda, (formerly Vodaphone Futures Programme)   |
| <b>UK senior business leaders</b>                          |   |
| Anonymous  | Company Chairman, UKCES Commissioner  |

|  |  |
|--|--|
| Rob Wall                                       | Head of Education and Employment Policy, CBI                                       |
| Toby Peyton-Jones                              | Director of HR, Siemens UK and NW Europe, UKCES Commissioner                       |
| Shaun McInerney*                               | Head of Engineering at BAE Systems   |
| Philip Woods*                                  | Head of Technology Strategy at BAE Systems   |
| Valerie Todd                                   | Director of Talent and Resources, Crossrail, UKCES Commissioner                    |
| <b>UK trade unions</b>                         |  |
| Grahame Smith                                  | General Secretary of the Scottish TUC, UKCES Commissioner                          |
| Frances O'Grady                                | General Secretary of the TUC, UKCES Commissioner                                   |
| <b>UK voluntary organisation</b>               |  |
| Karl Wilding                                   | Director of Public Policy, National Council for Voluntary Organisations            |
| <b>Policy makers (government and agencies)</b> |  |
| Peter Sellen                                   | Department for Education, UK   |
| Barbara Spicer                                 | Chief Executive of Salford City Council  |
| Michael Davis                                  | Chief Executive of UKCES   |
| <b>Education and training providers</b>        |  |
| Dr Liz Marr                                    | Director, The Centre for Inclusion and Collaborative Partnerships, Open University |
| Mark Beatson                                   | Chief Economist CIPD   |

\* Interview at BAE with 2 interviewees

## Appendix B: Future of jobs and skills conference

The study's draft scenarios, and their implications for jobs and skills in seven sectors, were tested and enriched at an expert conference on 21 November 2013 with high-level contributors representing employers, education and training providers and policy makers.

**Table B.1: Conference participants**

| Name                   | Organisation   |
|------------------------|--|
| Andy Green             | Institute of Education at University of London and Director of ESRC Centre for Learning and Life Chances in Knowledge Economies and Societies (LLAKES) |
| Andy Westwood          | CEO, GuildHE   |
| Annette Cox            | Associate Director, Institute for Employment Studies   |
| Colin Snape            | HR Manager, Langdon Industries   |
| Daniel Charles Mouawad | Chief Executive, South East Midlands Local Enterprise Partnership  |
| David Guile            | Professor of Education and Work, Institute of Education  |
| Emma Stewart           | Director, Timewise Foundation  |
| Grahame Smith (Chair)  | General Secretary, Scottish TUC  |
| Heather Bowers         | Director of Innovation, KPMG   |
| Holly Hardisty         | CBI, Senior Policy Adviser for Education and Employment Policy   |
| Jane Artess            | Director of Research, HECSU  |
| Jane Daly              | Head of Office Learning and Development, Marks and Spencer   |
| Jeremy Anderson CBE    | Chairman, KPMG   |
| Mark Cooper            | Skills and Business Growth Lead, Greater Cambridge/Greater Peterborough Enterprise Partnership LEP   |
| Martin Hottass         | Manager for Skills, Learning and Governance, Siemens   |
| Matt Edwards           | Head of Horizon Scanning and International , Centre for Workforce Intelligence, Horizon Scanning Unit  |
| Michael Gould          | Acting Director for Skills and Industry Division, NI Executive   |
| Mike Keoghane          | Senior Policy Manager, Welsh Government  |
| Paul Sparrow           | Director of the Centre for Performance Led HR, Lancaster University  |
| Rob Wilson             | Professorial Fellow and Acting Director, IER, University of Warwick  |
| Stuart King            | Principal Research Officer, Scottish Government  |
| Tom Wilson             | Director of unionlearn, TUC  |
| Urvashi Parashar       | Economic Advisor, Skills Policy Analysis, Vocational Education Directorate, BIS  |
| Wilson Wong            | Head of Insight and Futures, CIPD  |
| Michael Davis          | Chief Executive, UKCES   |
| Lesley Giles           | Deputy Director, UKCES   |
| Peter Glover           | Senior Research Manager, UKCES   |
| Aoife Ni Luanaigh      | Senior Research Manager, UKCES   |
| Helen Beck             | Research Manager, UKCES  |
| Martin Rhisiart        | Director, Centre for Research in Futures and Innovation, University of South Wales   |
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| Eckhard Stoermer       | Senior Foresight Consultant, Z_Punkt   |
| Cornelius Patscha      | Foresight Consultant, Z_Punkt  |
| Jessica Prendergast    | Foresight Consultant, Z_Punkt  |

## Appendix C: Analytical results

This section presents detailed outcomes of the analytical steps of the key factor selection as part of the scenario process. The selection is based on the identified full list of influencing factors (figure C.1 below) and is aimed at identifying the most active driving factors on the future of jobs and skills.

**Figure C.1: Full list of influencing factors**

| Society and the Individual     | Business and the Economy                   | Technology and Innovation                 | Resources and the Environment | Law and Politics                           |
|--------------------------------|--|---|-------------------------------|--|
| Age Structure of the Workforce | Specialisation of Work, Division of Labour | State of (non digital) Infrastructure     | Climate Conditions            | Scope of Government                        |
| Family Patterns                | Access, Forms and Modes of Education       | Digital Infrastructure                    | Resource Availability         | Employment and Labour Regulation           |
| Workforce Diversity            | Economic Conditions in the UK              | Digitalisation and Big Data Opportunities |                               | Global Trade Conditions and Trading Blocks |
| Employees' Values              | Economic Conditions in the World           | Speed of Innovation                       |                               | Environmental Policy, Regulations          |
| Work Environment               | Structure of UK Economy                    | Uptake of Innovation                      |                               |  |
| Workforce Mobility             | Globalisation of Business Activities       |   |                               |  |
| Contract Conditions            |  |   |                               |  |
| Income Distribution            |  |   |                               |  |

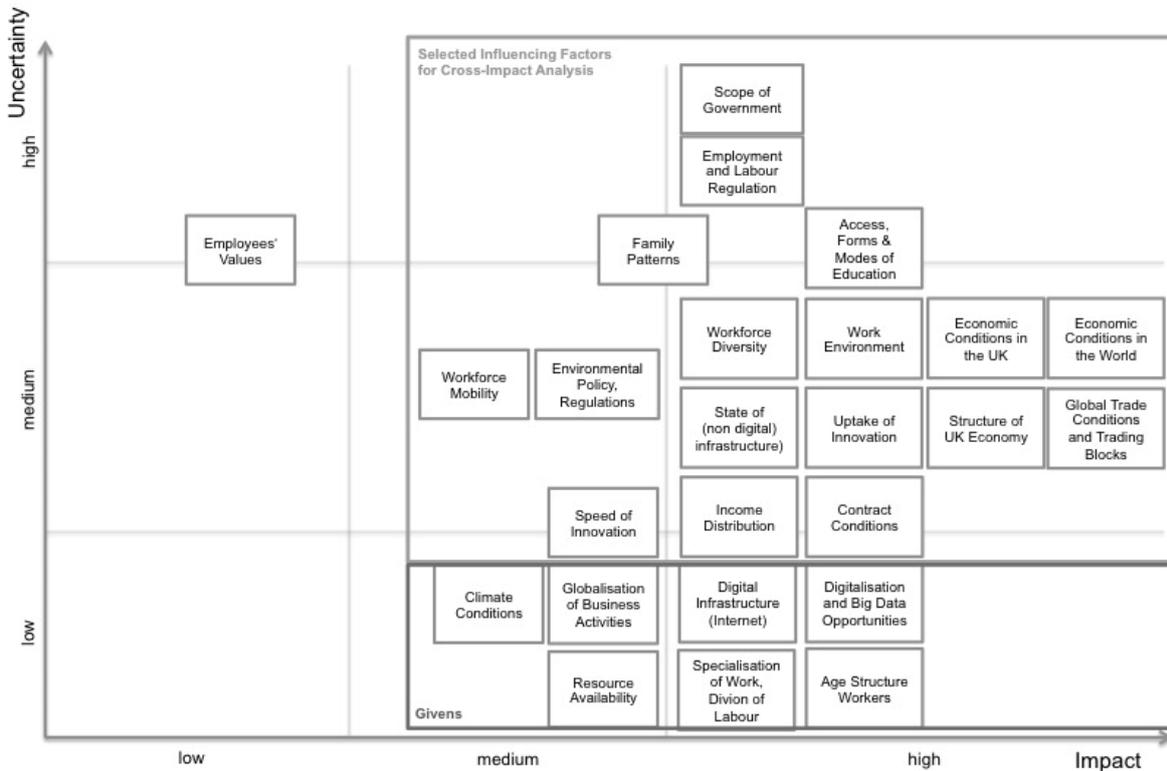
### The Uncertainty-Impact Analysis

The Uncertainty-Impact-Analysis evaluates two aspects:

- 1) How certain or uncertain is the development of a factor?
- 2) How strong is its impact on the field under investigation?

The main objective of this method is to single out the factors that are neither important nor uncertain. The identified disruptions were used to make valid assumptions on the degree of uncertainty. Figure C.2 below set outs the results of the analysis plotted in an uncertainty-impact matrix.

**Figure C.2 Results of the Uncertainty-Impact-Analysis**

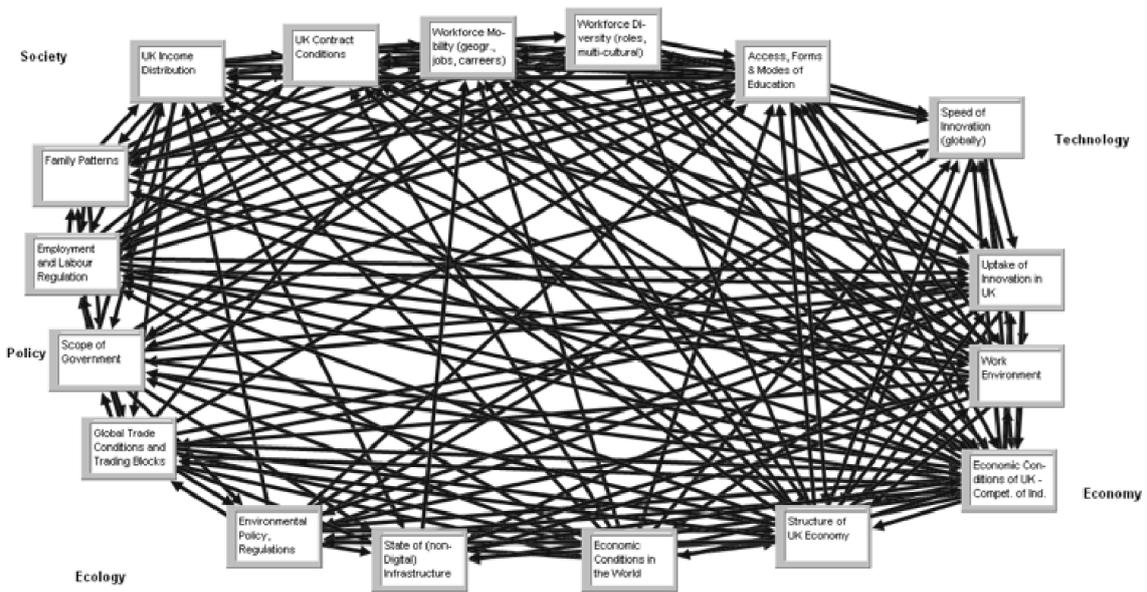


The “givens” are highlighted by the lower box in the matrix. Appendix D also provides more information on these. The selected influencing factors are highlighted in the larger upper box in the matrix.

The remaining set of influencing factors was reduced even further by evaluating their mutual impacts in a Cross-Impact Analysis (see Figure C.3 below).

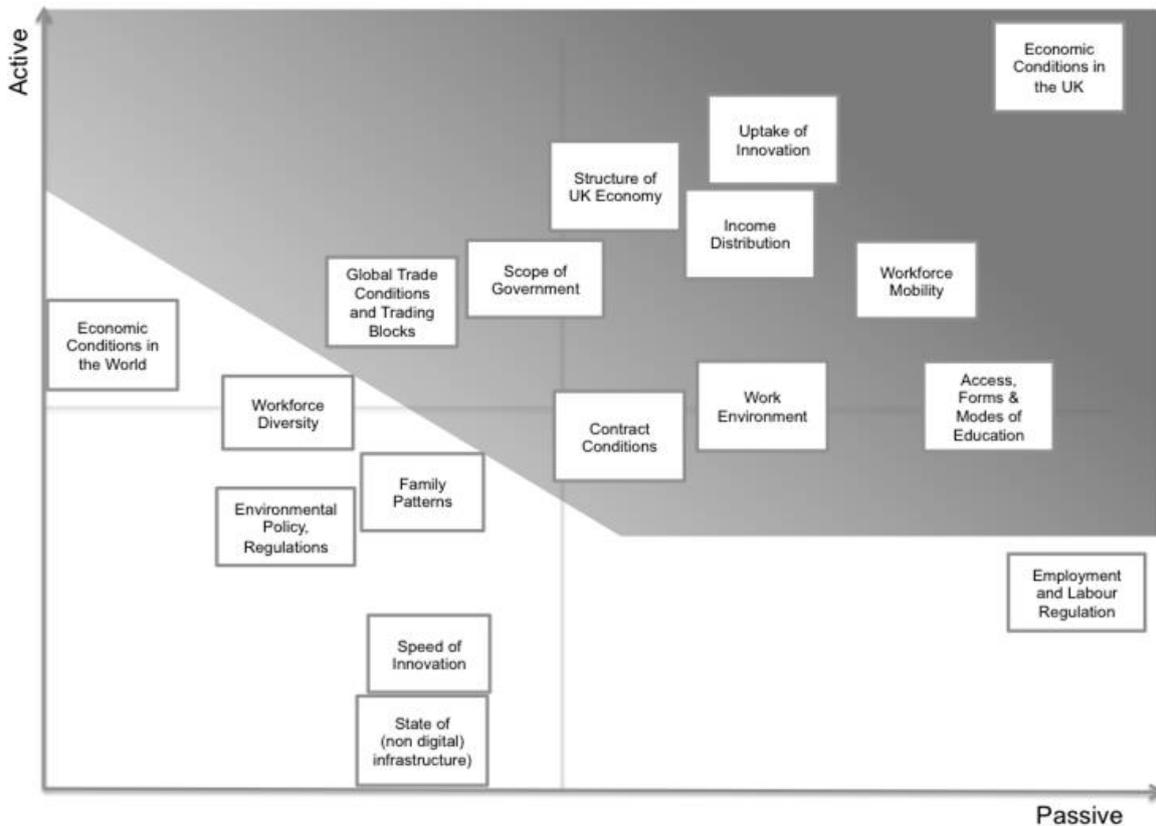
The objective of this analysis was to single out factors that are neither actively influencing other factors, nor passively influenced by a large number of other factors. Simultaneously, this analysis identifies major drivers (highly ‘active’ factors) and output factors (influenced by many other factors).

**Figure C.3: Mutual impacts resulting from the Cross-Impact-Analysis**



The level of activity and passivity of each factor were plotted in an Active-Passive Matrix (see Figure C.4).

**Figure C.4: Results of the Cross-Impact-Analysis in the Active-Passive Matrix**



The most active drivers were then selected as scenario key factors. Drivers with a medium level of activity<sup>35</sup> were selected based on the issue at hand.

The selection is highlighted by a coloured background in the Active-Passive Matrix in Figure C.4 above. The Parmenides EIDOS® software was used for both the Uncertainty-Impact-Analysis and the Cross-Impact-Analysis.

The key factors are presented in more detail in Appendix D.

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<sup>35</sup> *Workforce Diversity* is excluded, as it is strongly influenced by the remaining factor *Workforce Mobility* and the increasing role of women in the workforce is already present as a given. *Economic Conditions in the World* is strongly driven or represented by the included factors *Global Trade Conditions* and *Structure of the UK Economy*. *Employment and Labour Regulation* is also represented in parts in *UK Contract Conditions* and *Access to Education* and overall in *Scope of Government*. This factor is also a strong output factor and is discussed in the action needs at the end of the process.

## Appendix D: Key factor report

### Introduction

This Appendix sets out the key factors and their projections as well as the givens (at the end of this appendix). These are the backbone of the scenarios.

The key factor projections were developed to be thought-provoking. Key factors are multi-faceted; they often describe more than one issue. For plausibility reasons some elements of each projection might not appear in the same, exact manner in the final scenario description, as they are presented in the key factor report.

A set of projections was produced for each key factor. The material provided information on alternative and plausible developments for each factor identified during the analysis.

Each factor has one evidence-based “Reference Case” projection (which could be regarded as ‘business-as-usual or a trend continuation) and several other possible ones. Every key factor is concisely defined. The time horizon for each of these projections is 2030.

### Definitions

**Key factors** are defined as active drivers of the long-term future of UK jobs and skills. Due to the key factors’ uncertain long term development, different potential future states of each driver are plausible – these future states are called “projections”. Key factors are shaping the future of UK jobs and skills to 2030 (e.g. demographic change as one factor). These are selected from all relevant fields: society, technology, economy, ecology, and politics (STEEP approach).

**Projections** are alternative and plausible developments for 2030 within each key factor’s field (e.g. population boom would be a projection of the key factor demography). This study’s projections were developed by analysing future relevant studies and the expert interviews.

**Table D.1: Key factors and their definition**

|   | Key factor                               | Short definition  |
|---|--|---|
| 1 | Condition of Global Trade                | The development of foreign trade policies around the globe, i.e. the degree to which the free movement of goods and services is restricted in international trade relations and the degree of economic globalisation.   |
| 2 | Economic Condition of the UK             | Status and development of the UK economy, expressed in the dynamic of real GDP growth.  |
| 3 | Structure of the UK Economy              | The development of the sectoral structure of the UK economy, expressed in the relative importance of the service and the manufacturing sector.  |
| 4 | Public Funding for Skills Delivery       | The extent of political and regulatory action taken by government in order to affect social and economic matters. Social interventions include (amongst others) education provision, social welfare, and safety regulations for employment. Economic interventions include (amongst others) targeted taxes, minimum wage legislation, and import quotas and tariffs. Measured by political will to intervene, and the extent and level of regulation. |
| 5 | Employment Promotion Measures            | Active labour market policies, excluding education and skills policies that focus on creating jobs include funding for subsidies to individual businesses and sectors.  |
| 6 | Uptake of Innovation in UK Business      | The degree to which UK businesses implement technological and process innovations into their operations. This includes both innovations generated in-house and the adaptation of innovative concepts generated elsewhere.   |
| 7 | Work Environment                         | Aspects of the work environment regarding work arrangements and modes as well as the design of workplaces.  |
| 8 | Employment Contract Conditions in the UK | Employment conditions and the extent of employee rights in the UK. With a focus on the balance of power between employers and employees and the extent of employment regulation.  |

|           |   |  |
|-----------|---|--|
| <b>9</b>  | <b>Workforce Mobility</b>                         | The movement of workers in geographical and occupational terms as well as the possibilities and prospects of employees to build their careers.                       |
| <b>10</b> | <b>Access to and Forms and Modes of Education</b> | Skills acquisition and access to further education (including where the responsibility for skills acquisition lies). As well as the range of skills delivery models. |
| <b>11</b> | <b>Income Distribution within UK Workforce</b>    | Income distribution in the UK in and between occupations, sectors and regions.   |
| <b>12</b> | <b>Employees' Values</b>                          | The demands and desires of employees from their workplace and their implications.  |

### Key factors definitions and projections

Figure D.1: Morphological box

|   |  |  |  |  |
|---|--|--|--|--|
| <b>Condition of Global Trade</b>                | Between Tension and Cooperation                  | Continuing Liberalisation                                    | A more National Perspective              | Sluggish Global Trade                                      |
| <b>Economic Condition of the UK</b>             | Shaky Recovery, New Foothold for Growth          | Sturdy Recovery, Robust Growth                               | Prolonged Crisis, Threat of Stagnation   | Economic Vicious Cycle                                     |
| <b>Structure of the UK Economy</b>              | Maintaining the Balance                          | Slow Re-industrialisation                                    | Financial Sector Blues                   |  |
| <b>Public Funding for Skills Delivery</b>       | Reduced Funding and Priority for Skills Delivery | Focus on Skills Delivery, Despite Funding Restrictions       | Priority for Skills Delivery             | Market-Driven Education and Employment Conditions          |
| <b>Employment and Promotion Measures</b>        | Austerity Driven Restraint                       | Focus on Social Markets and Healthcare                       | Focus on High-Tech Industries            |  |
| <b>Uptake of Innovation in UK Businesses</b>    | Accelerated Incremental Innovation               | Focus ICT: Accelerated, Networked, Disruptive Innovation     | Entering a New Kondratieff Cycle         | Stagnation of Innovation in UK Relative to Other Economies |
| <b>Work Environment</b>                         | The Flexible and Smart Workplace                 | The Cyber Workforce  | The Individual Workplace                 | The Stagnating Work Environment                            |
| <b>Employment Contract Conditions in the UK</b> | Limited Employment Regulation Benefits Employers | Employees hold Balance of Power (Despite Limited Regulation) | Regulation Strengthens Employees' Rights | Employers Side-Step Regulation                             |
| <b>Workforce Mobility</b>                       | The Semi-Mobile Workforce                        | The Global Workforce   | The Virtual Workforce                    | The Static Workforce                                       |
| <b>Access to and Forms and Modes</b>            | Multiple and Accessible Skills                   | Online Education   | Elite (Offline)                          | Traditional Institutions Train                             |

|  |                           |                       |                        |               |
|--|---------------------------|-----------------------|------------------------|---------------|
| <b>of Education</b>                            | Delivery Models           | Trumps Other Modes    | Education              | the Workforce |
| <b>Income Distribution within UK Workforce</b> | Widening Income Gap       | Income Stratification | Inequality Restraints  |               |
| <b>Employees' Values</b>                       | New Values vs. Old Values | Struggle for Survival | Shaped by Generation Y |               |

## Condition of global trade

|                   |   |
|-------------------|---|
| <b>Definition</b> | The development of foreign trade policies around the globe, i.e. the degree to which the free movement of goods and services is restricted in international trade relations and the degree of economic globalisation. |
|-------------------|---|

### Dimensions considered in projections:

- Tensions between trading partners
- Amount of tariff and non-tariff barriers to international trade
- Global economic condition

### Projection 1 // Between tension and cooperation (reference case)

The volume of international trade has increased visibly. But drawn-out WTO negotiations highlight the conflicting interests between the major economic and trading blocs. These conflicts have considerable political weight, because many countries face economic challenges. While there are fewer tariff barriers to trade, the exchange of goods and services is complicated by a rapid increase in non-tariff barriers, a more subtle kind of protectionism that is used mostly between rather than within trading blocs (NIC, 2012).

### Projection 2 // Continuing liberalisation

Liberalisation of international trade has continued. Looking back, there have been no major breakthroughs in WTO negotiations but rather a number of bi- or multilateral agreements between individual states that significantly ease the exchange of goods and services within and between trading blocs. The number of barriers to international trade has dropped considerably. Also, conditions for the free movement of workers for short-time assignments in foreign countries have improved greatly. This process was boosted by a favourable development of the global economy, especially in the early 2020s (NIC, 2012).

### Projection 3 // A more national perspective

Unfavourable economic conditions have left a mark on economic globalisation. Trade barriers of all kinds are regularly used to foster the interests of one's own trading bloc and nation. Some areas remain connected to a regional or national core but become disconnected from more peripheral areas, developing more localised economies. The total volume of international trade may continue to increase, but tensions between the great export nations are high and culminate regularly in smaller or more intense trade conflicts. Tensions are especially high between Asian countries and the USA, but also between the Atlantic partners.

### Projection 4 // Sluggish global trade

Driven by multi-causal reasons, in 2030 the total volume of global trade has fallen below its 2013 level, with the goods trade volume responsible for the decline while the trade of services has continued to increase. In many areas, localised economies have emerged, sometimes based on a barter-type of economy, and for a variety of products material flows have been localised or regionalised to a good degree.

## Economic condition of the UK

|                   |  |
|-------------------|--|
| <b>Definition</b> | Status and development of the UK economy, expressed in the dynamic of real GDP growth. |
|-------------------|--|

### Dimensions considered in projections:

- Real GDP growth
- Inflation
- Government debt level
- Government budget balance

### Projection 1 // Shaky recovery, new foothold for growth (reference case)

The recovery process after the global financial crisis of 2008/9 affected the UK economy well into the second half of the 2010s. On average, real-term growth was about 1.4 per cent annually. Economic growth became more stable by the end of the decade and on average almost returned to its former growth path, with annual growth averaging about 2.0 per cent until 2030. This development was supported by inflation rates that, although elevated, remained overall within an acceptable range. Overall, government efforts for balancing the budget and deleveraging were successful. The 2020s saw mostly balanced budgets or budget surpluses. By 2030, government debt levels had dropped to well below 40 per cent of GDP (OECD, 2012).

### Projection 2 // Sturdy recovery, robust growth

The UK's economy continued to recover from the aftermath of the financial crisis of 2008/9. Economic growth did pick up stronger than expected by the mid 2010s, due to favourable factors both within and outside of the UK. Growth rates did not reach pre-recession levels, but allowed for a dynamic expansion of the economy. Inflation rates increased moderately due to the vigorous economic development, but remained within acceptable bounds. Government budgets saw mostly surpluses in the 2020s, and in 2030 the debt level is no longer a pressing issue (National Grid UK, 2012).

### Projection 3 // Prolonged crisis, threat of stagnation

The effects of the global financial crisis lingered and weighed heavily on the UK's economy. With many important trading partners also struggling, the economy was unable to recover in the way everyone had hoped for. On average, GDP growth did not exceed 1 per cent in the 2010s, but accelerated in the following decade, however without reaching its full potential. Economic uncertainty, inflation worries, and the challenges accompanying a drawn-out crisis were some of the factors contributing to the lacklustre growth. As a consequence, budget goals could not be met. With budget deficits until the early 2020s, public debt levels rose dramatically. By 2030, a stabilisation has been achieved at well above 80 per cent of GDP (National Grid UK, 2012; OECD, 2012).

### Projection 4 // Economic vicious cycle

The UK economy has gone through a painful period of decline, primarily caused by the loss of competitiveness in several key sectors crucial for growth. This became highly evident in the second half of the 2010s. Another major reason was vulnerability to economic and financial shocks in the EU, US, and Asian economies. High international in-

tegration in some key sectors served as a transmission channel for a number of economic crises that choked UK economic growth. As a consequence of the dismal economic situation and outlook, UK public debt became difficult to service in the 2020s, instigating a vicious cycle of GDP decline, spiralling debt, high inflation and currency devaluation. By 2030, GDP has declined in real terms below its level in 2013.

## Structure of the UK economy

|                   |  |
|-------------------|--|
| <b>Definition</b> | The development of the sectoral structure of the UK economy, expressed in the relative importance of the service and the manufacturing sector. |
|-------------------|--|

### Dimensions considered in projections:

- Relative size of the UK services sector
- Relative size of the UK manufacturing sector

### Projection 1 // Maintaining the balance (reference case)

The manufacturing sector struggled against the historic trend of seeing its relative share of economic output decline. Especially during the 2010s this struggle was not always successful; but in the late 2010s the relative decline was stopped. During the 2020s, the manufacturing sector grew in step with the other sectors, maintaining its relative share of GDP. In 2030, this share is below but close to its 2013 level, while the financial services sector remains the most important factor in the economy (Wilson and Homenidou, 2012; National Grid UK, 2012). There is a clear shift in the manufacturing sector visible from production to design and engineering. UK manufacturers are keeping the high value design phase and sourcing the labour intensive production out where a shift to Asia takes place as they are low wage and closer to the centres of demand.

### Projection 2 // Slow re-industrialisation

The financial crisis of the late 2000s brought to light how vulnerable the UK economy was to shocks due to its strong focus on financial services. A desire for a more diversified economy with a stronger manufacturing share emerged. Supportive industrial policies at the national and the European level proved helpful for breaking the trend of the declining relative share of manufacturing in the economy. Due to re-shoring activities, but also an uptake in foreign direct investments, the manufacturing sector experienced a prolonged boom period. In 2030, its share of GDP is considerably higher than in 2013, but still significantly lower, than in other manufacturing economies. The financial sector continues to be a very important contributor to GDP (EC, 2012b; National Grid UK, 2012).

### Projection 3 // Financial sector blues

International competition had been a major factor in the decline of the manufacturing sector. But off-shoring had begun to be an issue not only in manufacturing but increasingly also in the service sector, more specifically in financial services where competing financial centres, especially in emerging economies, gained a larger portion of the international financial markets. This had a tremendous impact on investment and hiring decisions of companies that were active in the UK financial sector. In 2030, the relative GDP share of the financial services sector is lower than in 2013. Other sectors have had to step in and the structure of the economy appears to be in flux.

## Public funding for skills delivery

|                   |   |
|-------------------|---|
| <b>Definition</b> | The extent of political and regulatory action taken by government in order to affect social and economic matters. Social interventions include (amongst others) education provision, social welfare, and safety regulations for employment. Economic interventions include (amongst others) targeted taxes, minimum wage legislation, and import quotas and tariffs. Measured by political will to intervene, and the extent and level of regulation. |
|-------------------|---|

### Dimensions considered in projections:

- Public expenditure
- Political will
- Extent of regulation

### Projection 1 // Reduced funding and priority for skills delivery (reference case)

In 2030, the UK government is grappling with issues associated with an ageing population and rising unemployment. Further, tax revenues are decreasing owing to the shrinking workforce and social welfare payments are on the rise.. Education and training policies are not high up the priority ladder receiving just 11 per cent of total government spending (compared with 14 per cent in 2013; HM Treasury, 2013). With decreased government scope and priority for issues related to jobs and skills, minimal efforts have been made to keep the employment regulatory framework up-to-date. Further, with the governments reduced focus on education, a number of private training institutions that once received support from the state are seeing these funding avenues dry up. But a measure of public funding is still directed to private provision of education. Rising co-investment from businesses and individuals absorbs some of the funding cuts. Due to changes both in the demand for and the organisation of skills delivery, the quality of services does not necessarily decline, but some institutions disappear as a result of rationalisation.

### Projection 2 // Focus on skills delivery, despite funding restrictions

In 2030, although the UK government faces rising issues associated with an ageing population, it remains focused on supporting education delivery with the aim of increasing the skills capacity of the UK workforce. In spite of reduced public spending across almost all departments and programmes, the education budget is protected as a priority area. In the 2030 budget, education and training policies received clearly higher share of total government spending than 2013. Efforts have been made to keep the employment regulatory framework up-to-date, in spite of decreasing governmental scope. Further, government has initiated partnerships with private training institutions to deliver quality skills training at a competitive market price.

### Projection 3 // Priority for skills delivery

Due to significant changes in both the governing and the taxation system, the UK government in 2030 has increased motivation and ability to intervene in social and economic matters. The four major focus areas of public spending (health, education, welfare, and pensions) have been allocated budgetary increases almost year on year over the last decade. But arguably, it is the education sector that has received the greatest

gains. In the 2030 budget, education and training policies received the highest share of total government spending of all projections. Further, significant policy efforts are focused on developing the UK's education sector to become the world leader in skills delivery. When compared to those of other OECD countries, the UK's educational and employment policy and regulatory framework are comparatively stronger in their aim to push the national industries' competitiveness and job creation. Further, government has initiated partnerships with private training institutions to deliver quality skills training at a competitive market price.

#### **Projection 4 // Market-driven education and employment conditions**

In 2030 the UK has significant means for economic and social intervention, however the political discourse of the day favours limits on state intervention. With the goal of creating a lean public service, reductions to the budgetary allocations for the four major areas of public spending (health, education, welfare, and pensions) are continually sought. Public education provision is confined to basic statutory education and ends at age 16. Private providers have taken over higher education, government intervention is limited to setting and monitoring standards and providing financial assistance to individuals for further education, e.g. in the form of block grants. In the 2030 budget, education and training policies received clearly less share of total government spending than 2013, solely for the provision of basic statutory education and monitoring and risk management. The educational and employment regulatory framework is minimal, with regulation covering basic conditions. Due to the radical rationalisation of the provision of educational services, a variety of institutions disappear from the market.

## Employment promotion measures

|                   |   |
|-------------------|---|
| <b>Definition</b> | Active labour market policies, excluding education and skills policies that focus on creating jobs, including funding for subsidies to individual businesses and sectors. |
|-------------------|---|

### Dimensions considered in projections:

- Active labour market policies
- Business subsidies

### Projection 1 // Austerity driven restraint

Budget constraints continued well into the 2020s, which led to an ingrained austerity oriented budget policy. In 2030, funding for employment promotion is very limited and business subsidies have been largely cut or significantly reduced below the level found in 2013.

### Projection 2 // Focus on social markets and healthcare

Healthcare, health-related services and social care have been a job motor for a long time. Employment promotion measures focus on these sectors for quick wins in job creation. Social markets and enterprises are also important targets for employment promotion.

### Projection 3 // Focus on high-tech industries

Employment promotion measures focus on medium- to long-term gains through supporting job creation in high-tech industries. They are strongly linked with an overall high-tech policy that promotes UK based businesses in important sectors such as life-sciences, material technologies, and information technology.

## Uptake of innovation in UK businesses

|                   |   |
|-------------------|---|
| <b>Definition</b> | The degree to which UK businesses implement technological and process innovations into their operations. This includes both innovations generated in-house and the adaptation of innovative concepts generated elsewhere. |
|-------------------|---|

### Dimensions considered in projections:

- Length of innovation cycles
- The nature of implemented innovations: from incremental to disruptive

### Projection 1 // Accelerated incremental innovation (reference case)

The speed of innovation has increased significantly, innovation cycles are considerably shorter. Driven by increased international corporate integration, higher market volatility and higher customer demands, production cycles and product life cycles are decreasing in length across all industries. Investments in R&D activities have increased. Implemented innovations focus on better integration of ICT into business processes. However, in most instances the progress achieved through innovation is of an incremental nature.

### Projection 2 // Focus ICT: Accelerated, networked, disruptive innovation

Innovation cycles are considerably shorter and investments into R&D have increased significantly. The integration of ICT into products and business processes remains the main focus of innovation. Existing innovation paths are developed further, but at times disruptive concepts open completely new paths and replace existing ones. In fostering the implementation of ICT into business process, the main goal is not only accelerating but also networking processes. Disruptive technologies include, for example, additive manufacturing and the diffusion of cyber-physical systems in production or AI-algorithms for managing 'big data'.

### Projection 3 // Entering a new Kondratieff cycle

Most businesses are continuously increasing their investment in R&D and focus more and more on new and interdisciplinary approaches. Existing innovation paths have often been substituted by these new approaches, which in some instances also involve a paradigm shift towards less materialistic consumption. While ICT remains an important field of development, systemic innovations in the rapidly growing fields of life sciences generate new growth markets, which in turn increase the dynamics of innovation across all sectors.

### Projection 4 // Stagnation of innovation in UK relative to other economies

Investment in innovation has been very small by businesses as well by the government (low r&d funding) since the financial crisis in 2008/9. There has been all the time a tendency to be restrained in taking up innovations and changing modes of production and business models. The businesses are still in 2030 following the motto "it the system works, don't change it" and are relying on business modes with long experiences and being critical on new solutions. Additionally, shareholders are pushing to raise the dividend, hence limiting the scope for R&D spending. At the end, in relative terms UKs competitiveness in terms of innovative business solutions and production modes is falling behind other countries in the West and also in the dynamically developing Asian regions.

## Work environment

|                   |  |
|-------------------|--|
| <b>Definition</b> | Aspects of the work environment regarding work arrangements and modes, the design of workplaces. |
|-------------------|--|

### Dimensions considered in projections:

- Flexible work arrangements
- Level of automation/digitalisation
- Number of co-working offices
- Number of conventional office spaces

### Projection 1 // The flexible and smart workplace (reference case)

The work environment in 2030 is characterised by more flexible, employee-friendly working modes and smart supportive collaboration systems. As a consequence, there is more part-time and project-based employment, as well as a rise in freelancing and home office work offered by an increasing amount of companies (Andre et al., 2013; EC 2012; TUC, 2013). Notwithstanding this increase in flexibility, most work is still done in a traditional office environment, which is providing the necessary cyber-physical-systems which intelligently assist employees in accomplishing their tasks. These systems connect the physical and the cyber world by merging information from embedded systems, smart infrastructures, communication systems (machine-to-machine communication), and human input via the internet (Fraunhofer IAO, 2013). This liaison is enabling better managing of processes and interactions, leading to a significant performance improvement for corporations.

### Projection 2 // The cyber workforce

Work is no longer characterised by space, time, or place constraints, but by the employee's preferences and the tasks he or she has to accomplish. Thus in 2030, conventional office spaces and work schedules have become redundant. The workforce is to a large extent fluid, employment is project-based. Workers may work for different companies from different countries simultaneously, setting their own schedules and workplace preferences. Collaboration is based on specialised communication networks and virtual exchange platforms. Work is supervised and controlled by smart computer systems which operate autonomously and manage tasks and processes and assist and guide employers and employees. In 2030, large manufacturing plants are outclassed by decentralized small-size additive manufacturing. As a result, the manufacturing of goods and products is shifted from central factories to decentralised additive manufacturing stations, creating the demanded products at home, at the customer's site, or at decentralised co-working spaces and labs using 3D printers (Wile, 2013).

### Projection 3 // The individual workplace

In 2030, new decentralised work arrangements emerge as knowledge work, services, and skilled crafts and trades become more and more important. People are increasingly becoming micro-entrepreneurs, working from their home, at co-working spaces or directly at the customer's location rather than in a conventional office space. In addition to white collar workers, craftsmen, manual workers, and service providers are part of this new entrepreneurship using various platforms to offer their skills directly to their customers without the involvement of employers or intermediaries (Wong, 2012). In these work-

places, high-tech diffusion is limited to improved tools, e.g. Google glass helping craftsmen with installation diagrams, etc.

#### **Projection 4 // The stagnating work environment**

The way in which work is structured, where and how it is done, has not changed much. In 2030, traditional office spaces and mass producing production plants are still the common places where work is found, done and organised. In western countries, the retirement of the baby boomer generation and continuous skill shortages demand a traditional, strict or even more time consuming work schedule. In an interconnected world, a much higher value is placed on physical, face-to-face contact between workers during projects, the design of creative products, or the solving of difficult problems. While smart systems support the way in which work is done by enabling new collaboration forms and providing technical assistance, the level of automation is only minor since most of the work is still done by humans.

## Employment contract conditions in the UK

|                   |  |
|-------------------|--|
| <b>Definition</b> | Employment conditions and the extent of employee rights in the UK. With a focus on the balance of power between employers and employees and the extent of employment regulation. |
|-------------------|--|

### Dimensions considered in projections:

- Employment conditions
- Contract types
- Employees rights
- Employment regulation
- Coverage of collective agreements

### Projection 1 // Limited employment regulation benefits employers (reference case)

In 2030, the balance of power between individuals and employers in the UK clearly favours employers (across all sectors). This is particularly evident in the weak position of individuals in contract bargaining (both on an individual and collective basis). There is a noticeable increase in the prevalence of limited project contracts, one example of such, zero-hour contracts, having become significantly more prevalent in recent decades. With limited regulation in place to curtail the use of zero-hour contracts, these contracts are now used by 65 per cent of all UK companies (compared with 27 per cent in 2013; REC, 2013). There is an increasing willingness from employees, both in low and high skilled occupations, to work more hours, or to work below their skill level to remain competitive in the job market. As a result, employers have benefitted from a rise in temporary and flexible working conditions. Further, collective agreements cover a much smaller share of the workforce; with only 20 per cent of all employees covered (compared to 31 per cent in 2013; Lansley and Reed, 2013).

### Projection 2 // Employees hold balance of power (despite limited regulation)

In the years leading to 2030, the position of individuals in contract bargaining strengthened (both individually and collectively) in the UK, despite little increase in the scope of employment regulation. Public and customer awareness for “fair” contract conditions is supporting employee-friendly employment conditions in UK and globally in the supply chains. As a result, by 2030 the balance of power between individuals and employers clearly favours the former – in almost all sectors. The use of temporary contracts within the UK labour market is confined to around 15 per cent, and mainly affects those in low-wage occupations (e.g. restaurant and hotel workers). The majority of employees are instead employed under flexible working contracts tailored to their individual needs, while others have signed onto permanent contracts. As a result of the relatively relaxed job market, there is little employee willingness, especially among highly skilled workers, to work more hours, or to work below their skill level. With the shift in the job market in favour of the employee, collective agreements have also gained in prevalence. Collective agreements emerge as a result of new forms of self-organisation amongst workers, coordinated, in particular, by Generation Y social networking. This self-organisation is a new form of collectivisation different from traditional trade unions.

### Projection 3 // Regulation strengthens employees’ rights

In 2030, strong employment regulation has strengthened employees’ rights and the posi-

tion of individuals in contract bargaining. The balance of power between individuals and employers has been tipped in favour of employees. While a strong rise in limited project contracts is evident, conditions are skewed to suit the needs of individuals. Over recent decades, zero-hour contracts have risen in prevalence amongst highly skilled contractors who pick and choose contracts at will. 35 per cent of all UK companies and 85 per cent of contractors now use these contracts. The increasing degree of regulation that was established around limited project contracts has been, in the most part, of benefit to individuals. With strong employment regulation guarding employees' rights, collective agreements have become increasingly redundant, a mere 20 per cent of employees continue to be covered by collective agreements.

#### **Projection 4 // Employers side-step regulation**

In 2030, despite growing employment regulation, employees' rights and the position of individuals in contract bargaining remains weak. The balance of power between individuals and employers strongly favours employers, particularly large multi-national companies who deploy innovative methods to stay one step ahead of UK employment regulation. There has been a strong rise in limited project contracts that allow companies to re-set contract conditions at will in order to remain out-of-reach of changing employment regulations. Over recent decades, zero-hour contracts have risen in prevalence across all skill level occupations, 70 per cent of all UK companies now use such contracts. The increasing regulation established around limited project contracts has had, for the most part, little effect. As such, collective agreements have also become increasingly redundant; around 25 per cent of employees continue to be covered by collective agreements. There is a clear tendency of a twin-track situation for low and for high skilled individuals. High skilled workers with scarce competences are sitting more in the driving seat with high bargaining power for better contract conditions, while lower skilled workers with broadly available competences have poor bargaining power.

## Workforce mobility

|                   |  |
|-------------------|--|
| <b>Definition</b> | The movement of workers in geographical and occupational terms as well as the possibilities and prospects of employees to build their careers. |
|-------------------|--|

### Dimensions considered in projections:

- Number of mobile employees
- international assignment rates
- job turnover rate
- Level of social mobility

### Projection 1 // The semi-mobile workforce (reference case)

The number of mobile employees has grown and led to a more fluid and diverse workforce in 2030. This development was driven, on the one hand, by employers' needs to deal with economic and market volatility, and on the other hand by a greater desire particularly of medium to high-skilled individuals for autonomy and for gaining a wider array of work experience. Employees have to be and/or are willing to work for an increasing number of employers during their work life, in some instances even switching between different occupations, although switching occupations several times remains uncommon (PwC, 2011). International workforce mobility has grown compared to 2013, in particular because multinational companies and international active SMEs are more frequently assigning their employees to local markets for short-term-projects to combat skills shortages or develop new talent whenever needed (Selko, 2013). However, a large proportion of employees prefer a more 'conservative' secure employment in their home country rather than continuous international migration. On the bottom end of the spectrum, low-to medium skilled workers are facing evermore competition on the employment market. Thus, securing a decent job and moving up the ladder is increasingly difficult (Rogers, 2012).

### Projection 2 // The global workforce

In 2030, the workforce of large corporations and internationally active SMEs consists of highly mobile project teams of diverse employees, moving between different business locations to wherever and whenever their skills are needed. As the baby boomers retire, skilled people are in demand particularly in western countries and globally, enabling individuals to switch between job positions more frequently as well as making it much easier for them to build their careers. Job opportunities in once emerging countries become increasingly attractive to younger generations which are more and more disappointed by limited job opportunities in the UK and other western countries. Further, they are increasingly seeking international experience with a clear mobility trend towards an economically strong Asia. But notwithstanding increased opportunities for taking a job abroad, the great majority of the population prefers to remain in the UK labour market. Inward migration is important especially for high level skilled occupations. Simultaneously, a growing amount of new jobs for low-skilled workers in the developed countries as well as new skill training programs are leading to a somewhat increased upward mobility, but only slightly combating the trend of rising employment polarisation.

### Projection 3 // The virtual workforce

Physical mobility is overtaken by a growth in virtual mobility enabled by new internet-

based collaboration forms that are making international assignments almost obsolete (Emergenetics, 2013; Parr, 2011). Employees enjoy the possibility to work location-independently while being connected in cyberspace to a virtual team whose members are based in geographically diverse locations. Furthermore, it is very common for people to switch occupations frequently during their career as interdisciplinary knowledge is demanded and multi-sector experience is valued. An increasing number of graduates, in what were once emerging countries, changes the skill supply for major corporations and internationally active SMEs. As a consequence, there is no longer the need for talent exchange through international assignments to reduce local skill shortages. Furthermore, novel up-skilling programmes, the creation of new virtual job opportunities as well as the possibility to find work location-independently leads to higher social mobility.

#### **Projection 4 // The static workforce**

Automation and digitalisation have reduced the amount of jobs created for low- and medium-skilled workers as job creation in 2030 is merely taking place at the top, where jobs are handed to a proportionally small social class. Thus, high workforce polarisation makes upward mobility for the low-skilled almost impossible. At the top, highly skilled employees are able to work in virtually connected teams. As a result of these new collaboration forms, the number of international assignments in terms of sending an employee to another country has dropped significantly leading to a rather immobile workforce. Furthermore, the scarcity of new jobs creates very loyal and/or job security-oriented employees evident in the decrease of job changers.

## Access to and forms and modes of education

|                   |  |
|-------------------|--|
| <b>Definition</b> | Skills acquisition and access to further education (including where the responsibility for skills acquisition lies). As well as the range of skills delivery models. |
|-------------------|--|

### Dimensions considered in projections:

- Cost of education
- Acceptance of new forms of learning
- Responsibility for skills acquisition

### Projection 1 // Multiple and accessible skills delivery models (reference case)

In 2030, there are a myriad of avenues for individuals in the UK to undertake further education and training in order to improve their skills profile. However, the high costs associated with many of these educational opportunities limits many prospective learners. Average course costs for full-time higher education in the UK are around £14,000 per academic year (compared with around £10,000 in 2012/13; NUS, 2012). Resultantly, the cost advantages of non-traditional education have led to a large rise in the number of students learning through methods such as peer-to-peer learning and online courses. Around 50 per cent of those participating in tertiary education in the UK do so through online courses (Uvalić-Trumbić, 2011). Technological advancements have contributed to the rise in online learning, assisted by ubiquitous Wi-Fi connections in public spaces. However, the qualifications gained through these non-traditional educational avenues are not yet universally recognised by employers, who are willing to pay a high premium for employees with qualifications from traditional tertiary institutions. Employers are increasingly willing to provide life-long on-the-job skills training to fixed contract employees throughout their employment tenure, due in part to rapidly changing skill requirements in the work place and the employers' acknowledgement of the high value attached to employees with up-to-date skills. Training means are mixed modes delivery models (online, peer-to-peer with mentoring, and traditional "school-class" learning). However, for those individuals who are in temporary employment or are self-employed, skill updating and up-skilling is their own responsibility.

### Projection 2 // Online education trumps other modes

In 2030, online education has permeated almost every household and workplace in the UK. With access to education no longer restricted to those with the sufficient means, free knowledge is readily challenging the survival of cost-based education. The cost advantages of non-traditional education have led to a significant decline in traditional university enrolment numbers and to the closure of a number of universities throughout the UK. Employers are supportive of the shift to non-traditional learning alternatives, as it has resulted in lower costs requirements to up-skill workers, plus it has provided a larger pool of highly skilled individuals from which to employ. Qualifications from non-standard education and training providers are being increasingly recognised as having a premium over out-dated education models. Peer-to-peer driven learning, gamified and experimental approaches are increasingly used to improve skills literacy over an individual's entire work life, both from within and outside of the workforce.

### **Projection 3 // Elite (offline) education**

In 2030, the cost of tertiary education in the UK is amongst the highest in the world, with average course costs for full-time higher education around £18,000 per academic year. Life-long learning is particularly offered by elite-MBA programmes and their alumni activities. Consequently, access to traditional tertiary education is limited to those from higher socio-economic backgrounds. While loans are available, their crippling price deters the majority of prospective students. While non-traditional education alternatives are available, the lack of willingness from employers to recognise such qualifications, among other factors, means they struggle to attract a significant number of students. Employers are increasingly acknowledging that if they want a skilled labour force, they must take responsibility for up-skilling employees themselves. Therefore, high numbers of employers are beginning to offer on-the-job training as well as providing resources for individuals to undertake further education opportunities.

### **Projection 4 // Traditional institutions train the workforce**

In years prior to 2030, government and the education sector made significant efforts to reduce the cost of tertiary education. As a result, the average cost of tertiary education in the UK has dropped from being one of the highest in the world, to being within the OECD average. Average course costs for full-time higher education in the UK are around £5,000 per academic year. The reduction in costs came as the result of the emergence of a new funding base for tertiary education which relies on donations, corporate sponsoring, and other private foundations. Resultantly, access to traditional tertiary education is open to students from a broad range of socio economic backgrounds. While non-traditional further education alternatives are available (such as online and peer-to-peer learning), the cost value curve still largely favours traditional institutions. Individuals take (the largest share of) responsibility for their education and skills literacy.

## Income distribution within UK workforce

|                   |  |
|-------------------|--|
| <b>Definition</b> | Income distribution in the UK in and between occupations, sectors and regions. |
|-------------------|--|

### Dimensions considered in projections:

- Income distribution
- High, medium and low-wage job distribution
- Under-employment rate
- Intra-regional wage ratios
- Inter-regional wage ratios

### Projection 1 // Widening income gap (reference case)

In 2030, the top 0.1 per cent of earners receive 14 per cent of the national income (compared with 5 per cent in 2011; HPC, 2011). The wage gap between the highest and the lowest earners is significant; the highest earners in 2030 earn over 250 times more than those on the average wage (145:1 in 2010, 214:1 in 2020; HPC, 2011). This is in part due to the significant increase in both high- and low-income jobs (with middle-income jobs declining relatively); the per cent of workers in low-wage jobs has reached nearly 30 per cent (21.6 per cent in 2013; CIPD, 2013a). The under-employment rate in 2030 is high at 15 per cent (9.9 per cent in 2012; Bell and Blanchflower, 2013). With high competition in the job market, graduates are willing to settle for lower average wages, less employment protection, and reduced social security provisions. Moderate to high inequality within regions persists: London has the highest wage inequality across all UK regions with an hourly earnings ratio of 20 between the 1st and 99th percentile (compared with 16.2 in 2011; ONS, 2012b). Wales continues to have the lowest wage inequality across all UK regions at a ratio of 8.5 (7.0 in 2011; ONS, 2012c). The two-tier economy becomes more pronounced. There is a noticeable wage inequality between UK regions, Westminster North continues to be the UK's highest earning constituency, with average annual earnings across all occupations being nearly three times those of the UK's lowest earning constituencies (compared with twice those of the lowest in 2011; ONS, 2011b).

### Projection 2 // Income stratification

Income distribution in 2030 is acutely disparate, the top 0.1 per cent of earners receive over 20 per cent of the national income. The wage gap between the highest and the lowest earners is severe; top tier earners receive around 300 times more than those on the average wage. There has been a considerable increase in the quantity of both high and low income jobs; approximately 20 per cent of workers are employed in high wage jobs in the UK, while around 35 per cent are employed in low wage jobs. Further, the under-employment rate is over 20 per cent due mainly to severe competition within the job market. Inequality within all UK regions is evident, London continues to have the highest wage inequality across all UK regions, with an hourly earnings ratio of 25 between the 99th and 1st percentile. Wales' hourly earnings ratio of 15, although the lowest across all UK regions, is the highest it has been in recent decades. Inter-regional wage inequality is significant, the average annual earnings across all occupations in the UK's highest earning constituency (Westminster North) is close to four times those of the lowest earning constituencies. Income inequality is a driver for inter-regional inequality, which has become entrenched. The two-tier economy has become a major barrier for upward social mobility.

### **Projection 3 // Inequality restraints**

Income inequality in the UK in 2030 is less severe than previously envisioned. The top 0.1 per cent of earners receive 10 per cent of the national income, with the highest earners receiving around 200 times more than those on the average wage. There has been no major shift in the share of high-, medium and low-income jobs; the percentage of workers in low-wage jobs is steady at around 25 per cent. With high competition in the job market the under-employment rate remains high at 15 per cent. Inequality within regions persists: London, with the highest wage inequality across all regions, has an hourly earnings ratio of 20 between the 99th and 1st percentile. At the lowest end, the wage inequality ratio in Wales is around 7.5. Wage inequality between UK regions is evident; the UK's highest earning constituency (Westminster North) receives twice the average annual earnings as those of the UK's lowest earning constituencies.

## Employees' values

|                   |  |
|-------------------|--|
| <b>Definition</b> | The demands and desires of employees' from their workplace and their implications. |
|-------------------|--|

### Dimensions considered in projections:

- Number of flexible work arrangements
- Number of corporations with CSR focus
- Generational structure of the workforce
- Sustainability and global awareness trends

### Projection 1 // New values vs. old values (reference scenario)

In 2030, the demands of employees have changed as people place more value on work-life balance, autonomy and a corporate social responsibility. This development is propelled by an increased share of women in the workplace which has resulted in more family-friendly work policies, by lower numbers of new workers entering the labour market which has led to more employee focused measures and ultimately by growing global and sustainability awareness among younger generations which has caused corporations to expand their corporate social responsibility image (Gregory et al., 2011; Adachi et al., 2013; PwC, 2013b). Despite these developments, the majority of the workforce still considers a secure employment status with an adequate salary as a top priority when searching for an employer. Thus, most corporations are still offering traditional incentives, such as high pay and a secure job position.

### Projection 2 // Struggle for survival

A decline in job creation has led to higher competition between workers on the job market. The decreased job opportunities changed the demands and values of employees substantially. Hence, trends of new employees' values such as autonomy, flexibility and sustainable responsibility have been undermined as people are evermore struggling to find a secure employment. Corporations are therefore able to construct job positions according to their own needs.

### Projection 3 // Shaped by Generation Y

By 2030, the rise of Generation Y, which now make up almost 60 per cent of the working population in the UK, has changed the world of work. The values of this generation differ from values of older generations in that they prefer personal learning and development opportunities as well as flexible working hours to financial rewards. As they are dominating the talent pool, employers face the difficulty to comply with the new demands of the workforce to create a workplace in which work-life balance, low hierarchies, career progression and a sustainable corporate culture are realised (PwC, 2011).

### **“Givens”:** Included factors without variance in the scenarios

In addition to those listed above, there are further factors that have a high impact on the development of UK jobs and skills until 2030, but have a low uncertainty, i.e. their future projection is assumed to be rather clear and the variation of the factor is low.

Therefore, these so-called “givens” are respected in the scenario process but they are not included in the scenario construction, as they do not have alternative projections.

The givens are:

- **Globalisation of business activities:** Globalisation has opened up major growth opportunities for international business. International business activities and integration are likely to continue to grow. Therefore, key sectors of the UK economy, which are already highly integrated into the global economy, are likely to have an even stronger international orientation.
- **Age structure of the workforce:** Demographic developments can be forecast relatively reliably. Thus, excluding possible wild card events, the age structure of the workforce in 2030 can be forecast with comparative accuracy.
- **Specialisation of work, division of labour:** The knowledge society is producing ever more complex and specialised knowledge across all fields of study and research. Specialisation and division of labour can be expected to expand, not only in white collar jobs but with further dissemination of digitisation and automation technology in manufacturing and crafts and trades
- **Digital infrastructure (internet):** Based on the dynamic of innovation and investment in the ICT sector, it seems reasonable to posit that the digital infrastructure, the data connections, will be increasingly improved in bandwidth and performance, particularly in agglomerations.
- **Digitalisation and big data opportunities:** The digitalisation of all processes in work and daily life will continue. The data thus generated will be increasingly stored and evaluated. This will also open the doors for changes in business models.
- **Climate conditions:** Until 2030, impacts of climate change will remain limited, however, the general message remains: the number of extreme events will increase (droughts, floods and storms). As a result of this, governments in Europe (and elsewhere) will retain a focus on climate change mitigation and adaptation measures.
- **Resource availability:** The global resource base will come under further pressure, leading to increasing and more volatile resource prices on the global market.

# Appendix E: Set of raw scenarios and their projections

Figure E.1: Set of raw scenarios and their projections

|   |  |  |  |  |
|---|--|--|--|--|
| <b>Condition of Global Trade</b>                  | Between Tension and Cooperation                  | Continuing Liberalisation                                    | A more National Perspective              | Sluggish Global Trade                                      |
| <b>Economic Condition of the UK</b>               | Shaky Recovery, New Foothold for Growth          | Sturdy Recovery, Robust Growth                               | Prolonged Crisis, Threat of Stagnation   | Economic Vicious Cycle                                     |
| <b>Structure of the UK Economy</b>                | Maintaining the Balance                          | Slow Re-industrialisation                                    | Financial Sector Blues                   |  |
| <b>Public Funding for Skills Delivery</b>         | Reduced Funding and Priority for Skills Delivery | Focus on Skills Delivery, Despite Funding Restrictions       | Priority for Skills Delivery             | Market-Driven Education and Employment Conditions          |
| <b>Employment and Promotion Measures</b>          | Austerity Driven Restraint                       | Focus on Social Markets and Healthcare                       | Focus on High-Tech Industries            |  |
| <b>Uptake of Innovation in UK Businesses</b>      | Accelerated Incremental Innovation               | Focus ICT: Accelerated, Networked, Disruptive Innovation     | Entering a New Kondratieff Cycle         | Stagnation of Innovation in UK Relative to Other Economies |
| <b>Work Environment</b>                           | The Flexible and Smart Workplace                 | The Cyber Workplace  | The Individual Workplace                 | The Stagnating Work Environment                            |
| <b>Employment Contract Conditions in the UK</b>   | Limited Employment Regulation Benefits Employers | Employees hold Balance of Power (Despite Limited Regulation) | Regulation Strengthens Employees' Rights | Employers Side-Step Regulation                             |
| <b>Workforce Mobility</b>                         | The Semi-Mobile Workforce                        | The Global Workforce   | The Virtual Workforce                    | The Static Workforce                                       |
| <b>Access to and Forms and Modes of Education</b> | Multiple and Accessible Skills Delivery Models   | Online Education Trumps                                      | Elite (Offline) Education                | Traditional Institutions Train the Workforce               |
| <b>Income Distribution within UK Workforce</b>    | Widening Income Gap                              | Income Stratification  | Inequality Restraints                    |  |
| <b>Employees' Values</b>                          | New Values vs. Old Values                        | Struggle for Survival  | Shaped by Generation Y                   |  |

**Legend**

- Scenario "Forced Flexibility"
- Scenario "The Great Divide"
- Scenario "Skills Activism"
- Scenario "Innovation Adaptation"

## **Appendix F: Full trend and disruption report**

This appendix is presented in a separate document, available:

[www.ukces.org.uk/thefutureofwork](http://www.ukces.org.uk/thefutureofwork)

It includes supporting data, more insights of implications on jobs and skills as well as a list of underlying drivers.

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