The Future of Work

Jobs and Skills in 2030

punkt
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Foreword

»This study presents an authoritative assessment of future challenges and opportunities in the labour market and the implications for jobs and skills.«

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

1/Introduction

»Our aim is not to predict a specific future, rather to influence and challenge thinking in a constructive, creative way.«

It is not possible to predict the future. Twenty years ago, there was a 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 over-take desktop to access the Internet, and work and leisure hours have become blurred by our increasingly 'mobile' lives. Jobs are being done on the move, at any time of day, in almost any location.

This example highlights the difficulties involved in fore-casting change and the need to take a modest and cautious attitude when communicating the results of such an exer-cise.

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.

This study looks ahead to the labour market of 2030. It analyses stable trends that are already shaping the future of UK jobs and skills, and identifies the plausible 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.

At the UK Commission for Employment and Skills, our mission is to transform approaches to skills investment to drive enterprise, jobs and growth. 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.

The global labour market in 2030 is likely to be highly competitive. New attitudes and behaviours will be needed by individuals and businesses founded on flexibility, resilience, collaboration, entrepreneurism and creativity. Above all, the ability to respond to continuous change will be critical.

This report is a resource for anyone with an interest in the longer-term future of the labour market. It has been developed for:

- individuals considering their career prospects and skills investment decisions;
- businesses looking to attract and develop talent as a key resource for competitiveness;
- education and training providers aiming to meet future learning market needs; and
- policy makers seeking to address market failures, build on strengths and maximise benefits for wider society.

This report presents the key findings of our research but further and more in depth information, including information by sector and detailed projections of UK employment, labour supply and skills, is also available: www.ukces.org.uk/thefutureofwork

"We have to recognise the flow of the tide. The labour market is agile – people can travel more easily. Rather than trying to fight against the flow, how can we embrace it?"
(UK senior business leader)

What trends shape the future of work?
If current trends run a steady path, in 2030 the UK workforce will be multi-generational, older, and more international, with women playing a stronger role. While the highly skilled will push for a better work-life balance, many others will experience increasing insecurity of employment and income. As businesses shrink their workforces to a minimum using flexibly employed external service providers to cover shortfalls, a much smaller group of employees will be able to enjoy long-term contracts.

"The idea of a single education, followed by a single career, finishing with a single pension is over"
(UK policy maker)

Information technology will pervade work environments everywhere. Technologies and disciplines will converge, giving rise to important innovations. Jobs and organisations will become increasingly fluid as people move from project to project.

"Artificial intelligence could make analytical jobs obsolete"
(Education and training provider)

Yet this proliferation of technology and our increased global interconnectedness will also make societies and business processes more vulnerable. Within this context, companies will be forced to make their business models more resilient.

"Companies with a global foot print will move jobs, opportunities and investment to the right areas for their organisation"
(UK senior business leader)

It is likely that deficit reduction will continue, providing less fiscal scope for political action. Demand for raw materials and natural resources will be even higher as the global gross domestic product (GDP) grows, threatening resource bottlenecks and shortages.

"Resource shortages could be a key driver for business innovation, British universities are strong assets"
(UK senior business leader)

What could the world of work in the UK look like in 2030? – The four scenarios
This study explored four different development paths, or scenarios, for the UK labour market leading to 2030.

'Business as usual' versus disruptions

The first scenario outlines how a 'business-as-usual' (BAU) 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.

"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)

What could the UK's future of work look like in alternative scenarios?

1. Forced Flexibility (BAU)
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 rigorous implementation of ICT solutions.

2/Study methodology

Our 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.

The chart summarises the research process. More information is available in the full report: www.ukces.org.uk/thefutureofwork

Exploring the evidence base

- Systematic literature analysis of more than 300 publications related to the future of jobs and skills, additional desk research and 23 interviews with senior UK and international figures.
- Production of a 360° view by looking at societal, technological, economic, ecological and political factors.
- A 'zooming in' from global and overarching developments to UK-specific and jobs and skills-related issues.

Mapping trends and disruptions

- Identification of 13 most important trends driving and defining the future of UK jobs and skills.
- Analysis of the major disruptions that might challenge future jobs and skills, marking a more radical departure from the main trends.

Analysing key drivers

- Analysis of central and common drivers underlying the trends and disruptions, to identify 12 key factors with decisive influence.
- Development of three to four projections of alternative future developments for each key factor.
- Refinement of the key factors and their projections in a workshop with internal experts from UKCES.

Analysis and scenario selection

- Assessment of the "match" between all projections with a software-supported consistency analysis, resulting in a list of possible combinations of projections (the raw scenarios).
- Selection of a set of four scenarios of the future of jobs and skills in 2030, consisting of a reference or business-as-usual scenario and three scenarios featuring disruptive developments.

Four scenarios of future jobs and skills

- Enrichment of the four scenarios and development of their narratives.

1. Forced Flexibility

2. The Great Divide

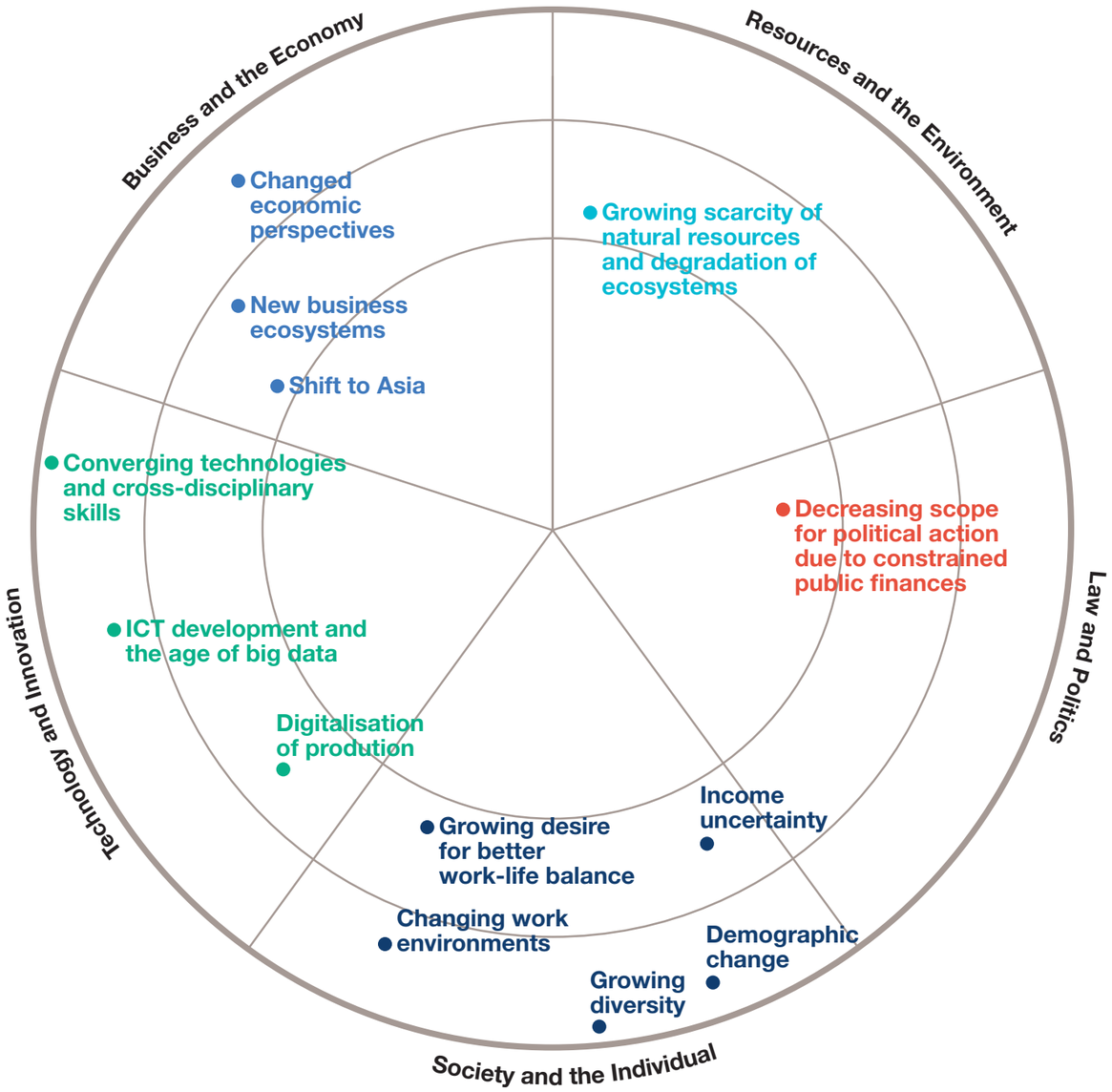
3. Skills Activism

4. Innovation Adaptation

Implications and action needs

- Strategic implications derived from each scenario (overall and by sector and stakeholder group).
- Testing and enrichment of implications at an expert conference with 34 UK high-level contributors representing different stakeholder groups (employers, trade unions, education and training providers, policy makers).
- Identification of potential actions to prepare for tomorrow's world of work.

3/Trends shaping the future of UK jobs and skills up to 2030



As a rule trends follow a clear and robust course. A 360° view; looking at societal, technological, economic, ecological and political factors identified the 13 most influential and plausible trends impacting the jobs and skills landscape in the UK to 2030.

These were selected from an initial longer list which included trends deemed to have less potential for 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.

Demographic change

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. The population aged 65 and over is projected to increase by 42 per cent in the period to 2030, whilst the population aged 16-64 is expected to grow by only three per cent[2]. Over the next decade the number of economically active people aged 65 and over is projected to increase by one third[3]. Workplaces will become more multi-generational, with four generations working together. From a spatial perspective, London's relatively young population is growing much faster than other parts of the UK and is expected to become the UK's first megacity (population of 10m+) in around 2025[4].

Growing diversity

The role of women in the UK labour market will continue to grow in scale and importance. Projections suggest that over the next decade women will take two thirds of net growth in higher-skilled jobs[5]. Rising global mobility of workers and new technologies are bringing together different and sometimes conflicting cultures, religions, races and languages. At the same time, the UK's national and ethnic make-up is changing and a regional distinction is clearly visible. Today in London, 26 per cent of those in employment are non-UK nationals, compared to the average across the UK of nine per cent[6]. It is projected that international migration will make a 10 per cent net contribution to population growth in London over the next decade[7].

Income uncertainty

Households in the UK face growing income uncertainty. The economic crisis led to a marked decline in real wages but there is evidence that the pay of low and middle earners was stagnating prior to this during years of economic growth. Between 2003 and 2008 wages for the bottom half of earners were flat whilst at the same time the UK economy grew by 11 per cent[8]. According to some forecasts, real wages are not expected to return to their peak level (2009) until the next decade[9]. The path to 2030 is likely to see a further real-terms reduction of household incomes whilst inequality between households and regions in the UK becomes more marked. If recent UK trends continue, the proportion of national income accounted for by the highest 0.1 per cent of earners will increase from 5 per cent to 14 per cent by 2030[10].

Growing desire for a better work-life balance

Faced with growing complexity and performance pressures in the work environment, individuals are increasingly seeking a more suitable balance and better boundaries between the requirements of work and private life. A majority (57 per cent) of employees say that the availability of flexible working in their workplace is important to them; this proportion is growing over time and is significantly higher for particular groups including parents, workers with caring responsibilities and the highly qualified[11]. Generation Y (people born between 1980 and 2000 and have grown up almost entirely in the digital age) will further drive this trend, with 92 per cent identifying flexibility as a top priority when selecting a workplace[12].

Changing work environments

Businesses are increasingly able to create and disband corporate divisions rapidly, as they shift tasks between slimmed-down pools of long-term core employees, international colleagues and outsourced external service providers. In 2013, 67 per cent of employees worldwide were working in more actively collaborative ways, while 57 per cent reported an increase in their number of co-workers who work from different geographical locations[13]. Jobs and organisations are becoming increasingly flexible in response to the shift towards a 24 hour society. 50 per cent of businesses say that flexible working (including flexible hours and offsite working) is now standard practice[14].

Converging technologies and cross-disciplinary skills

The boundaries between disciplines, such as natural sciences and informatics, are becoming increasingly blurred. As disciplines converge, so do the technologies. For instance, an industrial robot is an example of a mechatronics system in which principles of mechanics, electronics and computing are combined. The convergence of technologies can disrupt existing business models, but also creates completely new markets and novel application fields. This trend is particularly important to the UK with its strong dependence on sectors like the life sciences. Bioinformatics is an example of a rapidly growing inter-disciplinary scientific field that derives knowledge from computer analysis of biological data, using techniques and concepts drawn from informatics, statistics, mathematics, chemistry, biochemistry, physics, and linguistics. The global market for its products and services is forecast to see double-digit annual rates of growth[15].

Digitalisation of production

As digitalisation becomes pervasive in production, autonomous, decentralised and local production systems and factories are within reach, ushering in a new era of industrialisation. Tests of 3D-printed rocket parts at the National Aeronautics and Space Administration (NASA) have shown them to be as durable as those manufactured using traditional methods, but 70 per cent cheaper to produce[16]. In the UK, near-shoring and decentralised production could lead to employment increases in manufacturing of between 100,000 and 200,000 workers by 2023[17].

Information and Communications Technology (ICT) development and the age of big data

The development of ICT continues to be characterised by performance increases, miniaturisation and nanotechnology. The amount of data generated by the digital economy is growing rapidly. Analysing this data offers tremendous potential for efficiency gains and new business models and opportunities. By 2017, it is projected that the annual amount of data traversing global networks will exceed total accumulated data from 1984 to 2012[18].

Changed economic perspectives

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. For example, the ongoing restructuring of the Chinese economy has the potential to impact significantly on the activities of UK business[19]. This is demonstrated by volatility in the prices of commodities, which has been amplified by globalisation. Over the past 20 years the frequency and magnitude of extreme price changes have increased, with natural gas, for example seeing average annual price volatility of 68 per cent[20]. In this context companies have to make their activities and value chains more resilient to cope with uncertainty.

Shift to Asia

Economic power is shifting towards emerging countries. China has quintupled its number of graduates and doubled its number of higher education institutions in the last decade[21]. If current trends continue, within the next decade China and India will account for 40 per cent of all young people with a degree in G20 and OECD countries, while the United States and European Union countries will account for just over a quarter[22]. With Asia projected to account for about 60 per cent of global middle-class consumption in 2030, the continent promises high growth and profitable investment opportunities along with a strong and growing workforce[23]. This may mean further off-shoring and outsourcing of jobs for the UK. It will certainly mean more intense international competition for its businesses.

New business ecosystems

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. For example, in 2010, Procter and Gamble sourced more than 50 per cent of innovation externally via its open innovation programme "Connect + Develop", compared to less than 10 per cent in 2001[24]. About 40 per cent of global CEOs expect the majority of innovation in the future to be co-developed with partners outside the organisation[25].

Growing scarcity of natural resources and degradation of ecosystems

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. About 30 per cent of ecosystem services are currently declining and many others are in a reduced or degraded state. Business-as-usual will unequivocally lead to further decline and degradation[26].

Decreasing scope for political action due to constrained public finances

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. For example, according to projections, there will be an additional 5½ million elderly people in 20 years time, equivalent to an increased cost of £50bn per year in pensions and benefits[27].

You can find more details and evidence on the trends at www.ukces.org.uk/thefutureofwork

The trends above are considered to be relatively stable until 2030, describing a continuation of present events. With these trends as its basis, the following section sets out a 'business-as-usual' scenario.

4/The business-as-usual scenario

Forced Flexibility

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.

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.

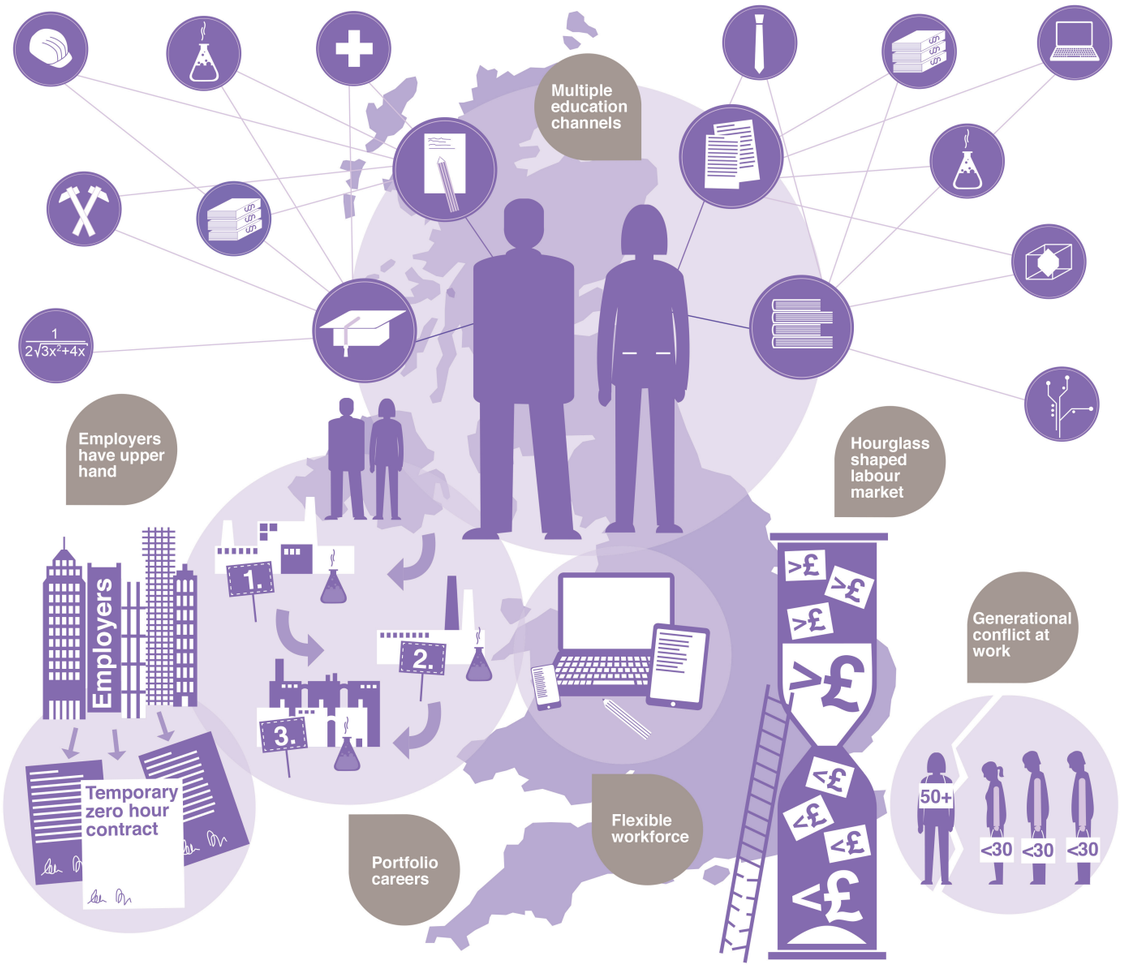
Employees find themselves in an hourglass-shaped labour market. For highly skilled individuals, a progressive work environment allows for greater autonomy and a better balancing of work and family life. While the "squeezed middle" of the workforce sees jobs disappearing, low-skilled workers compete ferociously 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.

Selected key implications of scenario:

- **Increasing agility and hybridisation of skills:** Increasing movement between careers and across sectors stimulates the hybridisation of skills. Portfolio careers, whereby people combine several different paid activities at the same time, become mainstream. Personal agility, such as the ability to adapt to or embrace change and acquire new skills and competencies, becomes more important. This focus on flexibility could lead to trade-offs such as insufficient time for personal development – potentially undermining productivity.
- **Entrepreneurism as a lifestyle:** The desire for more flexibility is not confined to business. Demographic factors, family care responsibilities, and a search for a better work life balance increase individual demands for more flexibility. Individuals pursue "micropreneurial" approaches that offer earnings potential, often alongside more conventional modes of employment.
- **Demand for 'core' business skills:** With the growth in collaborative business models and increasing project-based employment, fundamental business skills are needed more widely among individuals (such as organising, marketing, contract negotiation, and project management). Among businesses, there is an increased requirement for the ability to manage across networks and manage risk in volatile markets.



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 reach customers.

Fashination – The Future of Showrooming

Katie – Independent Fashion Blogger

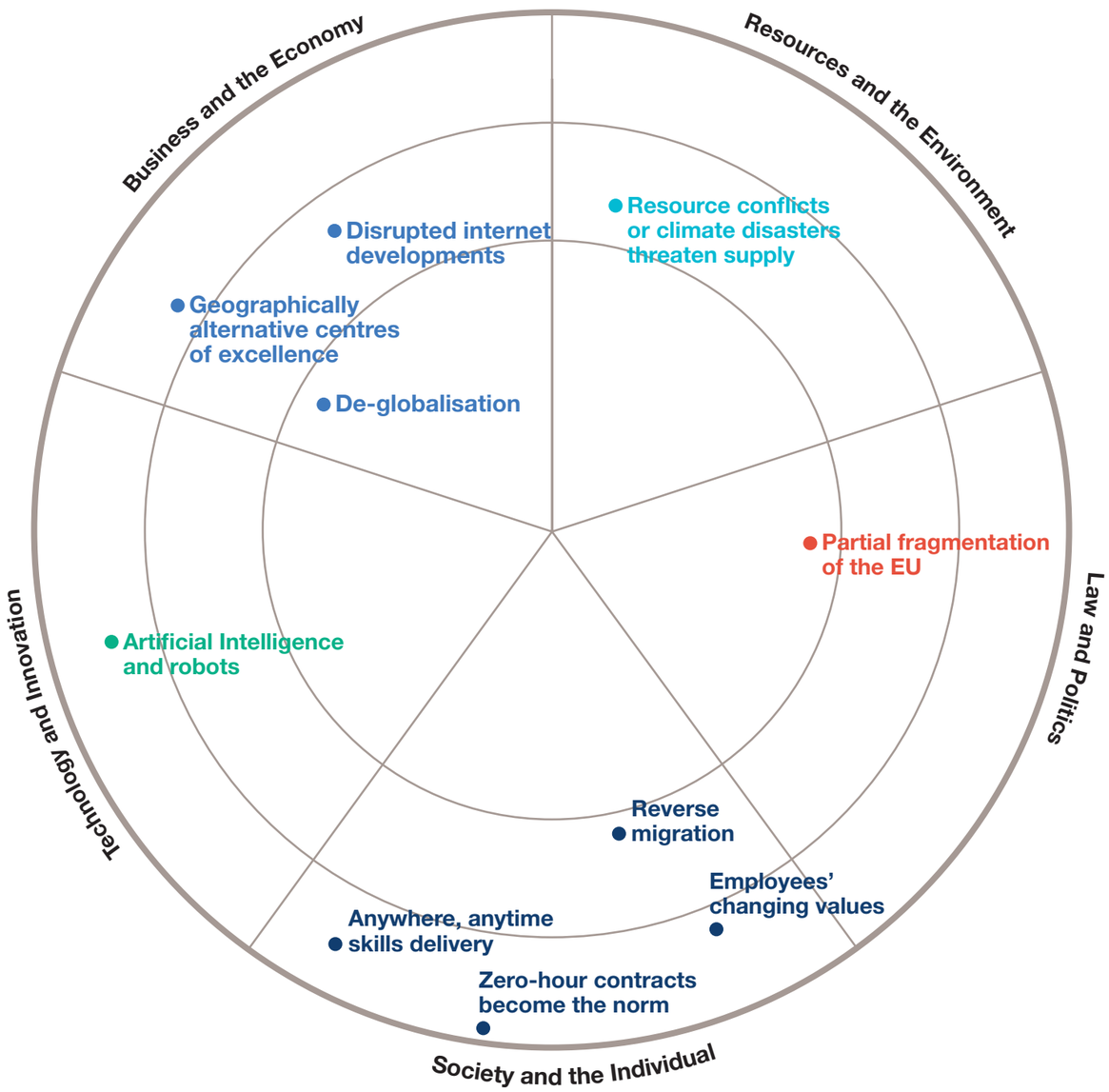
If you are strolling through London's Covent Garden during your next shopping spree, don't forget to check out *Fashination* near Newburgh Street. I found this stylish store accidentally and have since fallen in love with its boutiquey, yet futuristic character. The store manages to seamlessly combine the very personal experience of a small vintage showroom with state-of-the-art technologies like touch-screen walls, integrated augmented reality, quick try-on mirrors and convenient e-cloud buying systems.

At the entrance, sensors will scan your body and outfit and check for all your openly available data in order to create your personal profile. Alternatively, the retail assistants, equipped with bionic contact lenses, will use your profile data to recommend outfits. It's like having your own personal fashion guru, who knows you inside out!

Most of the retail assistants have their own fashion blogs and podcasts. *Fashination* offers a discounted customer loyalty programme which will not only give you the latest updates on new fashion trends and special offers, but also lets you create a more detailed profile to tailor the fashion recommendations you get.

For more information on how jobs and skills in the retail sector might change in the future: www.ukces.org.uk/thefutureofwork

5/Disruptions that could radically change the future of work



Long-term processes of change, including the 13 trends identified, are always at the mercy of uncertainties. Our outlook on the future has to account for possible disruptive developments, and sharp deviations from the path of 'business-as-usual'.

Ten key disruptions have been chosen on the basis of their conceptual plausibility to the UK context in 2030, and judgement of the severity of their impact on jobs and skills if they were to occur.

These 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[28].

The following questions aid us in imagining the potential of these disruptions to alter the future UK jobs and skills landscape:

Reverse migration
If low economic growth rates, or a job market with low prospects and high entry barriers, caused a reversal in traditional migration patterns, what would a net outflow of migrants from the UK mean for the UK labour market?

Employees' changing values
Making up almost 60 per cent of the working population in the UK in 2030, could the focus of Generation Y on increased flexibility and corporate social responsibility force organisational cultures to adapt their values and policies?

Zero-hour contracts become the norm
What if employers had the upper hand in structuring contractual conditions to meet their specific needs? If zero-hour contracts, and similar flexible arrangements, became the norm, what would the labour market of 2030 look like?

Anywhere, anytime skills delivery
As the rise of online educational opportunities, open universities and peer-to-peer learning are leading to new models of skills delivery, what if by 2030, traditional models of education were largely replaced by micro learning, gamified and experiential approaches?

Artificial Intelligence and robots
As robotics, smart algorithms and Artificial Intelligence are increasingly automating processes and services, including those that are currently the sole domains of highly paid experts, what would a radical automation of professional tasks mean for the UK labour market in 2030?

De-globalisation
If governments continued to protect their industries and increased the obstacles to free trade, what would reduced international cooperation and trade mean for the UK economy in 2030?

Geographically alternative centres of excellence
As emerging countries develop the infrastructure, supportive regulation and labour markets necessary to push them to the next level of development, what if, for example, the UK's financial sector relocated to Hong Kong?

Disrupted internet developments
If incidents of cyber crime continue to rise and corporatisation and privacy issues dominate the online space, what will be the major challenges facing UK companies in 2030?

Resource conflicts or climate disasters threaten supply
If disputes between countries and organisations surrounding the use of strategic resources arise, will the UK be well positioned to manage such situations?

Partial fragmentation of the EU
Should the UK leave the European Union, what would be the impact of a core Eurozone single market plus a detached UK on the future of UK jobs and skills?

Examples of past disruptive developments

- **Derivatives:** a derivative is a financial tool used in the banking sector. Derivatives were designed in the 1970s for speculative purposes, and as a way to manage risk and maximise profits. Their overuse contributed to the 2008/09 global financial crisis, heightening and concentrating risk and lessening transparency. The implications continue to negatively affect economies, societies and markets worldwide.
- **M-Pesa:** when Safaricom, the leading mobile-network operator in Kenya, launched M-Pesa in 2007, a service that enabled mobile phone owners to conveniently send and receive money through their phones, it completely transformed the Kenyan economy. The low-cost service spread rapidly across the country, allowing virtual banking and micro financing in a country where a large proportion of the population didn't have a bank account. Today, M-Pesa is the most successful mobile phone based financial service system in the developing world. It is expanding across Africa and into other markets such as India, creating business and employment opportunities in M-Pesa shops, and through the increased circulation of money within local areas.

A more detailed discussion of these questions can be found at: www.ukces.org.uk/thefutureofwork

These disruptions informed the development of three alternative 'disruptive' scenarios, each providing a possible picture of the future of jobs and skills in the UK in 2030:

- **The Great Divide:** informed by 'employees' changing values' and 'zero-hour contracts become the norm';
- **Skills Activism:** informed by 'artificial intelligence and robots' and 'anywhere, anytime skills delivery';
- **Innovation Adaptation:** informed by 'geographically alternative centres of excellence,' 'reverse migration' and 'anywhere, anytime skills delivery'.

The choice of the three disruptive scenarios was based on the study's literature review, insights from expert interviews and analysis of the central and common drivers underlying the trends and disruptions.

All scenarios have commonalities as some future developments are relatively certain. In all scenarios:

- the globalisation of business activities remains a key feature but varies in intensity;
- older workers are more prominent in the labour force;
- digitalisation is more pervasive in work and everyday life;
- climate change leads to an increase in extreme events like droughts, floods and storms and;
- the rising global demand on resources leads to volatility in prices.

The following table sets out the basis for each of the three 'disruptive' scenarios and provides a comparison with the business-as-usual scenario.

Summary of scenarios

	Scenario One: **Forced Flexibility**	Scenario Two: **The Great Divide**	Scenario Three: **Skills Activism**	Scenario Four: **Innovation Adaptation**
Economic conditions	Moderate economic growth in the 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
Social conditions	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 inequality as financial sector struggles to compete internationally
Labour market context	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
Policy context	Easing of employment regulation and focus on job quantity rather than quality. Reduced public funding available for training and skills due to fiscal constraints	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
Uptake of innovation	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
Education and training context	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

6/What if …? Disruptive scenarios of future jobs and skills in the UK

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.

Selected key implications of scenario:

- **Basic skills for innovation:** Knowledge in life sciences, ICT, cognitive and nano technology drive product development across all sectors. Thus, basic skills in these fields are also necessary for dealing and handling related products. For example, personalised medicine that is based on genetics enters into mainstream medical treatment. This increases demand for adequate skill sets in the areas of prevention, diagnosis and treatment. For instance, how will a physician explain to his or her patients the implications of their genetic make-up? How will a physical therapist use this knowledge in his or her work?
- **Converging technologies and disciplines:** On the research and product development side, innovation happens faster and requires more collaboration. The ability to collaborate in multi-disciplinary, multi-national teams is crucial in taking advantage of business opportunities that emerge from converging technologies. This puts a premium on 'network orchestration' skills that combine a sufficient knowledge of different technology areas with consortium building and coordination. This is likely to provide the greatest benefit to particular geographical areas with hotspots in London and the South East of England.

Illustrative Vignette: Potential future for construction

This scenario envisages a construction sector in which advances in material sciences have reshaped products and increased demand for those skilled in the installation, retrofitting and management of sustainable technologies.

Building for the Future. High-tech skills in the construction sector

Jamie Warren is studying Construction Technologies and Management at Broadway College. Even though he has already worked in the construction industry for several years, 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 in the college's courses. Jamie emphasised how important 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".

For more information on how jobs and skills in the construction sector might change in the future: www.ukces.org.uk/thefutureofwork

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.

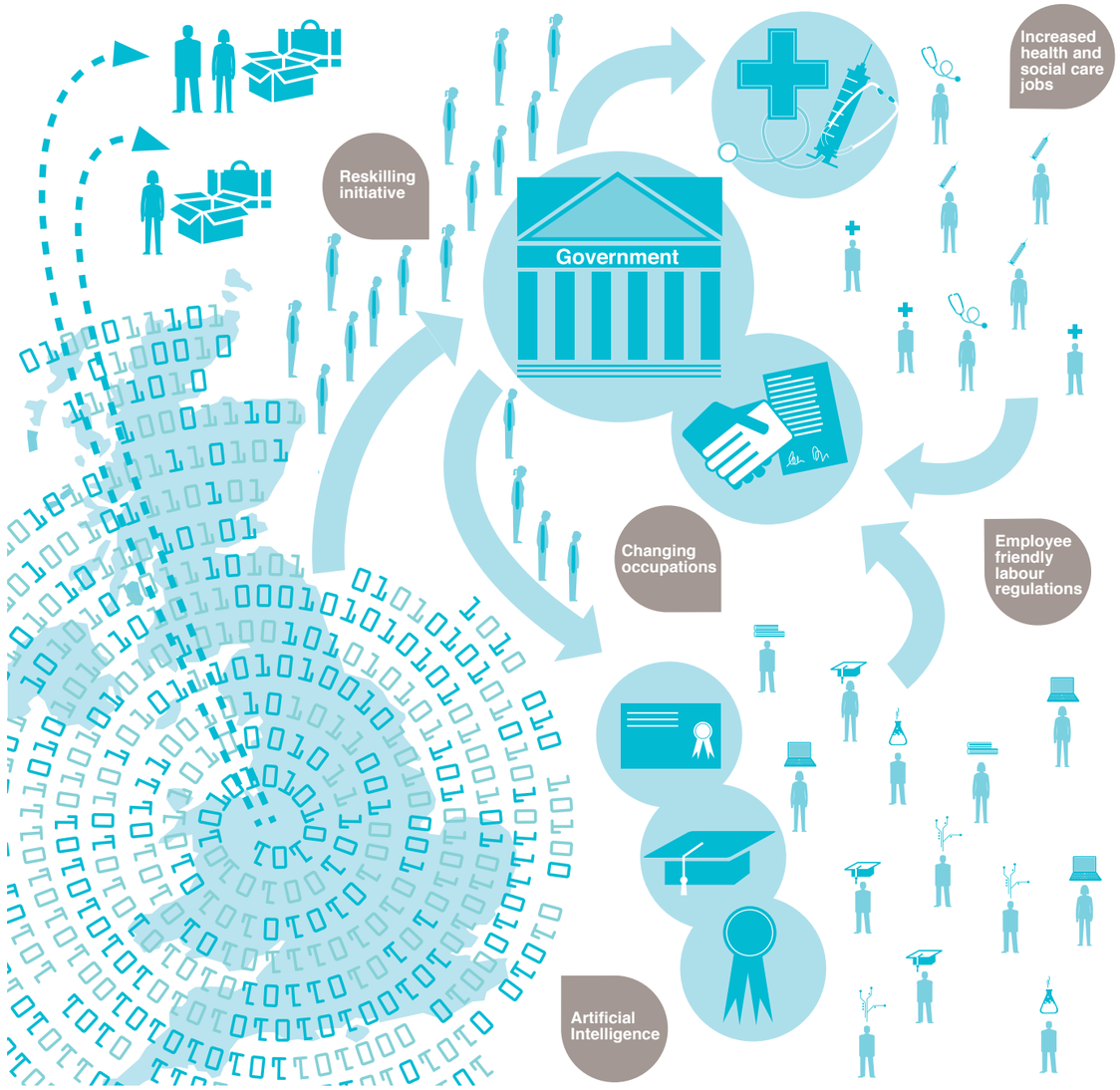
Employees face long periods of unemployment, in particular those professionals made redundant by IT automation. Work is mainly project-based, with a high turnover of jobs, which can make the development of new skills more challenging.

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 high 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.

Selected key implications of scenario:

- **Technical validation skills are key:** The ICT-driven wave of automation is felt across all sectors. But who designs and who controls the artificial intelligence and its decisions? Thus, occupational and professional skills are re-combined with technological literacy. New jobs arise in the field of checking and validating automated systems (although not in sufficient numbers to offset fully the jobs lost through automation).
- **Rise of the 'cyber-doc':** In healthcare, technical innovations allow for increasing automation of diagnosis. Being able to use increasingly complex electronic and digital medical equipment becomes a central requirement for medical staff. This includes guiding patients through self-applied diagnosis and treatment.
- **Growth of the smart factory:** In manufacturing, the digitalisation of production allows the construction of the smart factory. Imagine semi-autonomous robots using 3D-printers, for example! This increases the demand for high and medium-skilled technicians and engineers.



Illustrative Vignette: Potential future of professional services

The scenario envisages massive upheaval in the labour market for white collar workers as smart algorithms replace high-skilled work processes carried out by professionals.

Meta-Accountability Quality Assurance by MGPC, Global Professional Services Firm

MGPC is a Global Professional Services firm that has developed a strong team of Meta-Accountability and Quality Assurance professionals to manage the introduction of smart algorithms and technologies. MGPC has recently unveiled its new SUPERSMART System, which offers automated accounting services for companies and individuals. The pilot took place in Europe, the Middle East and Africa. Algo-Audit Qualified Practitioners are responsible for verification of the integrity of the automated processes. Following a successful pilot, the company will roll out the SUPERSMART System to the rest of the world. They intend to put 2,500 of their skilled staff through the programme to become Al-go-Audit Qualified Practitioners.

For more information on how jobs and skills in the professional and business services sector might change in the future: www.ukces.org.uk/thefutureofwork

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.

Selected key implications of scenario:

- **Increasing virtual workforces:** Advancements in ICT allow for jobs to be increasingly virtual, carried out remotely. Thus, the main task of company employees is in orchestrating this huge network of freelancers and short-term employees. Freelancers need to continuously invest in maintaining a distinctive and up-to-date skill set to compete in the job market.
- **Online education revolutionises the education sector:** Education is significantly different in 2030. The number of traditional jobs in higher education, especially lecturers, is decreasing substantially, as online education platforms allow one tutor to deliver skills to a much larger audience. But the surge in online learning and skills acquisition also leads to demand for specialised examiners and tutors, as well as programmers and "edutainment" developers that create bite-sized training apps and virtual learning environments. Skills assessment becomes especially important, as choosing the optimal pathway becomes critical to maximising return on investment.

Illustrative Vignette: Potential future of education and training

The scenario anticipates education and training becoming increasingly delivered via online platforms as customers seek flexible and relevant solutions that offer value for money. This shift makes 'bricks and mortar' provision largely surplus to requirements.

Alternative Futures with INTUS

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

With more than 120 multidisciplinary courses, such as mechatronics, over 500 industry leaders available 24/7, expert tuition, and award winning online training modules, INTUS offers qualifications* that 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.

For more information on how education and training may change in the future: www.ukces.org.uk/thefutureofwork

7/Key messages

»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.«

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 (4G) 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 4G 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)

8/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.

9/What next?

The information included in this report is underpinned by indepth research that includes implications by different sectors and detailed projections of UK employment, labour supply and skills. This is available at: www.ukces.org.uk/thefutureofwork

When thinking about the issues raised by this study, you may also wish to explore the resources provided by the UK Commission: http://www.ukces.org.uk/ourwork

Relevant organisations for further information

If the study's results have started you thinking about the way in which your future career could change and adapt, a range of organisations can help you think through these choices: www.ukces.org.uk/thefutureofwork

The Employer Ownership of Skills Pilot is currently investing up to £340 million alongside industry in employer-led proposals to tackle current and future skills needs in sectors, supply chains and localities.

www.ukces.org.uk/ourwork/investment/employer-ownership

Working Futures 2012–2022, is the most detailed and comprehensive model of the UK labour market that is available. The results provide detailed projections of employment prospects by industry, occupation, qualification level, gender and employment status for the UK and for nations and English regions up to 2022.

www.ukces.org.uk/ourwork/working-futures

UK Commission's UK Employer Skills Survey is the largest of its kind in the world. It gives a robust picture of skills needs and training investment in UK business.

www.ukces.org.uk/ourwork/employer-skills-survey

Sector Skills Insights research identifies the performance challenges faced in nine sectors and the real-life skills solutions implemented by leading and successful businesses to overcome them.

www.ukces.org.uk/ourwork/research/lmi

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The Future of Work study aims to stimulate thinking and dialogue on how people and organisations can prepare for tomorrow's world of work. It provides evidence, inspiration and alternative thinking for those with an interest in employment and skills. The results are derived from a robust, evidence-based approach that draws on expert input from key groups including business, trade unions and academia, as well as a detailed and comprehensive review of literature. A central finding is that in future, new attitudes and behaviours will be needed, founded on flexibility, resilience, collaboration, enterprise and creativity. Above all the ability to respond to change will be critical.

About UKCES

The UK Commission for Employment and Skills is a publicly funded, industry led organisation providing strategic leadership on skills and employment issues in the four home nations of the UK. See more at: http://www.ukces.org.uk

About the authors

Z_punkt The Foresight Company is a leading international strategy and foresight consultancy that focuses on strategic future issues. It translates findings derived from trend and futures research into practical advice to facilitate strategic management. Using corporate foresight processes, Z_punkt helps companies and institutions to make the most of sustainable future perspectives. See more at: http://www.z-punkt.de/en.html

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