GWENT FUTURES

H|O|R|I|Z|O|N SCANS

Scanning Report
from Ash Futures

March 2018

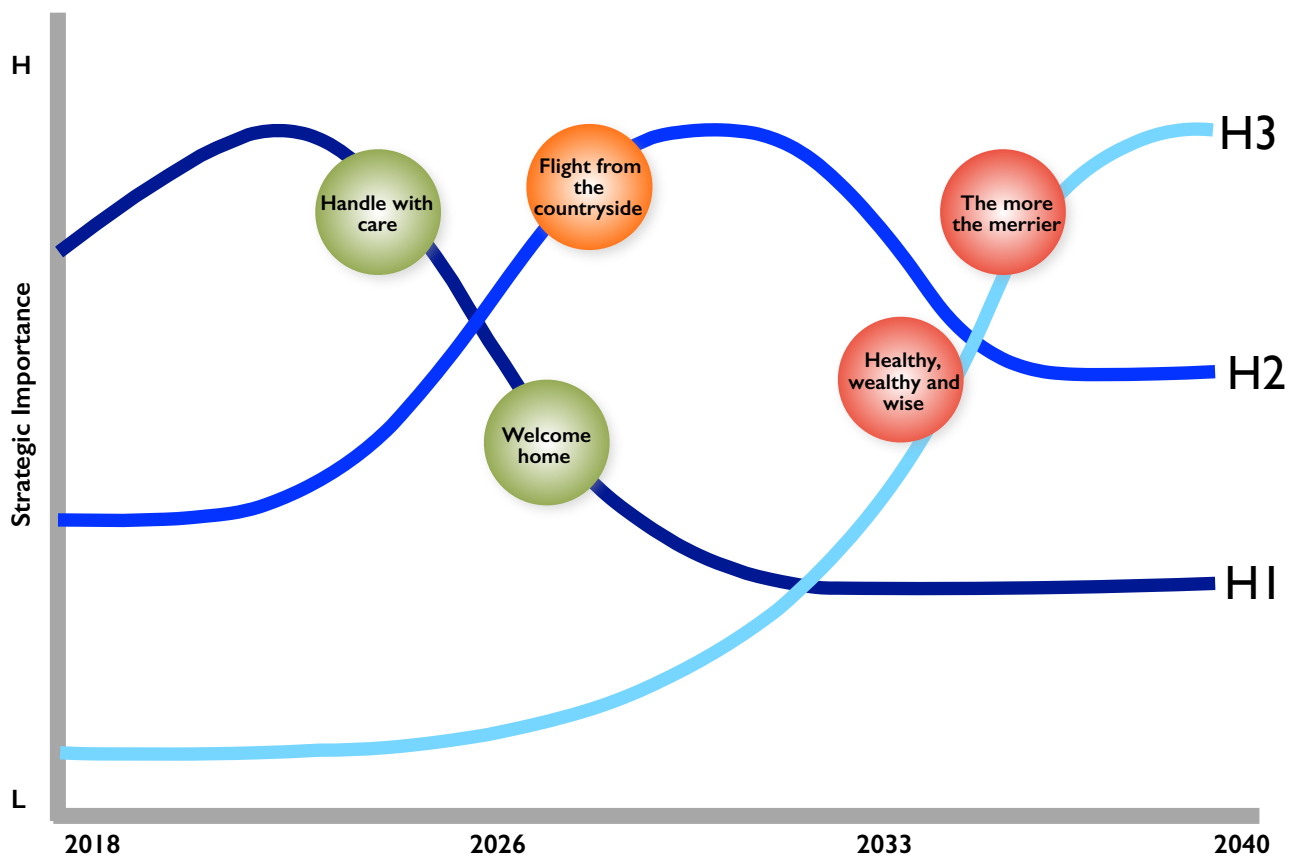GWENT PUBLIC SERVICE BOARDS

POPULATION

GROWING POPULATION - The more the merrier?

AGEING POPULATION - Healthy, wealthy and wise?

MIGRATION - Welcome home

RURAL DE-POPULATION - Flight from the countryside

GENERATION Y AND Z - Handle with care

The more the merrier?
GROWING POPULATION

Based on current trends in fertility mortality and net migration, the ONS projects that the UK population will increase by 3.6mn (5.5%) over the next 10 years, from an estimated 65.6mn in mid-2016 to 69.2mnin mid-2026.

England is projected to grow more quickly than the other UK nations: 5.9% between mid-2016 and mid-2026, compared with 3.1% for Wales. The UK population is projected to pass 70mn by mid-2029 and be 72.9mn in mid-2041. Over the period to 2029 54% of growth is projected to result directly from net international migration, with the remainder representing natural change.

The UK population growth rate is slower than in the 2014-based projections; the projected population is 0.6mn less in mid-2026 and 2.0mn less in mid-2041. This is because of lower assumptions about future levels of fertility and international migration, and an assumption of a slower rate of increase in life expectancy.

It is important to stress that population projections are not forecasts and will inevitably differ to a greater or lesser extent from actual future population change. Two factors that will affect future population are political and economic changes but it is not possible to know in advance what impact these will have. For example, the projections do not currently attempt to predict the impact of the UK leaving the EU.

On a global basis, the broad consensus of population forecasts is that the world population will reach 8.6bn in 2030 and 9.8bn in 2050. After the world population increased more than 400% over the 20th Century, population growth has slowed considerably. The fastest world population growth rate was already reached in the late 1960s, and it has been falling since. While the world population increased by 2% annually in the late 60s it has now slowed to an increase of just about 1%. Between 2020 and 2050 the growth rate is expected to halve again – to about 0.5% per annum. The absolute number of births is expected to peak at about 140mn per year from around 2020 onwards (reflecting reducing fertility rates), with the number of deaths increasing markedly from around 60mn per year currently, to 100mn per year in 2050 (although global life expectancy will continue to increase). However, despite these divergent trends, the excess of births over deaths means that the global population will continue to grow, albeit at a slower rate.
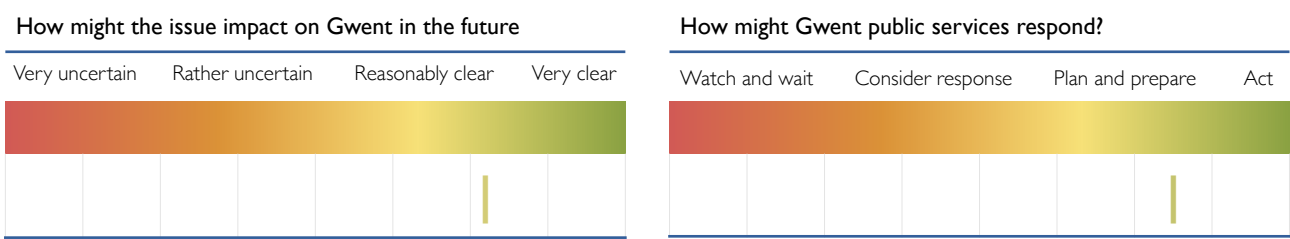
In fact, due to demographic structure a central challenge over the next two decades is that the UK, along with most other developed countries, will need to prepare for more deaths. There will be a 'tipping point' emerging and the current number of deaths of 0.5mn per year will increase by 20% over the next 20 years. There will also be an increase in the number of people requiring palliative care, nearing 0.5mn across England and Wales by 2040.

In Wales, the latest population projections are for reasonable robust population growth of circa 0.25% per annum for the period to 2028 and then slowing considerably. From 2035 onwards, the population is not projected to grow by more than 0.05% per annum and, in fact, from 2045 there is an expectation that population will decline marginally, or certainly be static.

Implications for Gwent

Population growth is expected to be significantly variable across Gwent, with areas such as Newport needing to accommodate relatively strong population growth and other areas such as Blaenau Gwent projected to suffer further population loss. This is within the context of an expectation of slowing UK (and national) population growth generally as previous expectations

regarding international migration, increasing life expectancy and fertility rates grow more muted. It is probably that any Local Development Strategy reviews within Gwent will need to take account of the revised population projections, when released.

How might the issue impact on Gwent in the future	How might Gwent public services respond?
Very uncertain · Rather uncertain · Reasonably clear · Very clear	Watch and wait · Consider response · Plan and prepare · Act

By 2031, the number of people aged 65 and over will double to 1bn globally, raising concerns for overall labour market productivity and the ability of existing fiscal systems to withstand the pressures of ageing. As the proportion of elderly people increases across economies, they will challenge the affordability of social welfare systems such as pensions and healthcare.

Ageing is not happening uniformly across the globe and will consequently change the balance of power. Europe will be the oldest region in 2031 with a median age of 44.7 years.

Dependency ratios – the number of over 65s per hundred population - place Europe (36), the US (33) and China (24) significantly ahead of Latin America (18), India (12) and Africa (7). Some commentators have highlighted India's demographic as ideal for sustaining economic growth to 2050.

In the UK, because the post second world war "baby boom" generation is about to retire, the number of people at state pension age and older is set to swell almost a third by 2039 to 16.5m — despite the Government's decision to raise the pension age. The number of people aged 75 and over is projected to rise almost 90% to 9.9m by 2039, while the number of people aged 85 and over will more than double. The number of centenarians will rise almost six-fold to 83,000.

The UK's dependency ratio will increase from 31 today to 37 by 2039. This will significantly strain public finances. The Office for Budget Responsibility predicts that, because of these demographic pressures, the UK will be running a budget deficit again as early as 2023-24 if nothing else changes.

This increase in the number of older people will have a profound impact on a wide range of public services. Many people are not saving enough and will need to work longer. Health and social care costs – already challenged - will rise. It is expected that there will need to be fundamental changes to the health and social care systems to ensure their future sustainability. There will also be a deepening onus on the working-age population to support the ageing; higher levels of taxation may be an inevitable outcome.
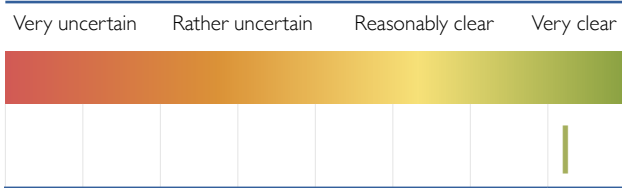
Ageing is already creating distinctive consumers – the so called silver economy – and will create a new class differentiation between the more affluent and the less affluent. This may result in a continuing divergence in life expectancy between communities, as already seen in parts of Gwent.
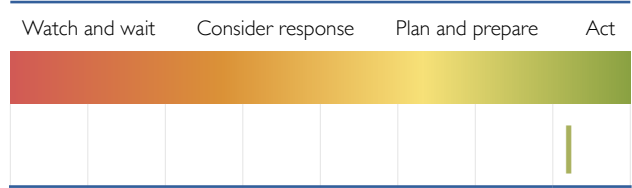
Implications for Gwent

The population of Gwent is ageing as elsewhere in the developed world. This is, and will, present significant challenges to public service providers. Whilst increases in life expectancy have slowed in recent years, the full impact of the post-war 'baby-boom' population coming through to retirement has not fully worked through. There will undoubtedly need to be an evolution in the models of service delivery in many areas of health and social care, with areas of provision moving to the private domain. This process has obviously already started over the past few years and the trend is expected to continue.

These particular pressures will not happen evenly across Gwent, with Blaenau Gwent, Torfaen and Monmouthshire tending to have slightly older populations.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

The World Economic Forum (WEF) Risk Report 2018 indicates that large-scale involuntary migration remains one of the most significant risks facing many countries in the next 10-20 years. Mass migration of labour poses challenges for social protection. Large and sudden inflows of people can put additional and unpredictable strain on social systems and resources. In Europe, for example, the influx of over 1mn migrants in 2015 was more than four times the number in 2014.

Immigration has been linked to populist voting in many countries. What appears important to voters is not so much about absolute levels of immigration, but rates of change. Voters are focusing on immigration policy for a complex range of reasons: to bolster national sovereignty in a globalised world; to reject the deep cultural changes of recent decades; or to express anger at mainstream politicians. As with globalisation, the overall economic benefits brought by immigration are not felt by all sections of society.

For the UK, net migration levels have recently fallen to 230,000 (for June 2017), down 106,000 in 2016. Over three-quarters of the decrease in net migration can be accounted for by EU citizens post EU referendum vote (which fell by 82,000 to 107,000 in 2017). While immigration continues to be higher than emigration, the total number of people immigrating has fallen. At the same time, the number of EU citizens emigrating has increased. The number of people moving to the UK to take up a "definite job" has remained stable, however, fewer people were coming to the UK "looking for work". Net inward migration is now expected to decline steadily to 165,000 a year by 2023. Importantly, net inward migration among working-age adults is expected to be lower than previously envisaged. The number of EU citizens leaving the UK is at its highest level for over a decade.

Much of UK Government policy on migration is dependent on the terms of BREXIT. However, a central tenet of the decision to leave the EU was for the UK to gain control of its own migration policy. The broad current policy of the UK Government is that the aim of improving migration processes to reduce abuse and limiting non-EU economic migration will better serve the national interest. The 2010 Coalition Government's target to reduce net migration to 100,000 a year has not been consistently met. However, there is a significant lobby to maintain levels of in-migration that serve important economic purposes i.e. by the UK Universities, financial sector etc. This will be a political background over the next few years.
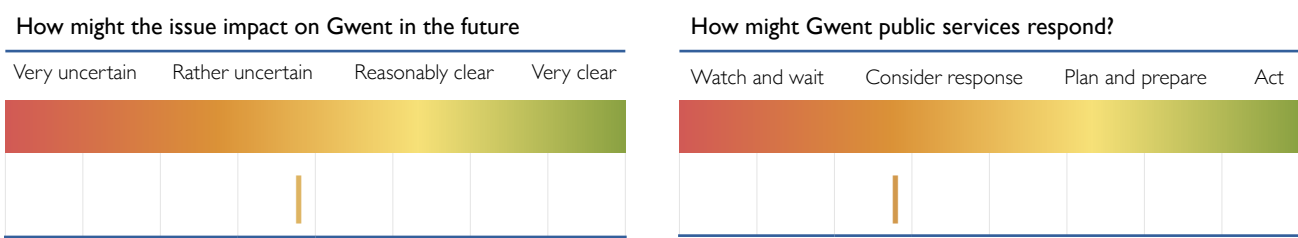
Despite lower levels, migration will still continue to place pressures on the social infrastructure within the UK. For example, in the housing market the foreign-born population tends to have different housing requirements than the UK-born population. They are almost three times as likely to be in the private rental sector, with commensurately lower levels of home ownership.

Implications for Gwent

The current expectation of lower levels of international in-migration is principally connected to the UK's decision to leave the EU. This has undoubtedly influenced individual's decisions to migrate to the UK. This may mean that the social pressures that had been created by the large influx of in-migrants may ease over the coming years. It is probable that the lower level of migration will also be reflected in future population projections, with some potential implications for future housing demand – although these may be marginal.

However, it may also mean a shortage of workers for those businesses who had previously relied on non-UK labour. There will be a number of these in Gwent, particularly in sectors such as agriculture

and retail. Collaboration between businesses and training providers may be required to address potential labour shortages.

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Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Rural Wales has faced many challenges over the last few decades including depopulation by young people, a decline in household incomes, the increased price of housing (especially for first time buyers), a decline in public services and transport, and the closure of rural schools.

The latest population estimates for Wales show the expectation that the population of areas such as Blaenau Gwent will continue to fall over the next 20 years – therefore extending the historical trend. In other areas such as Monmouthshire, Torfaen and Caerphilly, whilst the population is expected to increase marginally, this is only due to net internal migration. The natural change is for those populations to decline as the population ages. The future sustainability of rural areas is heavily dependent on their ability to attract people to come and live in those areas, particularly younger people.

These population trends are also reflected in the latest household projections for Wales. These projections show that number of households will increase by over 10% in all of the major cities in Wales (including Newport) to 2039. In comparison, in rural areas, only very marginal increases in households are expected (i.e. in Blaenau Gwent +1% and Torfaen +4%), and this is only driven by a change in household composition i.e. typically smaller households. These projections also show that by 2039 nearly half of rural households will be aged over 65.

There is currently a resurgence of population growth in cities which is partially reversing the long-term trend towards ruralisation. The 'life-cycle effect' (whereby young people move to cities for work and education, whilst older people and families move out to rural areas) is meaning that rural areas are ageing more rapidly than urban areas. This will have implications for public service delivery in rural communities. The 'liveability' of cities in the future will play a significant role in whether the cycle will continue.

However, the appeal of living in the countryside will still remain for many. This may continue to create upward pressure on property prices. As a consequence, the provision of flexible, affordable housing in rural areas will remain a prominent issue in the future. 'Affordability' in a rural context will remain a particular issue of debate.

New technologies will increasingly be important to help to deliver public services in innovative and sustainable ways to rural communities, particularly in the healthcare sector. Strict performance benchmarks for public services could act as a future barrier to rural provision, meeting targets in rural communities tends to be harder to achieve than in urban areas due to higher cost.

Public policy debates are currently focused on the role of cities in devolved decision-making, and 'city-regions' as an appropriate level for governance. It is not clear what devolution will mean for rural areas - will decisions made in cities, for instance on public services and infrastructure provision, reflect the needs of rural communities? What will devolution mean for more remote rural areas that do not clearly fit into a 'city-region'?
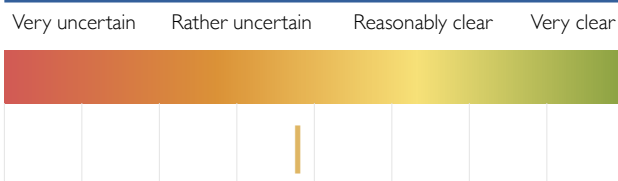
Rural areas are at cross-roads, they could simply shift more to being a commuter belt for cities, which will be the locus of economic dynamism. They could shift more towards environmental sustainability (particularly given the enhanced environmental focus in agricultural policy post-BREXIT recently announced by the UK Government), coupled with more efficient and resilient food production. Alternatively, they could focus on developing diversified economies, although this will be dependent upon flows of private sector investment.
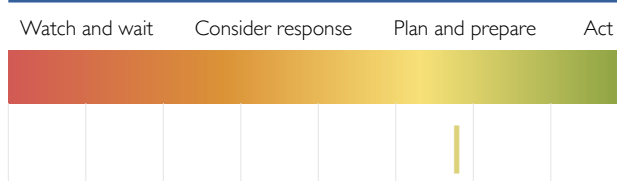
Implications for Gwent

The 'flight from the countryside' is a particular concern in areas such as Blaenau Gwent. Projections are for this to continue, although these projections are themselves 'policy neutral'.

In particular, the loss of young people continues to undermine the sustainability of many rural services which, in turn, creates disincentives for the young to stay - a vicious cycle is created. This presents two key policy issues: how to reverse the process of depopulation, and how best to continue to provide public services to those sparsely populated areas given heightened social problems and questions about affordability.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

Generation Y is the UK name for millennials, those born between 1980 and the mid-90s. A recent poll conducted by Ipsos Mori suggests that over half (54%) of the country believe young people's lives will be worse than their own - the highest percentage ever recorded. Over-50s were overwhelmingly positive about their own life course – but nearly half of Generation Y believe they will be worse off.

Young people entering the labour market today face far less favourable mobility prospects than their parents or grandparent did. Alan Milburn, the previous chair of the Social Mobility and Child Poverty Commission has consequently warned that Britain could soon become "permanently divided" as a result of this intergenerational inequality. "Unfortunately," Milburn says, "there is a growing sense that Britain's best days are behind us rather than ahead. That is so corrosive… The wind of change does have to sweep through the country."

The profound question underlying Milburn's comments is whether the familiar narrative of generational progress has now been upended. The concern is that all the old paths that allowed their parents to get ahead – careers with prospects, home ownership and decent pensions – are one by one being blocked off for Generation Y. Today's young adults enjoy greater social, sexual and cultural freedom than any before them. But they are also in hock to debts, to landlords and often unstructured work.

Generation Z is the demographic cohort that were broadly born after 2000. By 2020, over 50% of the workforce are expected to be Generation Y members who have grown up connected, collaborative and mobile. In many respects they are the most diverse, entrepreneurial and innovative of generations.

However, a report by the OECD suggests that British teenagers are among the most troubled in the world. They feel pressured by schoolwork and worried about the way they look. The life satisfaction of those aged 11-15 has gone down everywhere. They too worry about future economic opportunity and wellbeing and are profoundly anxious.
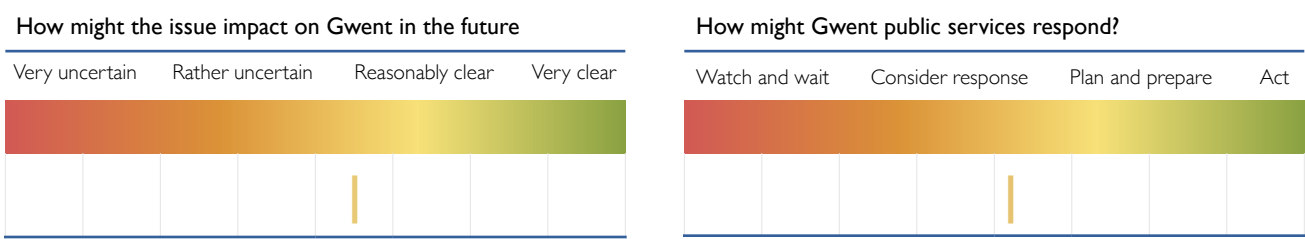
In England, there has been a threefold increase during the past 10 years in the number of teenagers who self-harm. They are deeply distrustful of establishment institutions and, if anything, see them as another source of anxiety. There is growing evidence of a link between social media use within children and mental health issues such as depression and anxiety. They will also present physical health issues, with recent research predicting that they will be the most overweight generation since records again, with 7 in 10 classified as obese.

However, they are also optimists too. The majority of Generation Z believes that helping others in need is important, 70% cite inequality as one of the issues that worry them greatly and 70% worry about terrorism. They are bright and talented. They are a generation of digital creators and inventors who want to consume as much as the generations behind them, but who also want to create. They just need a little more care and support than their older brothers and sisters; and, perhaps, for the older generation to recognise that it probably understands Generation Z rather less well than Generation Z understands themselves.

Implications for Gwent

Generation Y & Z, as the generations before them, will present their own problems and opportunities. Despite being more digitally connected than any previous generation, UK teenagers

also appear to be troubled. Of particular concern is the scale of mental health problems experienced. What is not clear is whether this may represent a 'bubble' that could burst in the future. However, it is expected to have increasing implications for public service providers in Gwent. Generation Y & Z may need to be supported in different ways and they certainly need to be handled with care.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

HOW WE LIVE - CITYSCAPES

SMART CITIES - Everything will be connected

URBAN DENSITY - The big squeeze

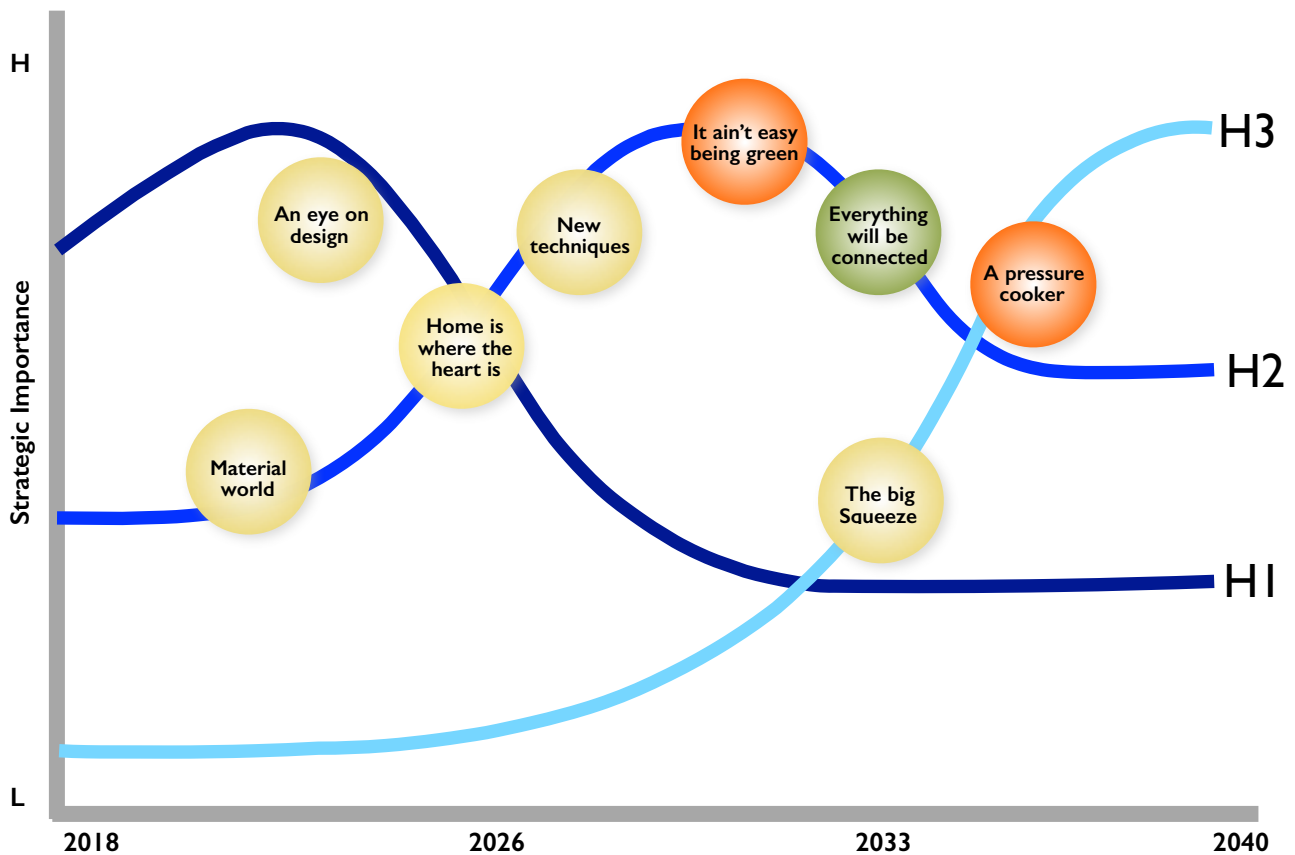GREEN CITIES - It ain't easy being green

CONSTRUCTION (1) - An eye on design

CONSTRUCTION (2) - Material world

CONSTRUCTION (3) - New techniques

HOUSING - Home is where the heart is

LAND USE - A pressure cooker

As cities around the world struggle to cope with rapidly increasing populations, congestion, pollution, digital infrastructure and housing issues, a key response has been to explore the benefits of data analytics to help improve the way that cities are managed. Big data / Open data is at the heart of a number of transformations.

In fact, as IBM have pointed out, cities that fail to address this agenda will become less competitive. The IBM Smarter Cities for Smarter Growth report points to strong evidence that these sorts of technologies are now a prerequisite for any successful city:

"The application of advanced information technology can help cities better understand, predict and intelligently respond to patterns of behaviour and events . . . . Cities that adopt this systems thinking and make wise investments to build a smarter city can position themselves to thrive".

And the spread of benefits, according to Canada's Open Data Portal can be widespread - supporting innovation; utilising pubic sector information to support development of commercial services; creating efficiencies in the running of infrastructure; and supporting informed decisions for consumers.

Just as, on a domestic scale, we will be able to control appliances in our homes through our smartphones, so citywide systems will be subject to monitoring and control in more sophisticated ways. Whether they will promote tele-health initiatives for the elderly through the use of remote sensing linked to home tablets; better traffic management through sensors embedded in parking spaces, roads and buses; more efficient energy use and power generation through smart grids; or improved recycling rates through sensors that can detect when bins are full and with what. And urban analytics is not just a matter of speeding up or automating certain tasks, it can offer solutions in context. Every city is different; what causes water waste or traffic jams in one place will differ from causes elsewhere.

One such example is Santander in Spain which has 5,000 sensors in place to collect data on carbon dioxide, noise, humidity and traffic levels. The data can then be analysed and used to predict situations and plan solutions to problems. Additionally, Santander's inhabitants can use apps to get a host of different information relevant to their everyday lives – for example the latest real time information on parking, the state of beaches or the nearest taxi ranks. Singapore has established

the Smart Nation Platform that strives to enable connectivity for everyone, in everywhere, and at any time in Singapore. The key concept of a Smart Nation is built on the collection of data and analysis of it.

Cities throughout the UK are building the connections - where new solutions can 'plug and play' with their open data hubs. Using data about the 'infrastructure of the city, the 'systems' of the city and the 'life' of the city - innovative companies are and will develop new tools to make cities more liveable and more efficient.

A 2016 report from Kings College, London identified 73 cities in the UK that have plans to implement smart city initiatives, with 33 of them that already have some systems in place. Most of those 33 were focussing on the environment, economy and mobility; though many were also looking at social sustainability and governance. Achieving all their ambitions may take some time - but there is little doubt about the pace and direction of travel. However, with this vision for cities comes a warning: "that vision raises multiple questions about the prospects for liberal democratic societies. These not only include worrying implications for social justice, as inequalities become embedded into the intelligent infrastructures of cities, but also the prospect of unacceptable compromises of human dignity and liberty in the drive to regulate urban populations and spaces efficiently."
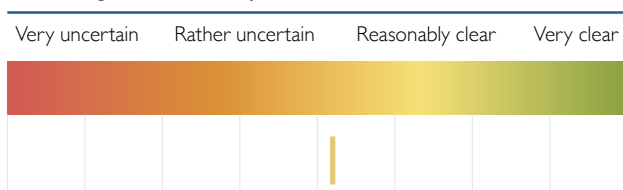
The UK Government's Future of Cities report, from 2016, highlights the opportunities from leveraging available data on city processes and integrating systems to improve liveability.
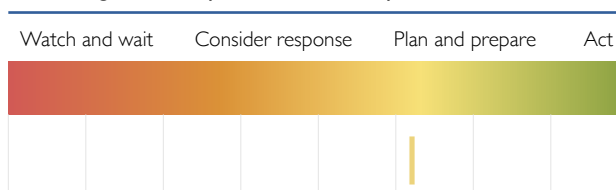
Implications for Gwent

Urban administrations face the challenges of growing populations, diminishing resources, increased traffic and climate change. Similar to most cities, Newport has an aspiration of implementing Smart technologies into its urban fabric to help deliver innovative solutions to its residents and visitors. In a wider context, the Cardiff City region is also emphasising its aspiration on being a truly leading Smart city-region. The Welsh Government also recognises the importance of Smart technology. A key question for Gwent will be how it can be included in any smart technology initiatives that are developed as part of the Cardiff-City Region deal, particularly so in Newport, given its connectivity to Cardiff.

However, in many respects, most of the UK's urban areas are behind the curve, often limited by constraints in the physical environment. Cities that do not place sufficient political weight behind Smart technologies are likely to be left behind. Solutions will need to be developed and delivered through public-private partnerships and collaborations. Profit incentive may be a necessary prerequisite for the involvement of private partners and the public sector needs to be open to this prospect.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Cities are growing. As more people move to cities to find employment, many of the world's largest cities will continue to expand, becoming megacities (over 10m people). By 2011, half the global population was living in urban areas; by 2050, it is forecast that the proportion will grow to 66%. The number of megacities is also growing - from 10 in 1990, to 28 in 2014, and 41 by 2030 - with the biggest growth in the developing world.

If properly planned, providing public transportation, as well as housing, electricity, water and sanitation for a densely settled urban population is typically cheaper and less environmentally damaging than providing a similar level of services to a dispersed rural population. However, cities are huge consumers of resources and their environmental footprint can be substantial.

Going up

Skyscrapers already dominate the skylines of big cities but there's still room for them to extend their reach. As the cities stop growing outwards they are starting to grow upwards – in some cases up to 1000 meters in height like the Kingdom Tower currently under construction in Jeddah, Saudi Arabia. It will take over the title of the world's tallest building from the Burj Khalifa in Dubai when it is completed in 2018. Meanwhile, the World One tower in Mumbai will be the planet's highest residential building at 117 floors when it is finished this year. And Tokyo has plans for the Sky Mile Tower, to be completed by 2045.

In the UK, the trend is still upward, even if not quite so ambitious. A recent survey by New London Architecture, found that there were 455 new tall buildings (over 20 stories) in the pipeline. "If you can't build out, build up!" The pressures to build at the heart of cities, often on brownfield land, is not just a demand of urban planers. Demographic and economic aspects are driving the change too: more students, immigrants, singles and childless couples; more city-centre jobs in service and the knowledge economy, as well as increased costs of commuting. The challenge is to accommodate this growth in ways which enhance the urban areas. However, as the concept of 'good density' becomes more established and better understood, cities will see pay more attention to considerations of scale than merely that of height.

Getting it right

At a spatial level, density is all about the concentration of things in an area. Most local authorities, as well as the ONS, collect information about things they can readily count, such as the density of houses and people. With these two figures, along with other kinds of information, such as brownfield availability and where certain services are located, cities make decisions about how land is used, how it is described and what future uses might be needed.

Described in this way, density shapes how cities look, feel and are experienced. However, it is debatable whether these types of density alone are enough to make decisions. What about the density of rubbish bins? Cars? Cycle lanes?

Getting cities right in terms of density is difficult. For example, those advocating a more compact city model suggest that higher overall densities in cities can: support better and cheaper public transport, promote greater energy efficiency in buildings, create more opportunities for mixed-tenure housing, engender more social equality and provide greater control over who people contact. At the same time, high-density cities also lead to: more pedestrian casualties, urban heat

island effects and waste; poorer ecosystem quality; loss of privacy and direct sunlight; and reductions in our physical and mental wellbeing.

However, the pressure of an increasing population will continue to put pressure on our towns and cities - and the people who live in them. Part of the responsibility rests on developers, as well as planners, to make sure that their new buildings 'accentuate the positive and eliminate the negative'.
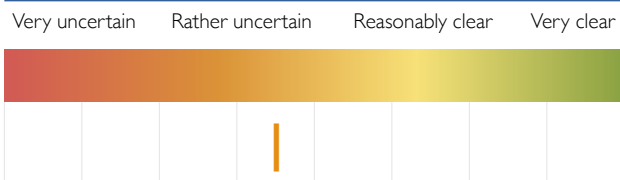
Implications for Gwent

There is increasing pressure of development along the M4 corridor, including the Newport urban area. With each development the available land resource decreases, although much of the recent development has been on brownfield sites. However, the pressure for increasing urban density will only increase and this will require a shift in expectations among the resident population. Higher density housing may be inevitable. The current Newport Local Development Plan tends to mostly have a focus on higher density development on smaller sites.
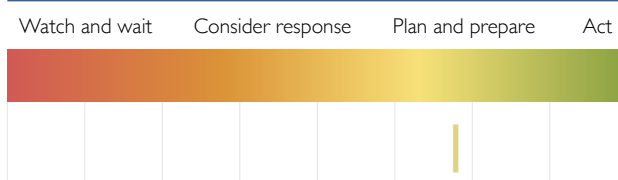
The difficulty will be to deliver higher density development whilst maintaining the quality of the built environment. Some sacrifices may need to be made. Increased urban density needs to be accompanied by similar improvements in the urban infrastructure, particularly transport infrastructure and evolving Smart technologies.

Higher density will also need to take place in the context of the 'typical' house buyer growing older. Whilst younger generations have always been open to living in higher density environments, the same cannot be said of older generations – particularly pre-retirement. Therefore a further difficulty will be to deliver higher density development, whilst making subtle shifts in expectations.

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According to a McKinsey and Co study, green districts within urban areas are economically viable, environmentally beneficial and improve the quality if life. They point to increasing interest around the world to try and harness these benefits.

Evolving styles of architecture also mean that many buildings are adding green spaces that seamlessly integrate with the environment around them. An increasing number of them now have living walls or green roofs – for example the city of Linz in Austria requires green roofs on all new residential and commercial buildings with rooftops larger than 100 or 500 square meters, respectively. Toronto also passed by-laws mandating rooftop vegetation; with San Fransisco becoming the first US city to follow suit.

Reinforcing this new policy, the Mayor of Paris introduced a plan with a goal to reach 1 million square meters of green roofs and facades in the city by 2020.

Green roofs have a number of benefits, such as reducing run off and so mitigating the effects of flooding; they typically save save between 15% and 45% of energy usage, and they can minimise urban heating when several buildings have them in proximity.

Adelaide has just completed an urban forest initiative, started in 2003, to plant 3 million native trees and shrubs by 2014 on 300 project sites across the metro area. The projects range from large habitat restoration projects to local biodiversity projects. Thousands of Adelaide citizens have participated in community planting days. Sites include parks, reserves, transport corridors, schools, water courses and coastline. Only trees native to the local area are planted to ensure genetic

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Case Study

Cities around the world have set targets for local reduction of CO_2 emissions. This development is being spearheaded by Copenhagen, which the lifestyle magazine Monocle named the "most liveable city" for the third time in 2014. The Danish capital has a lot to offer its inhabitants: For example, the city provided 2,000 bicycles this year, which users can ride on 300 kilometres of bicycle paths. These bikes are equipped with the full range of comfort features, including a touchscreen, a GPS device, and even an electric motor for cyclists who like to take things easy.

Copenhagen has set itself the goal of carbon neutrality by 2025. In practice this means that the city is implementing a variety of strategies to reduce its CO_2 emissions by as much as possible and then offsetting the rest through investments in renewable sources of energy.

Combined heat and power plants fuelled by biomass will be part of the power mix. Today over 98 percent of the city's heating requirements are already met by district heating, and 30 percent by waste incineration. At the same time, Copenhagen needs to improve its energy efficiency. The city is therefore striving to modernise existing housing stock and to develop models to finance such measures. The regulations governing energy efficiency for new buildings are also to be tightened. Additionally, there will be an increasing use of intelligent building systems to control energy and heating consumption.

By 2025, three quarters of all trips in the city are expected to be by foot, bicycle or CO_2-neutral public transport such as electric or biofuel buses. The remaining car drivers will be encouraged to switch to electric, hydrogen or hybrid vehicles.

In 2017, Copenhagen had already reduced carbon emissions by 40%, while the population has grown by 50%. It also has plans to be a fossil fuel free city by 2050. See this

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integrity. The project aims to beautify and cool the city and make it more liveable; improve air and water quality and reduce Adelaide's greenhouse gas emissions by 600,000 tonnes of CO_2 a year.

Creating green space in city centres has become a key aspect of city development. In European cities urban orchards are becoming popular. One example is in the German city of Andernach, known as the Edible City for growing its own vegetables. It's one of the oldest cities in Germany and over the last few years it has converted its public spaces into authentic urban orchards which are tended by its inhabitants. Another example is Madrid, a city which already has more than 30 urban orchards.

There are wider benefits for the population of 'green' cities - they are healthier as well. A study from the University of Exeter Medical School's European Centre for Environment and Human Health, says: "We've found that living in an urban area with relatively high levels of green space can have a significantly positive impact on wellbeing.

SOLAR

As innovation in the solar power industry continues to ramp up, the potential for new technologies and more efficient solar power sources grows. Current research is demonstrating a range of new technologies that will allow solar PV to become embedded in the design of buildings and neighbourhoods, rather than stand out features. And both local and national policies are following close behind - seeking to encourage greater energy generations from buildings.

Roof coverings

Toronto has mandated green roofs on new industrial and residential buildings since 2009. France was set to follow suit with a law decreeing that all new buildings in commercial zones should have either green or solar roofs. Unfortunately, the French Senate overturned the law in March 2016. Increasingly, planners are accepting and even encouraging roof space to be utilised for power production - as there is less public resistance to the visual impact.

Solar roads

France is set to roll out over 1,000km (621 miles) of solar road that will deliver an eco-friendly way to produce enough energy to power millions of households. The project will see these electric avenues hit highways over the next five years. The Wattway photovoltaic solar panels, which have been five years in development by Colas, will be laid over the top of existing roadways and harvest energy to provide electric power to approximately one household per metre. The first installation was one kilometre long and cost €5 million but costs are expected to fall in future. It is understood the amount of power will be sufficient enough for most household needs apart from heating.

With the panels only 7mm thick the cost and time to retrofit them to roads will be relatively inexpensive and quick, with minimal disruption to traffic. Wattway has developed the technology so cars and trucks are able to freely drive over them as well as providing the same traction as tarmac, eliminating the threat of slipping when it rains.

A number of other countries are already experimenting with solarising roads, with a project in the Netherlands having 70 metres of solar road in operation since 2014 in the form of a bike path
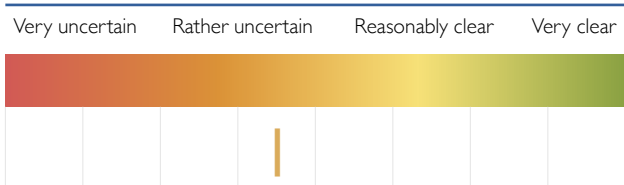
Cycle Paths

Now, with a little data out, the news is that the Dutch solar bike path is generating more electricity than originally planned. In November 2014, a solar panel bike path, measuring some 70 metres, was inaugurated in the Dutch city of Krommenie. The stretch of bike path, near Amsterdam, was considered a pilot demonstration by SolaRoad, the company that built it.

This particular pilot project is now being hailed as a success because the solar bike path is generating more renewable electricity than anticipated. Several months into the pilot now, it's become clear that the solar panels are notably outperforming expectations — having already generated 3,000 kilowatt-hours (kWh) of electricity. The test period comes to an end in 2018.
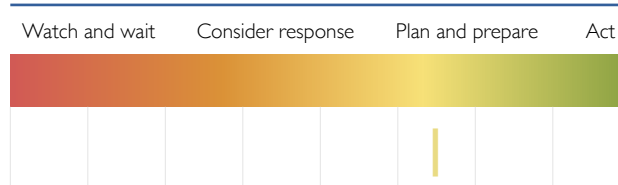
Implications for Gwent

Newport City Council has as one of its corporate objectives to provide a 'Greener and Healthier City'. The LDP focuses development on previously developed land and protecting green spaces. There is less emphasis on developing smart technologies that are focused on delivering green solutions. There are more examples of innovative solutions in European cities than have emerged in the UK. Again, many cities face physical issues such as topographical constraints, and the age of its built environment. However, future planning policy may need to move on from the simple protection of green spaces to a wider consideration of what green technologies can be implemented. This may require a more ambitious (and riskier) approach than currently reflected in local planning policy.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

Passive building

With the speed of climate change accelerating, attention is turning from how to provide buildings with efficient heating to efficient cooling. In hotter climates, air-conditioning accounts for up to 80% of utility costs, and changes the patterns of energy use throughout the day.

In order to avoid increased costs for cooling as well as heating, building designers are increasingly drawn to using passive techniques. Some are well known and tested in warmer regions, others are mixing state of the art management systems with more natural construction methods.

Passivhaus construction, started in Germany, has spread and one can see examples in many countries. Most of the development interest to date has been in residential buildings. However, increasingly, a number of office developments have utilised similar techniques to manage heating, cooling and air quality. Some hotels are aiming for zero energy status. New techniques are allowing for retrofitting of existing buildings and digitisation to boost energy savings.

A report for the Urban Foresight Laboratory suggested that energy costs can be reduced in commercial properties by 30-40% by implementing just a few technologies. These include efficient lighting and controls, building services, and management systems. As 70% of current building stock will still be in use in 2050, these retrofitting technologies remain important.

Retrofit

It seems that retrofitting old buildings not only makes environmental sense, by reducing the new resources needed and increasing the lifespan of the structure, but is also the preferred option for many tech-savvy employees. At a recent conference on London's commercial retrofit market, it was argued that older buildings with character and a sense of place were a way of creating difference in the search for discerning staff.

Surveys of office workers have found that almost three quarters want eco-friendly buildings with more communal areas. The agenda is shifting to thinking about sustainability, wellbeing, character and style.
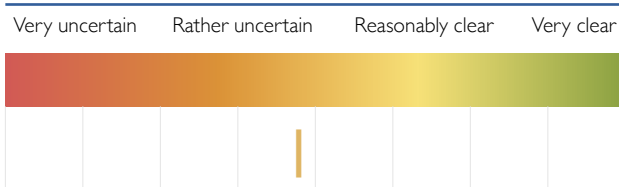
Green Walls

Green walls, also known as vertical planting systems, vertical gardens, plant walls or vegetated walls have been successfully implemented around the world over the past 15 years. In 2004, a four-story plant "biowall" was installed at the University of Guelph-Humber Building in Ontario, Canada. With plant life visible from nearly every floor, the wall acts as an indoor air purifier, pulling air through the wall and into the mechanical air ducts. According to the University, the biowall could supply all of the building's fresh air intake needs. Irrigated by a vertical hydroponic system, it naturally cools the building in the summer and humidifies in the winter. Today, architects and design teams are specifying brilliant walls of live greenery with functions ranging from fully scrubbing the air to simply humanising windowless and 'nature deficient' indoor spaces.
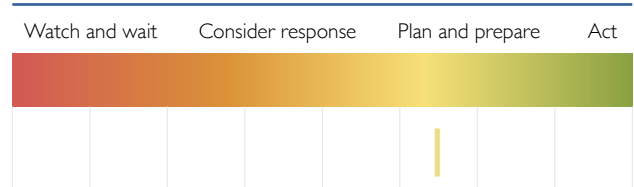
Implications for Gwent

In the UK, the examples of truly innovative building design are few and far between. Where they do exist they tend to be in high-specification and bespoke residential development. Commercial (short-term cost) considerations have limited the application of new technologies into larger

buildings. Planning policy has a role to play in encouraging such development and local authorities in Gwent have an opportunity to work with private developers to 'showcase' construction technologies. In some areas such as Torfaen and Blaenau Gwent – with their ageing housing stock – there is significant potential to think about how retrofitting can work for the residents and the environment. Gwent holds significant housing stock which demands better environmental and energy performance.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

Smart windows

New materials, such as nanocrystal are enabling building components to be re-thought. Smart glass allows you to tune certain parts of the solar spectrum. This can control heat—near infrared—transmission independently of visible light, with the option of having a window in which you don't alter the appearance from the occupant's or the outside observer's point of view. By applying voltage to the nano-crystalline film, its properties can be fine-tuned so that in the winter, you can allow some of that heat through for passive solar-heating purposes, but you can block it in the summer when you don't want it.

Key design issues for new, passive buildings are thermal mass, building alignment, shading, air circulation, energy efficiency, use of renewables and control systems. Looking ahead, the European Patent Office has noticed four trends that are shown in the number of patent applications:

1 Heating, ventilation and air-conditioning (HVAC)
2 Energy-efficient insulation
3 "Green" lighting. LED and OLED technologies are improving all the time
4 Incorporating renewable energies into building design

Thin film solar panels are a fast growing technology. Back in August 2014, researchers at Michigan State University created a fully transparent solar concentrator, which could turn any window or sheet of glass (like your smartphone's screen) into a photovoltaic solar cell. According to Richard Lunt, who led the research at the time, the team is confident the transparent solar panels can be efficiently deployed in a wide range of settings, from "tall buildings with lots of windows or any kind of mobile device that demands high aesthetic quality like a phone or e-reader."

Today, Ubiquitous Energy, a company co-founded by Lunt is changing the way the cell absorbs light. The cell selectively harvests the part of the solar spectrum we can't see with our eye, while letting regular visible light pass through.

The prototype currently has an efficiency of around 1%, but they think 10% should be possible once production commences. On their own these aren't huge figures, but on a larger scale - every window in a house or office block — the numbers quickly add up. The researchers - and Ubiquitous Energy - are confident that the technology can be scaled up for large industrial and commercial applications while remaining affordable.

Solar paint

New breakthroughs at a molecular level are bringing spray-on solar PV paint several steps closer. A team of scientists at the University of Sheffield has fabricated perovskite solar cells using a spray-painting process – a discovery that could help cut the cost of solar electricity. Efficient perovskite based photovoltaics were first demonstrated in 2012. They are now a very promising new material for solar cells as they combine high efficiency with low materials costs.

The spray-painting process wastes very little of the perovskite material and can be scaled to high volume manufacturing – similar to applying paint to cars and graphic printing.

Nanoflex Power Corporation describe how their technology can be used. "Our new photovoltaic technologies allowing for more lightweight and flexible solar materials, making it possible to integrate photovoltaics into the structure of a building, as opposed to relying on heavy and rigid rooftop solar panels."

It's concrete, Jim - but not as we know it

Green Cement

Cement has been a notoriously damaging substance as far as climate change is concerned causing about 5% of all man-made CO^2 emissions. Recently a number of new products have come to the market and are being evaluated. These new 'cements' actually absorb carbon as they dry and lock it into the resulting material. This process can sequester up to 850Kgs of carbon for each tonne used. Different products use slightly different approaches - some include magnesium silicate, others waste ferrous dust from steel making (Ferrock).

'Green'cements are forecast to take 13% of the market by 2020.

Smart concrete

Self-healing concrete is a concrete mix embedded with capsules of sodium silicate which rupture and release a gel-like healing agent that hardens to fill the void when a crack forms. The advantages would be the elimination of concrete cracks and expensive concrete maintenance. An extensive trial is being undertaken on the Heads of the Valleys Road, in South Wales. Newer technologies are using types of fungus.

Smart bricks

Remember lego? Well, a company called Kite Bricks has devised a product that works in a similar way. The bricks are made-to-order in terms of shape, size and finish, allowing for a less cost and labour-intensive construction process, in addition to a building site that is apparently quieter and with less debris. The construction process does not require scaffolding or cranes, as the bricks can be taken up in an elevator onsite. The blocks are designed with open internal spaces for insulation and infrastructure elements to be run through the bricks.

According to Kite Bricks, the Smart Brick is suitable for buildings, houses and bridges. In addition to the benefits described above, the developers list the brick's other advantages as:

- Construction cost reduction: up to 50% savings of the total expenses associated with building an 8-storey building
- Lower energy costs: the brick's design allows for greater thermal energy control.
- Resilience: its material (high strength concrete) and design have been developed to withstand the stresses of extreme weather and earthquakes

Back to basics, with wood and bamboo

Building with wood and bamboo is nothing new. Neither is pre-fabrication. The advantages and disadvantages are well known.

Modern technologies have enabled the fabrication process to be faster and more accurate than ever, and allowed for wood, a more sustainable material, to be utilised throughout the construction. Digital design integrated to digital manufacturing techniques enable fast and efficient fabrication - including windows, conduits, insulation and finishing to be created in a single process.

These processes are highly advanced in Sweden, where several companies have linked prefabrication, using wood, with latest the digital design and automation, to create residential units and student accommodation up to six stories high.

Lindbäcks, a 90 year old company in northern Sweden, is truly taking modular construction to new heights, cranking out apartments, condos, student housing and seniors buildings a rate of twenty units per week.

However, some forecasters feel that prefabricated, modular buildings will be replaced by the move towards mass customisation, using techniques pioneered in 3D printing. Even the Broad Sustainable Building company (who built a 57 storey skyscraper in 19 days using a modular system) in China, acknowledge that customers want more personalised architecture.

Lighting

In mid-February, General Electric's new spin off company, Current, scored a massive contract to install smart LED lighting across every single one of banking giant JPMorgan Chase's 5,000 U.S. branch offices. After it is completed, the project could cut energy consumption across the bank's facilities in half.

This isn't just a pilot: the technology will cover more than 25 million square feet of commercial building space, according to Current. Equally as important, the installation will blanket the buildings with a sensor network capable of controlling myriad other smart building applications, such as occupancy-inspired climate control management and smart commuting services.

The Chase deal is the most vivid example yet of why smart lighting shines as one of the most effective technology investments that sustainability-minded businesses can make — and why big companies such as Chase, mail operator Simon Properties and hospitality firm Hilton Worldwide have embraced the GE Current platform.

"The falling costs of including controls in lighting projects has made the decision to implement these systems much easier," said Navigant Research analyst Jesse Foote in a statement. "From dimming ballasts to controls software, as well as the prices of LEDs themselves, all of the key components in networked lightings controls systems are becoming less expensive." That makes for a pretty massive market opportunity. Navigant expects commercial spending for networked lighting controls to total $38.2 billion for the nine-year period from 2015 to 2024.

Naturally, that revenue potential has inspired a number of new entrants, such as Enlighted, which has sold its smart lighting service to the likes of Starbucks, and familiar companies like networking giant Cisco. The latter has dabbled with lighting networks for some time, but recently invested heavily on its "Digital Ceiling" initiative.

Through the program, Cisco is teaming up with more than a dozen other companies that sell technologies related to smart lighting solutions. The idea is to specify technologies that work together, which should speed up the time it takes for companies to retrofit existing buildings.
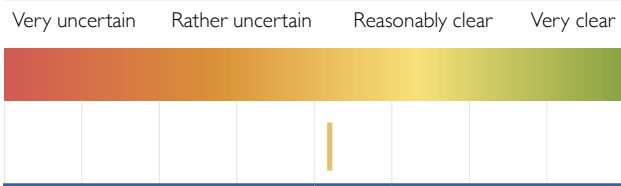
The public school district in Mobile, Alabama, which represents more than 57,000 students across 89 facilities, plans to phase in smart lighting as existing fluorescent technology ages out. The ultimate goal is to save "tens of millions of dollars" on the district's power fill while creating an environment that is more conducive to learning.
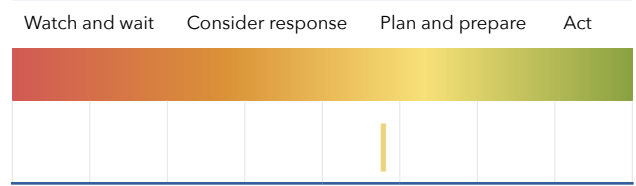
Implications for Gwent

As with the potential to 'showcase' new construction technologies, there is also an opportunity for Gwent partners to collaborate with partners to demonstrate how emerging new construction materials can deliver real benefits. As shown by the self-healing concrete pilot on the Heads of the Valley Road, Gwent partners are open to piloting new materials that may help to address long-standing problems. Given continued fiscal constraints on the public sector, new materials may have an important role to play in reducing whole-life costs of public buildings and infrastructure.

This may also require different models of delivery, undoubtedly with a greater role for the private sector who will demand a return on their risk exposure.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

The development of new, efficient and green building techniques continues apace. Modular, or offsite, construction goes in and out of fashion but advances are likely to see this become a more normalised method - especially for commercial buildings. And the need for far higher rates of housebuilding may force another look at how to use offsite prefabrication to gain volumes.

Robot construction

As discussed elsewhere in the report, the move towards ubiquitous robotics maybe closer than previously thought. The construction sector is no exception - and a range of new automated machines are being site tested. The Termes system, invented by researchers at Harvard and was modelled after termite colonies. These self-organising robots would work together to build structures. The robots would be given a blueprint for building and a set of "traffic laws" that where they can and can't go during construction. The benefit of these construction robots would be the ability to build in places it isn't easy or cost effective for humans to go. The downside could be a loss of jobs.

In addition to the Termes system, there is also the SAM (Semi-Automated Mason) 100 brick laying robot, which made its debut at World of Concrete 2015. Built by a New York robotic firm, SAM still needs a crew of three to operate but is capable of applying mortar to brick, setting the brick and moving a long a face wall predetermined by a laser. The self-contained SAM can lay a brick every 20 to 25 seconds. At World of Concrete, SAM built a 2,640 modular brick wall with one mason and one tender in just 16 hours.

3D printing

3D printing could revolutionise the construction industry. The lower costs of this process could also affect housing affordability, with lower material usage and lower labour costs creating a less expensive construction method which can in turn create lower-cost housing. It also allows for more bespoke designs.

Chinese company Winsun has already claimed to have built 10 3D constructed houses in one day at a cost of just $5,000 per house. In addition to making housing more affordable, many architects also hope that 3D printing will increase their ability to customise homes and buildings. Earlier this year, Winsun took its 3D printing construction beyond single houses, building a five-story apartment building and an 11,840-square-foot villa. Winsun used a large 3D printer that fabricates the building parts in large pieces at the company's facility. Winston then assembled the pieces on-site adding steel reinforcements and insulation.

According to an article from CNET, Winsun says the 3D process saves between 30 and 60 percent of construction waste, can reduce production times by 50 to 70 percent and reduce labor costs by 50 to 80 percent.
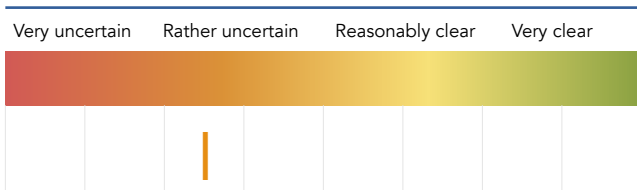
Implications for Gwent

The construction industry has been slow in adopting new technologies, particularly on a large-scale. The majority of buildings built today are largely built in the same way as they were several decades ago. However, technology development continues apace. Therefore much of the concentration of effort, and where public authorities can assist, is to promote the adoption of the
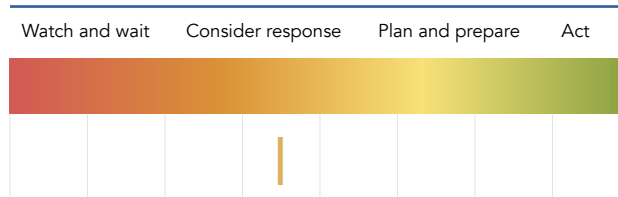
emerging technologies. The need for higher rates of housebuilding may provide the necessary commercial impetus for developers to adopt new technologies (or they may face competitive pressures from new entrants into the market), but planning policy and consent will have a role.

Public procurement may also begin to play an important role and it could be possible that construction procurement is used as a tool to encourage the adoption of new construction technologies. This may provide some certainty (reduced risk) to construction companies and developers in adoption. The potential application of new techniques could also become a greater consideration in planning policy i.e. the identification of strategic sites which may be appropriate for new techniques to be tested and developed.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

The latest figures indicate that the housebuilding industry has responded to policies aimed at stimulating housing supply in the UK, and is on track to deliver the Government's one million homes by 2020 pledge. According to Energy Performance Certificate records, the number of new homes completed reached 211,000 in the year to June 2017, up 49% in three years.

However, access is highly unequal; the relative cost of a buying a home for the poorest households and individuals has risen faster in the UK than anywhere in Western Europe, fuelling a "worrying" increase in homelessness, European-wide research has found. Housing costs for people who earn about £16,000 a year increased by 45% between 2010 and 2016, compared with an average rise of 10% for the lowest earners across Europe. This is part (not all) of the reason why homelessness has increased across Europe, including the UK and Wales (estimated to have increased by a third over the past year), as well as other reasons such as the end of assured tenancy. The growing problem of homelessness has received recent policy re-focus, for example, through the 'Housing First' programme which is being implemented in Wales and elsewhere after being successfully implemented in countries such as Finland.

As has been well-documented, there are generational issues with access to housing, particularly for the young. Currently, almost half of 25-34 year olds are renting privately, up from 21% in 2003-04. The proportion of private renters has reached the same levels as in the early 1970s, and has overtaken the number of social renters. Affordability of housing is partly driven by the cost of land. The total value of UK land has increased more than fivefold in just over 20 years. According to the Valuation Office, whereas the average price of agricultural land in England is £21,000 per hectare, the equivalent with planning permission for housing now comes in at a cool £6m. The requirement proposed in the Housing White Paper for local authorities to proactively plan for rented housing will bring to the fore the challenge for policymakers and landowners to balance delivery with land value.

In the rush to meet the one million new homes targets, concerns over the quality of new housing development are increasing at pace. For example, Shelter reported that more than half of buyers of new-build homes have had major problems with construction, fixtures and fittings. This may represent a 'time bomb' in terms of the quality of housing as it ages.

There is increasing industry focus on Brexit's potential impact on build costs and access to skilled labour. One possible outcome could be further emphasis on modern methods of construction (MMC). The industry is struggling to deliver 300,000 homes per year through traditional construction techniques. It is estimated that more than 70% of the components of a traditional build can now be manufactured offsite. Several companies have ambitious plans in this area – for example, Live Verde, has plans for five factories in the UK producing 25,000 units per year by 2022. Other big developers such as Berkeley Homes and Legal and General are investing in factories for volumetric housing.

One of the next steps beyond modular builds is the potential application of 3-D printing in construction. The UAE has said it wants 25% of buildings to be 3D-printed by 2030. Dubai has already produced the first 3D-printed office, constructed by a robotic arm in 17 days. In the UK such techniques are in use by construction firms such as Skanska, which is "printing" concrete blocks at a facility at Loughborough University. London-based architecture firm Facit Homes has

recently completed a luxurious house in Highgate, north London, using what it describes as "digital manufacturing", a combination of digital printing and traditional construction methods. Building a house in one go in just 24 hours with just one machine is clearly a huge step towards the goal of commercial viability. Apis Cor, the 3-D construction printing company ,estimates that it can build a single-storey house 70% more economic than traditional methods. However, other commentators believe there are major hurdles (planning systems and availability of sufficiently large sites) to overcome for widespread application in the UK.

The role of housing will change, and this will be partly driven by demographics. Whilst the number of households headed by people aged over 75 will increase by 150,000 per year, only 7,200 homes targeted at older households are being built annually. There is a market opportunity for more development aimed at older buyers, and privately rented. This will shape the 'home of the future', with the integration of AI helping to integrate into health and social care. Housing Associations are well placed to act not just as place makers but as leaders in integrated service provision.

The social housing sector is expected to continue to experience consolidation between providers. Current expectations are that larger associations will morph into developers of a wider range of housing as well as commercial and mixed-use schemes. Management, particularly more responsive, tenant-centred management, may become less of a priority.
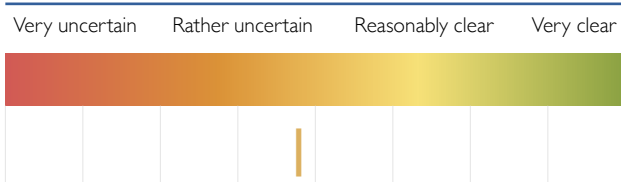
Implications for Gwent

Stimulating housing supply, partly to increase affordability and access to housing, is currently a hot political topic. The industry – helped by considerable policy and financial UK Government assistance – is responding to the call for one million homes. In Gwent, the demand for new housing continues to concentrate in its communities along the M4 corridor. The demand for development land, when set against limited supply, means that land values are relatively high here – further constraining the scope for affordable housing development at the level required.
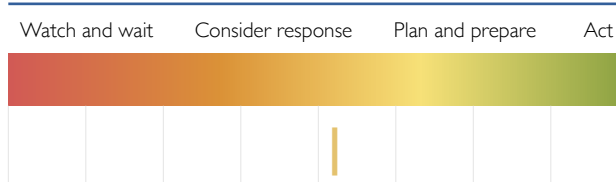
The construction industry – which has effectively used the same broad methods for decades – is at the cusp of some significant innovations. However, these still tend to be niche, and not yet applied on a mass scale. Whilst elements of modern new housing do incorporate modular construction, application is lower than technology capability. There are opportunities for proactive local authorities to fully embrace these new technologies (or certainly host 'pilot' development), be it modular design and construction, or emerging technologies such as 3-D.

Similarly, there are emerging opportunities for the showcasing of homes of the future that are fully integrated with service delivery. The ageing population will demand homes to be more interactive, and public service providers in health and social care will need to build relationships with house developers – whether in the social or private sectors (or a hybrid of the two) – to investigate how this can be achieved. Again, there are opportunities for Gwent to be at the forefront.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Globally, the demands made on the land are unsustainable. The growing demand for food, fodder, fuel, and raw materials is increasing pressures on land and the competition for natural resources. At the same time, degradation is reducing the amount of productive land available. The drivers of land degradation are mainly external factors that directly or indirectly impact the health and productivity of land and its associated resources, such as soil, water, and biodiversity. The need to secure resources and fertile soil have led some countries and global agri-businesses to 'land grab' from poorer regions.

The pressures of climate change, resource depletion, biodiversity loss and so on are quite likely to make different demands on how we use our land in the UK - especially given that we live in a crowded country, with many vested interests. Clearly there will be enormous pressure to grow more food within the UK - but what sort of food (less meat?), and where? In addition, we will need to create more low carbon energy - so there may be pressure to allocate land to renewables and bio-fuels. How will we protect (and enhance) space for nature - ensuring functioning eco-systems on which we depend? How can we ensure that we continue to protect fresh water supplies and allow for more storage and distribution? Our increasing population (and pressure for a growing economy) will fuel demand for more land for development - whether for building or infrastructure. And how can we, given all those pressures, still keep enough land for our leisure and pleasure?

England has the greatest population density in Europe, apart from Malta - and this will increase with a growing population. Nevertheless, only 9% of the land area is actually built on. The UK is currently 61% self-sufficient in all foods, and current government policy aims to increase that proportion.

In a fragmented system, competing interests and parts of government make the case for specific uses for land. The UK government has a target for 12% of the UK to be wooded by 2060 (up from 9.5%). The country needs upwards of 4 million new homes by 2035. The Climate Change Committee have identified that more land is needed to offset the effects of climate change - such as managing floods and preserving peat bogs.

There is no clear overarching land-use policy that can help to balance these increasingly important needs. Securing Wales Future highlights how any Brexit risks to Welsh farming are also risks to managing environmental resources. It notes that: *"Securing resources is not only about supporting farming. With 83% of Wales' land surface being managed for farming and 14% for forestry, a separation between the management regimes for 'environment' and 'agriculture' is at best artificial."*
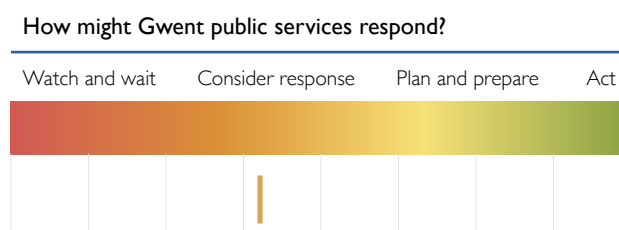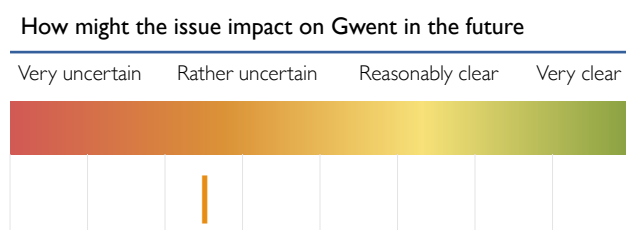
Friends of the Earth have developed a 'Land Use Calculator' for the UK which offers the opportunity to test out future land use scenarios for 2030 - using both demand and supply calculations.

Implications for Gwent

Land policy in Gwent needs to be wider than a simple consideration of development and/or protection. Currently, land use is primarily determined by the land owner and planning policy. However, there is an opportunity to take a more holistic view on land in Gwent to have a real discussion about the role of land in place-making. This may mean that some difficult decisions need to be made, some trade-offs between potential uses. Potential changes to agricultural policy

post-BREXIT will be at the forefront of such discussions in the medium-term, with suggestions that UK Government policy may move more towards environmental protection/diversification rather than food production.

As illustrated, Gwent is characterised by different pressures on land in different parts. There may be different solutions/outcomes to longer-term considerations of land-use across Gwent – reflecting these differences. Gwent might consider adopting the Scottish Principles of Sustainable Land Use - and, in particular to look for opportunities to deliver multiple benefits from land use.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

MOBILITY

AUTONOMOUS VEHICLES (1) - Are we nearly there yet?

INFRASTRUCTURE - Staying connected
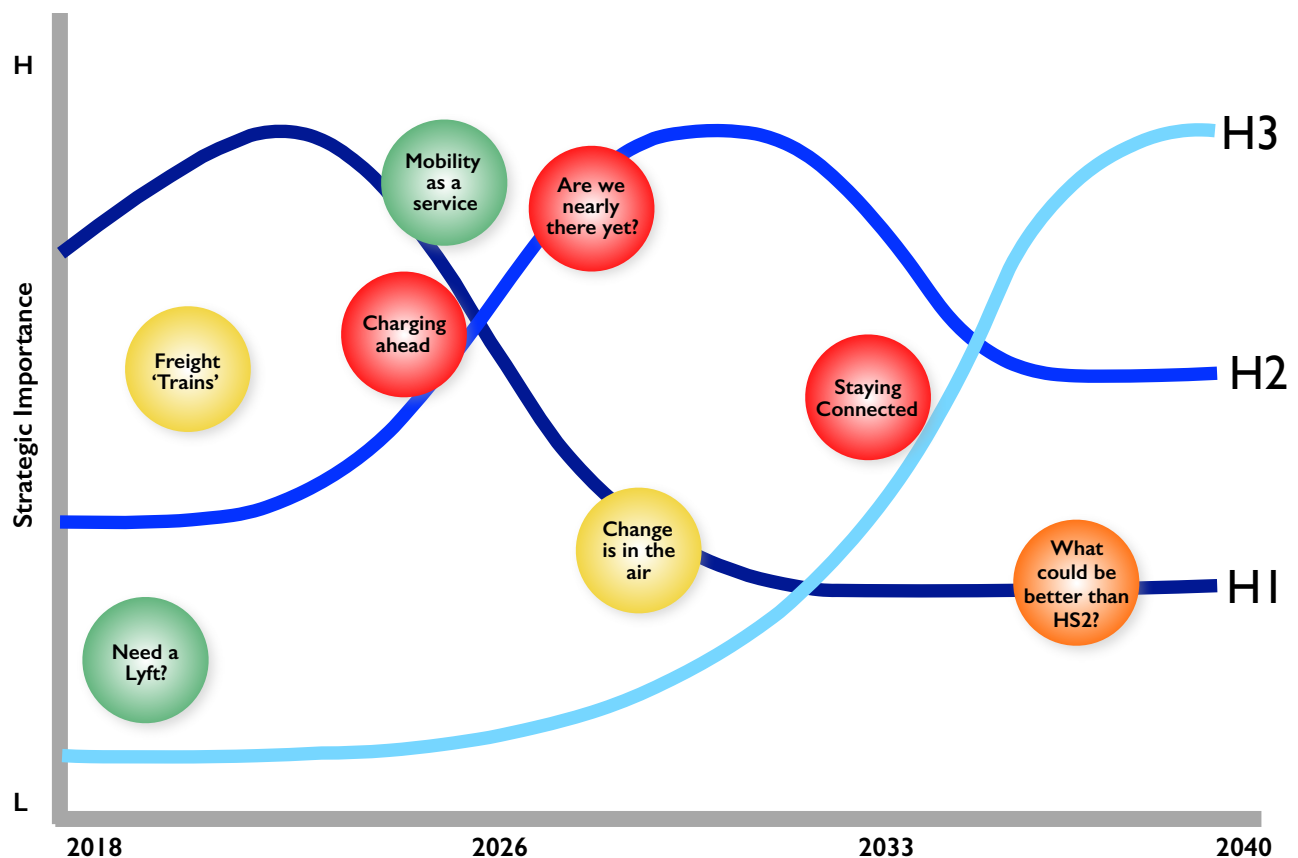
INFRASTRUCTURE - Mobility as a service

SHARED TRANSPORT - Need a Lyft

ELECTRIC VEHICLES - Charging ahead

HIGH SPEED TRAINS - What could be better than HS2?

AIR TRANSPORT - Change is in the air

TRANSPORTING GOODS - Freight 'trains'

The Chancellor announced in the autumn budget 2017 that the government wants to see fully self-driving cars, without a human operator, on UK roads by 2021. He also announced that the National Infrastructure Commission (NIC) will launch a new innovation prize to determine how future roadbuilding should adapt to support self-driving cars (see *Changing infrastructure: who pays?*).

Not everyone believes this to be a realistic timescale - even those who are optimistic are seeking to manage expectations. Lucy Yu of FiveAI, a company building software for autonomous vehicles (AVs), believes they will have a car able to operate without a human driver by 2021 but only under a limited set of circumstances based on weather conditions, type of road and time of day.

And it is not certain that the market is ready for or interested in AVs. Research published by MIT in May 2017 on US attitudes found that trust in fully automated vehicles is declining, particularly amongst younger age groups. A study by Deloitte published in November 2017 suggests the same may be true in the UK; and a report published by the House of Lords in March 2017 expressed concern that government is too focussed on road vehicles at present. There remain, too, safety concerns about driver disengagement from the driving task.
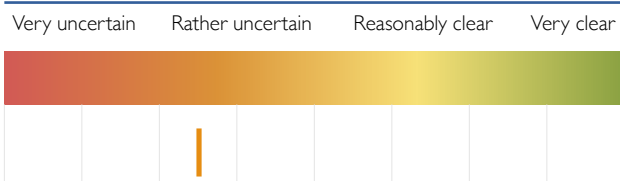
Implications for Gwent

Innovate UK is spending £2.5 million to trial self-driving vehicles in and around Milton Park, the large, high-tech business and science hub near Didcot, Oxfordshire. The trial - undertaken by a consortium of organisations led by UK transport operator FirstGroup – will see AVs link private roads at Milton Park with nearby transport services. The hope is that, by the end of the 30 month trial, 50% of journeys around the business park will be by AV.

Cambridge has announced its own AV project, working with Aurrigo to build and trial six 10-15 seater self-driving shuttles on an existing guided busway between Trumpington Park and Ride and Cambridge Station. The first shuttle will be engineered and ready for prototype testing by April 2019, with the first passengers set to step on board in Summer 2020.
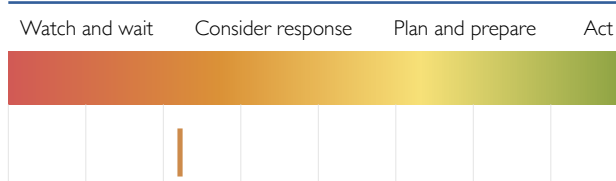
While it may feel like there is plenty of time for Gwent to watch and consider what all this might mean, the region should start to debate its options soon. The jury may indeed be out on consumer uptake, but business applications may lead and build acceptance. Deploying AV's in low risk, high visibility functions such as home delivery could be a rapid route to building familiarity (see Shops that come to you, 8 paragraphs into Self-driving cars will profoundly change the way people live in the Economist's special report from 1 March 2018).

Gwent should keep an eye on developments and begin to consider its response. It could consider the feasibility of an autonomous vehicle trial in a low risk, high visibility service.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

The rise of connected and autonomous vehicles (CAVs) is expected to be one of the most significant and potentially disruptive changes in future personal mobility. Connected vehicles promise integrated, reliable, and safer travel, whilst autonomy could increase mobility, reduce incidents, and increase national productivity.

AVs use information from on-board sensors and systems to understand their global position and local environment, enabling them to operate with little or no human input. Connected vehicles have a driver but communicate with their surrounding environment (including infrastructure and other vehicles) to provide him or her with information that informs decisions about aspects of the journey such as route, travel conditions, destination details and so on.

One problem for AVs is that the world was built to cater for human drivers, with whom they must share the roads. Humans communicate by flashing their lights and using other non-verbal cues, which (like other driving customs) can vary from place to place. AVs will probably end up being tuned to fit in with their surroundings. "You have to make the vehicle so it can operate in the world as it is today," says Chris Urmson of Aurora, an autonomous-driving startup.

There may soon be road lanes or entire districts dedicated to AVs, and special equipment to support them. Already, in some areas where AVs operate, traffic lights have been modified to tell approaching vehicles when they will change. In future, vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) technology should allow AVs to co-ordinate their actions better.

Implications for Gwent

One issue that may slow adoption in the UK and Gwent is the weather. AVs are on the cusp of working on public roads, but – as The Economist notes - in orderly environments with good weather. "Once you can crack that nut, it's incremental," says Chris Urmson, a man who is used to trialling vehicles in California and Boston.

Another issue may be how quickly the UK can develop and put in place the technological infrastructure required for level 5 autonomy – particularly (and perhaps critically) outside the cities. Signficant questions about the network need answers too. Where will regional government get the money to make roads more CAV-friendly? Who will be responsible for the vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) low-latency wireless networks required to manage the traffic?

Will AVs change the nature of cities and threaten Britain's natural environment? And what kind of autonomous infrastructure will create competitiveness in the future?

Gwent should keep an eye on developments and begin to consider its response (perhaps with other parts of Wales and the wider UK). This will require further analysis of potential impact.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Mobility as a service
INFRASTRUCTURE

H2

Highways England's recent strategy, published in December 2017, identifies a number of trends which will shape the strategic road network (SRN) and influence operations over the next 30 years and beyond. One of these trends in particular – Mobility as a service, or MaaS – is generating significant interest across government and in the business community.

In fact, MaaS is not so much a trend as an emerging business model for transportation in the digital age. MaaS offers users the promise of better journeys across intelligent transport systems that utilise technology to combine modes of transport. Seamlessly.

'Users' can be individual travellers or businesses moving goods.

Since 2016, Helsinki residents have been able to use an app called Whim, heralded as the world's first MaaS offering, to plan and pay for all modes of public and private transportation within the city - be it by train, taxi, bus, carshare, or bike-share. Anyone with the app can enter a destination, select his or her preferred mode of getting there - or, in cases where no single mode covers the door to-door journey, a combination - and go. Users either pre-pay by monthly mobility subscription, or pay as they go using a payment account linked to the service.

The goal is to make it so convenient for users to get around that they opt to give up their personal vehicles for city commuting, not because they're forced to, but because the alternative is more appealing. According to Sampo Hietanen, the visionary behind Whim, "We want to prove that we can beat the service level of a car. Or at least be comparable to it. We want to show that people want it, not just that we can do it."

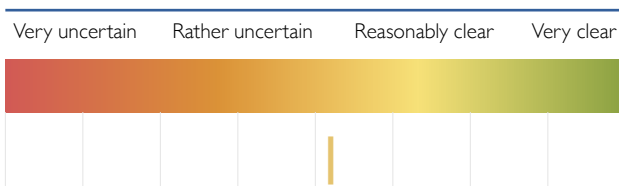## Implications for Gwent

Whim is being piloted in the UK in the West Midlands from April 2018. The pilot will initially be rolled out to 500 people who will be able to use the app to combine different modes of transport to find the best route – at a set price – for their journey. Participants will be able to travel anywhere around the West Midlands via bus, train, tram, bike and taxi (within a certain radius). If successful, Whim be available to all users in the region from summer 2018.
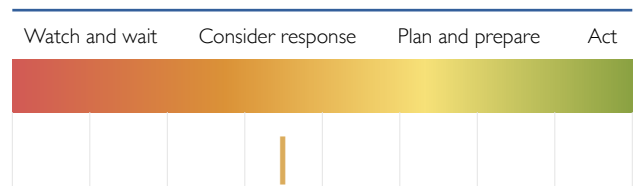
MaaS Scotland has created a new positioning document, outlining the investment and support which the organisation believes could make Scotland a world leader in the future of transport. As part of the project, Dundee City Council's Mobility Innovation Living Laboratory has put out a call of almost £1 million pounds to develop and trial new products, services and business models.

Google the terms "mobility as a service Scotland" and "mobility as a service Wales" and the results are strikingly different. What can Gwent learn from Dundee? Gwent must find out more about emerging practice in other regions and must track progress. It should review its findings every 6 months and review options for introducing MaaS.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

The public transport system in San Francisco - home of both Uber and Lyft – is limited, clogged and barely usable; which is why Uber and Lyft have grown. Lyft has now introduced a new service called Shuttle, which offers a fixed-fare, fixed-route trip in a shared vehicle. In other words, a private car acting like a bus. Some cities in North America now pay Uber or Lyft to provide public transport services. Innisfil in Ontario has signed a deal to subsidise the cost of Uber rides for residents, rather than pay for two new bus lines. Summit (New Jersey) subsidises Uber rides rather than spend $20m on a new parking garage next to the train station. Cities that are concerned about the Uber or Lyft business model have taken a third approach, launching their own on-demand, carpool app.
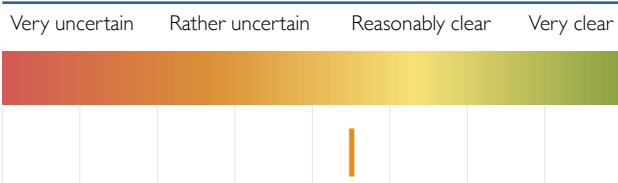
Implications for Gwent

Uber and Lyft are, one might argue, something more than cab/delivery/courier businesses. They are businesses which are exploring how new technology can be used to improve existing services and create new one. They are also relentlessly innovative, bringing (for example) your hairdresser to you, rather than have you waste your time going to the salon or forming partnerships with doctors' surgeries to bring patients to their appointments on time.
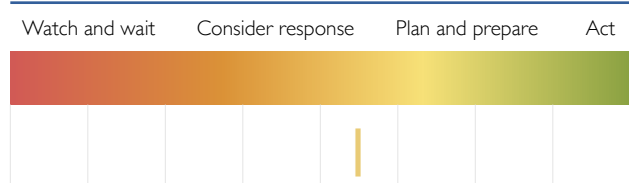
Think of the cost and time savings in GP surgeries…

Uber and Lyft and other web based business will continue to challenge the status quo and to raise difficult questions. Cities that embrace the technology – like Newport has – may be set to gain advantage. Gwent might consider trialling a single (or a small fleet of) Uber or Lyft shuttles. These could be rolled-out to rural areas, helping to reduce accessibility issues for many of the population?

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

One of the key infrastructure policies in the UK Government's Industrial Strategy, is to support development of infrastructure for electric vehicles (EVs) through investment of £400m in charging infrastructure and £100m to extend the plug-in car grant. These developments are key to the Government's Clean Growth Strategy and part of the global push for EVs.

While there are some concerns that the government is falling behind on its targets for EVs, banning petrol and diesel cars may just be the push that consumers needed. EVs are now increasing in popularity in the UK and historic concerns about poor performance and limited range are changing. The best electric cars today can – at a price - surpass 300 miles of range, produce 0-62mph times to rival supercars, and offer 7-seat variants for those need extra space.

So far so good; but as the number of EVs rises so will the infrastructure – and specifically the charging infrastructure - requirements. Figures released at the end of 2017 show that the the UK added less than one new public charging point for every six new plug in vehicles. The figures make particularly grim reading for early adopters in Wales, where, despite having around half as many plug-in vehicles as Scotland, it has just a tenth of its total of rapid chargers.

Of course, people can charge their cars at home but if you live in a block of flats there are additional problems. There are two other implications. The first is that people may become concerned about the lack of charging points - which may slow the adoption of EVs. The second is that an increase in charging vehicles at home may have significant and serious consequences for grid capacity and stability. Local networks in particular could face significant problems.
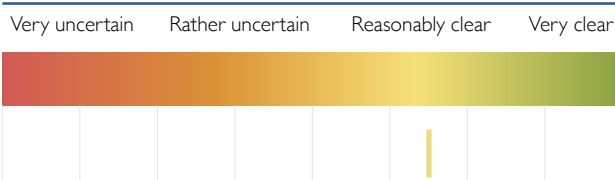
Implications for Gwent

Electric charging infrastructure will be crucial for the successful uptake of EVs and the availability of public charging points in Gwent – and in Wales – will need to increase significantly.

Around one third of car owners live in terraced houses or in flats and therefore have no access to off street parking. For them, plugging in overnight is not yet an option and so innovative solutions – such as converting street lights to charging points or adopting a workplace charging scheme – are going to be required. But things are slow to get off the ground. A recent government scheme where councils could bid for funding for 75% of the cost of installing charging points received applications from only five local authorities.
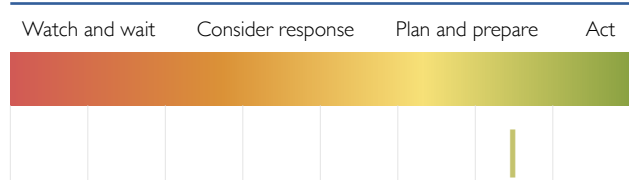
Government has created a new £4.5million fund and is urging councils to bid this time. We're likely, too, to see rapid developments in charging networks and new energy storage technology that may soon mean charging takes minutes rather than hours.

Which is all good news as long as people can actually recharge locally. This is going to be important for more than residents; leisure and business drivers will need to feel confident that they have access to power once they enter the region. Or else, there's a danger they won't. Gwent should begin to plan its electric charging infrastructure.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Hyperloop and maglev, according to the Institute of Directors (IoD).

The IoD believes that HS2 will be yesterday's technology by the time it is ready. It suggests that, instead of making incremental upgrades to infrastructure. The UK needs to invest in newer technology that will deliver much greater outcomes.

This view, delivered in advance of the Chancellor's November 2017 budget *may* have been designed to capture headlines rather than to deliver a serious message.

Or may not. Virgin Group has invested in Hyperloop One – the company has completed and tested a prototype in the Nevada desert and Richard Branson was named Chairman in 2017. The business has some cash flow problems, but it's not stopping continued international investment.

The promise of hyperloop ranks – as Wired Magazine put it in December 2017 – at the top of the spectacular index. The article also notes that, even if the challenges around creating the required infrastructure prove too much, the engineering works going on now could produce tools and techniques to improve existing industry.

Implications for Gwent

How likely is hyperloop technology and how much could it change things? If Hyperloop really does - one day - transport people between London and Scotland in 45 minutes (or between London and Cardiff) the economic and physical geography of the UK could shift dramatically.

This isn't likely to happen soon, of course - but Virgin Hyperloop One has announced a preliminary agreement with the Indian state of Maharashtra to build a shuttle between the cities of Pune and Mumbai. The shuttle will travel at 240 miles an hour and deliver passengers from Pune's city centre to Navi Mumbai international airport in 25 minutes, shaving three hours from the current journey time and connecting 26 million people in the process. It also hopes to play a major role in logistics, ferrying freight and light cargo to the Port of Mumbai for international distribution.

A fully operational demonstration track will be built over a two to three year period following the signing of the final agreement, with the second phase of construction due for completion in five to seven years. The total estimated cost of the project has yet to be established but a feasibility study now underway will be used to determine the structure of any subsequent public-private partnership entered into.

Pie in the sky maybe. But if hyperloop technology really could reduce the journey time from Heathrow and Gatwick to five minutes, what would the emergence of a south east giant hub mean for Wales?

A paper published by the Department for Transport in November 2017 said that hyperloop in the UK would be "at least a couple of decades away". Which might – just might – bring it within the scope of this horizon scan. There are no immediate implications for Gwent.
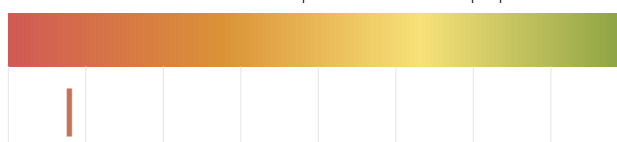
How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear
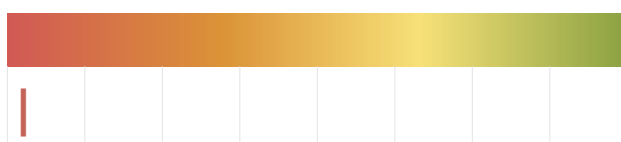
How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Air travel is facing some disruption, but there is little suggestion that demand will slow down any time soon. The industry is investing in technology across the sector and, while there is some talk about pilotless planes, it's fair to say that not everyone is on board with the idea There is much greater interest in using technology to fix existing system issues and to improve the passenger experience.

Other areas will follow soon enough. Far Eastern Air Transport, the Taiwanese airline is the latest (but not the first) airline to accept Bitcoin to pay for tickets and related travel.

Singapore Airlines is developing a travel technology community to help diversify its own product and service offerings with stronger capabilities in the digital space. Planned projects include developing digital solutions to help personalise the end-to-end travel experience and augmented reality to enhance aircraft maintenance.
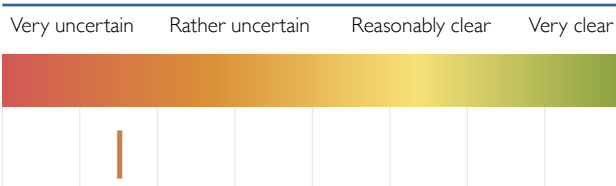
Dubai – which has a target for autonomous transport to account for a quarter of total trips by 2030 - has begun testing crewless two-person flying taxis.
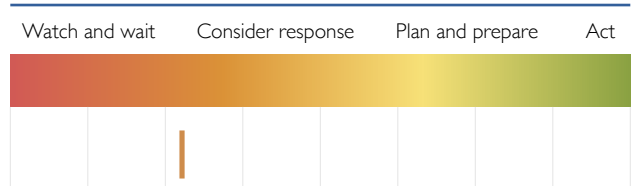
Implications for Gwent

Soon – and irrespective of size, perhaps – the airport experience may be factored into the choice about where or how to travel. Or, at the very least, when to linger and when to rush through.

Cardiff Airport's planned investments are therefore good news and will continue to strengthen the passenger experience. Perhaps the next wave of development will be to work closely with airlines to ensure that future ground side technology infrastructure matches the aspiration of carriers and the expectation of passengers. Gwent should keep an eye on developments. Once it has a clearer idea of how things will develop, it may wish to consider possible responses.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

The UK Government has given the go ahead to trial 'platooning;' convoys of semi-automated HGVs that will have acceleration, braking and steering controlled by the lead vehicle. Each lorry will have a driver in the cab ready to retake control at any time. Proponents say platooning could cut both congestion and the cost of fuel for hauliers. Motoring organisations have voiced concerns about safety, particularly on motorways.

Platooning road trials are already underway in Japan as part of the Japanese government's Future Strategy 2017. Road trials in parts of Europe other than the UK are planned – the target is to be able to drive across Europe with platoons by 2023 - and Daimler has been given permission to test the system in the US.

There are concerns about the impact of jobs, with the International Transport Workers' Federation suggesting that 4.4m of the 6.4m professional trucking jobs in the US and Europe could be eliminated by autonomous technology. The International Road Transport Union, on the other hand, suggests that autonomous trucks will help the haulage sector deal with the current shortage of drivers in many parts of the world.

Implications for Gwent

Automated driving will have a major impact on the entire mobility system in terms of labour costs, safety, environmental impact and traffic flow. Platooning reduces air drag and therefore fuel consumption and emissions.
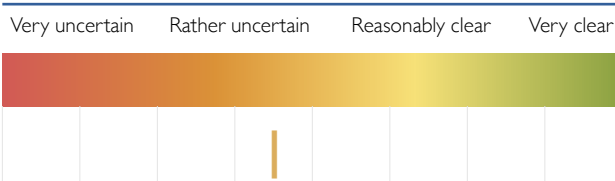
Making roads available for platooning will be straightforward in the short term and will require very little (or no) upgrading of existing infrastructure. In the longer term, augmented infrastructure may improve the reach and function of platoons.

For now, then, the economic costs of platooning are likely to be low and the benefits are likely to be high. It will also make AVs visible on the road and help to build acceptance.
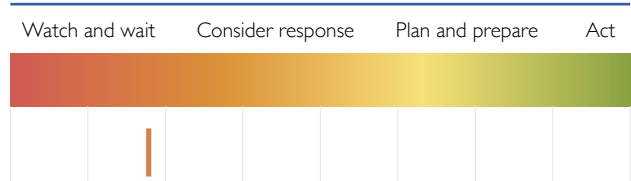
There is no indication yet that the public will dislike or campaign against platoons – but who knows? Fears of job losses may lead to negative press; and while the main headache may be for government and road transport business, there may be a lot that local government can do to raise awareness about the benefits and to communicate clearly.

If Gwent were to approach early adopters and explore how it might work with them to create a positive and high impact communication campaign about the benefits of platoons, that might be well received. Perhaps more importantly, it will give Gwent an opportunity to engage with some of the issues around automated vehicles at an early, low risk stage. Gwent should engage with early adopters of platooning to explore emerging issues.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

POLITICS

BREXIT - Divided we fall
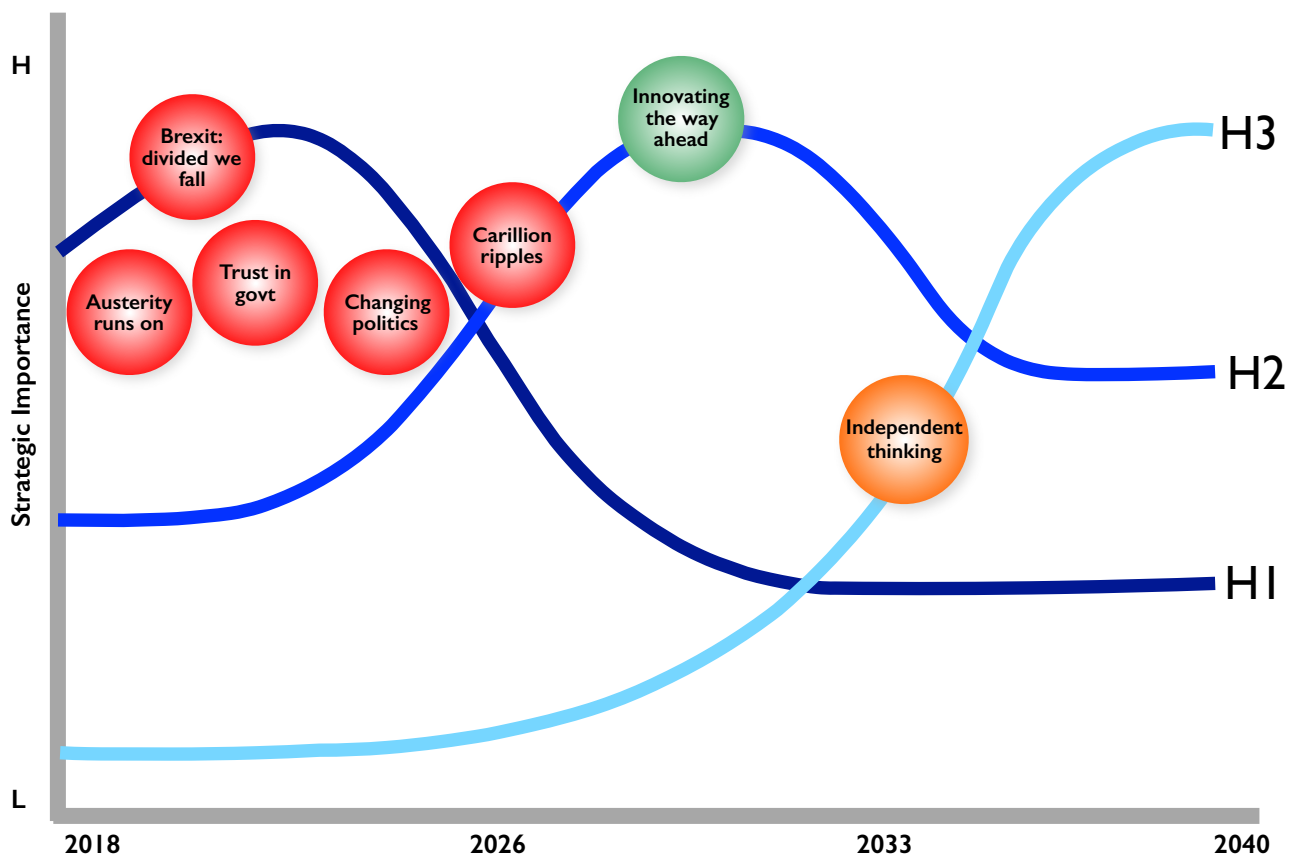
DEVOLUTION - Independent thinking

PUBLIC SERVICE - Austerity runs on

PUBLIC SERVICE - Innovating the way ahead

TRUST - Trust in government

TRUST - Carillion ripples

PARTICIPATION - Youth representation

An article in The Sunday Times in March 2018 suggests that the real winners from Brexit will be the senior Civil Servants in Whitehall who will take the top jobs in the new constitutional order.

The article suggests that a new Joint Committee to be co-chaired by the Union and the United Kingdom will be responsible for the implementation of Brexit. As well as settling disputes, it will monitor and supervise daily political life, overseeing implementation of the political promises and parliamentary legislation on relations with the EU.

The article further suggests that this will be "a quiet coup [that] will transform British politics, representing an entrenchment of power by the civil service over parliament" and that "just as the EU curbed popular and parliamentary sovereignty before Brexit, the joint committee, and Whitehall, will limit it afterwards."

It's a strikingly downbeat analysis.

Equally striking, but for different reasons, is the furore over the blue passport that hit the press in late March 2018. The decision to award the contract to print Britain's blue passports to an overseas firm was greeted with anger by Brexit-minded Tory MPs. Priti Patel called it "a national humiliation", while Bill Cash, the chairman of the Commons European scrutiny committee, called it "symbolically completely wrong".

Those who didn't want Britain to leave the European Union suggest that the whole affair shows the fallacy of the 'taking back control' argument, and that British businesses are going to lose out as a result of Brexit. Those who were delighted by the referendum result think it shows contempt for Leave voters because the blue passport was supposed to be a symbol of British independence.

Fundamentally, as Isabel Hardman wrote in The Spectator after the contract was awarded, there is a wilful misunderstanding between the two sides. Remainers want to caricature Brexiteers as being jingoistic protectionists, while Brexiteers suggest that Remainers want to hand over all Britain's business to Europe anyway. The longer these caricatures persist, Hardman notes, the harder it will be to heal the divisions in Brexit Britain.

Implications for Gwent

It is not a comfortable thought, but the arguments and (sometimes) bitter disagreements of the last 2 years may just be the start of a long, long spell of difficult negotiation within Britain.
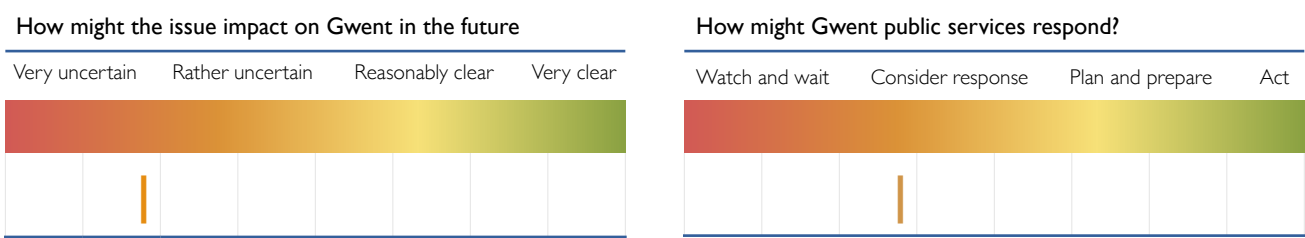
There are times when Brexit feels like a Pandora's Box. In a different era, it might have been only a little local difficulty but its domination of print and broadcast media – coupled with a seemingly insatiable appetite to engage the public in debate – means that divisions are indeed becoming entrenched.

Increasingly, it seems that public debate has raised unrealistic expectations of what Brexit will deliver and encouraged naïve hopes about where power will lie.

There may be some turbulent water ahead when Whitehall resumes its authority. Britain won't heal itself. We will need our institutions to help us.

It is too early to predict how the implication of BREXIT will play out in different parts of the UK. However, it will be important for Gwent partners to keep a watching brief, particularly for any high

risks that develop for its important economic sectors. Partners may need to quickly respond to counter any negative impact.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Plaid Cymru would hold a referendum on independence if it got in to government in Wales according to Carmarthenshire AM Adam Price.

That might be a bold move. While 44% of the Welsh electorate reportedly want an assembly with greater powers, there remains little appetite for Welsh independence currently, with support running at only 7%. Support has been below 10% since 2011.

Commentators suggest the low level of support is a mix of factors, most notably (perhaps) the high level of poverty (likely to grow post Brexit because of the loss of EU funds) and the low number of jobs per capita.

Could it be, though, that other parts of the UK might effectively make Wales' decision on its behalf?

The UCL (University College, London) Constitution Unit is exploring options for an English Parliament. Any move of the UK Parliament outside London would require relocation of English government departments and UCL proposes that a national competition might be the best way to resolve any jealousies over which city might be chosen as the location.

Where - if the political institutions of the UK begin to change - might it end? An article in the FT in November 2017 imagining post Brexit London as a city state may (or may not) have been tongue in cheek but it follows a 2016 petition calling for Sadiq Khan to declare London independent. Scotland biding it's time on indyref2 and with complex negotiations in Ireland still to work out, the odds on the long term survival of the UK may just be shortening.
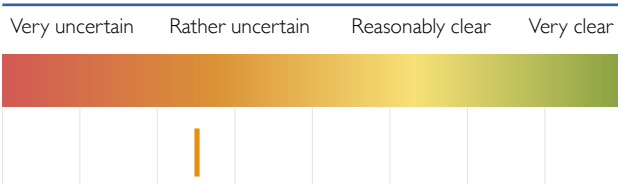
Implications for Gwent

While noting that the idea of Welsh independence is "off the radar at the moment", Laura McCallister, Professor of Public Policy at the University of Cardiff, also noted that "things can change very quickly."
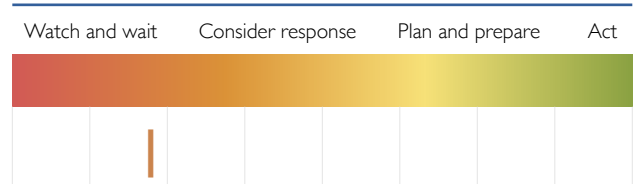
Whether or not independence is a rational choice in a stable world, it may rise in popularity in an unstable one. As the Huffington Post suggested in the run up to the Scottish Independence Referendum in 2014, reasons for choosing independence are more likely to be complex and emotional than to be rational. And emotions may run high from 2019 onwards.

There are no immediate implications for Gwent, but it should monitor public opinion.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Austerity remains the new normal around the world as governments continue to wrestle with the aftermath of the global financial downturn. The prevailing rhetoric is that austerity is here to stay - at least until the mid 2020s. The route depends on which government is in control; spending cuts on the right, increased taxation on the left. Culturally, the language of austerity is retrogressive.

The numbers in the Government's 2018 spring statement may be better than projected in 2017 but Paul Johnson, Director of the Institute for Fiscal Studies (IFS) says that "We are nowhere near out of austerity. There are still big spending cuts and big social security cuts to come."

Johnson also says that local government, which was coping fine until 2014, "really isn't any more."

Government borrowing has come down from about 10% of national income to 2% - which is good – but Britain still runs up extra debt of £40bn a year. And the national debt - approaching £2tn - equates to around 90% of GDP. If interest rates climb and UK debt debt goes, there's a question about when institutions will stop lending to Britain. That, says, Johnston, is when "you lose control in quite a big way. You're managing a very small risk of a very bad outcome."

Johnson reckons it is time for politicians to level with the public about the financial challenges facing the UK. Brexit, plus our ageing population and the resultant pressure on health, pensions and social care, means something has to give. "It's very hard to see what's left to squeeze," he says. "There is no defence budget to squeeze. There is no industry budget to squeeze, no housing budget to squeeze. Where do you go next?"

He says both of the main political parties are living in a fantasy world. "On the one side you have a party saying you can have all the welfare state we've ever had and pay no more tax, which isn't true. And on the other side, you've got them saying we can levy more tax and it'll be somebody else who pays because it'll come off companies and the rich, which also isn't true. You can't have European standards of welfare with American-style tax levels. You have to make a choice."

Making choices and being honest with the public is not, Johnson suggests, something politicians are good at.
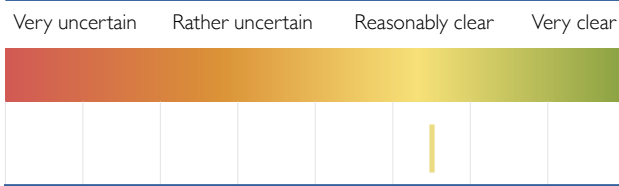
Implications for Gwent

Johnson is alarmingly clear in his message: There is no free money. If we want better health care, social care, education, transport, we are all going to have to stump up: VAT on food; paying social insurance to help fund the NHS; road pricing to replace the £30bn a year in fuel duty that will be lost as cars move away from petrol and diesel; wealth taxes levied on expensive properties, second homes (which he sees as a key factor in the housing crisis) and even personal pensions, which have been sacred until now.
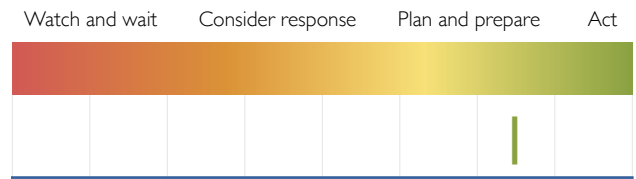
He also estimates that in the next 20 years, we will have to pay an extra 3% of national income in tax – equivalent to about £60bn a year – just to meet the rising pension and social care bill.

Continuing austerity continues to provide the overall context for Gwent public service providers to think innovatively about how services can be delivered more effectively. It will also continue to force them to prioritise services in some instances – difficult choices will remain part of the landscape. G-SWAG should consider developing the scenarios to explore the implications of austerity on specific outcomes.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

Very uncertain	Rather uncertain	Reasonably clear	Very clear

Nesta is working with leading innovators around the world to determine how innovation approaches can be useful and what skills and competencies are needed to enhance problem solving in an administrative and political context.

The learning from this works suggests the key to improved practice is to

- **Accelerate learning**: Identify knowledge gaps, create new understanding and inform decision-making in new ways

- **Work together**: Engage with citizens and multiple stakeholders to ensure co-creation and collaborative ownership of new solutions

- **Lead change**: Create space for innovation and change processes that mobilise people, inspire action and ensure strategic outcomes

The New Zealand government is trialling these ideas in an 'innovative lab' that provides a mechanism to bring together design, technology, information management and agile development for more rapid and targeted service design and delivery.

The lab involves highly skilled public servants from several agencies as well as private sector companies across different disciplines such as design and technology, information, policy and data science. The lab establishes a collaborative space, additional expertise and tools for service delivery teams to work differently in design and implementation.
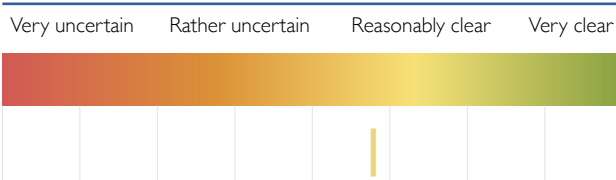
Implications for Gwent

The Nesta project has resulted in a framework that identifies the core skills public servants need to adopt to achieve a greater range of innovative practices for public problem solving. These include creative facilitation, intrapreneurship, data literacy and storytelling.
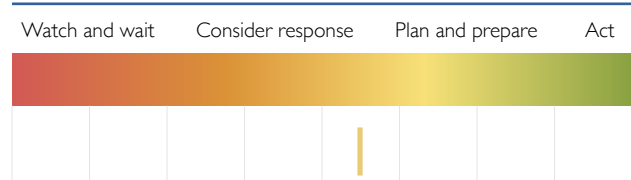
Skills are only part of the story, however. Innovation requires space and legitimacy – an enabling culture, in other words – and, perhaps above all teams that are agile, curious, courageous, imaginative and resilient.

Rolling out these skills across Gwent will speed performance improvement. Gwent must identify the core skills it needs in the future and must begin to plan how it will develop them.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

In January 2017 Edelman a global communications marketing firm, published a separate UK-specific supplement to its annual trust barometer survey. The survey showed a sharp drop in levels of trust in the British government, from 36% pre Brexit referendum to 26% by the start of 2017.

One year on, things have not improved much - and public trust in many institutions remains low. It's not only the public; one of the conclusions of the European Union (Withdrawal) Bill is that, whilst the Government has said that it plans to work with the devolved administrations to reach agreements on UK common frameworks, *"the devolved administrations have insufficient trust in the process for agreeing these future relationships and have, accordingly, indicated that they will withhold legislative consent from the Bill. The Government must improve engagement with the devolved administrations to resolve this deadlock."*
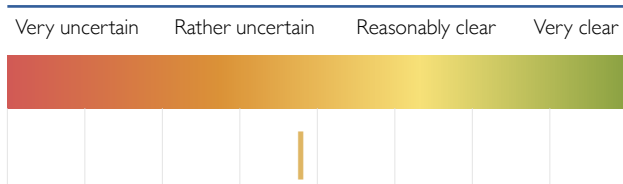
Implications for Gwent

The upside – if that's not the wrong way to look at the loss of trust *in* government and *between* governments - is that, in the run up to Brexit, frustration is mainly directed at central administrations rather than at local government.
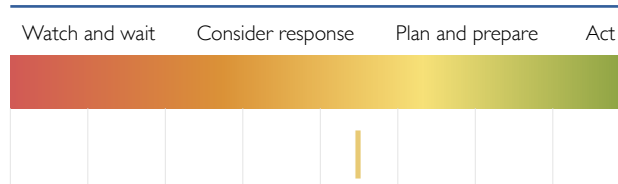
It will undoubtedly be important for local and national government to work together effectively post March 2019. Chances are that they will have to do so quickly and that they will also have to be consistent and coordinated in moving forwards.

The disagreement over council merger plans may make this difficult in the short term. In the longer term, building trust between electorate and government will be essential. Gwent should prepare guidelines for how to engage in discussion with political partners and how to be as open as possible in its communications with citizens.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

Carillion ripples
TRUST

HI

Carillion, Britain's second-largest construction firm, collapsed in January 2018 with debts of about £1bn and pension liabilities of almost as much again. Carillion began as a construction company, then moved onto providing a wide range of services, almost all of which was outsourced to subcontractors. At the time of its demise, it had about 450 government contracts, constituting about a third of the company's revenues. To expand the business and keep enough cash rolling in to pay creditors and shareholders, Carillion bid ever more aggressively for public-sector contracts so that, when costs rose, many contracts quickly become loss-making. Shortly after Carillion's collapse, the NAO published evidence that PFI is a pricey way to fund infrastructure, and that it does not reliably bring benefits. Many of the problems that sank Carillion are common to the outsourcing industry – and outsourcers are coming under intense pressure to change their ways.

By the end of February 2018, Carillion had made over 1,300 staff redundant.

Vaughan Engineering, a 60-year-old engineering company that was subcontracted by Carillion to work on a school near Liverpool, became the first casualty in the collapsed contractor's supply chain one month later at the end of March 2018. Vaughan Engineering was owed £650,000 for works already completed for Carillion and was due to complete a further £1.1m of work in the first three months of 2018.

Vaughan is owed for work on a school in Liverpool. They have offices in Edinburgh, Warrington and Newcastle and, as a result of Carillion's collapse, 160 people are expected to lose their jobs.

The finance director, said in March that the collapse was a devastating blow. "We have tried everything we can to save our business, and despite approaches to Scottish Enterprise, the Scottish Government, MPs, local and national government, no assistance has been forthcoming."
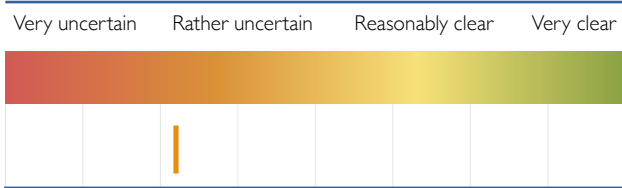
Implications for Gwent

"No assistance has been forthcoming" is a difficult statement. While the scale of the Carillion collapse inevitably means that jobs will continue to be lost, the nature of the business also means that those jobs will be distributes around the UK. In the immediate future, then, some local business may be affected and may need support – even of that is only advice or a listening ear.

In the longer term, something will need to be done to ensure that the business model that Carillion used – described by some as a sort of Ponzi Scheme that was incredibly profitable for those at the top of the firm while contractors bore the risk – is not used for public contracts.
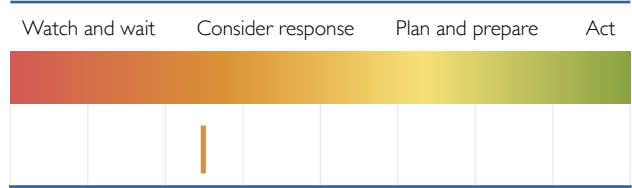
Government is not coming out of the collapse well, with questions asked about why it gave so many contracts to Carillion despite a series of prior warnings as to the continued viability of the company. One answer given to that question is 'because politics is also infected by the British disease of short-termism." That's a disease that government must cure itself of as quickly as possible.

Given a similar developing story at Capita, it may be prudent for Gwent partners to undertake a risk assessment of its exposure to such 'out sourced' providers – understanding how exposed public service delivery is to these models. The outcome of that risk assessment may require contingency planning to be put in place to safeguard those services. Gwent might also want to review procurement processes in light of Carillion.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

The high turnout amongst youth voters in the 2017 election was reportedly the highest in 25 years and is regarded as a key element in Labour's strong showing in the polls.

The finding is the latest that suggests a growing divergence between the generations. It appeared in the 2015 vote for Scottish Independence (where 71% of the young voted Yes) and again in the 2016 Brexit vote (where 75% of the youth vote backed remain).

An analysis published by Global Future in February 2010 suggests a significant cultural divide between people aged 18 to 44 and those over 45. Younger voters are more likely to be open on a range of issues such as multiculturalism, anti-discrimination measures and nationalism. They are positive about multiculturalism and diversity, comfortable with immigration and in favour of Britain taking an internationalist, outward-looking approach to the world. Their views contrast with those of closed voters, who are more likely to be sceptical of things.

Recent research by the LSE reinforces Global Futures view, suggesting that today's politically engaged youth are not committed to any one ideology but are concerned - above party politics - with influencing young people's situation.

Implications for Gwent

It's hardly surprising that today's youth want to influence – and improve – their situation.

A 2017 report by the Resolution Foundation found that today's youth are the first generation to be worse off than their parents, something that the report's authors describe as a "highly unusual" finding. Providing something of a double whammy, a March 2018 study from Newcastle University and Youth Employment UK shows that parents hoping to improve their family's social mobility by giving their children money could be doing more harm than good The research found a conclusive link between increased financial support and increased dependence.

What does it all mean?

First of all, perhaps, that the life progression we have all become familiar with – and upon which some public services are predicated – is not holding.

Secondly, that today's youth are very clear indeed that they are not going to enjoy the same quality of life as their parents.

Thirdly, that they are going to need different services.

Working out what those services are might just make a big difference to Gwent's young people. It might even make Gwent a more attractive location for them.

Gwent should develop a plan for engaging with young citizens. It's first step should be to engage in a consultation exercise - and perhaps to set up and track a cohort of young citizens.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear
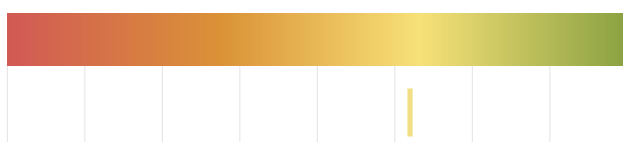
How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

ECONOMY

EQUITY - Unequal and divided?

PROTECTIONISM - Closed borders
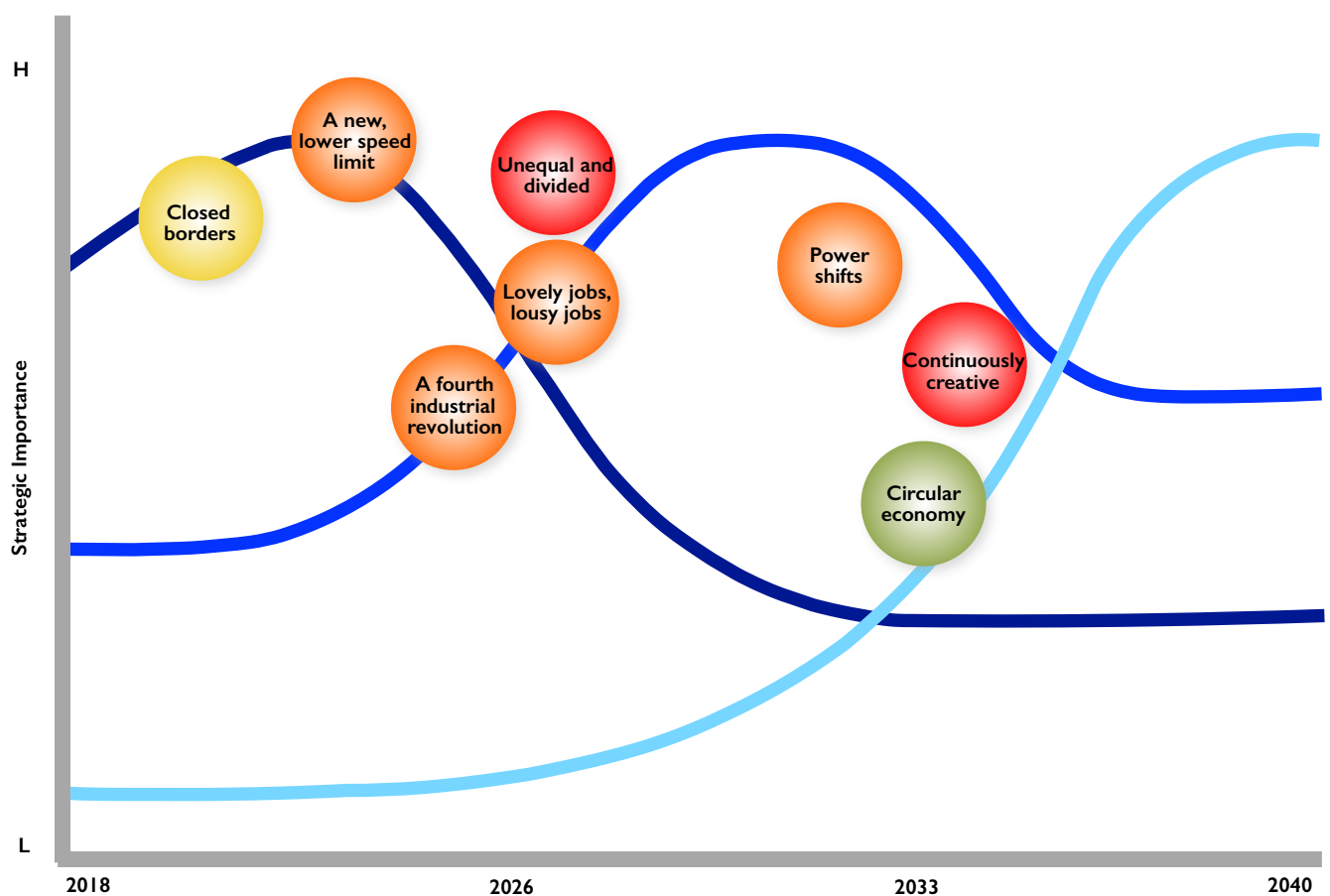
LOW GROWTH - A new, lower speed limit

MOVING EAST - Powershifts

DISRUPTIVE BUSINESS MODELS - A fourth industrial revolution

SKILLS AND LEARNING - Continuously creative

EMPLOYMENT - Lovely jobs or lousy jobs

FUTURE DRIVERS - Circular economy

Recent work by the Joseph Rowntree Foundation and Institute of Fiscal Studies (IFS) predict that continuing slow earnings growth and rising inflation over the coming years, combined with planned tax and benefit changes, will only lead to modest growth in average income. However, these changes would lead to no growth in income for low-income households, and actually result in a rise in child poverty. For the worst 15% of households, real incomes after deducting housing costs are projected to be lower on average in 2022 than in 2014. The IFS's projections show that relative child poverty is set to increase from 30% to 37% by 2022, rising to over 5.2mn children 2021/22.

Any projections relying on macroeconomic forecasts come with substantial margins of error, particularly when the macroeconomic and policy environment is as uncertain as it is now.
The future path of real earnings (encapsulating both incomes and inflation) is an important source of uncertainty. What is notable, though, is that even in a high earnings growth scenario, overall absolute poverty falls only slightly, and absolute child poverty still increases. The increases will be particularly marked in certain regions, including Wales. The projections are that absolute child poverty in Wales could increase by at least 8ppts.

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% of earners will increase from 5% to 14% by 2030.

Social mobility has not improved in the UK, and is not expected to improve. For example, only one in six of those workers who were in low paid jobs in 2006 had managed to find a permanent route out of low pay a decade later. In Wales, it is disadvantaged youngsters, particularly in areas with high levels of deprivation, who appear to be losing out most in the crucial early years of their lives and in their school years. For example, in Monmouthshire there is an attainment gap of 41 percentage points between disadvantaged and more advantaged pupils at GCSE level.

The persistent and growing inequalities impact on a number of health issues, not least health outcomes. A recent study has found that, on average, a boy born in an affluent area will outlive one born in one of the poorest by 8.4 years. This was up from 7.2 years in 2001. In recent years, the gap between the life expectancy of rich and poor people in England and Wales has risen for the first time since the 1870s.

This also extends to Healthy Life Expectancy (HLE), where there are substantial inequalities in health between small populations. In Gwent, there is a gap of 18.2 years in the HLE expectancy of a male living in the Dixton with Osbaston ward in Monmouthshire and a male living in the Pillgwenlly ward in Newport. For females, the gap is even larger – 19.9 years between St. Kingsmark in Monmouthshire and Pillgwenlly in Newport. These are significant health inequalities which have major impact on health provision across Gwent.

Age differences are now a major division in how income growth will play out over the next couple of decades. Typical pensioner incomes have been growing consistently faster than working-age ones – ten times as fast in fact since the mid-2000s. Whilst this has meant a welcome fall in pensioner poverty, it will increasingly lead to an unprecedented situation where typical pensioner incomes after housing costs are higher than those of a typical working-age household.

These differences in income growth will be accentuated by growing wealth inequality. The housing market no longer acts as an escalator when growing numbers cannot get on it. This was

highlighted in a [recent speech by Vince Cable](#) - "Perhaps most significantly, wealth inequality is greater than for incomes and is growing, a trend apparent in almost all western economies. In the absence of compensating wealth taxation, high earners can turn their income into assets, and the value of assets can be compounded through investment. This is then passed on as inheritance, entrenching inequality across time between generations and classes."

New models of capital ownership will be needed to ensure prosperity is broadened rather than a further concentration of wealth in the 'new economy'. Capital is currently highly unevenly owned in the UK. [The wealthiest 10% of UK households own an estimated 77% of all equity stocks. The richest 10% own five times more wealth than the poorest half.](#)

The changing workforce will also impact on inequality trends. The 'shrinking middle' will provide challenges. [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.](#)

The critical challenge of automation is likely to be in distribution of benefits rather than their production. Managed poorly, automation could create a ['paradox of plenty'](#): society would be far richer in aggregate, but, for many individuals and communities, technological change could reinforce inequalities of power and reward.
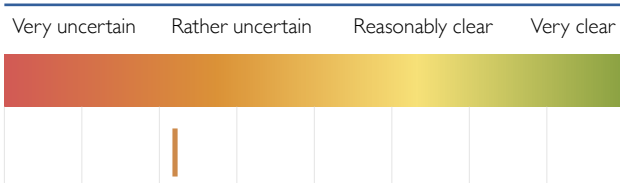
Implications for Gwent

Gwent already has relatively high levels of absolute and relative poverty, with pockets of severe deprivation. For many individuals and communities there is a sense that they have already been 'left behind'. This is despite both absolute and relative inequality having fallen over the past 20 years in the UK.
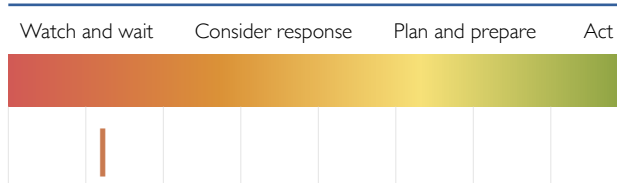
The scenarios detailed above show that poverty and inequality is expected to increase in the short-term (over the next 5 years), with a risk that longer-term trends such as automation and deepening capital ownership accentuating factors even further. It is extremely difficult to break the cycle of social immobility. There is a fracture line running deep through labour and housing markets and the education system. Those on the wrong side of the divide are losing out and falling behind.

There is a significant risk that communities could become even more polarised, creating deepening social tensions. This provides one of the most crucial policy considerations for Gwent partners (which will certainly not be unique to the area); how to provide a 'safety net' against potentially worsening inequality. This may require some further spatial prioritisation of resources on those areas where inequality is most marked.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

There is currently a trend towards more protectionist policies being implemented countries across the globe. Protectionism is on the rise. Recent research has revealed that the world's top 60 economies have adopted more than 7,000 protectionist trade measures on a net basis since the financial crisis. These have been made in order to shore up key industries, protect jobs, maintain strategic advantages, and for political reasons. Imposed trade tariffs are now estimated to equate to £300bn.

Importantly, in terms of future implications, with the EU closing its borders to those outside its membership since 2009, it is argued that it has become harder for those non-member countries to trade within it - which could be bad news for those seeking a post-Brexit deal between the EU and the UK. Many countries in the EU are highly dependent on trade, with Germany seeing its trade equate to 87pc of its GDP. Because of this, the UK a relatively high risk of being affected by protectionism implemented by other countries, having a 57% dependency on trade as a percentage of GDP. The UK has been classified as the world's eighth biggest victim of protectionist trading measures since 2009, but it is not blameless for the rise of protectionism, with many of its protectionist policies.

Many have called for the UK to strike a trade deal with the US. However, the US currently has a significant protectionist stance - and with Donald Trump at the helm, more protectionist measures are expected. Since 2009, the US has passed 1,297 economic or trade measures deemed to be 'harmful' to global trade, compared to just 206 regarded as liberalising. This can be seen in the recent move by US authorities to consider imposing duties of 300% on Bombardier's C Series jets.
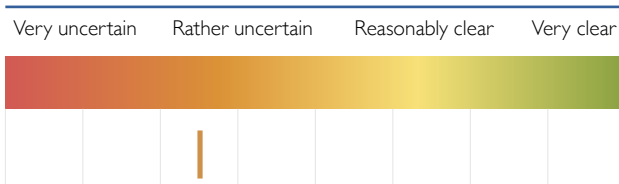
There have been sector-specific trade spats in recent years. For example, the EU has increased barriers to non-EU digital trade, taking measures that were seen by the US as discriminating against non-European service providers, such as fining Google $2.7bn for undermining competition. There is a danger of a trade-war escalating between the US and the EU in the medium-term.

It is not certain whether these protectionist tendencies will continue over the longer-term, or are a product of the fall-out of the financial crisis. However, given the particular uncertainty in the UK of the post-BREXIT trading relationships, protectionism is a significant concern for UK businesses.

Implications for Gwent

In some respects, there is little that partners in Gwent can do about protectionist policies being implemented. There are geopolitical factors at play on a global scale. Much will depend on the shape of the UK's trading relationships post-BREXIT. Gwent may have some important businesses that currently trade within the EU and may be susceptible to additional costs if a 'hard BREXIT' is the outcome.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act
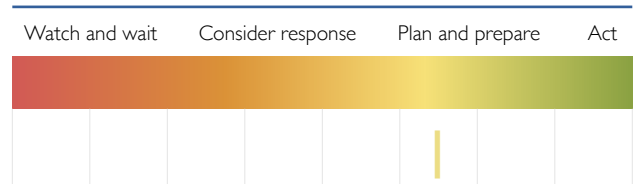
There is a 'productivity conundrum' in the UK and the rest of the developed world which questions whether longer-term rates of economic growth can be sustained. There is a long-standing gulf between productivity levels in the UK and its leading competitors. The UK is 18% less productive than the average of the G7 countries. Ultimately, over the longer-term, productivity growth drives economic growth.

The UK faces longer term issue: as the population ages, boosting productivity will become extremely challenging. A school of thought is that current interest base rates have meant that banks have had little incentive to support the innovation in firms that could drive up productivity. A 'normalising' of rates back to 4-to-6% would force banks to search for higher-return investment to make a decent margin, stimulating productivity-boosting activities including the development of new and innovative products.

Recent employment growth has been skewed towards low productivity jobs and industries. This has dragged down average productivity growth in the economy, as well as providing a partial explanation for the weakness in earnings growth. This has accounted for a good part of the weakness in UK productivity growth relative to other advanced economies. Future productivity growth needs future employment growth becomes more balanced.

However, low productivity growth may prove more durable, especially since it appears to be a common phenomenon across the advanced economies. Some commentators argue that we have entered an era of more or less permanently subdued productivity growth for essentially structural reasons. Mark Carney, Governor of the Bank of England, calls this a "new, lower speed limit".

As a consequence, economic forecasts (themselves highly uncertain) expect that the average rate of productivity growth over the next 5 years (1.1%) is only just above pre-financial crisis levels. Beyond that period is highly uncertain, but certain structural weaknesses – such as an ageing society – will provide constraints on the growth potential of the UK economy.

The other significant uncertainty is the UK trade relationship post-BREXIT. The recently partially released – and hotly debated – economic forecasts looking at potential scenarios for the UK economy over the next 15 years suggest that economic growth (under one scenario) could be 8% lower than a 'non-BREXIT situation'. In Wales, this scenario forecasts economic growth to be 9.5% lower than would otherwise be expected. Other scenarios are more sanguine, with growth in the UK and Wales being 2% and 1.5% lower respectively. Again, the uncertainty of these forecasts cannot be underestimated.

The other factor is that productivity growth is highly uneven in the economy, with definite winners and losers. Productivity growth among 'average firms' has stalled, partly due to slow rates of technological adoption, low investment, and weak management. While the top 1% of businesses have seen average productivity growth of around 6% per year since 2000, one-third of UK companies have seen no rise in productivity at all. Overall business spending on ICT, machinery and other equipment has hardly grown in real terms since 2000.
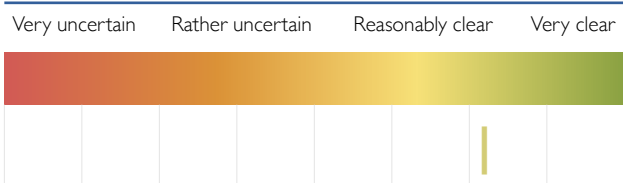
Implications for Gwent

Relative and absolute productivity growth in Gwent has been lower than other areas of the UK over many decades. This 'productivity gap' has not narrowed despite the best efforts of policy makers. According to the latest estimates, the average productivity in Gwent (as measured by GVA per
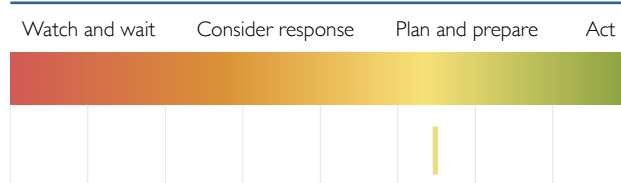
hour) is only 83.6% of the UK average – it has remained at similar levels for the past decade. The structural problem of narrowing the productivity gap has remained 'sticky'.

As always, it is the performance of its businesses that will drive economic growth in Gwent. Stimulating investment by Gwent businesses is crucial to improving their long-term productivity and relative competitiveness. This needs to be in capital and, crucially, the ability of employees to fully exploit that capital. A continued – and perhaps heightened – focus on improving productivity needs to remain central to the economic strategies of Gwent partners.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

The global economy will continue to be dominated by three major regional economies: the US, China and (if it remains intact) Europe, which will together account for over half of the world's GDP in 2031. The centre of gravity will, however, continue its current shift towards Asia (and, in the longer term, the other developing economies). China is likely to remain the largest advanced emerging economy, with India's dynamic population growth driving its economy. New economic powers — notably Mexico and Indonesia — are likely to emerge and join the current middle-ranking group, which will still include Brazil, Japan and possibly Russia.

The EU will continue to enjoy one of the highest per capita incomes in the world, but lower relative growth means that the EU's share of global GDP will shrink to around 10% by 2031. The European economy will become smaller in relative terms and less influential on global issues. The leverage in trade negotiation provided by its internal market could suffer.

Asia currently contributes more than 60% of global growth. Asia's share of global exports is expected to double over the next 15 years to 40%. By 2030, China may replace the United Sates as the largest economy in the world. The proportion of world's GDP from non-OECD countries will rise from 39% in 2016 to 47% in 2031.

India's economy is expected to grow from \$2tr currently to \$6.6tr in 2031. India's demographics are particularly significant; the majority of its population is less than 30 years old and by 2031, average age will be 32, compared to 45 in Western Europe and 42 in China.

By 2031 two-thirds of the global middle class (defined by Ernst Young as those who earn between US\$10 and US\$100 a day) will live in the Asia-Pacific region - increasing spending power from this region significantly. China's middle class is set to grow from 150mn to 1bn by 2030 (70% of its population). India's middle class is set to grow from 50mn to 475mn by 2030.

Despite this overall shift eastwards, there are certain structural issues for Governments to address. For example, after 35 years of rapid growth, the Chinese economy is undergoing a major transition from export-led growth to one increasingly driven by consumption and services, with less emphasis on debt financed public investment. The emphasis in China's 'Manufacturing 2025' Initiative is to transform its manufacturing sector from a low-end mass production industry to a more profitable model harnessing technologies such as artificial intelligence and the Internet of Things. Looking ahead, China still has great potential for growth. Its urbanisation process is still at a relatively early stage, and its services sector has scope to evolve further.

Looking closer to home, Turkey and Poland are expected to emerge as the fastest growing European economies, reflecting their lower initial level of income and so catch-up potential, as well as more favourable economic fundamentals compared to, say, Russia. This will depend upon political stability (in Turkey's case) as well as facing some demographic challenges.

Implications for Gwent

It will be important to support Gwent businesses to create export opportunities with those economies that are expected to grow the fastest over the next 20-30 years. The opportunities in markets such as India, Indonesia, China, Mexico will be highly significant and may counter the expectations of lower growth in the UK and Europe.

In terms of the potential loss of economic activity and jobs, this depends on how 'contestable' or 'transferable' activity in Gwent is to Far East competitors. Given its legacy of relatively high

manufacturing employment, there is an argument that Gwent is relatively exposed to competition. However, the counter argument is that this manufacturing base has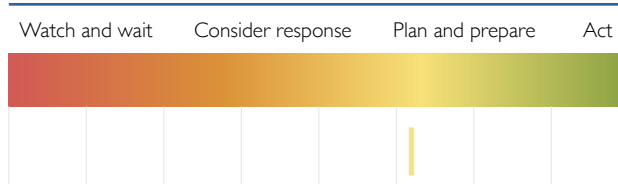 been under competitive pressure from low cost-high volume economies for the past 30-40 years. This competition has meant that the manufacturing base that is left today is actually highly competitive and high value. This may mean that it is robust to the competitive pressures of elsewhere. The competitiveness of Gwent businesses, particularly its manufacturing sector, will be key to how it can withstand the emergence, and sustained, competitive pressures.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

A fourth industrial revolution
DISRUPTIVE BUSINESS MODELS
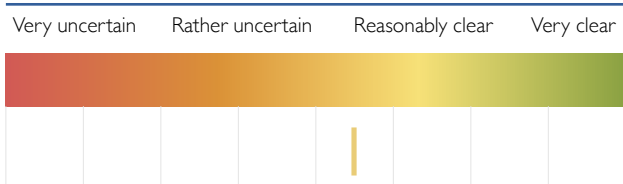
Two powerful forces are transforming the nature of consumption. The empowered consumer and disruptive technologies have sent businesses scrambling to find new strategies and business models for creating consumer value. At the same time, businesses have to overhaul their operating models to drive innovation and increase their market agility. This emerging phase is being termed the 'Fourth Industrial Revolution'.

There will be an unprecedented level of digital disruption that will affect entire systems of production, distribution and consumption. Digitalisation is transforming the way consumers discover, evaluate, purchase and use products and services. Consumers are increasingly demanding experiences, not just products, and have become active participants at every stage of the value chain – acting as innovators, marketers and even employees. Meanwhile, disruptive technologies (e.g. robotics, the Internet of Things, artificial intelligence) are driving a step change in business performance, and allowing businesses to offer once-impossible services. We can expect more and more innovations to take place at the borders of disciplines and sectors.

There will continue to be an explosion of consumer-focused start-ups, whose new business models (e.g. sharing, on-demand and subscription models) will redefine the nature of consumption. The World Economic Forum projects that consumer industries will change more in the next 10 years than in the last 40 – and at an ever-accelerating pace of transformation. Businesses that thrive over the next 10 years will be those who embrace the empowered consumer and disruptive technologies. They will be data driven and far more externally oriented.

Disruptive technologies will dramatically change how work is done, integrating the roles of people, processes and technology. New skills and dynamic, adaptable workforce models will be required. Shockwaves from these changes will be felt across society. Major societal impacts are expected to include – 1) the effect of physical retail evolution on communities, 2) the transformation of the workforce, and 3) the environmental consequences of last-mile delivery.

There will be particular evolution of retail. The line between online and offline will continue to blur. With slow-growing incomes in most digitally developed economies and a shift in consumer spending from products to services, the retail industry is likely to see greater value migration (from one company or business model to another) than value addition. In the future, e-commerce penetration is projected to grow to approximately 40% in 2026. Despite this growth, the physical store will continue to be the channel that contributes the bulk of revenue for the majority of large multichannel retailers. However, its value proposition will evolve from being a distribution channel to that of a platform for discovery, engagement, experience and interaction. Stores will be recalibrated more as hubs for social interaction. There will be a drive to reduce the physical retail footprint, whether the sheer number of stores and/ or their respective size. Impact of physical retail evolution on communities will be important to solve for the challenge of mitigating impact on communities.

Automation in the service sector will also be a key driver. Research from Oxford University argues that 47% of current occupations in the US are at high risk of being automated – including accountancy, legal work and technical writing. Alternative foresight work suggests that 30% of UK jobs face a similar threat. But there will be opportunities; an oft quoted figure is that 65% of children entering primary school today will work in jobs that don't yet exist.

Businesses will increasingly take a longer-term view of their impact, with a particular focus on environmental sustainability. There may be a growing emphasis on the 'circular economy'. Given increasing regulation and the ever-increasing need for cost competitiveness, Governments and businesses will increasingly encourage consumers to move away from a traditional 'linear model' (make, use, dispose) to an alternative system which keeps resources in use for as long as possible, extracting the maximum value whilst in use, then recover and regenerate products and materials at their end of their life. Several large international businesses are already adopting such practices. This emphasis on greater environmental efficiency and longevity will increasingly be driven by populist opinion, as shown in the recent focus on plastic waste. Consumer behaviour and action will have increasingly swift influences, often facilitated by social media, which Governments and businesses will need to quickly react.
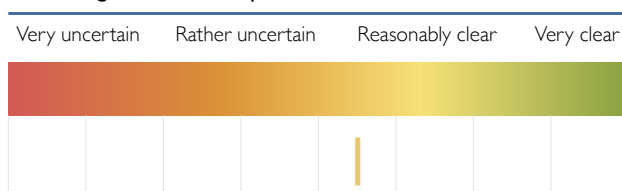
'Green growth' will become an increasingly important outcome, with the policy commitment strengthening amongst most countries, particularly in the wake of the Paris Climate Agreement (despite the US's withdrawal from the accord). The UK's scope for developing a competitive advantage in green technologies, particularly in a post-BREXIT environment, will be dependent upon the right policy environment. However, it could be argued that the UK is 'behind the curve' in low carbon industrial transition. It is estimated that 13 out of the UK's 15 largest industrial sectors - including spacecraft, aircraft and cars - are less effective in low carbon innovation than their counterparts in other countries, such as Germany and Japan, where the low carbon industrial transition is currently happening quicker than the UK. Without strong policy support from UK Government, the UK could fall further behind, accentuated by uncertainty regarding trade relationships.
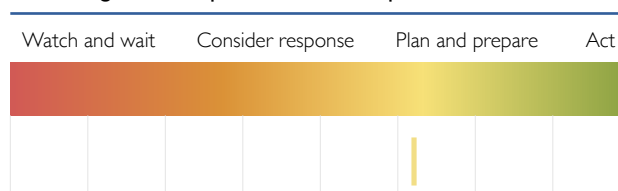
Implications for Gwent

Adaptability will be crucial – in organisations, individuals and society. Inevitably, much of the responsibility will be on the individual. They will need not only to adapt to organisational change, but be willing to acquire new skills and experiences throughout their lifetime, to try new tasks and even to rethink and retrain mid-career. National and Local Governments can help by easing the routes to training and retraining, and encouraging and incentivising adaptability. There will need to be innovative solutions to address unemployment caused by business disruption.

There will also be significant physical changes caused by continued economic disruption. It will be important for local economic development strategies to repurpose physical spaces previously used for retail as hubs for experiences, leisure and lifestyle activities to continue to provide the foundations for vibrant communities.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

The pace of change in the workplace is accelerating. Competition for the right talent is fierce. And 'talent' no longer means the same as ten years ago; many of the roles, skills and job titles of tomorrow are unknown to us today.

There are a number of 'megatrends' that are reshaping the world of work including the redistribution of global economic power, disruptive technology, new business models and resource scarcity. These changes make the continuous adaptation of skill sets absolutely fundamental for successful participation in the labour market. More so than ever before, individuals or communities that are not willing or able to do this will face being left behind.

The boundaries between disciplines, such as natural sciences and informatics, are becoming increasingly blurred. For example, in the health sector we will see care workers assisting with home-based diagnostic and monitoring devices. As disciplines converge, so do the technologies. As almost every job becomes increasingly technology-related, there will be winners and losers. The spread of disciplines and jobs across sectors will also stimulate the hybridisation of skills.

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.

Competition of talent is changing rapidly. If current trends continue, within the next decade China and India will account for 40% of all young people with a degree in G20 and OECD countries, while the US and EU countries will account for just over a quarter. 70% of young people with tertiary education will come from non-OECD countries.

These countries are also producing more graduates in STEM subjects. China has over 40% of its overall graduate pool in STEM graduates, and in India the figure is 35%. In comparison, in the UK and the US, graduates with STEM qualifications represent less than one-third of the talent pool. This share would be even lower if international students (themselves from emerging economies) are excluded from the figures.

By 2030, if these trends continue, China and India will account for more than 60% of the OECD and G20 STEM graduates. Considering the BRIICS countries as a whole, it is estimated that they will produce three-quarters of the global STEM graduates. Europe and the United States will be lagging well behind with 8% and 4% of STEM graduates by 2030 respectively.

Government scope to invest in employment and education initiatives will be increasingly challenged by continuing fiscal pressures, with a trade-off between sustaining an ageing population and promoting opportunities for the young. As a consequence, there will continue to be a shift to the privatisation of education and training.
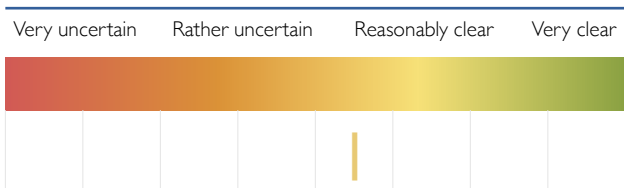
Implications for Gwent:

There may be an emphasis on empowering individuals to develop their own careers and skillset through better access to high quality careers and training information and advice, as well as facilitating access to finance to support individual investment in skills. It will also be important to work with local training providers to adapt learning programmes to reflect the increasing importance of an interdisciplinary approach to skills development in and out of the workplace. It will be important to better understand the increasingly diverse demands people will place on modes of education and training, helping to develop flexible learning pathways and smaller

modular based opportunities to reflect the increasing flexibility. Local partners will have to help individuals navigate job transition, perhaps on multiple occasions.
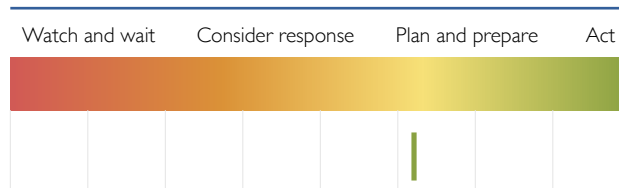
At a wider level policy level (Welsh and UK Government) there will need to be navigation between fostering economic growth and new labour market regulations that meet the challenges set by a changing labour market.

The partners in Gwent will need to 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. Partners will need to help conditions to avoid a race to the bottom and work to equip today's low-skilled workers with the skills to respond to tomorrow's labour market.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

There are a number of scenarios which will shape how the workplace will look in future years. These were usefully set out in The Future of Work study published by the UK Commission for Employment and Skills (focusing on period to 2030):

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 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.

The 'Great Divide' and the 'Skills Activism' scenarios would present the greatest societal impacts. These are scenarios where applications increasingly draw on smart algorithms to replicate the judgment and experience of human workers. These trends are only just developing and once their accuracy and resultant productivity gains had been confirmed, a sharp leap forward in IT innovation will lead to significant disruption for traditional professions. Professional service firms may shed a significant proportion of their workforce. 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 even lower-paid opportunities.

The 'doomsday' scenarios reflect a world where businesses are increasingly able to create and disband corporate divisions rapidly, as they shift tasks between slimmed-down pools of long-term core employees to lower-cost international bases and outsourced external service providers. Jobs and organisations become increasingly flexible in response to the shift towards a 24 hour society.

There is a risk of the continued polarisation between 'lovely' jobs and 'lousy' jobs. Automation could increase the demand for work in creative, cognitive, planning, decision-making, managerial and caring roles, where humans still outperform machines. New jobs and ways of working, often in close partnership with machines, will emerge. However, some emerging technologies will risk reducing autonomy at work and intensifying exploitation. The quality of work should therefore be a key focus of policy.

However, there are counter views that automation can be a power of good if managed correctly. Work will be transformed by automation, not eliminated. In this scenario, automation is likely to lead to the steady redeployment of labour over a period of decades, rather than a sudden and rapid elimination of employment. Indeed, a managed acceleration of automation is needed to reap the full productivity benefits and enable higher wages. Due to the UK's low investment rates, poor management practices, and long tail of low-wage, low-productivity firms, it is the relative absence of automation in the UK economy, not its imminent rise, which provides the biggest challenge. Productivity growth among ordinary firms has stalled, partly due to slow rates of technological adoption. While the top 1% of business have seen average productivity growth of around 6%p.a. since 2000, one-third of UK companies have seen no rise in productivity at all.
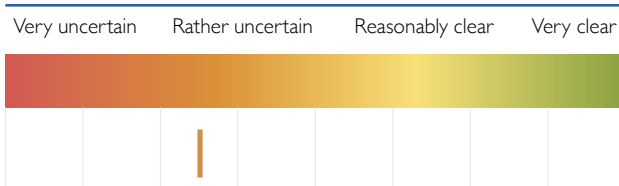
Automation may also provide positive opportunities in terms of greater flexibility and 'work-life balance'. It is estimated that there are now approximately 2mn freelancers in the UK. Over the last 10 years the number of freelancers has grown by 43%. There will continue to be growth in platforms which connect clients to workers.
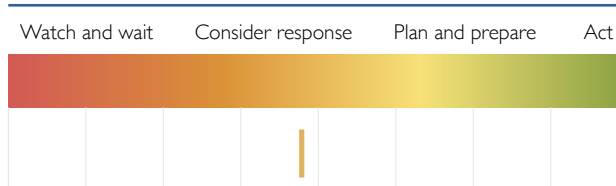
Implications for Gwent

Different regions and sectors are variably susceptible to automation. Poorer regions (including Wales) are felt to have a larger number of jobs with greater technical potential for automation. Transportation, manufacturing, and wholesale and retail sectors are at risk. All of these sectors have a reasonable presence in Gwent, particularly along the M4 corridor.

In the absence of policy intervention, the most likely outcome of automation will be an increase in inequalities of wealth, income and power. Whilst the UK Government, partly in response to the Taylor Review into working practices, has promised an overhaul of employment rights to improve conditions (i.e. stricter enforcement of holiday and sick pay rights) for millions of workers, including those in the gig economy. There will need to be safety nets for those who lose out in the evolving modern economy, particularly if the more aggressive forms of automation take place. This will need to include local solutions.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

We are already seeing the effects of excessive consumption. Economic losses related to extreme weather have increased by 86% to $129bn over the last decade. Even basic resources like water are under threat. By 2030, the global population is projected to need 40% more water than the planet can sustainably supply. The current business models are not sufficiently providing resource-efficient solutions but they need to respond to a growing demand for action in many countries.

As a consequence of pressure from the consumer, several businesses are tentatively, beginning to develop 'circular' solutions, in which resources are reused at the end of their life, rather than disposed of. For example, Unilever has pledged to make 100% of packaging recyclable, reusable or compostable by 2025. Procter and Gamble (P&G) have also increased its efforts towards the conversion of packaging to Post-Consumer Recyclate (PCR).

Many companies have adopted Extended Producer Responsibility (EPR) as a form of product stewardship, although it is estimated that only 45% of product and packaging waste within the EU is currently covered by an EPR scheme. The legislation around EPR responsibilities are expected to be strengthened in forthcoming EU legislation, although it is not clear what the UK's policy will be post-BREXIT. The Scottish Government are considering introducing a specific mandatory EPR system – a national deposit return scheme for drinks packaging. The Scottish consumer pays a small cash deposit, typically 10p, when they buy a canned or bottled drink which is then refunded when they return the item back to the retailer or a central collection point.

New processes are emerging which are allowing previously unrecyclable products to now be recycled, although these are not necessarily economically viable at this stage. However, there are encouraging signs. Another example is provided by the opening in Italy of the world's first industrial-scale plant capable of recycling virtually 100% of used absorbent hygiene products, such as baby nappies and sanitary towels. The first steps are being taken to eliminate absorbent hygiene products from landfills and local authorities will have the opportunity to scale this model, potentially creating a parallel growth cycle out of waste.

There are lots of examples of young and innovative businesses developing circular solutions that deliver commercial, environmental and societal benefits – from a firm in the US that is incentivising fishermen in Chile to collect old fishing nets in the ocean and turning them into products such as skateboards and clothing, to a Danish company who offers high quality, organic clothes for a monthly subscription fee for babies and mothers and then re-circulating them once no longer required, and to a company in the Netherlands which uses surplus food from supermarkets in its restaurants, helping to raise awareness of food waste.

In Europe, there is also a developing regulatory focus on implementing circular economy solutions to its food systems. The European Commission's 'Food 2030' programme focuses on circularity and resource efficiency and the significant reduction of food waste.

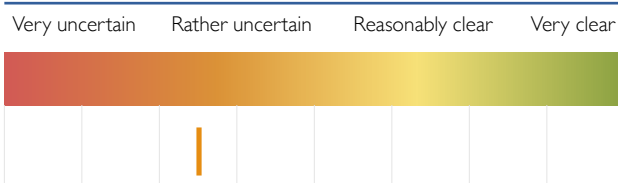### Implications for Gwent

The recent high profile focus on the burgeoning plastic waste problem highlights the issues that face us all. The current economic and business models are not working in terms of protecting the planet, and something new needs to be done. The 'circular economy', the model which redefines products and services to design waste out, whilst minimising negative impacts, is growing in
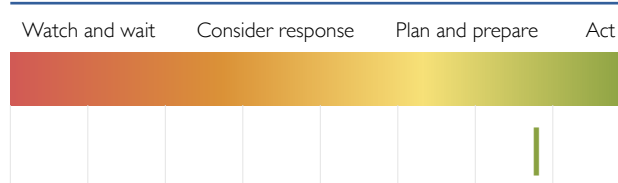
traction. It is developing from a 'concept' to a model which is being adopted by forward-thinking and innovative businesses on a global basis.

Consumer pressure is providing much of the impetus, but the enabling aspect is the development of new technologies. Whilst these are not all currently commercially viable, that will come. Gwent businesses have an opportunity to develop new products and services, whilst helping improve Gwent's environment. Businesses that are developing 'circular' solutions may need some public support to help them through the typically difficult early days. As forward-thinking areas, the Gwent local authorities have an opportunity for a policy focus on circular solutions.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

SOCIETY

NEW SOCIAL NETWORKS - Anti-social media

WELSH LANGUAGE - Hey Syri

COMMUNITIES - Co-living
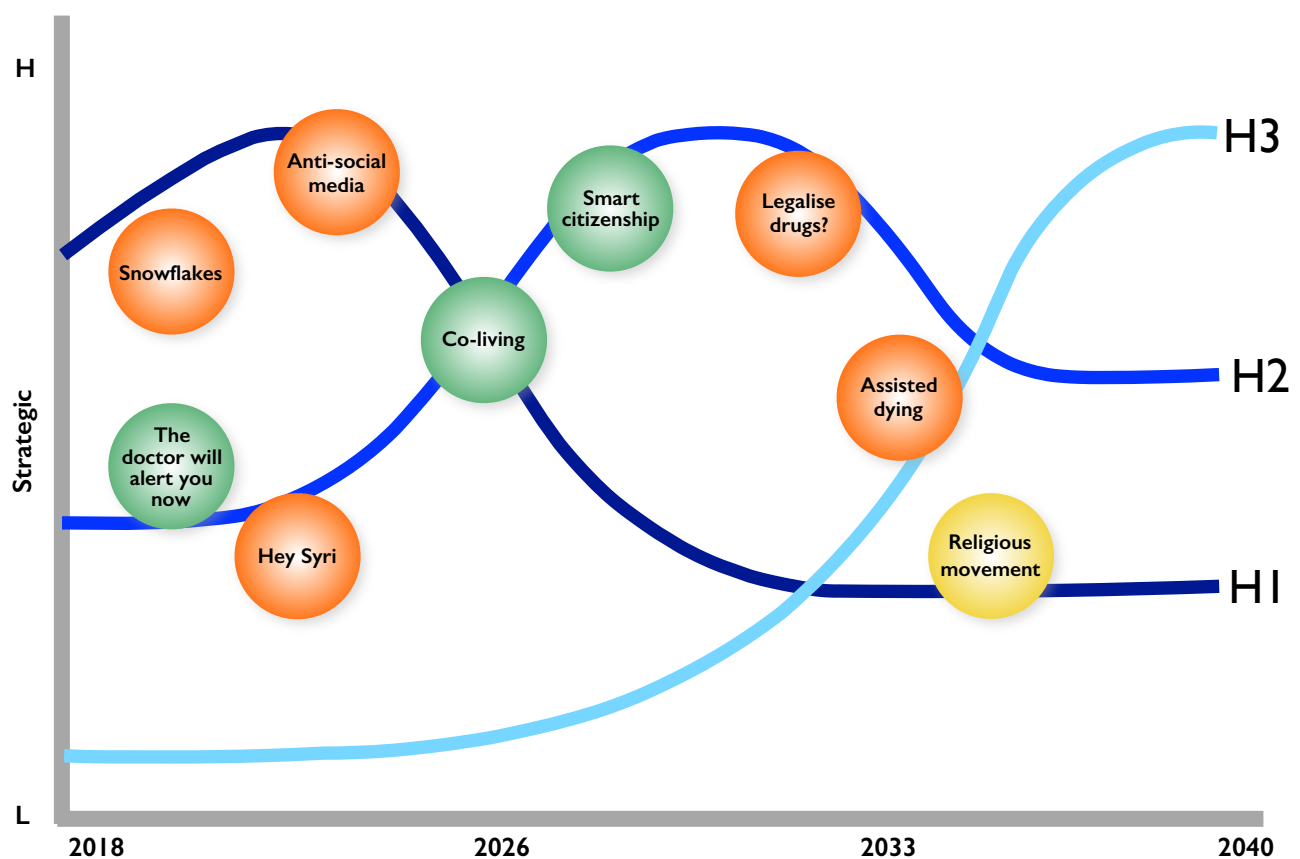
COMMUNITY ACTIVISM - Smart citizenship

RELIGION - Religious movement

WELLBEING - Assisted dying

WELLBEING - Legalise drugs? What's the harm?

WELLBEING - Snowflakes

WELLBEING - The doctor will alert you now

#stopthebullies #nofakenews #pendulumswings #incumbentsunderthreat @gwentwellbeing

Recent concerns that social media companies have failed in their duty of care to children might actually lead to a change in practice. Not driven by government, necessarily, but by consumers themselves.

Government is definitely upping the rhetoric – Jeremy Hunt, UK Health Secretary announced in February 2018 that social media poses as great a threat to children's health as obesity – but users are doing it for themselves. There is a growing backlash among young people, adults are getting bored, the 'corporitisation' of social media influencers is turning people off and players such as Facebook and Google are losing users' trust.

It's not helped by the fact that social media is rapidly becoming the channel of choice for broadcasting fake news. Or that social media firms are failing to tackle cyber bullying.

Investors are getting rattled.

Social media isn't going away but in the long term, it may change and may hand some control back to users. How that might happen is not yet clear, but this issue is likely to be the focus of continuing research for some time.

Implications for Gwent

Should public sector partners in Gwent review how they use social media? Or is current practice making the most of what can be an excellent and immediate channel of communication?

Is practice within partner organisations sound? And should officers be encouraged not to use social media while at work?

It might be off topic, but could current concerns about social media have an impact on advertising revenue in the future?

Public sector partners in Gwent might discuss whether they need a co-ordinated approach to social media or whether they need to develop guidelines for how social media is used. In the longer term, partners should monitor how social media is developing as a channel of communication and whether it is valuable to G-SWAG partners.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Hey Syri. Allwch chi siarad Cymraeg nawr?
WELSH LANGUAGE

H2

An article in the Guardian in February 2018 looks at the Icelandic language's threat of digital extinction. The article highlights that, "as old, pure and inventive as it may be, as much as it is key to Icelanders' sense of national and cultural identity, Icelandic is spoken today by barely 340,000 people - and Siri and Alexa are not among them."

In the age of Facebook, YouTube, Netflix, smartphones and voice recognition, Icelandic is sinking in an ocean of English. Eiríkur Rögnvaldsson, a professor of Icelandic language and linguistics at the University of Icelands calls the process 'digital minoritisation' the process whereby a majority language in the real world becomes a minority language in the digital world.

The emergence of English is rapid. 15 years olds now hold whole playground conversations in English and primary children often already know the English word for specific objects shown to them on flashcards in English lessons.

Iris Edda Nowenstein, a PhD student working with Eiríkur on an exhaustive three-year study of the impact of digital language contact on 5,000 people says that the range and volume of English that is readily accessible to Icelanders has expanded exponentially – and most of it is more relevant and more engrossing than ever before.

Although the number of people speaking Icelandic is less than the number of people speaking Welsh, what makes this alarming – from Wales' point of view – is that Icelandic is the official written and spoken language of the country.
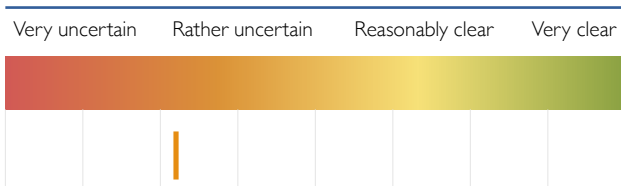
Implications for Gwent

As many as 21 European languages are potentially at risk of digital extinction according to research by META-NET, a network of research centres from 34 countries dedicated to building the technological foundations of a European information society.
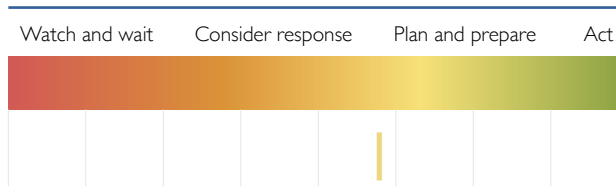
META-NET was a partner in an international forum held at the University of Cardiff in 2014 to explore digital extinction. Four years ago, one challenge identified by Jeremy Evas of Cardiff University's School of Welsh was the limited use of Welsh language in web browsers. The challenge is greater now: the rapid rise of voice-search enabled digital assistants means that some analysts are predicting that 50% of internet searches in 2020 will be by voice. Others are more measured in their predictions – not because they don't accept the outcome but because the voice activated speakers market is rapidly changing – and is likely to have a significant impact.

Neither Siri, Alexa or any of their siblings recognise Welsh and it is seems pretty certain that they won't in the foreseeable future. Will a Welsh language app interface work? Even if it could technically, sales would be limited, so it might be something the Welsh Government should look at. There are no immediate implications for Gwent.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Co-living is an emerging trend. It started out as a way to create communities for start up and tech professionals but has broadened out geographically and sectorally. Residents in co-living buildings have individuals rooms or apartments in a shared building, with communal spaces - quiet spaces to work in or open spaces to socialise in - are designed on each floor to bring people together. For some providers, these are commercial propositions alone; for others there is a strong and purposeful focus on shared values. Primarily aimed at millennials, co-living is attracting a lot of investor interest.

Many of the current developments are largish in scale and seem to be more focussed on young professionals. That's certainly how the co-living brand is emerging - but others are starting to look at it more widely. Ikea's research lab, Space10, launched an interactive website and survey called One Shared House 2030 in November 2017. Framed as an application to a shared house that one would move into in the year 2030, the survey asked for people's preferences in a co-living house – from what spaces they'd want to keep private to what types of utilities they wouldn't mind sharing.

More than 7,000 people from 147 countries have answered the survey. People want their own bathrooms and bedrooms but are happy to share kitchens, workspaces, gardens, and the internet. The biggest concern is privacy (except for people over 65, who are most worried about having arguments and dealing with other people's mess).

Respondents are most interested in living in shared houses of between 4 and 10 people. That's considerably smaller than the current business models and different from what is currently on offer.

Implications for Gwent

Co-living has had something of a stuttering start globally but the signs are that it is now ready to gain traction. Given the expectation that in the UK 67% of 25-34 year olds will be renting in 2025 (up from 48% in 2013), demand for co-living spaces is likely to increase as the idea takes off.
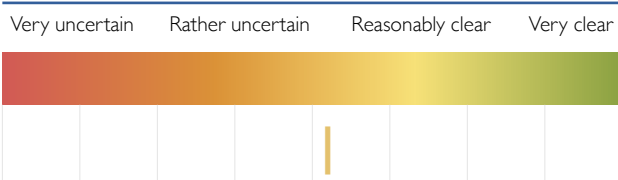
Ikea's research is challenging the received wisdom, too, that co-living arrangements are just for millennials, suggesting the average age of those who want to be part of a co-living community is going to rise.

Will people rent or buy co-life? At the moment it seems to be mainly rental; but where might it go?
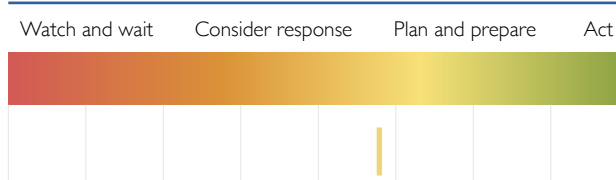
Should Gwent pilot one or more co-living houses? Again, planning policy may play an important role. Planning for more co-living developments will respond to growing demand, as well as increasing density – alleviating some (albeit marginally) of the land pressures. It is likely that the demand for co-living spaces will be most marked in Newport.

Gwent should track development of this trend to determine whether co-living grows in popularity over the next 3-5 years; and review annually. Gwent might choose to research attitudes to co-living amongst different age cohorts (students, non-students, females, males, older citizens, for example).

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

Most visions of the smart city put government or corporations in charge of the technology and infrastructure. Critics of the smart city idea worry that they may get *too* smart, "reducing people to data-points…surrounded by more and more circles of service that create bubbles of control."

A number of initiatives are therefore focussing on how citizens can take more control, gathering data and using it to reshape the urban environment to meet their needs. Detroit's Sensors in a Shoebox project, for example, puts sensors in the hands of local teenagers to engage them in identifying problems in their community and working on solutions. Edmonton's BetaCity project uses wifi connected sensors to gather data and inform citizens about the quality of the urban environment. Smart Citizen, an independent environmental monitoring network is now live in Manchester. The Smart Citizen Kit gathers data about CO, NO2, temperature and noise and streams data over WiFi to the Smart Citizen network. As the project evolves, Smart Citizen plans to extend community engagement into new areas.

So far so good. But, of course, giving citizens the tools to be smarter has a darker side as well. The Vigilante app, launched on the Apple store in November 2016, was designed to inform New York City residents of nearby crimes in progress that had been reported to the police, allowing users to avoid the area. Or, should they prefer, to go along and video the action.

Guess which one happened.

New York City police were unimpressed. So was Apple, which removed the Vigilante app from its store days after its launch.

But you can't keep a good app down and Vigilante is back in the app store, this time called Citizen. There's considerable unease about Citizen. While it now offers "strong guidance" to "never approach a crime scene, interfere with an incident, or get in the way of police," it does allow users to see incidents as red dots on a map, which is something that could still make it a tool for checking crime out.

Implications for Gwent

The first message is that, just like in other aspects of our lives, there's an app for good citizenship.

The second is that the technology is a powerful force that can be used either for honourable or (we might suggest) questionable reasons.

What is clear is that, as a means of finding, engaging and mobilising good citizenship – in all its forms and to achieve a range of objectives – technology must be a part of the armoury. But it's also clear that putting the tech in place will be enough on its own. An app can be the first step in building a relationship between different parts of society – but the different parts need active facilitation to bring them together to achieve that honourable outcome.

How to use this technology is still unclear, so just a watching brief for Gwent.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Religious movement
RELIGION

H2

Recent press coverage of religion has, regrettably, been for the wrong reasons. Religious hate crime increased by 35% in England and Wales between 2016 and 2017. The actual figure might be higher since the number of race hate crimes over the same period increased by 27%– and many victims of race hate may be targeted for their religious beliefs as well.

Christianity is in decline in the UK. Those with no religious belief now make up 48.6% of the British population. Anglicans account for 17.1%, Catholics 8.7%, other Christian denominations 17.2% and non-Christian religions 8.4%. Islam, however, is on the rise, and while the timescale for it to become the world's largest religion is long term, the trend is clear.

The decline of religion overall means that some Christians now believe that freedom of religion is under attack.

Writing in the Times newspaper in September 2017, the political columnist (and one time advisor to John Major and to William Hague) Daniel Finkelstein suggested that the decline of religion will leave a hole in the fabric of British life that could easily be filled by extreme nationalism. He also suggested it threatens the important social institutions and cultural openness that give comfort to the vulnerable and sick and that help create a sense of community. The decline of Christianity, Finkelstein argues – is not something that can just be overlooked.

Implications for Gwent

Wales is among the UK's least religious areas, alongside the south-east of England and Scotland.

On one hand, it's hard to believe that the nation's loss of faith matters. On the other, that seems an astonishing sentence to write.
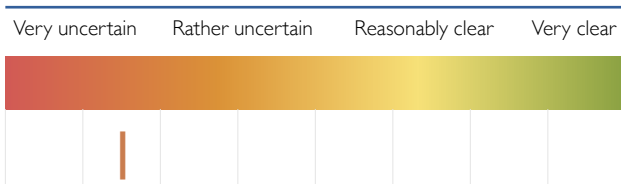
In his recently published book, Reimagining Britain, Justin Welby, the Archbishop of Canterbury sets out to identify the values that will enable us to reimagine, and to enact, a more hopeful future.

His thesis is that the work of reimagining required today is as great as it was in 1945, and will happen either by accident – and therefore badly – or deliberately. And Welby asks where the leadership to take this reimagined Britain forward will come from. He suggests that, even though political leadership is required, it is the "little platoons" of society - the intermediate organisations between the state and the individual: schools, universities, hospitals, the family – that will make reimagining a success or a failure.

He wants every organisation to reimagine the kind of society it wants and to reorder its priorities in that light.

It feels like that is an idea – even an ideology – that definitely matters.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act
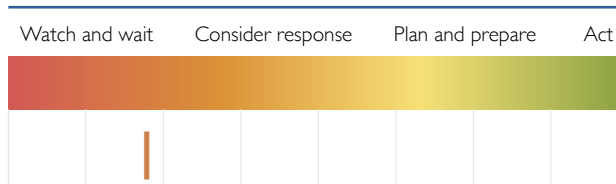
In November 2017, the Australian state of Victoria became the nation's first state to legalise assisted dying. Doctor aided voluntary euthanasia will be allowed for terminally ill patients from mid 2019. The legislation includes. The legislation has 68 safeguards, including new criminal offences to protect vulnerable people from abuse and coercion, and a special board to review all cases.

In March 2018, India's Supreme Court upheld a landmark verdict that permits the removal of life-support systems for the terminally ill or those in incurable comas. Passive euthanasia, as it is called, will apply only to a terminally ill person with no hope of recovery, a panel of five judges said. Active euthanasia, by administering a lethal injection, continues to be illegal in India – but the debate about whether this should be the next step has begun.

Physician assisted dying is legal in six US states - Oregon, Washington, Vermont, California, Montana, Colorado - and in Washington DC. It has been legal in Canada for two years, but implementation has not been smooth.

Belgium, the Netherlands, Luxembourg and Switzerland also allow physicians to assist in the death of patients. Hawaii and New Zealand are currently exploring legislation.

Legalisation has not stilled debate in many quarters. Religious organisations are particularly opposed.

The UK Parliament voted against the right to die in England and Wales in 2015 but the debate continues and there has been a steady number of cases brought to the High Court. Those in favour of assisted suicide continue to argue for it, while those against remain concerned that evidence against legalisation is being swept under the rug.

Writing in The Times in February 2018, Baroness Finlay, professor of palliative medicine at Cardiff University School of Medicine, pointed out that there is already a right to die in the UK – by asking doctors to stop treatment - and that it is different from a right to be killed. She also highlighted that "*how we manage death in an age of increasing longevity and loneliness is a complex question. It calls for careful and sensitive thinking rather than quick-fix solutions. We don't resolve the question by disposing of the patient.*"

Implications for Gwent

Assisted dying is a complex and challenging issue but it is almost certain to gain traction in public debate. Gwent may need to explore what that means for its long term vision of well-being.

At the moment, the debate is centred on moral and ethical issues but – uncomfortable as it is to acknowledge this – it is not difficult to see how it could tip over into a very unpleasant, corrosive and challenging discussion about public funding and resources and how to spend a limited budget.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Legalise drugs. Where's the harm in that?
WELLBEING

H2

In September 2017, the Duke of York visited a charity in London that supports recovering addicts and asked them if they thought the law on illegal substances should be changed. "It feels like a question I have to ask," the Duke is reported to have said.

No wonder he did. The UK is the leading country in Europe for deaths from drug overdoses, and many believe that the current drug policy is not working. Criminalisation appears to have failed – but efforts to cultivate fresh thinking are getting nowhere.

A 2016 study conducted by Volteface and backed by former deputy prime minister Nick Clegg, former Conservative cabinet minister Peter Lilley and Green Party co-leader Caroline Lucas aimed to cultivate fresh thinking on drug policy.   The report argued that cannabis legalisation and regulation is 'now inevitable'. The report called on the UK to emulate the market-based approaches emerging in North America, where legalised cannabis represented a market worth an estimated $7.1bn (£5.73bn) in 2016. A legal cannabis market could be worth £6.8bn in the UK and net as much as £1.05bn for the Treasury.

The UK government has no plans to decriminalise drug use.   Evidence from countries such as Portugal which has completely decriminalised drugs   and from the US (which has in part in some states) suggest that this is not the right way ahead. The question is complex, but consensus seems to be growing that decriminalisation might be a more progressive and less harmful approach.
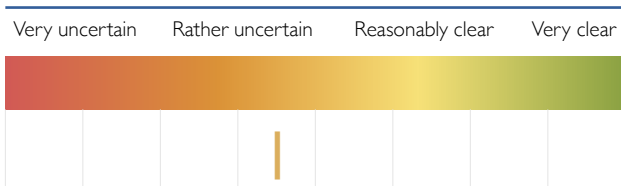
Implications for Gwent

Governments have to consider legislation to minimise both individual harm and societal harm. Current drugs policy seems to be failing on both counts and prohibition is not working. Decriminalising cannabis – as a first step – will not solve all the problems by any means, but it might be a step in the right direction. If the evidence supports the move.
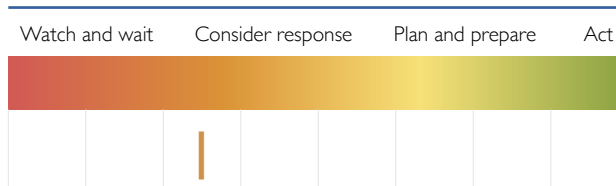
That may be the core question for Gwent to address. Do you have an agreed view on the social and economic cost of prohibition? Have you modelled the consequences for minimising harm individual, societal and economic harm if cannabis were to be decriminalised? Do you know what impact decriminalisation would have on county lines?

With this knowledge, Gwent might want decriminalisation. Or it might not. It needs to be clear which – and be willing to engage in debate with government if necessary. This is a challenging and difficult issue to discuss and any discussion needs to be managed sensitively and perhaps in confidence. Gwent should consider how it might respond to different policy outcomes from central government.   First, Gwent should review evidence and arguments from jurisdictions which have legalised certain drugs or are considering doing so.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

'Snowflake generation' is a derogatory term for those who have become adults in this decade and is meant to suggest a cohort that is less resilient and more prone to taking offence than previous generations. "Poor little snowflake" has been called the defining insult of the post Brexit, post Trump election era.

The snowflake generation – millennials who have grown up connected through the internet to people their own age the world over and who have considerable empathy with viewpoints and cultures other than their own - value individuality and reject the casual racism, homophobia and transphobia which may have been a part of popular culture for preceding generations. They believe that respecting someone's identity trumps the right of others to make fun of it and they condemn films, books and individuals who try.

It's easy for the older generation to be dismissive of something they don't understand or value – that is, after all, what older generations do – but something more profound and less palatable than intergenerational difference seems to lie under the surface and has led some to suggest that the older generation is, in fact, failing the younger generation. And, of course, dismissing something that is scary is a popular tactic in political debate as well.
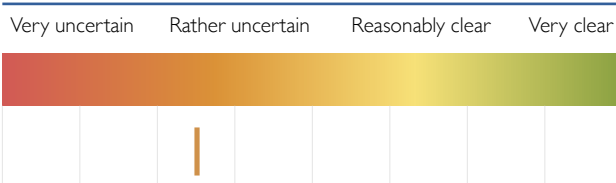
Whatever we think of the term and the individuals labelled with it, millennials suggest that it is a contributing factor to mental illness in the young. Certainly, Britain is in the grip of a mental health epidemic which disproportionally affects young people and where one in four deaths of young men between the ages of 20 and 34 is by suicide. The number is lower for young women but - at over 10 per cent - is still high. In Wales, women's death by suicide increased by over 60 per cent between 2014 and 2017. Welsh men are three times more likely to kill themselves than women.
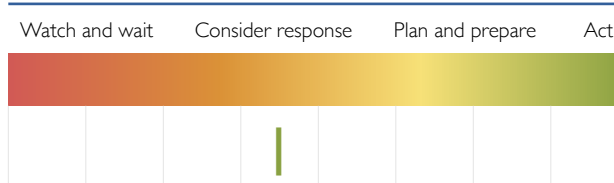
Implications for Gwent

The new generation coming through are indeed facing future prospects – higher unemployment, lower opportunity to buy a home – that are quite different to those faced by generations before. Few people now leave school or further/higher education and simply walk into a good job. Those that do generally walk into it somewhere else.

Mental health issues may not be new but that doesn't mean that society can simply ignore the problem; especially since it costs the economy 4.5% of GDP. Existing mental health guidelines are a good start to providing care, but regions need to take a deep look at the systemic causes – such as social media or the "mother lode of uncertainty" (housing) and – if they want to help our young people begin the long walk back to wellness. It may be useful for Gwent specific research into the state of mental wellbeing in this generation, understanding the underlying issues that Gwent's young people face and possible support mechanisms that need to put in place. Gwent should explore this further and, in particular, should explore the importance of the social and cultural divide between generations.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Google "artificial intelligence medicine" and an impressive array of news articles appears, highlighting the rapidly developing ways that AI will have an impact on healthcare. The Economist article entitled A revolution in health care is coming, highlights how technology is putting health monitoring, diagnosis and disease management in the hands of the patient: watch straps contain medical grade sensors that detect arrhythmia; apps are being developed to diagnose a range of diseases from skin cancer to Parkinson's; research is under way to see if certain molecular biomarkers can be detected in sweat, reducing the need for blood tests. And so on.

In spring 2018, Apple's iOS 11.3 will launch Health Records, a new app that allows patients from participating hospitals to view their health records on their phone. In the long term, Apple and other tech firms are hoping to aggregate individual patient data in order to create AI diagnostics - as individual patients stream data, AI systems will aggregate it and (for example) provide automated medical diagnosis from changes in biomarkers, spot behavioural traits that suggest patients are depressed or identify patients who are at special risk of cardiac disease.

Giving patients access to their medical data is perceived by some to be one of the most significant aspects of the healthcare revolution. Sweden aims to give all its citizens electronic access to their medical records by 2020; over a third of Swedes have already set up accounts. Studies show that patients with such access have a better understanding of their illnesses, and that their treatment is more successful
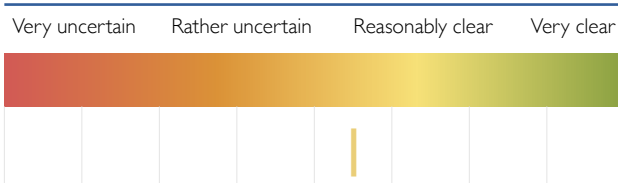
Implications for Gwent

Beyond the next few years, developments such as personalised medicine will be tailored to the unique needs, genetic makeup and lifestyle of each patient. New approaches such as gene therapy and immunotherapy will target genetic diseases and cancers.
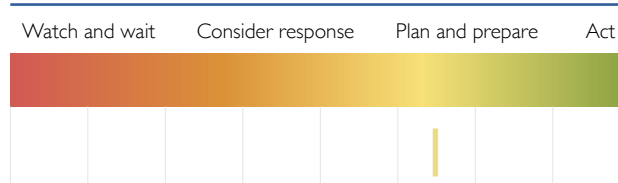
Healthcare policy makers are alert to the potential for such developments to create haves and have nots and this will be a focus for future policy thinking. It's not clear whether haves and have nots will fracture along economic lines, along age lines or along 'familiarity with technology' lines. The danger will be that it is digital natives who are able to access data and the digitally excluded who need help or who are overwhelmed by it.

What to do? Well, one thing Gwent could do is follow Ealing's lead and develop an app to provide information for citizens. The app in questions - @home – provides information about recycling services and sets reminders about when to put recycling out for collection. It is very low key but it is a toe in the water. And while it may seem a million miles away form healthcare, it could be the first step in ensuring personalised, digitised healthcare is available to everyone. Gwent should identify a range of services which can be supported using apps and should begin to organise services around them. While there is no immediate disadvantage in not having app based services, there will be in 2- 3 years. Gwent should be at the forefront**.**

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

| How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

SECURITY

CYBER CRIME - The dark web

CYBER SECURITY - (In)secure services

CYBER SECURITY - IoT to IoS nightmares

SURVEILLANCE - Safety or intrusion?

SURVEILLANCE - Predictive policing

GLOBAL RELATIONSHIPS - Home alone

GLOBAL RELATIONSHIPS - America first

The Dark Web
CYBER CRIME

H2
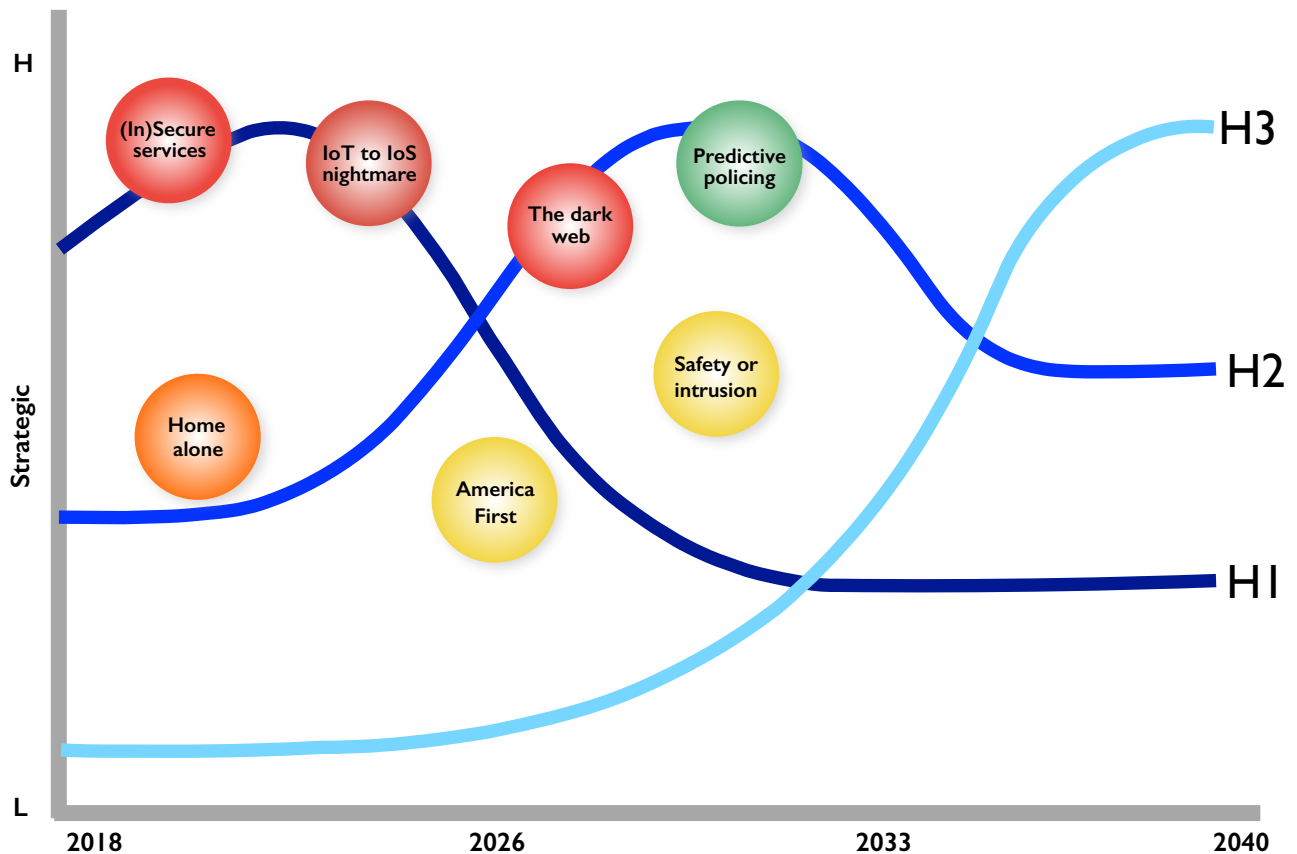
The dark web is a small segment of the internet mainly used as an online black market for illegal trade in illegal goods and services such as drugs, fake passports, child pornography, weapons and software exploits (computer hacking services). The dark web is accessed through specialist software such as the Tor browser which conceals the user's location and dark web use.

Less nefarious users are beginning to use Tor and the dark web for legitimate purposes in order to benefit from the ability to remain hidden from prying eyes - whether law enforcement, marketers or nosy neighbours. Policing the dark web is challenging, but authorities are increasing their efforts.

Sadly, so are criminals. The RAND Corporation think tank believes that, since the FBI shut down Silk Road in 2013 (believed to be the first large scale website to sell a variety of banned goods), 50 similar sites have appeared on the dark web to meet demand.
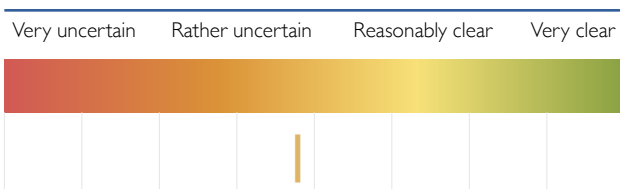
Implications for Gwent

The proportion of UK drug users believed to have obtained illegal substances on the dark web in 2017 – 1 in 4 - was double the proportion in 2014. Ecstasy is the most commonly purchased drug followed by cannabis, new psychoactive substances (NPS's) such as Spice and Clockwork Orange, and LSD. Rand believes the UK's online drugs market to be the largest in Europe accounting for 20,000 web transactions worth £1.8 million each month. Globally, only the US market was larger in terms of profit, though the UK boasted a greater number of sales per population.

The dark web is perplexing crime fighting agencies who see it as a growing threat to health and security. The success of law enforcement will depend on (amongst other things) international co-operation between technology industry actors and to establish joint investigations units and cyber patrols.

Research into practice will be important, too. The Global Drug Policy Observatory based at Swansea University is exploring ways to tackle the Dark Web. They might be worth a call.

Gwent must understand the implications of the dark web for cyber crime. G-SWAG must consider its response.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act
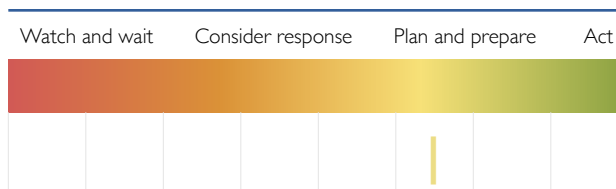
Increased connectivity has increased the need for cyber security. Once everything is networked, small groups and individuals working remotely can launch covert attacks, stealing (for example) personal information from customer databases, distributing and activating malware or carrying out botnet distributed denial of service (DDoS) attacks. Organisations may come under cyber attack from individuals, criminal groups or hostile nation states. It is now accepted that all future conflicts will have a cyber element and that some may be fought entirely in cyberspace.

The cost of some types of cyber attack is simple. In the US, 1.4 million Jeep Cherokees were recalled in 2015 after a vehicle was hijacked by hackers taking control of the car's air-conditioning, radio, and windscreen wipers before removing control of the accelerator and brakes from the driver. The hackers were ten miles away from the car at the time they took control of it; and it was an experiment.

What does this mean for the future of cybersecurity? Simply put, that companies with no experience of the information security industry - toymakers, carmakers, financial institutions and more - should not work alone on products which require a connection to the interneT but should work with experts.

No surprise then that demand for cyber security skills is expected to surge; but tackling the issue will also require all workers to become cyber aware – and, governments and business to maintain up to date security software.

Implications for Gwent

This is an issue that faces Gwent directly as well as requiring Gwent to advise business.

Research published by Invotra at the end of 2017 highlights that the majority of senior IT managers working in the public sector view data and system security as their 'biggest priority'. 79% of IT managers saw security as their main priority while 60% said high profile cyber attacks had prompted more scrutiny of their systems.
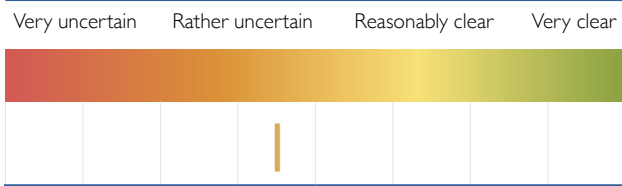
Just over a quarter (26%) said the attacks made people within their organisation 'fearful', which negatively impacted productivity. A further 23% described high profile hacks as 'demotivating'.

When asked about the progress made towards the Government's 'digital by default' standard, 44% described digital transformation as 'an important focus', but said the public sector is 'way behind' the private sector. Almost a third (32%) feel too little is invested in technology to achieve digital transformation goals, and 29% believe a lack of skills is a barrier. The survey found that, even when investment has been made in technology, just over half of respondents did not believe there was sufficient training in new systems.

Perhaps Wales should follow the US in launching cyber security badges for Girl Scouts. Or perhaps it should launch a Welsh version of the badge for local government staff. Gwent could suggest and pilot the scheme.

Gwent must understand the implications of cybersecurity for itself, for its partners and for local businesses. Gwent might consider sponsoring cyber security programmes in schools and youth groups.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act
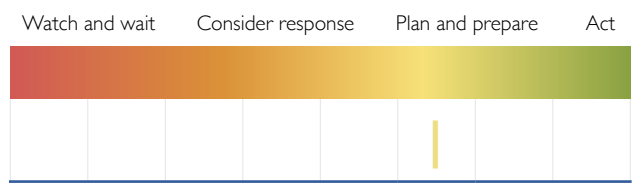
The Internet of Things (IoT) is the network of devices which don't necessarily have keyboards, mice or screens.

IoT has had a mixed reception in the tech community amid security fears, especially in the wake of the first Mirai attack in late 2016, which crippled the Internet for hours and relied on IoT devices with poor security to do so. However, several companies still make high-quality Internet of Things devices, often with a heavy focus on home automation. Now, the government is planning to introduce tough new cyber security and compliance measures to protect the millions of smart IoT devices already online around the UK as part of its ongoing, five-year, £1.9bn cyber security programme.

There is now a move is towards the Internet of Services, which leverages the same technology behind IoT devices but with a radically different business model. Where IoT revolves around selling smart devices, the Internet of Services, or ioServ, offers a service which comes with a free device. Taking inspiration from industry, and especially Rolls Royce, the new paradigm for how consumers interact with their smart technology will pose legislative challenges as well as technical ones. Consumers will need strong legal protection against companies who harvest data from their devices and then fail to secure it. These issues already exist of course which means that, without the right rollout, ioServ may turn into an ioSecurity nightmare as uptake increases.
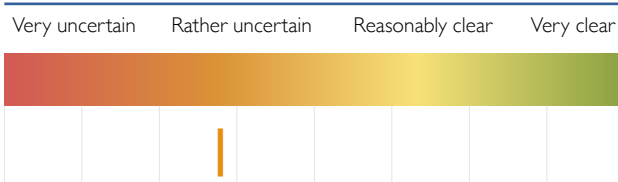
Implications for Gwent

IoT uptake in the public sector has been slower than in the private sector, but is now picking up speed. San Diego has installed 'Smart Streetlights' which have resulted in energy savings of 60% and Philadelphia's network of rubbish bins which automatically request emptying has resulted in savings of over $1mn.

So, putting aside some of the security issues for a moment, there are some straightforward ways that Gwent could build a business case for applying IoT technology to improve existing services.

And as far as security goes, everyone has a role to play. Gwent will want to train its employees and build a culture of security awareness and may want to reflect on how to raise awareness (and perhaps educate) tenants. There is also scope for Gwent partners to take a lead on some innovations, using the Cardiff-City Region as a potential enabler.

Gwent must train its employees and build a culture of security awareness. It might consider sponsoring cyber security awareness programmes for tenants.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act
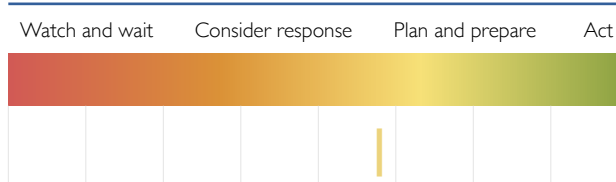
Human rights campaign group Liberty wants new legislation introduced by July 2018 to amend sections of the Investigatory Powers Act (IPA), known as the 'Snooper's Charter', that it says are incompatible with EU law. Liberty argued in written submissions to the Royal Courts of Justice that the government's continued retention and access to communications data amounts to a significant intrusion into the rights to private life, protection of personal data, and freedom of expression under the EU Charter for fundamental rights, and the e-Privacy Directive.

The government said that it has already revised proposals, limiting the ability of senior police officers and officials at the Department for Work and Pensions (DWP) and HM Revenue and Customs to authorise their own access to communications data. Officers will require permission from a new authorising body, the Office of Communications Data Authorisation. The government also plans to restrict police and other public bodies' access to communications data for investigations into crimes that carry a prison sentence of at least six months, rather than the usual three-year threshold for serious crime.

There is little public support for the IPA. Concerns (expressed, for example, in this Huffington Post article) are that the legislation will invade personal and professional privacy and increase mistrust between citizens and the state.

The debate on IPA is probably distracting citizens from a potentially much more intrusive issue: covert tracking of app users' movements, relationships and shopping habits (apple and Uber have questions to answer as well...).
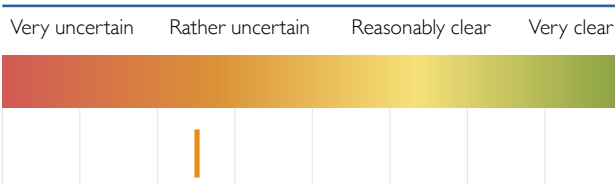
Implications for Gwent

The pros and cons of surveillance seem complicated. On the one hand, citizens are concerned that the state does not watch their every move. On the other, they willingly carry devices and drive cars that can be tracked and they willingly hand over all sort of personal data to private corporations who are mining their personal information, choices and purchasing profiles for commercial advantage.

It may be that the public discourse on surveillance – even the word itself – is simplistic and out of date; in which case, the argument needs to change significantly and quickly. This feels like an important space that local government can – and should - have a voice in. Maybe it's time for partners to begin a communications campaign to raise awareness of some of these issues. Any such campaign should probably have an eye to the long term and begin slowly.

And probably not be delivered through the mobile phone channel. Yet. Gwent should monitor developments.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act
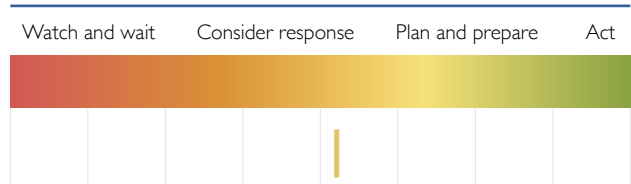
Predictive policing uses predictive analytics to tie crimes to people or places. The techniques are moving beyond existing approaches such as CCTV-based pattern analysis and surveillance towards algorithms that forecast where crimes are likely to occur and who might commit them; and on towards making recommendations for allocating police resources.

Responses are granular and directed. Patrols are sent to a specific city block rather than to a whole neighbourhood and crime data are added daily to generate predictions for each shift.

Of course, predictive policing raises a number of issues around privacy and civil rights. Emerging reports on practice in China suggest that the approach might be used for social control as easily as it might be used to fight crime; and New Orleans police could surely have predicted that piloting the approach without telling officials they were doing so was a risky approach.

Nevertheless – and more openly – Chicago is increasing its investment in the technology. And new systems like LineSight, a Unisys system which could help authorities flag suspicious people and cargo at border crossings and airports around the world "in as little as two seconds," show how technology can support policing.
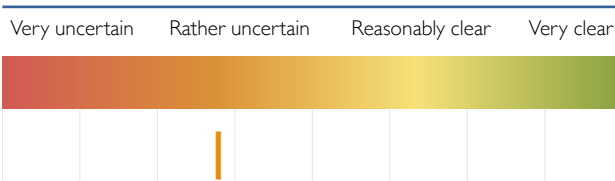
Implications for Gwent

Greater Manchester Police and Kent Police have been trialling predictive policing since 2012 and are (broadly) positive about the results. While some experts believe there is a lot of progress yet to be made – that is, of course, the nature of trialling something new – the general mood seems to be that this is one important approach to crime fighting in the future.

An important issue for improving predictive policing is the accessibility and quality of the data being used. Big Data and Policing, a report published by the Royal United Services Institute in September 2017 explores the issues around this in some detail and identifies four priorities for strengthening predictive policing. It also identifies barriers to implementation and calls for greater investment and improved practice to support the approach.

Most of the report's 14 recommendations are directed at Police Forces and Policing bodies but one - *Shared MASH (Multi-Agency Safeguarding Hub) databases should be created to allow for better data sharing between the police and partner agencies* - calls on local authorities, social services and the police to collaborate closely when identifying vulnerable individuals in need of safeguarding. Shared MASH databases would facilitate this while also giving the police quick access to information that could prove vital for ongoing investigations.

However, it should continue to track developments in this area and review its options periodically.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Home alone
GLOBAL RELATIONSHIPS
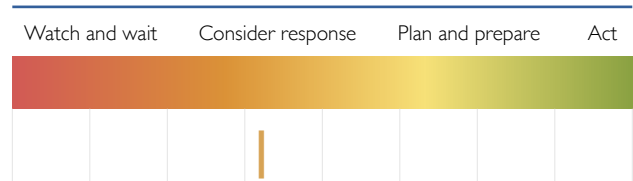
The international community is increasing its efforts to organise and co-ordinate the international fight against terrorism. Europol, the European Police Office, opened the International Centre for Counter-Terrorism in The Hague in 2015 to improve information exchange and identify the links between terrorism and other criminal sectors. However if Britain goes for a no Brexit deal, the UK and Europe face the possibility of homeland data flows, and police and judicial cooperation, being turned off within hours. This would give free rein to terrorists, traffickers and organised criminals. Some politicians believe this means Britain must avoid a no deal at any cost.

Brexit is only one policy challenge facing the UK as it implements the Strategic Defence and Security Review. A report published in March 2018 by the independent academic group The UK in a Changing Europe entitled *A successful Brexit: three foreign and security policy tests* provides a framework for assessing what a successful Brexit may mean for the UK's international role. The intention of the report is not to answer the question as to what that future role may look like but, rather, to consider how we may begin to assess the impact of Brexit on the UK's foreign and security policy. It asks three (pretty searching) questions:

- What would a Brexit that had a positive impact on security look like and how could we tell?

- Will Brexit increase or decrease the UK's ability to shape the international agenda?

- Will the UK increase its ability to take its own decisions on foreign and security policy once it leaves the EU?

In her speech to the Munich Security Conference in February 2018, Theresa May said that the UK is committed to building a 'deep and special partnership' on foreign, defence and security policy with the EU after Brexit.

It is, however, not too clear what that will look like.

Implications for Gwent

Paragraph 2.4 of the Strategic Defence and Security Review sets out that the UK government "*is strengthening our domestic resilience, giving more power to local communities, investing in infrastructure across the UK, and delivering devolution so that we can focus on how powers are used to better the lives of the people of England, Scotland, Wales and Northern Ireland in a strong United Kingdom.*"

Security will be an issue post Brexit and getting it right will be critical. There is probably little that Gwent can do at the moment other than maintain a watching brief, however.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act
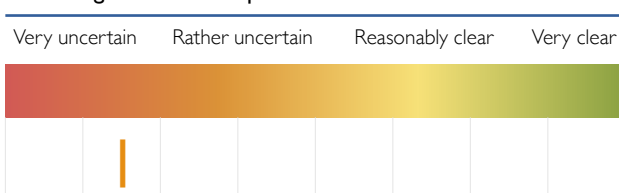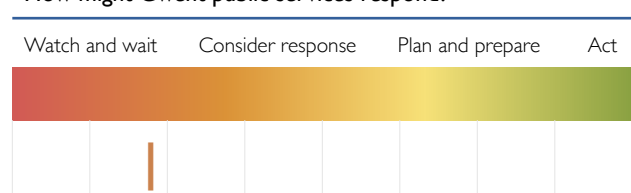
America's new National Defence Strategy (NDS) - the first for 10 years - puts inter-state competition rather than terrorism as the primary concern for US national security. Its aim is to restore America's competitive military advantage to deter China and Russia. The strategy seeks to strengthen US power globally, warning of a loss of cohesion among allies and partners, and reduced access to markets "that will contribute to a decline in our prosperity and standard of living" if it fails. The NDS envisions modernising the "nuclear triad" of US strategic forces, as well as cyber systems and missile defences – treating both space and cyberspace "as war fighting domains." When it comes to conventional forces, the buzzword is "agility" – in operations, deployment, basing and logistics alike. China, at least, appears to see no conflict with continuing trade relations.

Implications for Gwent

The Defence Strategy is the military expression of a deeper cultural approach to America's place in the world that is causing ripples as the US President takes on old and new enemies - and speaks frankly to old friends.

It may feel like there is little Gwent can do other than watch and wait. And maybe that is all that's required – simply to observe what is happening, to model the global dynamics and to anticipate alternative outcomes.

Doing this matters because it is going to be important to understand how global shifts will change trade flows, alliances, power brokers and trade. The implications for security are numerous and the UK will have to pay attention to – and perhaps consider disruption caused by – a range of trends.

This will be, of course, particularly important as the UK exits from Europe and has to renegotiate trade and security relationships

Possible disruptions include – but are not limited to

- Increased protectionism in the US
- Cyber attacks by foreign powers
- Post Brexit trade partnerships
- Securing the UK's food and energy supply

What seems likely is that, as the world changes and big forces bang up against each other, national government will be more outward and upwardly focussed – and it will be local government that will need to nudge citizens forwards. Future service may need to be balanced with directive delivery.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

TECHNOLOGY
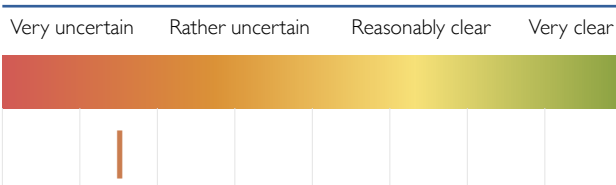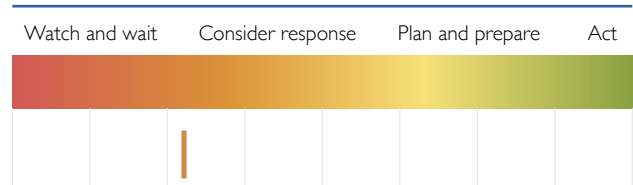
ADOPTING BLOCKCHAIN - Transforming public service

ANTIBIOTICS AND DRUG RESISTANCE - Use with care

AUGMENTED REALITY - Making the leap

BIG DATA - Betting on the numbers

CONNECTIVITY - Finding the right space

CRYPTOCURRENCIES - Following the money

AUTOMATION- Jobs lost, jobs gained

ARTIFICIAL INTELLIGENCE - Securing a slice of the AI pie

ADDITIVE MANUFACTURING - Layers of intelligence
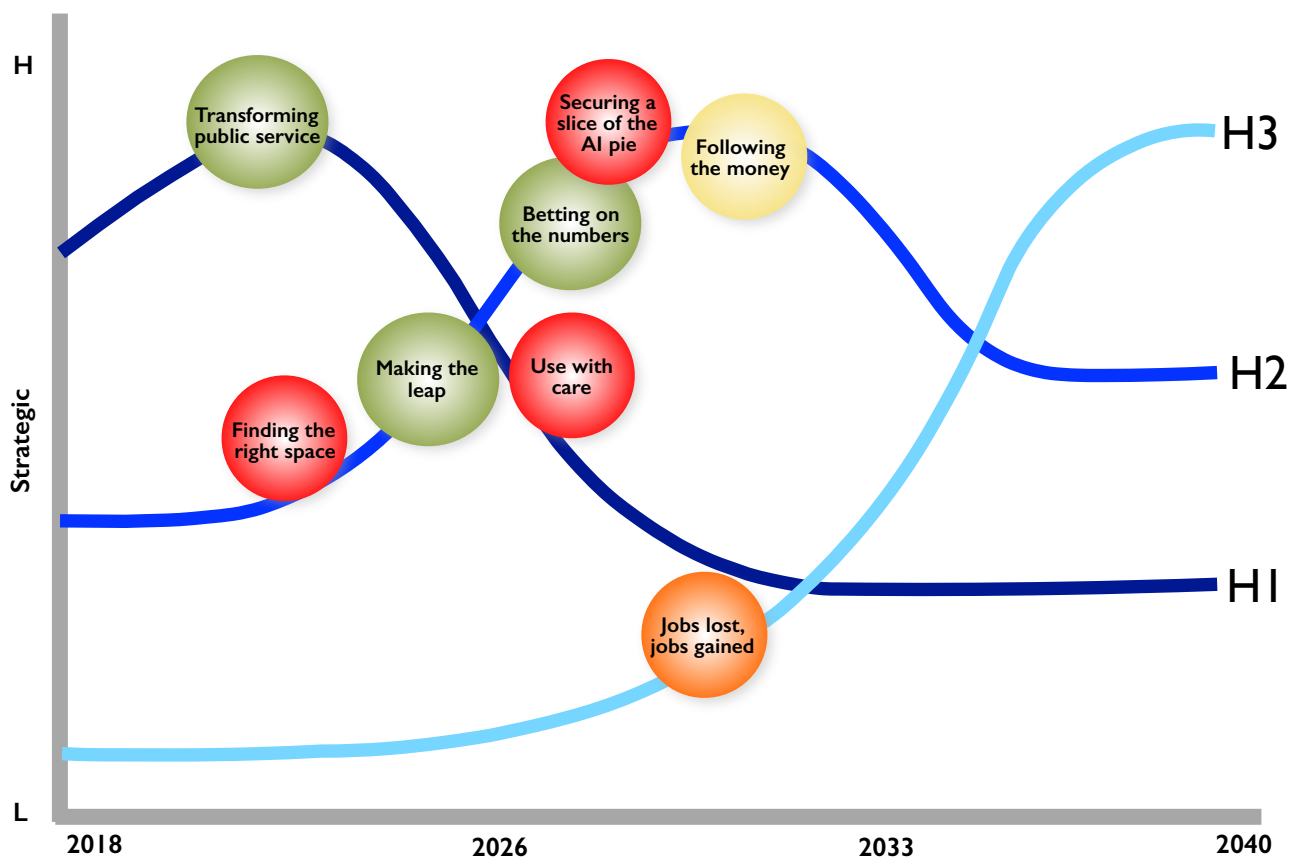
Blockchain is the technology that has underpinned cryptocurrencies – but its application is much wider than that. Companies in financial services, medicine, energy, media, insurance, shipping and much more are now looking at ways to use blockchain to improve efficiency in business processes and to create new business opportunities.

Why? Because hacking, security issues and privacy breaches have eroded trust in existing on line systems. Blockchain creates real-time transparency and a permanent audit trail of every transaction across every network distributed over thousands of computers. This makes it almost impossible to hack. It also time-stamps and geo-stamps every transaction creating an audit trail regulators and everyone else can love (and can't dispute).

In November 2017, Reform – an independent UK think tank - published The future of public service identity: blockchain, a paper which suggest blockchain has the potential to enable radical public services transformation by giving citizens control over how their information is shared with public services.   The report says that blockchain has the potential to enable radical public services transformation in a more profound way than previous technologies; and calls on the UK government to adopt blockchain to provide a secure and efficient mechanism that puts the individual in control of their own identity management.

In this model, citizens access their public service identity via an app on their smartphone, and control what data they share with government to access public services.

Implications for Gwent

A handful of countries around the world are running blockchain trials for service provision. The Ministry of Citizens' Services in Canada is testing blockchain for business registration. In Estonia, the government is piloting a blockchain-based solution for voting, the United Arab Emirates is studying its use in central bank operations and the state of Delaware is piloting a blockchain-based corporate registry. The government in British Columbia is using blockchain to track marijuana sales through the supply chain. Arizona is considering letting people pay taxes via bitcoin. Sweden's government is planning to place all real-estate transactions on a blockchain so all parties involved can track dealings.

Why bother? Smart councils: the evolution of technology in local government, an article published in the LSE's British Politics and Policy blog in January 2018, offers a simple explanation. Blockchain allows local councils to significantly reduce transaction costs in the delivery of services, while also providing greater transparency and participation for citizens. And, also liberating staff for other things. At the very least, Gwent partners could be open to the potential application of blockchain for service provision, whilst being mindful of the risks, as they become better understood.

Blockchain technology is moving rapidly into a range of applications which will include public service delivery. Gwent must explore the implications for its own services.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Drug resistance has becoming a global issue because of inappropriate use, or overuse, of antibiotics in humans - particularly treating infections not caused by bacteria, such as colds and flu – and in animals to contain infections and to speed up growth. Inappropriate use helps to increase resistance in the bacterial population leading to (for example) the rise in superbugs that cannot be treated.

This has caused concern that the world is heading to a post-antibiotic era in which common infections will once again kill people across the developed (and less developed) economies. Failure to tackle the problem could lead to 10 million deaths every year globally by 2050. Encouraging responsible prescribing by doctors and informed use by patients is critical.

Research continues but cannot be seen as an alternative to good practice, despite two recent positive developments (previously unrecognised pathways to antibiotic tolerance in *E.coli* that could act as targets for new drugs to treat bacterial infections; and the discovery of a new class of antibiotics in soil that is effective against the group of bacteria that includes MRSA).

Implications for Gwent

Good practice – or rather poor practice – is a known issue. Analysis from Public Health England published in February 2018 indicates that at least 20% of all antibiotics prescribed in primary care in England are inappropriate. Public Health Wales suggested in 2017 that practice locally is the same as the rest of the UK.

And so the issues is not going away. While the UK seeks to persuade world leaders to do something there is a need to raise awareness and educate the general public as well as health professionals. Perhaps local government – or parts of it - should adapt the antibiotic guardian approach. This will need to be targeted carefully, but is worth considering.

It may be a small step, but the Care Quality Commission believes that future quality of health and care is precarious. Perhaps we all have a part to play.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
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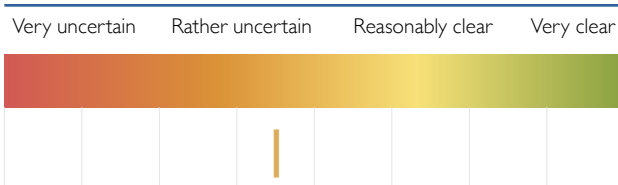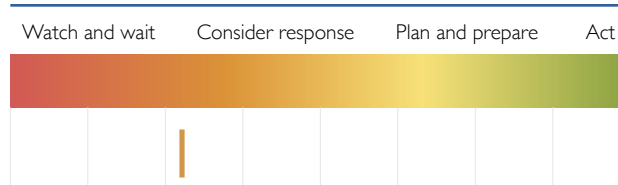
Tim Cook, CEO of Apple recently said that he believes augmented reality (AR) to be a more profound technology than virtual reality (VR) and one which he sees uses for in many aspects of life and business.

Virtual reality immerses us in new, synthetic worlds with 360 degree views and little to no sensory input from the room or space we are actually in. Augmented reality overlays virtual 3D graphics onto our real world, augmenting the way we see everyday life and bringing us more information.

VR is slightly ahead of AR in terms of the technology required to deliver it, but that maybe matters less than how the technologies are going to be applied. What is beginning to emerge is that a number of big players (including some of the leading players in VR) agree with Apple that the future is more likely to be one where technology augments our interactions with people and our environment rather than one where we retreat to artificial environments. Or at least, for anything much other than immersive gaming and perhaps some educational experiences.

The big game changer for AR will be how users access it. Magic Leap, one the most eagerly watched tech companies in this space launched its AR goggles, Magic Leap One, in December 2017. While there is still a long way to go before the goggles look more like glasses, AR is beginning to look a credible prospect for the future of education, tourism, construction and healthcare. To name just a few sectors.
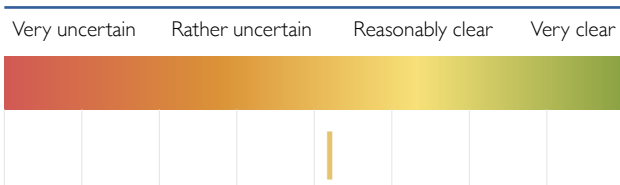
Implications for Gwent

AR is beginning to land. The government announced in February 2018 that one of 10 innovative rail projects being funded to the tune of £3.6m is an AR application which uses Google Cardboard and passengers' phones to highlight virtual landmarks as they pass them – Viking villages around York, or a herd of Newcastle-supporting Toon Army zebras running alongside the A1 (according to developer Meyouandus…). And the National Gallery announced in March 2018 that it is to set up an innovation lab to explore how new technology – including AR – can be used to bring the arts to a new tech savvy audience.

Lincoln High School's experiment with AR in the classroom is the latest in a growing list of trials. The barriers to entry are low and the potential learning gains are high.

For now, the costs can be high and the applications are still developing – but the use of AR is being driven by business as well as by universities and schools.

What can Gwent learn from these early adopters and how might it work AR opportunities into its digital service offer? The answer may be less obvious or less immediate than in other tech areas, but Gwent needs to be ready for anything. As a recent article by the Head of Digital Services at Newham Council points out, councils need to develop both digital services and an internal digital culture if they are to reimagine the way services are delivered and consumed. Gwent should review the implications of AR for public services delivery.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
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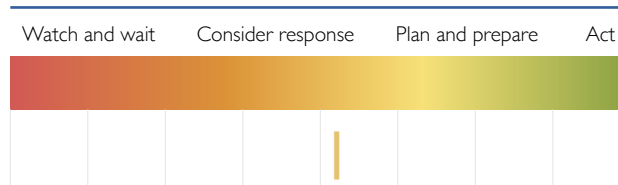
A 2016 report into data analytics in local government found that big data is being increasingly applied to (for example) predicting service need, enabling deeper population level analysis, improving traffic management, improving services such as waste collection and reducing inefficiency and duplication of effort in service provision. The report identified a number of ways local government can improve their use of data analytics. These include data warehousing to enable deeper analysis and use, data sharing, creating a data-oriented culture that puts data and analysis into the decision and policymaking processes – and investing in data science skills and capacity in local government workforce.

A 2017 report from the ESRC Business and Local Government Data Research Centre, however, found that these opportunities are not being taken up sufficiently. It identified three main structural barriers to the fruitful exploitation of big data by local government: data access; ethical issues; and organisational change. In addition, skills and investment in information technology are problematic.

One promising example of big data use is the London Borough of Barking and Dagenham's recent findings from its data science team on modelling how local betting shops can influence gambling addiction. Speaking at Nesta's City Data Analytics event – designed to showcase UK regions that are working to join up, analyse and act upon data at a city or regional scale to reform public services – the borough's Insight Hub manager Pye Nyunt explained how the model uses a range of data - demographics, the proximity of schools and colleges to betting shops, local mental health problems, the presence of homeless shelters, food banks and payday loan shops – to identify how many vulnerable people live close to the betting shops.

The team expected gambling addiction to be scattered across the Borough, but found it to be concentrated in three wards. It also established that the shops were clustered together to attract gamblers who had exhausted their credit for fixed odd betting terminals in one to go to another.

In addition to using the evidence in its own gambling licensing policy, Nyunt believes it could influence future legislation in a range of policy areas.

Implications for Gwent

Is Gwent using – or considering using - big data to support service provision? Does it have the right data science skills and infrastructure? And how is it doing with respect to those three barriers to its exploitation: data access, ethical issues and organisational change?

This is an area where it could become very easily to fall behind the pack. Data analytics has the potential to provide much greater insight than ever before, with benefits being pulled through to better targeted service provision. It may be appropriate for Gwent partners to identify the 'big questions', and to investigate the role that data analytics could play in answering those unknowns.

Gwent should review where big data will assist it to deliver services more effectively and plan accordingly.

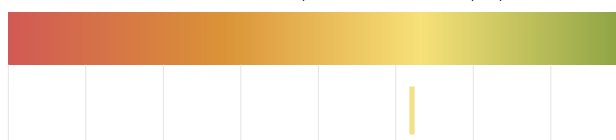| How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

The UK wants to be a global digital player, but the latest figures show it has lower 4G speeds lower than countries such as Mexico, Lebanon, Romania, Lithuania and Serbia. The reach of 4G also leaves something to be desired. Ofcom's 2017 Connected Nations report found that while 97% of the UK's population can receive a 4G signal, actual geographic coverage fares much worse - with only 40% of the country by area able to get a signal.

Connecting remote or rural environments using existing technology isn't practical or commercially attractive but innovative approaches - such as TV white space technology or leftover wireless spectrum from digital TV switchover - are being used to connect communities in the highlands and islands. Connectivity is not just about having the technology, it's about having access to opportunities to participate and thrive in the digital economy. And, of course, access cuts both ways, offering commercial opportunity to providers.

Implications for Gwent

The UK government has promised to boost 5G connectivity for Wales. The Welsh Government is also working with the industry to improve connectivity; its action plan, published in October 2017, highlighted that, because of the country's topography, Wales needs 67 masts to reach one million people, while England only requires 12 masts to reach the same amount of people, Northern Ireland requires 25 and Scotland requires 45.

The Mobile Action Plan will be reviewed regularly so it is worth Gwent being sure that it identifies any gaps in provision and ensures government is clear what Gwent public services require.

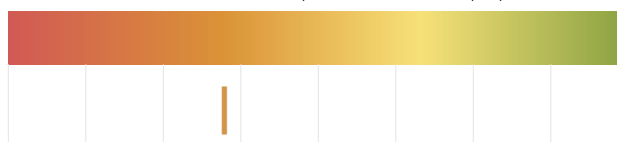| How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

Cryptocurrencies such as Bitcoin provide a secure system for storing and exchanging money on the internet. Cryptocurrencies are not regulated or controlled by any bank, government or centralised financial authority, and offers users a range of advantages over traditional banking (anonymity, secure transactions, low transaction fees and no forgery - to name a few).

Bitcoin, invented in 2009, was the first cryptocurrency but is not the only one. By the end of 2017, there were over 1,000 cryptocurrencies and significant volatility the market; largely because of continuing speculation.

A number of leading retail websites accept cryptocurrencies and they are now beginning to be accepted in the physical world too. There is even a small but growing network of Bitcoin ATMs in the UK, with 2 in Cardiff.

Running counterintuitively (perhaps) to the provenance of cryptocurrencies, the Bank of England is currently investigating the possible introduction of a cryptocurrency linked to sterling. A Bank of England-issued digital currency would potentially allow British citizens to keep their money - in digital form - with the central bank itself, dispensing with the need for a retail bank. Big-ticket transactions, such as buying a house, could happen in nanoseconds.

And, of course, as interest in cryptocurrencies rises, so do the potential security issues such as cryptojacking – whether by individuals or nation states.

Implications for Gwent

Gwent will need to ensure its systems can't be cryptojacked. There's a lot of that going on at the moment. Once that's sorted, Gwent will want to turn its attention to how cryptocurrencies might pay for local services.

The UK Government is a bit concerned about cryptocurrency and is looking at regulation but despite these concerns, popularity is increasing.

Other governments are being more experimental. Dubai issued the first cryptocurrency license in mid February 2018 and by late February, a local developer was offering a discount to buyers willing to pay with cryptocurrency. The incentive is clear – security, no fees, saved time. And, perhaps a focus on the future. Venezuela has launched the petro.

For now, then, it's a watching brief for Gwent. And, of course, you have some local experience you might want to capitalise on. Why not host a cryptocurrency forum to explore where things might be going?

There is no immediate response required from Gwent, but it should watch developments and might want to explore the possible implications of cryptocurrency.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act
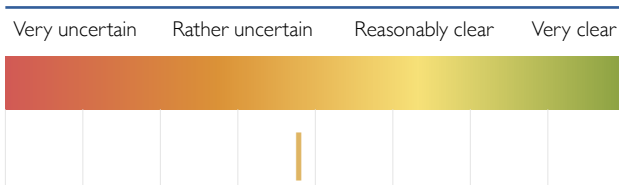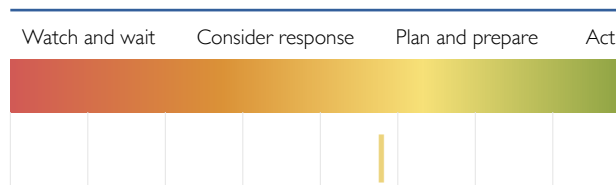
There is no doubt that robotics will have a major impact on the economy; but how seems a little hard to read at the moment. The current mood – perhaps exemplified by a 2017 report from the Centre for Economics and Business Research (CEBR) and a January 2018 report by the Centre for Cities – is that automation will deepen economic divisions across the country.

The Centre for Cities report suggests that 1 in 5 existing jobs in British cities are likely to be displaced by 2030 as a result of automation and globalisation – 3.6m jobs in total – with retail occupations, customer service roles and warehouse jobs among those most at threat. Cities in the North and Midlands more exposed to these job losses than wealthier cities in the South.

The RSA's Age of Automation report published in September 2017 aims to bring a more reasoned voice to the discussion of automation on jobs and the economy. One of the report's main conclusions is that AI and robotics are more likely to alter jobs than to eliminate them. Many tasks, it argues, remain outside the scope of machines to deliver; particularly those demanding manual dexterity and deeper forms of creativity and communication. A more important question is how AI and robotics will alter the substance of the many jobs that remain in place.

Seven in ten people in the UK are currently in jobs that are likely to need redesign and workforce retraining. New technologies like artificial intelligence and robotics will generate significant productivity gains and economic growth but will also change the nature of work. The supply of work for people leaving school with limited or no qualifications will decline significantly as jobs requiring limited educational attainment become fully automated and up to one third of work requiring a university degree could be automated by 2030.

This does not necessarily mean that one third of these jobs will disappear – but rather that one third of the constituent activities of most jobs will go. These changes will challenge current educational and workforce training models, as well as business approaches to skill-building. Mid-career job training and worker redeployment will be essential.

Much will come down to the choices we make as a society. However, as the RSA report argues, these choices will be largely irrelevant unless the UK accelerates its take-up of AI and robotics – an area where we are falling behind our main competitors.

Implications for Gwent

It's easy (in early 2018) to believe that unemployment is likely to rise and opportunity is likely to fall – but it's important to take away the key message that it is tasks that are going to be automated rather than jobs. In some cases (where a job is made up of tasks that will all be automated), the jobs will disappear. In other cases (where only some elements of the job can be automated), jobs will change.

Other things will change as well. People will not always have to go to a place of work to do their work. People will not necessarily have to – or choose to – work for one employer. People can generate ideas and work with ideas.

Many people are going to need skills development but perhaps more than that, society needs a more sophisticated narrative and discourse on the nature of work. They need to become used to thinking differently about jobs and skills. Flexibility in approach will be key amongst Gwent public

service partners - for instance, ensuring that schools are preparing pupils for this 'new future' will be fundamental. Education policy will be central.

Gwent should explore the implication of AI and robotics for the labour force and for jobs and skills.

How might the issue impact on Gwent in the future	How might Gwent public services respond?
Very uncertain Rather uncertain Reasonably clear Very clear	Watch and wait Consider response Plan and prepare Act
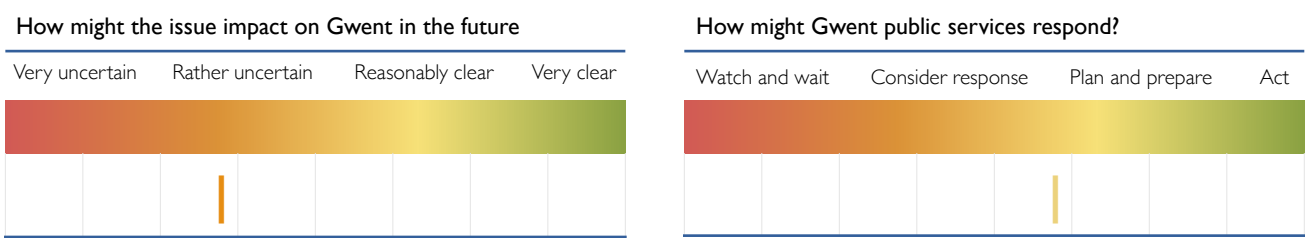
A report published by the UK Government in October 2017 suggests that artificial intelligence (AI) could add an additional £630bn to the UK economy by 2035, increasing the annual growth rate of GVA from 2.5 to 3.9%. The report notes that AI offers massive gains in efficiency and performance to most industry sectors and sets out a vision for the UK to become the best place in the world for businesses developing and deploying AI to start, grow and thrive.

The report make 18 recommendations in 4 strategic areas:

- Improving access to data
- Improving supply of skills
- Maximising UK AI research
- Supporting the uptake of AI

Research carried out by PWC in 2017 suggests that AI could increase spending power per household in Wales by up to £2,300 a year by 2030.

Implications for Gwent

Recommendation 17 of the Government report states that *Government…should develop a programme of actions to prepare the public sector and spread best practice for applying AI to improve operations and services for citizens*. The programme should help 'the broad UK public sector, including Devolved Administrations and the local public sector' to become AI ready and to transform public services through

- improving the flow of information and analysis in services, including early and better insights from economic and other data
- improved decision-making in complex areas
- managing new and increasing data resources, for example from internet of things and smart city applications
- improving the efficiency, effectiveness and usability of services for users

It is, pretty well, an agenda for action for local government in Gwent.

Gwent should explore the implication of AI for how it delivers its services and needs to understand the consequences for jobs and skills in public services in the future.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
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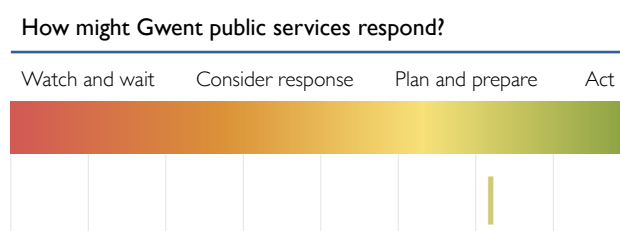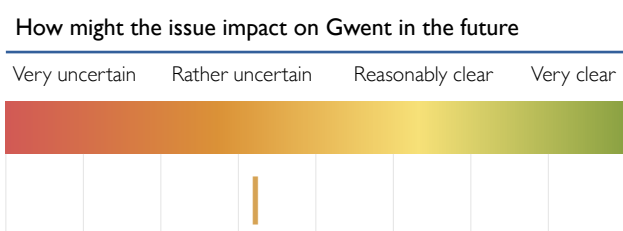
Additive manufacturing (AM) is the collective name for the range of technologies and process that build 3D objects by adding layers of material. AM is, effectively, synonymous with 3D printing – but remains the preferred term in industry.

AM is gaining a lot of publicity for high profile (and easily understood) projects such as the 3D printed house that can be built in one day at low cost - which start up business ICON wants to use to print affordable houses for families living in slums across the world – and Arup's collaboration with CLS Architects in Europe. Future developments mean that houses will likely move from concrete to advanced hybrid materials.

Designers are experimenting with smaller scale processes and using it it to develop the technique. 3D printing (even with plastics) is eco-friendly because it uses a precisely calculated amount of material and generates little waste. Future production process are likely use carbon neutral materials such as the bioplastic developed by Dutch designers.

The next wave of AM is exploring how to combine both structural and functional materials in the manufacturing process to create intelligent systems; and AM is likely to move into new industries such as agrochemicals, pharmaceuticals and electronics. Current research is exploring the use of AM to print human tissue.

Siemens has announced that it will build a 3D printing facility in the West Midlands in 2018 which will develop the technology to print metal parts for the aerospace, automotive and power generation sectors (amongst others).

Implications for Gwent

Additive manufacturing is beginning to come of age. Who knows what the quality of AM houses will be in 15, 20 or 25 years will be – but the likelihood is that it will be high and that homes will be affordable. The development of intelligent materials could provide a breakthrough in creating custom built communities using AM rather than kits.

Cheap to build, easy to recycle? As the technology improves, bioplastic houses could be designed and built according to need. Sheltered housing for ageing communities could be recycled into urban cabins for low income families. All quick and easy.

What might be the implications for planning? As a part of new construction techniques, it may become a greater consideration in planning policy – could sites be identified where 3D printed houses could be showcased?

What are the implications for land ownership? How would services be provided? Would people want to live in AM houses? In short, could 3D printed houses solve the housing crisis as ICON hopes they will?

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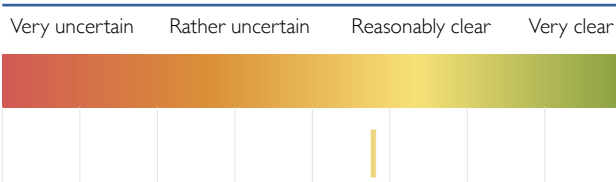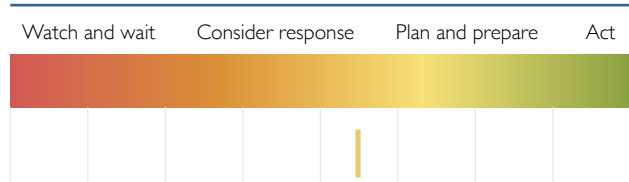
RESOURCES

RESOURCES - Peak everything

RESOURCES - Mud, mud, glorious mud

RESOURCES - And not a drop to drink

ENERGY - Renewables

ENERGY - Distribution and storage

ENERGY - Cost and security
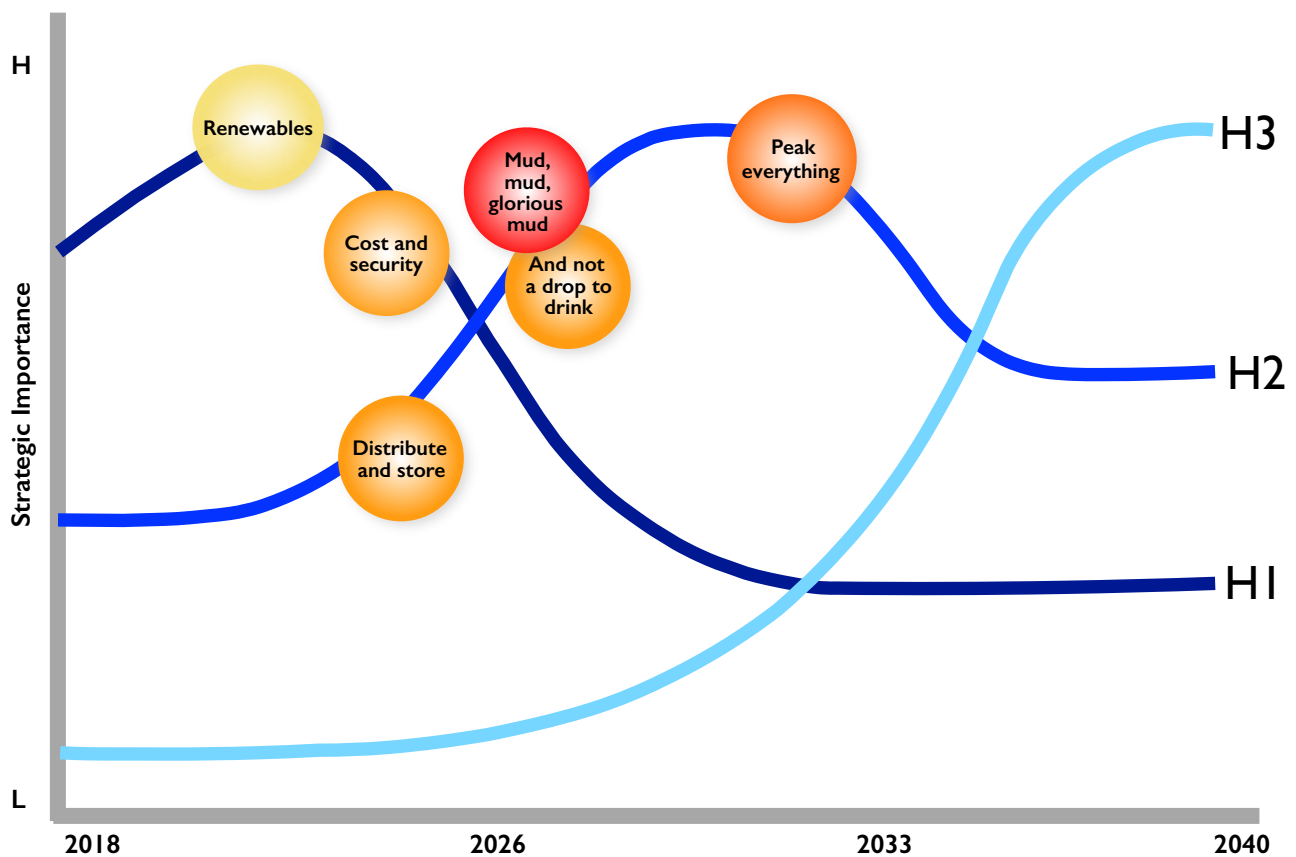
Every resource on the planet has finite reserves - apart from those driven by the sun (solar, wind, wave energies). How long these reserves will last depends on the rate of extraction or demand, potential new discoveries and the price of the commodity. The economics of mining, or drilling, can be changed by an increase in the price. However, the fundamental truth remains - all metals and fuels will eventually run out - and, before that, they will 'peak'. That is the point at which the depletion of existing reserves can no longer be economically replaced by additions of new capacity.

Oil is a good example. Like all fossil fuels, the beds of oil were laid down millions of years ago - yet within 150 years of the first serious drilling happening, we are now believed to be close to 'peak'. There is still oil in the ground but it is being extracted faster than new deposits can be found. At the same time demand is growing and the cost of extraction is rising too.

An 2007 study demonstrated clearly that mercury, lead, cadmium, potash, tellurium, phosphate, thallium, selenium, zirconium, rhenium and gallium had reached this point, with their production values showing the classic Hubbert curve. Some of these metals are key components in the semiconductor sector, others are key parts of high temperature production processes. In some cases, new materials cane found replace them, and substitution will occur; but others have no obvious substitutes. Other important metals and rare earths are forecast to peak over the next decade or so, with significant consequences for industries and new product development.

mining.com has provided an infographic of its estimation of the useable reserves of various metals and energies.

Born in 2010: How much is left for me?
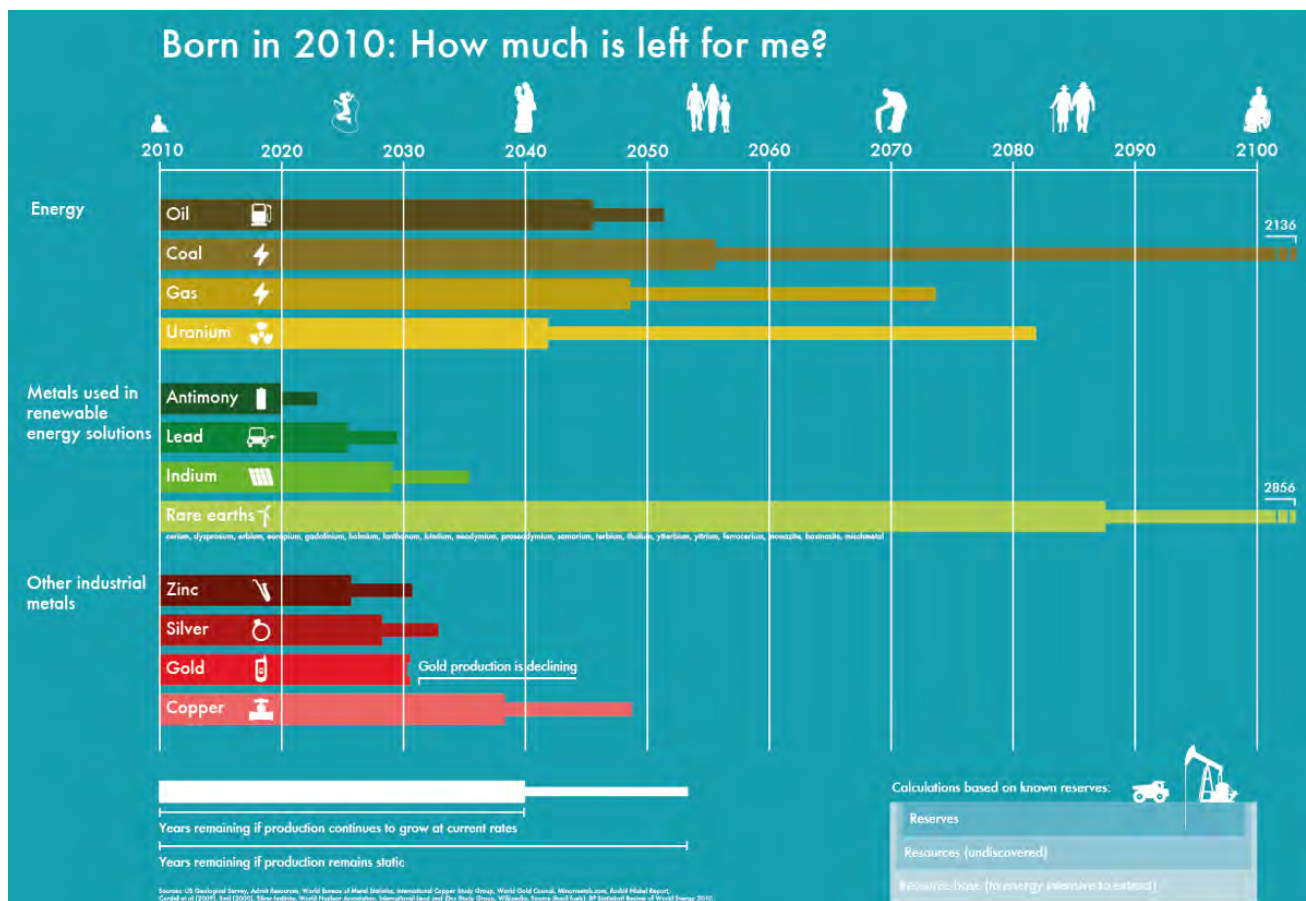
More recently, Chatham House has identified the possible resource constraints of a range of foods, fuels and minerals. The issues are not only that of actual reserves, but also concern the investments needed to maintain supply, the cost of extraction, the environmental damage and political sensitivities.

Implications for Gwent

Given the laws of demand and supply, an increasing scarcity of resource such as oil will likely continue to mean that the cost of that resource will increase over time. The price of oil, and oil-based products, will only be sustainable if alternative substitutes are developed. Not only will price increase over time, but volatility in these fossil markets will increase. These periods of increased volatility have already been experienced over the last few years. In many respects, the market volatility is more difficult for Gwent businesses and citizens to deal with. For businesses that are particularly exposed to the volatility in these markets, such as the transport and distribution sector, it is difficult to have any confidence in long-term cost planning.

The shift away from fossil fuels is happening, as demonstrated by the UK recently being able to generate electricity for three days without the use of coal, but it is a slow process. The shift from fossil to renewables will need to take place at a national scale. However, there are initiatives that Gwent partners will need to consider that will make the area less fossil fuel dependent, such as continued promotion of renewables, and infrastructure considerations such as the development of an electric charging system, and smart grids across the area. The shifts in technology tend to be sporadic, and therefore the infrastructure needs to be in place to take advantage of technology-readiness.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act
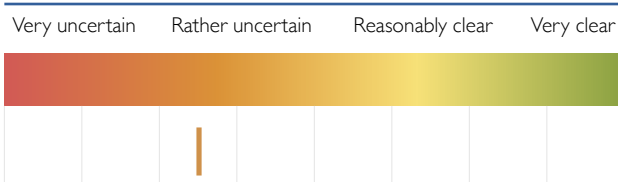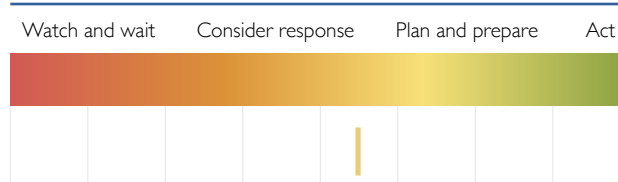
Half of the worlds fertile topsoil has been lost over the past 150 years, and the quality of much that remains has been degraded. Looking forward, as the world needs to feed 2 billion more people, there is an urgent need to replace the soil structure, nutrients and fertility in many areas. It will become increasingly important not to encourage the shift from natural forests and grasslands to intensive agriculture - and artificial subsidies will need to be withdrawn. And more sustainable forms of agriculture will be needed to protect what is the 'foundation' of all agriculture.

It is an enormous challenge to work out what land will be needed to grow the food to feed 9.5 billion people, by 2050. Pressure on land will intensify, with competing demands - for agriculture, forestry, industry, mining, housing, recreation and amenity use. At the same time the availability of quality land, and soil, for agriculture will be compromised by reduced water availability, less fertile soils and desertification from changes in the climate.

Implications for Gwent

There are areas of Gwent that already suffer from poor soil quality, as demonstrated by its suitability for farming and natural biodiversity. At the same time, where the soil quality tends to be better in Gwent i.e. in coastal areas, those are the areas which are under the greatest pressure for development. As a consequence, it will be important for Gwent partners to ensure that the pressure on good quality farming land, and areas of high quality environmental credentials, to be protected from development. As discussed elsewhere, this will require a difficult balancing act against the competing development requirements, such as the need for housing and employment. At the same time, the move toward higher intensification of farming will continue to be seen across Gwent. Whilst Gwent does not have significant areas of arable/food production, the intensification associated with grazing yields will continue. This provides further pressure on that land.

Gwent partners should develop a strategic approach to protecting areas of high quality land from development and high intensity farming techniques.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act
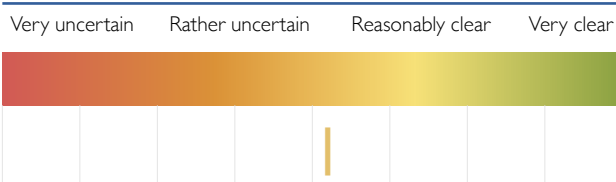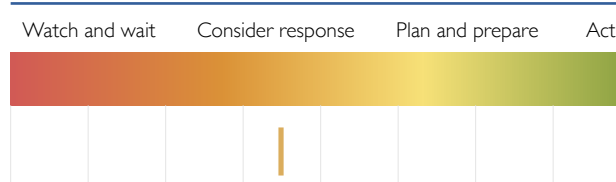
With changing climate and warming overall, the pressure on fresh water across the globe continues to grow. Almost 2 billion people rely on glacial meltwater to feed their water supplies - yet almost all major mountain ranges are seeing rapid decrease in glacier coverage. Upward demand from increased population, intensive agriculture and industrial uses have seen groundwater tables dramatically lowered and aquifers drained. Given the problems of finding locally practical solutions within human timescales, water stress is likely to remain a significant issue for many decades. More and more countries are relying on desalinisation to ensure their populations and businesses have access to clean fresh water.

IBM estimate that more than half of the world's population will be living in water-stressed areas within 10 years. A range of new technologies are being tested and brought into production to allow desalinisation in more remote areas, at lower cost and using only solar energy. From a graphene sieve to metal organic frameworks, they could transform the availability of fresh water across the globe.

Parts of the UK are now regularly under water stress and new ways to store and distribute water and reduce demand are being planned. By 2030, 27 of the water zones are forecast to be in supply / demand deficits. In particular, London and the North West are thought to be vulnerable to supply shortages. By the 2050s, climate change will further impact fresh water supplies and there could be a 10% reduction in water available for public use.

Implications for Gwent

Gwent is not one of those areas that is most prone to water shortages, the upland areas receive some of the highest volumes of rainfall in the UK. However, increased development will place further pressure on the water supply infrastructure, particularly the need to shift water from the north part of the Gwent to the south. There may even be calls to take more water from Gwent to service other areas in Wales and the UK. This may involve some disruption to infrastructure.

There is also uncertainty around the impact of climate change on the volatility of rainfall. Whilst the modelling expects that more intense rainfall events to occur, it is possible for increased incidence of drier periods. Therefore, careful planning of water management will remain crucial. In the future this may require additional storage, although not clear in the timeframe of this work.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
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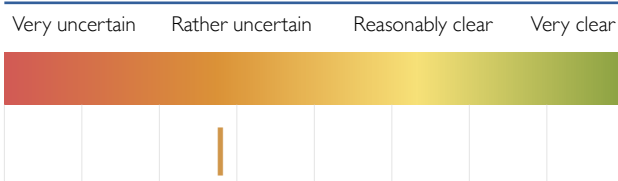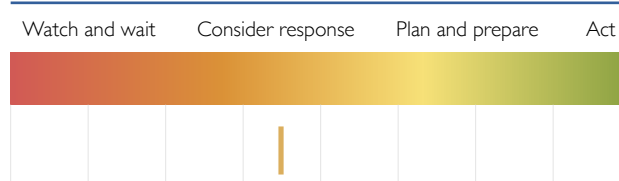
As oil becomes more scarce and, over time, becomes more expensive, and the need to decarbonise our economy intensifies in the light of climate change, we have to find new ways of creating and distributing energy. The recent fall in oil price (due to over production and reduced demand) has reduced investment in some risky exploration sites. The means to generate near-zero carbon energy are already with us - and the technologies are becoming more efficient and cheaper, and the will to install them is growing. Until the various renewable industries mature, they are likely to require some form of public subsidy. However, efficiency improvements and scale is bringing price parity with gas much closer. Fossil fuels and nuclear power receive much higher subsidies than renewable energy.

Technology	Description	Potential for Gwent	Issues
Solar PV	Typically small scale, used on buildings and installations and in off-grid areas. Converts light into electricity.	Medium	Prices are much higher than conventional energy generation, but reducing. Reduced efficiency from dust.
Concentrated solar	Huge potential and capacity. Industrial scale plant. Concentrates sun's rays to create steam to drive turbines	Medium	High relative cost. High use of water - need to locate close to major water source. Technology rapidly maturing.
Solar thermal	Heats water directly from sun's rays. Useful at domestic scale for hot water use.	Low	
Onshore wind	Wind turbines generate electricity from the turning of the blades. Can be installed at different scales. Wind can be intermittent - so needs balancing with other energy sources.	Medium	Wind energy resources often highest when the sun is not shining, so a good fit with solar.
Offshore wind	As above, but moored or fixed to the sea bed on continental shelf. Wind often more constant.	Low	Requires new infrastructure to bring power to land. More expensive than onshore wind. Less visual intrusion.
Hydro	Electricity creates by forcing water through a turbine, Force usually generated by a large drop from dam to turbine.	Medium	Conflict with wildlife and habitat protection on mountainous areas. Potential for micro-hydro.
Geothermal	Works by tapping to the heat of the earth's core.	Unknown	Viability varies across the country
Wave	A range of technologies to capture movement from the waves and convert to electricity. Widely available along the coast, but low density power.	Low	Technologies still new. Big potential in western coasts. Expensive at the moment.
Tidal - wave	Using barriers or lagoons to capture water and high tide and create a 'head' as tide ebbs. This difference can drive multiple turbines.	Low	Few suitable locations. Estuaries are most productive. Very high initial infrastructure costs but return over 100+ years
Tidal stream	Creates electricity from the tidal waters turning underwater turbine blades (like an underwater wind farm.	Medium	Can use the tide on both ebb and flow. Few suitable locations.
Biofuel	Using plant material or animal dung to create gas or ethanol to burn in power plant.	Low	Animal waste needed for fertiliser. Crop lands too valuable for growing food.
Storage	Various technologies, including batteries, compressed air and pumped hydro. Battery technologies improving rapidly at both domestic and industrial scale	High	

A mix of renewable technologies can provide reliable coverage (solar thermal, solar PV, onshore wind, offshore wind, wave, tidal, hydro, biomass, geothermal) at both localised and industrial scale. This will need to go hand in hand with huge improvements in energy and thermal efficiency, and more effective load balancing. Rapid improvements in battery technology can make the intermittent nature of some renewables irrelevant. Smart grids will be developed that can cope with two-way transmission. There is likely to be higher electricity demand as transport and heating move from fossil fuels to electricity.

A report for the Vancouver Resource Investment Conference 2018 makes it clear that to fully transition to a green economy, we'll need vast amounts of metals like copper, silicon, aluminium, lithium, cobalt, rare earths, and silver. These metals and minerals are needed to generate, store, and distribute green energy. Without them, the reality is that technologies like solar panels, wind turbines, lithium-ion batteries, nuclear reactors, and electric vehicles are simply not possible. To fully work our way off of fossil fuels, we will need to procure large amounts of the metals that make sustainable energy possible.

The renewables revolution is happening at a breakneck speed – and new records will continue to be set each year. Over $200 billion was invested into renewables in 2016, and more net renewable capacity was added than coal and gas put together:

Power Type	Net Global Capacity Added (2016)
Renewable (excl. large hydro)	138 GW
Coal	54 GW
Gas	37 GW
Large hydro	15 GW
Nuclear	10 GW
Other flexible capacity	5 GW

Implications for Gwent

The evidence shows that around 43% of electricity consumption in Wales came from renewable sources in 2016, a significant increase in prior years. Therefore, good progress is being made. However, there have also been increasing calls that shifts in UK Government policy have 'stopped many renewable projects in their tracks'. Changes to the financial support available to renewable projects were made in 2015, with onshore wind and solar developers excluded from competing in the UK Government's subsidy auctions. Many have claimed that onshore wind and solar provide the biggest opportunity. For Gwent, many upload areas are obviously suitable for wind energy and the rate of development has significantly stalled due to these subsidy changes.

Gwent partners may wish to add impetus to the Welsh Government Energy Secretary's calls for power over subsidy payments for energy schemes to be devolved for the Welsh Government.

The game-changer remains the possibility of the Cardiff Tidal lagoon (or even the Newport Bay scheme). Given its proximity to Newport, not only would this provide the opportunity for Wales to make the transformational switch to a wholly renewable energy system, it would also provide enormous economic benefits to Gwent during its construction. It is not clear whether the development of the lagoon will happen, but it certainly remains in future thinking.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act
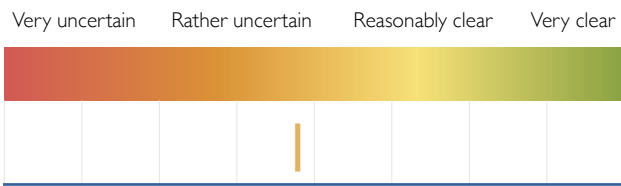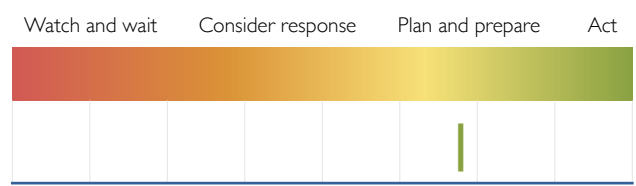
Micro-grids are localised systems that generate and deliver electricity to a defined geographic area, such as a building, campus or neighbourhood. They are beginning to transform businesses, universities and urban areas in the industrialised world. Micro-grids can serve as backup power sources to organisations also connected to the grid or can be operated independently, allowing homes or businesses to operate off the grid.

Micro-grid deployment is a "global phenomenon," according to a 2015 Navigant Research report. It identified 1,437 micro-grid projects worldwide representing 13 gigawatts of capacity either operating, proposed or under development. The market for micro-grids will soar to $40 billion by 2020, a fivefold increase over seven years, Navigant predicted.

A convergence of technological, economic and environmental forces, each coming to a head over the past year, are pushing micro-grid development forward rapidly.

The increasing efficiency and lower cost of battery storage is one of them. Storage effectively eliminates a key barrier to renewable power generation: the intermittent nature of sunshine and wind. Batteries enable a micro-grid to store energy tapped during sunny or windy times of the day and save it for use during times when those weather conditions don't exist.

Improving software, developed for Internet of Things technologies, means that exactly the right amount of energy from the cheapest source can be delivered via micro-grids or shifted in split-second response to changes in weather or demand, reacting just like the bigger grid does.

As these technologies have advanced, the costs of solar and wind power have plummeted, making renewables a compelling prospect for electricity buyers. The price of solar has fallen 82 percent per watt in the past six years, while wind power has dropped 61 percent during that time, according to Lazard's Levelised Cost of Energy Analysis. That makes them price-competitive with — or in some markets cheaper than — fossil-fuel power. And across all these elements, software manages electrical loads, responding in real time to changes in demand or supply.

And then there's resilience. The perceived vulnerability of centralised electrical grids to extreme weather, terrorism and other disruptive events are making micro-grids an attractive option. As hurricanes, floods and terrorist atrocities become more frequent, utility power grids appear increasingly susceptible to outages.

There is a growing group of companies, cities and institutions tapping into micro-grids to meet economic, environmental and resilience goals. For example, the University of California at San Diego relies on a microgrid to power its 13-acre campus of research labs, hospitals, classrooms, living spaces and a fleet of electric vehicles.

Electricity at scale

How can businesses in crowded urban areas become producers of renewable energy at scale? In most cases, they do not have the land, or roof space, to generate the sustainable power needed for their buildings and operations.

While a keen emphasis on energy efficiency measures can reduce carbon footprints and energy expenditure to some extent, some organisations are aiming to go further and generate their own power. One way to achieve this is to create a direct link between their properties and solar/wind farms offsite, in more rural areas.

George Washington University in the US partnered with nearby institutions to create the [Capital Partners Solar Project](#) - planning to generate 52 MWs of electricity. Aside from the 60,000 tonnes reduction of CO2 each year, the partnership have fixed the price over 20 years, at a lower rate than current alternatives which is likely to lead to greater savings over time.

The World Resources Institute, said the project is a "model" for others. "GW and its partners have developed a model that directly ties the solar source with their use and payments," he said. "Their approach could help move the market to more direct sourcing of renewable energy by large retail buyers. This solution could be widely replicated by buyers in the public and private sectors."

Gas Mills

As well as electricity from renewable sources (solar PV/wind/wave etc), it will shortly be possible to buy renewable gas from UK sources. While initially aimed at domestic consumers, both Ecotricity and Good Energy are keen to provide this to commercial customers.

Back in 2010, renewable energy firm Ecotricity launched a service [providing biogas to households](#), aiming to replace the use of natural gas for heating, cooking and other non-electricity energy applications. At the time, the company was sourcing biogas from abroad—but the end goal was to create "green gas" mills across the country which would use waste and/or agricultural inputs like grass as a feedstock.

That vision appears to be taking shape. The company has just submitted a planning application for [a green gas mill at Sparsholt College,](#) near Winchester, which will generate enough gas to power 4,000 households once completed. The feedstocks for the plant will be grass and rye, sourced from marginal, non-food growing land on local farms, and the byproduct of the anaerobic digestion process will be returned to the farms as a soil improver. [There are several more such plants in the pipeline.](#)

The benefits of these green gas plants will reach well beyond decreasing carbon emissions. According to Dale Vince, the founder and CEO of Ecotricity, "it's good for our economy, because we'll no longer need to import those expensive fossil fuels; it's good for the environment, because it's carbon neutral and creates new wildlife habitats; and it's good for farmers, because it allows them to diversify, rely less on farming livestock, and build a more sustainable future."

Ecotricity is working closely with the Royal Society for the Protection of Birds and other conservation organisations to ensure that the growing process will enhance, rather than harm, local wildlife.

Implications for Gwent

It will be important for Gwent partners to develop the infrastructure to take full advantage of the shift to renewable production and a better management of energy. It is expected that there will a shift to local solutions, such as smart micro-grids, and particular areas of Gwent may be better suited to such shifts. In particular, larger-scale new developments present real opportunities for innovative energy solutions to be implemented. As well as 'normal' planning considerations such as transport, energy and local electricity management should become a greater planning focus. Whilst energy and thermal efficiency in new developments have taken great strides in recent years, local generation and demand management systems have lagged, mostly because the technology has not been in place. However, the capability is now there and Gwent could be at the forefront of the implementation of such technology if it had the appetite. At the very least, the feasibility should be investigated.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

Very uncertain	Rather uncertain	Reasonably clear	Very clear

Watch and wait	Consider response	Plan and prepare	Act
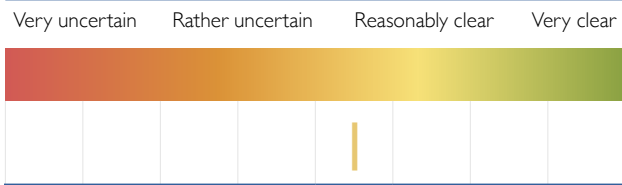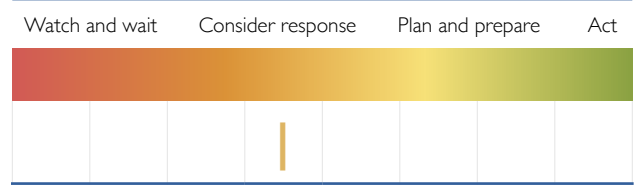
Economics of energy

Despite the very low prices for oil and gas at the moment, the basic laws of economics would suggest that the price will rise again - as supply levels drop and demand increases. Rapidly growing economies in India, China, parts of Africa, East Asia and South America will, in the medium term increase demand for fossil fuels. Even though those countries have all signed the Paris Climate Accord, the need to satisfy the consumerist aspirations of a growing middle class is likely to drive short-term decisions with regard to power stations, transport and agriculture. By 2030, Indian and China alone are forecast to have a middle class of 211 million people.

However, at the same time, the cost of fossil fuel extraction is rising. Most of the easy to reach sources of oil and gas have been used and a range of high-tech and expensive solutions are being employed to extract reducing amounts from smaller and more remote fields. Many commentators suggest that the world has reached 'peak oil' - where production starts to decline, not because it is running out but because the costs of extraction are too high.

Recently fossil fuel companies have been hit by a perfect storm. Very low prices (driven largely by political decisions); increasing extraction costs from both conventional and unconventional sources; public disquiet; and competition from renewable growing much faster than expected.

In 2015, investments in renewable energy were double that going onto fossil fuel power plants. Renewable generations costs continue to fall as technologies improve and economies of scale kick in. In particular, onshore wind and solar PV are becoming more competitive with conventional fossil fuel costs in some markets - in terms of the 'levelised cost of electricity'. By 2040, the US Energy Information Administration estimates that onshore wind, hydro, geothermal and biomass will deliver cheaper energy than most fossil fuels.

As a result of these factors, the world's largest privately owned coal company, Peabody Energy, has recently filed for bankruptcy; and many new conventional energy projects (totalling $400 billion) have been cancelled. Even the Kingdom of Saudi Arabia is planning to move away form oil as primary source of income - and it plans to sell shares in state-owned Aramco.

Energy security

The energy sector in the UK is facing some difficult times over the next few years. A combination of the closure of old, uneconomic plants; new plant taking longer than expected to come on stream; abrupt changes in government energy policy and frailties in parts of the grid infrastructure has led to a reduction in capacity.

The government and Ofgem have moved to secure back-up energy supplies but energy intensive industries have been warned that they may need to reduce power usage at times of peak demand.

It is unlikely that 'the lights will go out' over the next few years. Unless the government moves quickly to put a credible energy security plan in place, there is the potential for outages in future.

Implications for Gwent

The shift to technologies highlighted above, such as renewables and smart grids, will reduce the possible impact of volatility and security of supply threats in the fossil fuel markets. However, the UK is not at that place yet, and remains exposed to such threats. As stated, unless the Government puts in place a credible energy security plan, the potential for power outages remain. Energy

supply is also increasingly becoming a geopolitical 'power play', and therefore threatened by factors outside of normal economic considerations.

There is little that Gwent partners can do at this global geopolitical level. However, the continued development of localised solutions, and helping businesses and households reduce their fossil fuel dependency, will help reduce the exposure of Gwent to volatility in cost and security. Diversification of energy generation and consumption in Gwent remains fundamental.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

NATURAL SYSTEMS
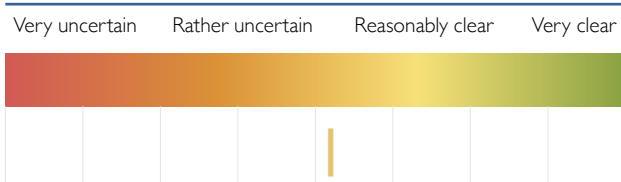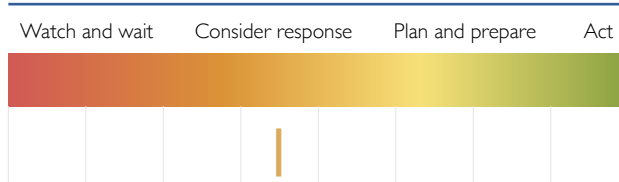
CLIMATE (1) - A taste of what's to come

CLIMATE (2) - It's not just about the weather

CLIMATE (3) - International action

CLIMATE (4) - Public mood

CLIMATE (5) - Economics

BIODIVERSITY (1) - Eco-systems

BIODIVERSITY (2) - Impacts of species / habitat loss

FOOD (1) - We are what we eat (inc fish)

FOOD (2) - Yields (inc soil)
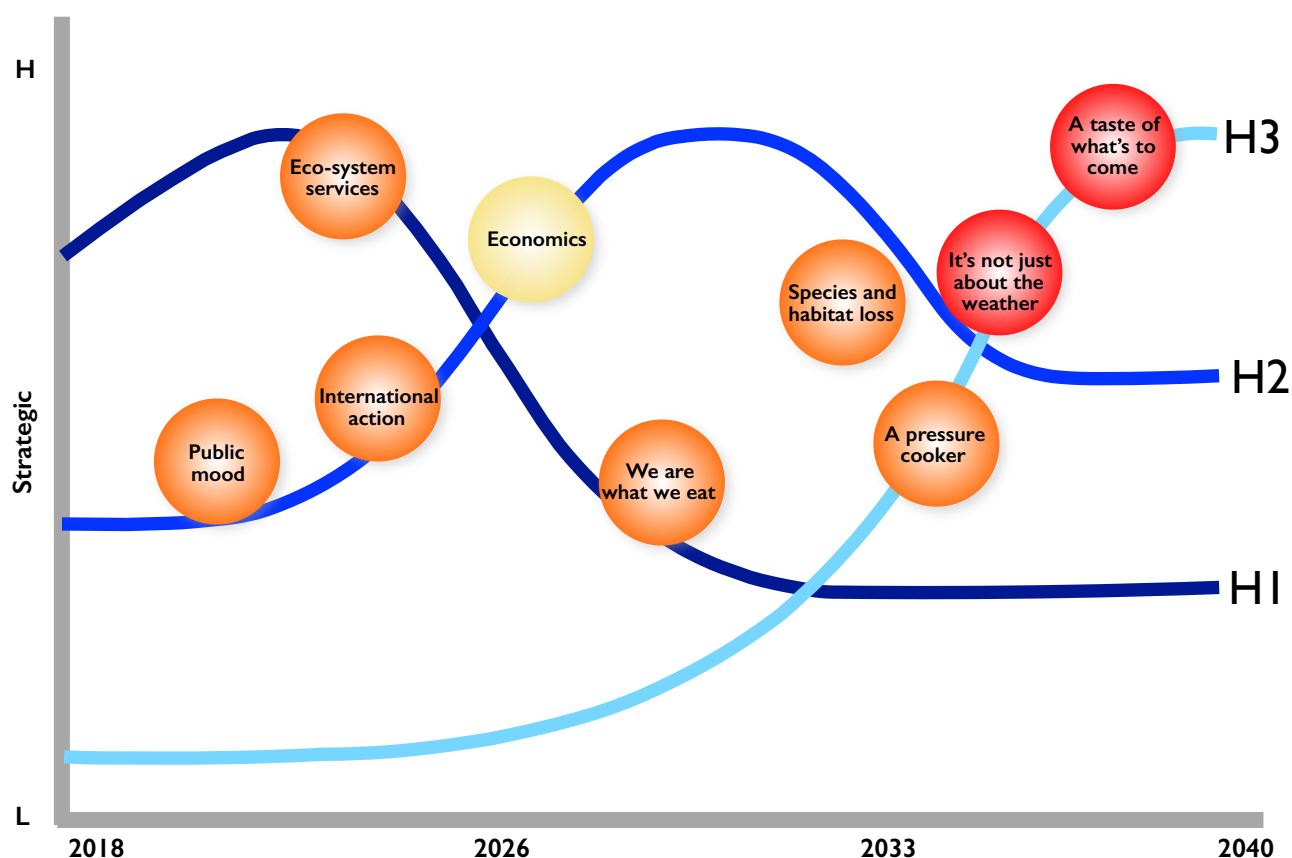
The Intergovernmental Panel on Climate Change (IPCC) is responsible for providing governments with authoritative overviews of the latest climate science. Every seven years it produces a "synthesis" report which sums up the scientific knowledge on climate change – the most recent one warned global warming would have "severe, widespread, and irreversible impacts".

In case anyone doubted the urgency, 2016 was the hottest year on record globally, by a considerable margin; with 16 of the 17 warmest years occurring since 2001. The Greenland Ice Sheet is melting further and faster than ever before; some reports show that CO_2 have reached 400 parts per million (when the accepted 'safe' level is 350ppm). Extreme weather events have increased in frequency and strength across the world and sea levels are the highest on record. What has alarmed scientists most is the fact that rate of warming is increasing much faster than expected. NASA is clear that the evidence for rapid climate change is compelling.
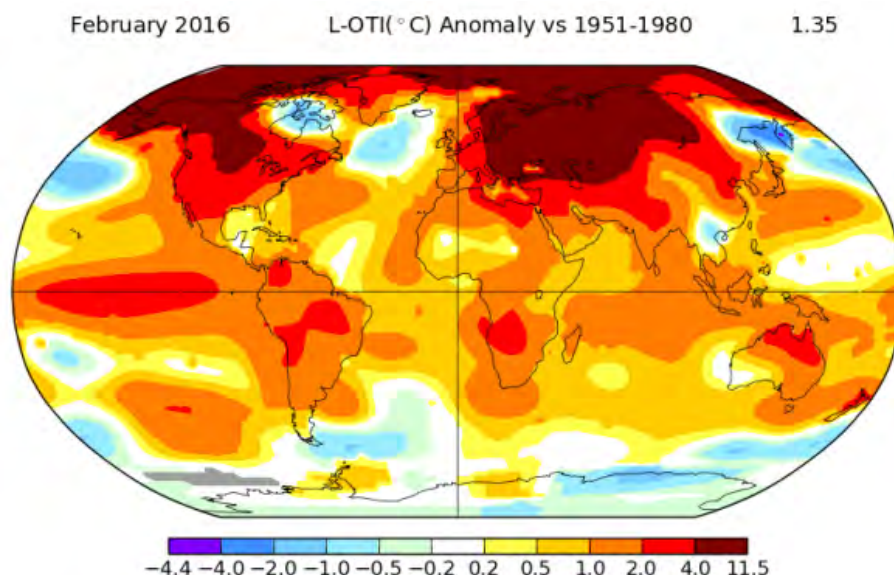
While the UK and the EU have made reasonable progress in meeting agreed Kyoto targets, much of the developing world is continuing to increase greenhouse gas emissions significantly. As these gases know no boundaries, the global impact is still severe - as we can see from the extreme event climate 'records'. On current trends, the forecasts indicate that the planet is likely to warm by more than 2°C. Once average temperatures increases reach near 4°C, a number of feedback loops are predicted to increase the warming even further - with extreme consequences. Note that temperature increase is much higher near the Arctic.

Feedback loops include the melting of icecaps (reducing reflective surfaces and increasing absorbing surfaces); melting permafrost (releasing huge quantities of methane - another dangerous climate gas); dieback of major forested areas (reducing CO_2 absorption); and acidification of the ocean (reducing CO_2 absorption).

Selected values from the UKCP09 projections for Wales

Parameter	Projected Change by Time Period:		
	2020s	2050s	2080s
Winter Mean Temp °C			
- Low Emissions Scenario	+1.2	+1.8	+2.4
- Medium Emissions Scenario	+1.3	+2.0	+2.8
- High Emissions Scenario	+1.2	+2.3	+3.3
Summer Mean Temp °C			
- Low Emissions Scenario	+1.5	+2.2	+2.7
- Medium Emissions Scenario	+1.4	+2.5	+3.5
- High Emissions Scenario	+1.3	+2.8	+4.5
Annual Mean Precipitation			
- Low Emissions Scenario	+1%	-1%	0%
- Medium Emissions Scenario	0%	0%	0%
- High Emissions Scenario	0%	0%	0%
Winter Mean Precipitation			
- Low Emissions Scenario	+5%	+9%	+16%
- Medium Emissions Scenario	+7%	+14%	+19%
- High Emissions Scenario	+5%	+13%	+26%
Summer Mean Precipitation			
- Low Emissions Scenario	-6%	-12%	-13%
- Medium Emissions Scenario	-7%	-17%	-20%
- High Emissions Scenario	-4%	-17%	-26%
Sea Level Rise at Cardiff cm			
- Low Emissions Scenario	8.2	18.4	30.5
- Medium Emissions Scenario	9.7	21.8	36.2
- High Emissions Scenario	11.5	25.9	43.3

Notes:
- The figures presented are the **central estimates** for each projection.
- The **2020s, 2050s** and **2080s** refer to the periods 2011-2030, 2031-2060, and 2061-2090 respectively.
- For climatic variables UKCP09 uses **1961-90** as the baseline period. This means that the projections of changes are reported relative to the average climate experienced between 1961 and 1990.
- For sea level rise the baseline is the level in **1990**. The figures quoted are the projected levels in 2020, 2050 and 2080.

Implications for Gwent

The focus for climate change is now on adaptation and mitigation against the potentially worst effects of changing conditions. Given that many low-lying coastal areas are already classified as at risk of flooding, these areas are vulnerable to rising sea levels and costal surge. There will be difficult questions about coastal protection, or whether some areas are simply left. Similarly, the increase incidence of extreme weather events, particularly rainfall, means that fluvial flooding will become a greater risk. Gwent does hold significant assets in the form of upland areas which may play an important role in managing flood risk. Less intensive farming of upland areas may provide a dual benefit in terms of flood management and improving biodiversity, similar to work being done in other upland areas.

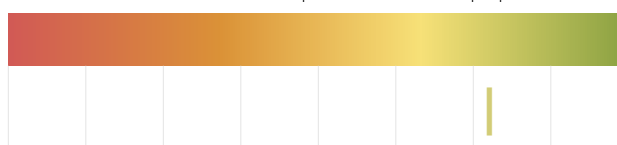How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

Some of the potential impacts of climate change are relatively well known, others much less so.

The changing climate is predicted to increase sea levels by between 0.5 and 2 metres by the end of the century (depending on how swiftly emissions are reduced). As many of the worlds's major cities are at, or only slightly above, sea level - the risk of severe flooding is high. England and Wales are predicted to experience 30% higher sea level rise than mainland Scotland and NI.

Extreme weather events are predicted to get worse and more frequent. The IPCC project that by the end of the century there will be more hot and fewer cold days; there will be longer and more intense heatwaves; there will be more frequent and intense rainfall events and that there is likely to be more drought and more hurricane activity. Many of the projections are already being recorded.

There are many health threats from climate change. These include changing patterns of contagious diseases, as vectors move northwards; starvation brought on by water scarcity and desertification and more deaths from the effects of excessive heat. There are predictions of 250,000 deaths per year caused directly by climate change, by 2050.

Rapidly rising temperatures are predicted to have adverse effects on biodiversity. Changes in habitats, rainfall patterns and temperature are likely to affect many species of animals and plants as they are unable to adapt quickly enough. Some insect borne diseases and pests are likely to increase and move into new areas, threatening indigenous species.

Environmentally induced migration, increased by climate change, is already happening. However, desertification, failing ecosystems, different climate patterns and an increase in natural hazards will render some parts of the world all but uninhabitable. The consequence of which will be mass migrations on a scale not yet seen - as whole communities are forced to seek better conditions elsewhere.

Oceans absorb carbon dioxide and heat. They have reduced the effect of global warming by doing so. However, some studies warn that as the oceans become saturated with CO2, they are less able to keep absorbing it. Another consequence is that the oceans are becoming more acidic - which is in turn affecting marine life (algae, fish, plants).

Implications for Gwent

The UK Climate Change report offers a national summary for Wales and identifies the most important risks to Wales. Most of these apply equally to Gwent.

- Risks to infrastructure (from all sources of flooding)
- Risk to public water supplies from drought and low flows
- Risks from some land management practices exacerbating flood risk
- Risks to ecosystems and agriculture businesses from changes in climatic conditions
- Risks to communities from all sources of flooding and sea-level rise
- Risks to infrastructure, business and buildings from high river flows, erosion and extreme weather
- Risks and opportunities from changes to agriculture and forestry productivity
- Risks to people's health and wellbeing and associated service delivery from high temperatures, flooding and extreme weather

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act
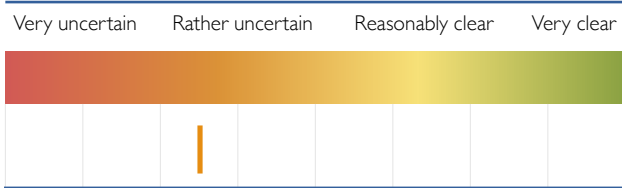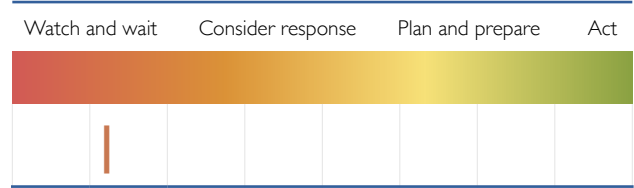
At the Paris climate talks last December, delegates somewhat surprisingly signed up for an accord which aimed to limit global warming at 1.5°C above pre-industrial levels. It had been expected that the accord would agree on a 2°C limit. However, the faster rates of increase, as outlined above, and which new research showed serious risks of sea-level rise and coral destruction at only 1.5°C, and increased danger of reaching 'tipping points' changed the discussion radically.

The Paris Climate Change Agreement was formally signed at the UN building in New York, in April 2016, by representatives of over 130 countries.

Limiting average rises to 1.5°C is welcome and very challenging - especially given that temperatures have already risen 1°C and latency in the climate system will continue that trend for some time. Many serious climate scientists believe that we are already to committed to 2°C or more. Even to cap at that temperature rise would need fossil fuel use to fall twice as fast as previously thought.
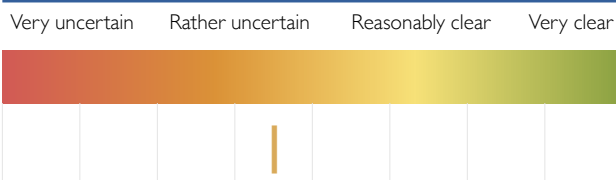
The important question is: are we doing enough to limit temperature increases to 1.5°C, or even 2°C? and the inevitable answer is No, not nearly enough. In order to peak emissions by 2020 and to reduce that by 50% by 2040, there will need to be a very rapid shift away from burning fossil fuels towards renewable energy; there will need to be a shift in agriculture away from meat production and fertiliser use; there will need to be a massive reforestation programme across the world, and in the tropics in particular; there will need to be a major shift in how we construct new buildings and retrofit older ones; and transport systems will need to be radically different. Even the OECD acknowledges that without greater urgency, damaging emissions will rise by 37% by 2030 and 52% by 2050.

Implications for Gwent

Political action on climate change needs to take place on an international stage for it to truly make a difference to global temperatures. However, local areas play a fundamental role in providing political pressure and, importantly, putting in place innovative and forward-thinking actions will demonstrate their commitment to addressing climate change. Reducing emissions and waste are important steps in demonstrating that local action can lead to global change.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act
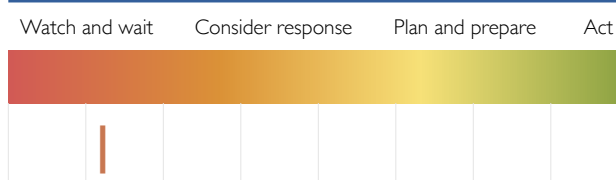
Although there remains some pockets of scepticism about climate change, the vast majority of the public, in the UK and across the world, understand that it is real and that it is a threat. Globally, 61% of people questioned felt that climate change was a major threat, with those in Latin America showing the greatest concern.

That awareness is leading to a rapidly increasing series of campaigns and groups that are opposing policies and developments which are likely to cause climate change. From organisations promoting solar power and renewables, to global protest groups, to legal teams taking governments to court - the stakes are high and more people seem to be prepared to get active.

Over the past seven years, the world has seen the biggest co-ordinated gatherings of people to protest about climate change - a series of International Days of Action have seen thousands of linked events in over 175 countries. Supported by groups such as 350.org, Avaaz and the climate coalition, the ability and willingness to mobilise is growing.

And some targets are becoming more specific - focussed on potential damaging proposals: the Keystone pipeline in the US; the Vättenfall coal mine in Germany; new coal plants in Bangladesh; fracking in the UK and; oil companies sponsoring the arts. These actions grab headlines and swamp social media. Coal, the most damaging fossil fuel, is the subject of increasing opposition.

Many campaigners are now aiming to hit companies involved in the fossil fuel industry and others at the core of their business - by targeting investors. A worldwide campaign of divestment from fossil fuels has claimed some well known support. Sovereign wealth funds, universities, churches, trade unions, public pension funds and many others are part of a growing movement that, it is claimed, now represents over 500 institutions and $3.4 trillion of assets divested.

The Smith School at Oxford have analysed likely impacts on the industry, investors and campaigners. While divestment is not in itself likely to change the industry, the small effects on stock prices and larger effects of stigmatisation may grow (as with tobacco or apartheid previously).

Implications for Gwent

Social media is clearly having an impact on how quickly public opinion can snowball and begin to place pressure on bad environmental practice. The recent outpouring of outrage regarding the burgeoning amount of plastic waste in the oceans after the issue was highlighted by the BBC's Blue Planet II, is an example of how sentiment can quickly snowball. Political action has followed quickly in relative terms because politicians have felt compelled to act in response to this groundswell of opinion. Given that modern technology has 'shortened' the relationship between the consumer and big business, it is highly likely that 'consumer activism' will become more widespread.

Public service providers will also need to be mindful of local opinion being transmitted quickly, often via social media, if the public become unhappy with bad practice on environmental issues. They may need to respond in more flexible and proactive ways then they currently (or able) to do.

How might the issue impact on Gwent in the future			
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How might Gwent public services respond?			
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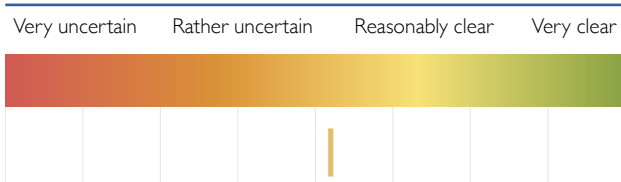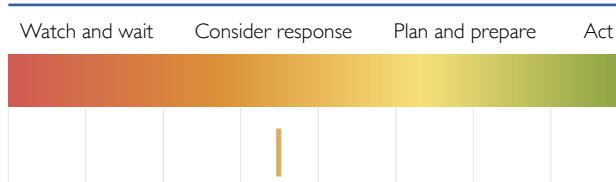
Various attempts have been made to analyse the economic costs of climate change and the costs of taking action to prevent, or minimise, the impacts. One of the most well known was the Stern Review in 2006, which was revised in 2008. The central message was that the cost of acting now to mitigate the onset of climate change would be much less than dealing with the impacts after they have occurred. He suggested that, to keep emissions within the 500-550ppm level would cost about 2% of global GDP. However, we now know that such a level would lead to warming of 4°C, and that we need to keep emissions below 450ppm and preferably nearer to 350ppm.

More recent research by scientists at Stanford and Berkeley, has estimated that unless global warming is checked, by 2100, 77% of countries will see incomes fall relative to current levels - and that global incomes will decline by 23% from current levels.

The price of carbon

A number of ways of pricing carbon have been tried across the world, from a cap and trade system in the EU to full carbon taxes. The World Bank analyse the tends in carbon pricing and, in a 2017 report, identified 42 countries and a further 25 cities or regions that had put a price on carbon.

However, many large corporations are aware that legislation and regulation in this area is inevitable. They are also aware that they need to be transforming their business operations to reduce their impact on climate change and, in doing so, drive efficiency. The same World Bank report estimates that over 1,300 companies are planning introduce internal carbon pricing within two years. These companies cover all industries and operate across the globe.

There is no single method or price that is used. Broadly speaking, internal carbon pricing is most frequently used as a shadow price which can be added to future investments and operational costs as a way of hedging against future policy decisions to implement any carbon-pricing mechanisms. The CDP report identified some of the key benefits of doing this, including:

- To anticipate government legislation on carbon pricing
- To comply with existing government legislation
- To avoid intermediary/transaction costs associated with trading permits in national schemes in favour of factoring in these prices internally
- To justify investments that may have smaller margins without a carbon price
- To manage risk for future investments
- To monetise and record social cost

In some exceptional circumstances, a carbon price can underpin a more expansive company scheme. In 2012, Microsoft made the decision to use an internal carbon fee which was charged to individual business groups using Microsoft services. The funds from this internal tax were then used to invest in energy-efficiency initiatives, renewable energy and carbon offset projects in order to meet net-carbon neutrality targets.

Implications for Gwent

As shown in the developing fall-out of the quick swing in public opinion (and awareness) of plastic waste, if Governments feel that legislation can play a role in changing the economics, then changes can be made. The UK Government's announcement of surcharge on single-use plastic

bottles and aluminium cans (with the full details subject to consultation) highlights that legislation can be used to try to alter both producer and consumer behaviour. Similar schemes, as well as Producer Responsibility Schemes, are being studied by Welsh Government and different policies may develop in Wales. The devolution of tax powers provides a range of opportunities for the Welsh Government to develop a Welsh approach to taxation and presents an opportunity to implement so cutting-edge solutions to help recycling and waste reduction, reduce emissions, and improve air quality. Gwent partners will have an important role in expressing the views of their residents in this evolving policy and fiscal environment.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act
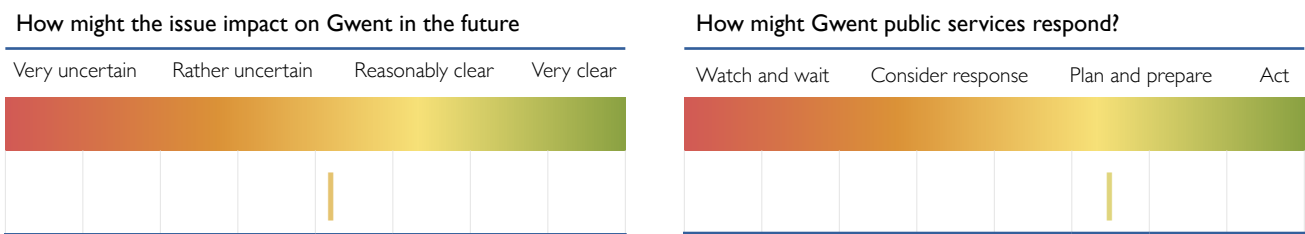
Population pressures, over-fishing, and intensive, industrial agriculture are already leading to massive loss of biodiversity and protected environments across the world. As the loss in rainforest cover and rich savannahs increases, there are consequent threats to water management, carbon sinks and indigenous cultures.

There was a 28% loss of species populations globally between 1970 and 2008. Climate change scenarios point to an extinction of over 25% of terrestrial species if average temperature increases reach 4°C, and slightly greater loss for freshwater and marine species.

The UK has a relatively stable species population. However, as habitats come under threat from development, intensive agriculture and warming, some species are vulnerable. Climate change is likely to change the range of many plant and animal species and so bring 'foreign' species into conflict with indigenous ones - with unpredictable consequences.

The World Economic Forum describes biodiversity loss and ecosystem collapse as one of its top five environmental risks in its 2016 and 2017 Global Risks reports. This would have irreversible consequences for the environment, resulting in severely depleted resources for humankind as well as industries. Recent reports have shown that the the rate of vertebrate loss is up to 100 times higher than the 'background' rate - and that most of this is due to human activity.

The 2017 NERC report on biodiversity identifies a range of other factors that are also likely to have an impact in the future - ranging from gene editing and vitamin deficiency to infections hidden within thawing ice.

The primary reason for the loss of species is habitat destruction. This is mainly as a result of urbanisation, pollution, intensive agriculture and fishing, deforestation and the effects of climate change. These habitats, the species that depend on them and the resources they contain are part of intricate webs, called ecosystems. Healthy and diverse ecosystems are critical not only for their own sake but for our health and wellbeing. The services that they provide maintain our planet and give us the resources that we need for every aspect of our lives.
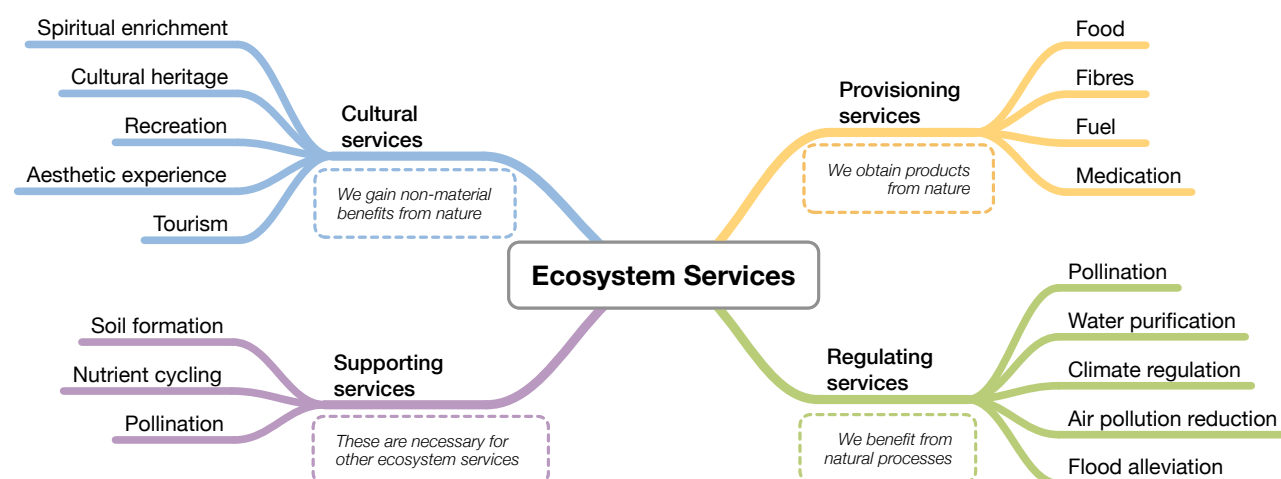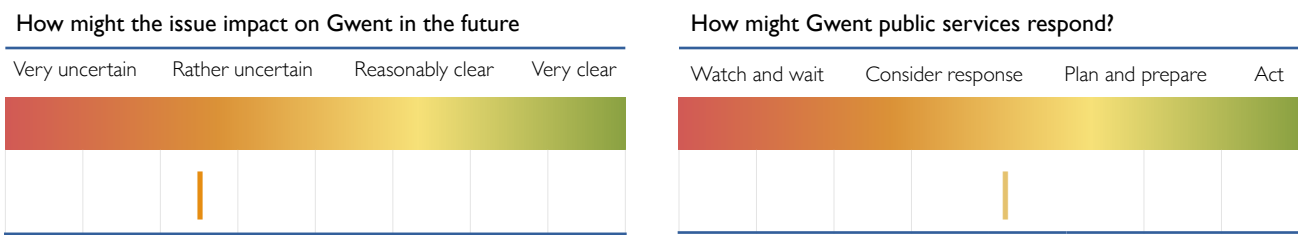

As with climate change, the process is not linear - and many predict that there will be 'tipping points' which could lead to large, rapid and potentially irreversible damage. Terrestrial, freshwater and marine systems are all under increasing pressure. Nearly two thirds of the services provided by

nature to humankind are found to be in decline worldwide. In effect, the benefits reaped from our engineering of the planet have been achieved by running down natural capital assets.

In recognition of this challenge, some economists now refer to eco-systems as natural capital and have found ways to value the stocks and flows of the environment. This accounting for nature helps decision-makers *recognise* the wide range of benefits provided by ecosystems and biodiversity, *demonstrate* their values in economic terms and, where appropriate, suggest how to *capture* those values in decision-making. By recognising the true value of nature - both in an economic sense and in the richness it provides to our lives - we can acknowledge the 'ecological debt' and prevent it from growing.

Implications for Gwent

There are several emerging examples of developing new markets for ecosystem services, although many are still in 'pilot phase'. Ecosystem services are increasingly seen as a potentially effective way of natural resource management. Gwent has an abundance of natural resources that delivers a wide range of ecosystem services at a significant scale, such as carbon sequestration (delivered by wetlands and woodlands), fluvial flooding (delivered by upland peat), and amelioration of coastal erosion and flood hazard (delivered by intertidal habitats, salt marshes, and sand dunes). However, the full value of the ecosystem services these natural capital assets provide are not fully reflected in payments into the rural economy. It will be important for Gwent partners to be aware of emerging examples of payments for ecosystem services, which may be crucial in helping protect these important natural assets.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

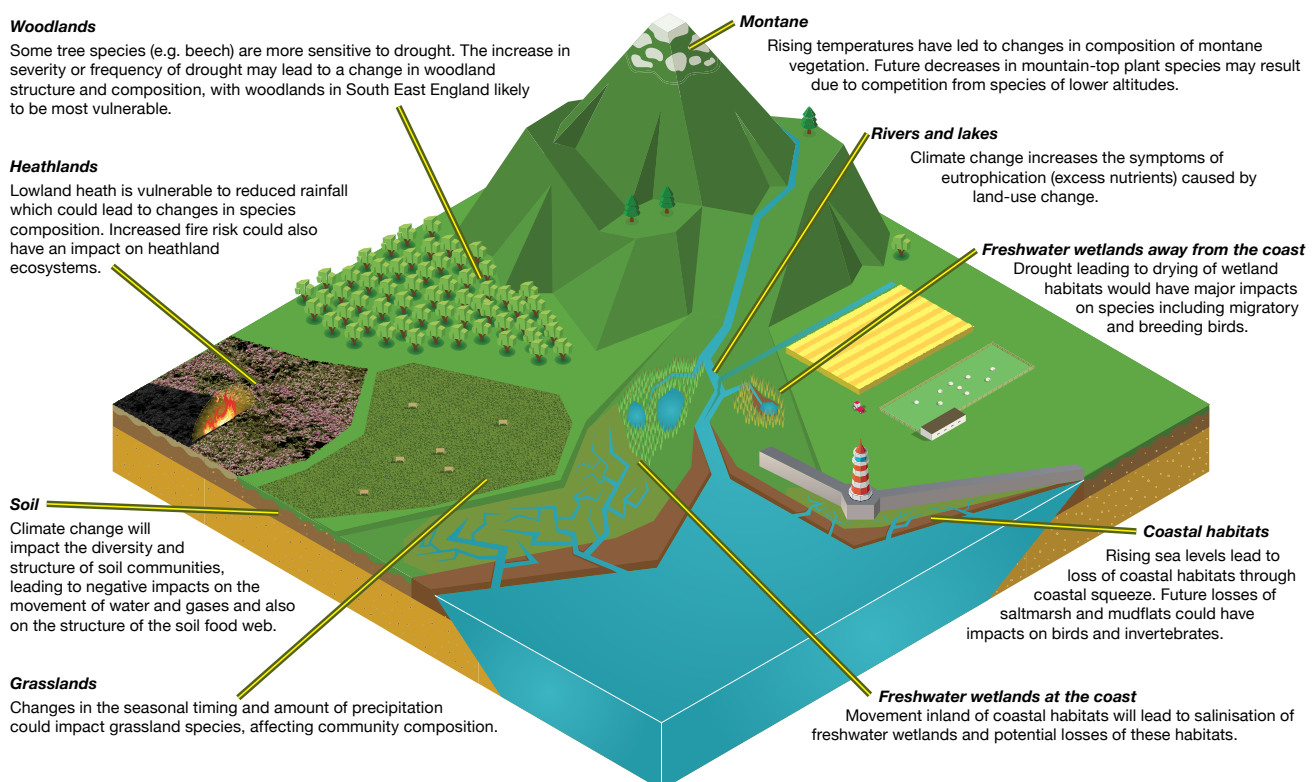| How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act

A recent study showed the impact on birds and butterflies of habitat degradation and climate change. Some species of birds are disappearing completely from parts of England, where intensively farmed land gives them no room to adapt to warming temperatures. Several other species to birds and mammals are shifting their normal distribution patterns northwards.

That same report suggests that spring life cycle events are advancing and autumn ones are occurring later. This could lead to an increase in generations of some species such as aphids. As ranges of some animals and plant species shift northwards, there is likely to be increasing competition for resources. Particularly vulnerable habitats include isolated mountain areas and fragmented areas.

A number of research papers have concluded that higher temperatures encourage faster development of insect pests and crop diseases, with unpredictable results. And, as the climate changes, it is forecast that diseases and predators will move into new ranges with potentially damaging impacts on existing bio-diversity. Some upland areas may be invaded by bracken.

The impact of reduced biodiversity may be felt across a number of important sectors, such as agriculture and horticulture, upland land management and tourism. There may also be implications for public health.
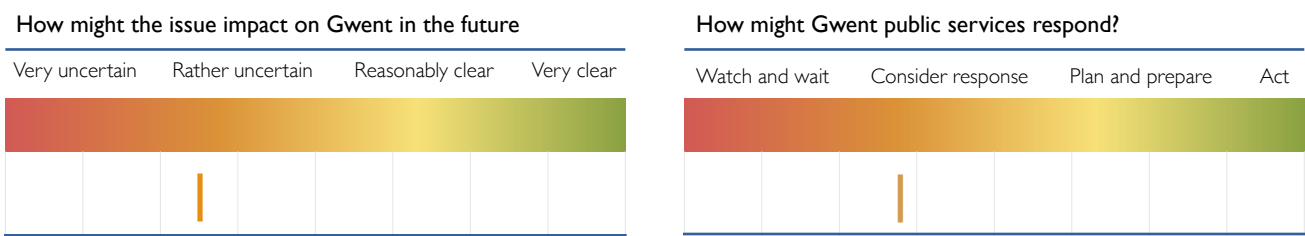
Woodlands
Some tree species (e.g. beech) are more sensitive to drought. The increase in severity or frequency of drought may lead to a change in woodland structure and composition, with woodlands in South East England likely to be most vulnerable.

Heathlands
Lowland heath is vulnerable to reduced rainfall which could lead to changes in species composition. Increased fire risk could also have an impact on heathland ecosystems.

Soil
Climate change will impact the diversity and structure of soil communities, leading to negative impacts on the movement of water and gases and also on the structure of the soil food web.

Grasslands
Changes in the seasonal timing and amount of precipitation could impact grassland species, affecting community composition.

Montane
Rising temperatures have led to changes in composition of montane vegetation. Future decreases in mountain-top plant species may result due to competition from species of lower altitudes.

Rivers and lakes
Climate change increases the symptoms of eutrophication (excess nutrients) caused by land-use change.

Freshwater wetlands away from the coast
Drought leading to drying of wetland habitats would have major impacts on species including migratory and breeding birds.

Coastal habitats
Rising sea levels lead to loss of coastal habitats through coastal squeeze. Future losses of saltmarsh and mudflats could have impacts on birds and invertebrates.

Freshwater wetlands at the coast
Movement inland of coastal habitats will lead to salinisation of freshwater wetlands and potential losses of these habitats.

From the NERC Biodiversity Climate Change Report Card

Implications for Gwent

New farming techniques may need to be developed to react to changing biodiversity, with a loss of pollinators and increase in non-indigenous species a potential outcome of climate change. Whilst the extent of potential change in Gwent's biodiversity and natural capital is difficult to

predict, changes are already occurring. The impact on Gwent's rural areas could be particularly marked, particularly those with an agricultural dependence. The potential shift in UK agricultural policy post-BREXIT towards greater environmental protection could present a significant opportunity for reversing the trend of biodiversity loss. Practices such as arable field margins, set-aside etc. will be important to promote.

How might the issue impact on Gwent in the future

Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?

Watch and wait	Consider response	Plan and prepare	Act

We are what we eat
FOOD

The growing global population, with greater demand for food, is also leading to greater development, habitat destruction and climate changes - with each adversely impacting on the ability to produce the food required.

Desertification and urbanisation are forecast to reduce the amount of land available for farming. Equally the competition for agricultural land puts eco-systems at risk. More countries, with wealth but limited productive land, are buying or leasing land abroad for food production to support their own populations. In the decade to 2016, land deals amounting to 30m hectares were concluded - driven largely by issues of food security and agribusiness opportunities

Soil fertility is declining dramatically and fertile soil is being lost. Some new partnerships emerging to reduce pressure on land and increase resilience.

A risk of the increasing demand for food is that science will be used to increase productivity, despite not always being favoured by the consumer. The use of hormones in growing animals for meat remains unpopular although public support for GM crops has recently swung slightly in its favour.

A range of work continue to find alternatives to the current agricultural system. Five of the most significant are:
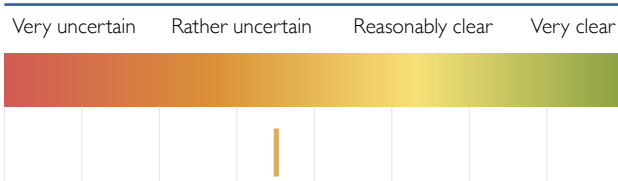- Urban agriculture
- Automated vertical farms
- Aquaponics
- Lab-grown meat
- Artificial animal products

Implications for Gwent

There is clearly a difficult tension between needing to produce more food (and in a more resource-efficient manner) with the need to protecting our natural assets. The population has grown used to eating food that is relatively cheap (in historical terms) and in increasing volume – hence the rise in obesity. It could be argued that the true 'value' of food is not reflected in the price that consumers pay; the external cost of food production's impact on the environment is not necessarily implicit in the price we pay. The impact of the environmental cost of increasing food production is felt at a local level, with soil fertility declining and a loss of biodiversity.

As with elsewhere, partners in Gwent will face difficult choices behind sustaining its important agricultural base and improving the environment. A higher price of food may be a necessary requisite, and this will require a shift in consumer behaviour. This may need to be achieved through subtle shifts over time, and public health bodies may have a role to play.

How might the issue impact on Gwent in the future			
Very uncertain	Rather uncertain	Reasonably clear	Very clear

How might Gwent public services respond?			
Watch and wait	Consider response	Plan and prepare	Act