Adam & Company

Investment Outlook 2017

OUR EVER-CHANGING WORLD

CONTENTS

Image: Shutterstock

KNOWN UNKNOWNS.

We ended 2016's *Mid-Year Investment Outlook*, published just after the EU referendum, quoting Donald Rumsfeld's famous line. It's apt still – and if we learn anything from 2016, it's that unusual events can and do occur. And 'we' – observers, mainstream media, politicians, pollsters and bookmakers – are not very good at predicting them, whether Brexit or Trump's triumphant ascension to the White House.

As long-term investors, our ambition to think beyond and outside politics seems more pertinent than ever. In our *Investment Outlook 2017* we aim to reflect a little on this year in the UK, but also to look forward, with careful optimism, to underlying trends that have momentum and are unlikely to be diverted.

> There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know.
>
> RUMSFELD, 2009

Our articles, written by our Investment Team, look at the opportunities and challenges that face companies, policy-makers and investors. Emerging markets are becoming not only more demographically dominant, but are also growing in economic and geopolitical clout. We explore sustainable energy production and the importance of better storage and cheaper batteries. Both sides of the US presidential debate agreed on increasing infrastructure spend, and as we make clear, this is a global and pressing issue requiring new resources, both governmental and private.

We show how Virtual Reality is gaining steam, and that it reaches beyond gaming to many, wider applications you may not have considered; and that new innovations in Pharmaceuticals will try to address a growing and ageing population.

We hope you enjoy looking forward to 2017, and far beyond, with us.

Dickson Anderson

Head of Adam Investment

Brexit means ~~Brexit~~ what exactly?

The current state of the UK economy is perhaps not as gloomy as 'remain' advocates had expected

Much has been written about the negative impact of Brexit both before and since the June referendum. Currency weakness, falling markets and a raft of political resignations perpetuated a high level of uncertainty in the immediate aftermath of the vote. And yet recent economic data suggests that the current state of the UK economy is perhaps not as gloomy as 'remain' advocates had expected.

Consumer spending has been strong, which is not too surprising given that nothing has really happened yet, and businesses have largely opted to wait and see rather than make changes to their investment plans.

The most recent Monetary Policy Committee forecasts expect the impact on growth to be most prominent in 2017, with recovery thereafter. This should be helped by supportive fiscal policy, as Chancellor Philip Hammond has freed himself from George Osborne's austerity cuts and promises of clearing the deficit.

The sterling safety valve

While the pound trading at multi-year lows against other currencies may feel uncomfortable, and make overseas holidays more expensive, sterling's post-referendum plunge demonstrated the release of an important safety valve for the economy. A weaker pound is good news for exporters as it makes our goods and services more competitive abroad, helping to boost sales and profits while reducing demand for expensive imports. We still have some way to go, however, in correcting our current account deficit.

STERLING'S POST-REFERENDUM PLUNGE DEMONSTRATED THE RELEASE OF AN IMPORTANT SAFETY VALVE FOR THE ECONOMY

THE GOVERNMENT SEEMS PREPARED TO STEP IN TO SUPPORT BRITAIN'S MANUFACTURERS

We could also see a spike in mergers and acquisitions as UK companies become an increasingly attractive target to overseas firms – and indeed, soon after the vote, we saw Japan's Softbank swoop on ARM Holdings, a FTSE100 technology company.

Currency movements can also help to explain much of the post Brexit strength seen in UK stock markets. The companies in our index are truly global in nature, and around three quarters of FTSE100 earnings are generated overseas. A weaker sterling means that these earnings are worth more when translated back into pounds.

More domestically-focused smaller and mid-size names in the market have struggled on a relative basis due to their higher proportion of UK earnings, despite outperforming larger companies over the longer term. Domestic holdings have been hit – while consumer and business confidence has stayed relatively high in recent months; expensive imports will lead to higher inflation, which will hit wallets eventually.

Our new place in Europe and the world

One of the challenges we face is that no one really knows what Brexit is going to look like yet, and the outcome of key elections in France and Germany will no doubt shape the timing and texture of negotiations.

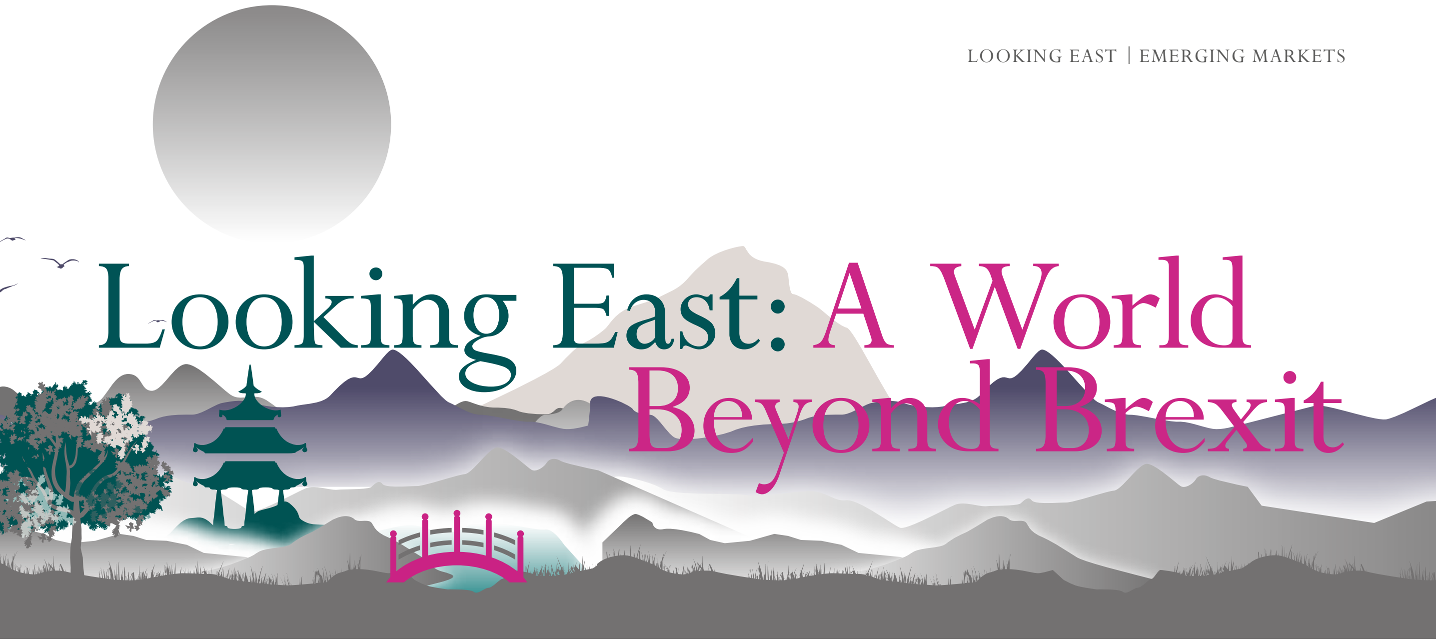
Theresa May's plan to trigger Article 50 of the Lisbon Treaty by March 2017 sparked fears that the UK may be heading for a so-called 'Hard Brexit', where we would likely give up full access to the single market and take a tougher stance on immigration. Critics suggest that this would make trading with EU members more difficult, resulting in job losses and 'splendid isolation'. And yet as with all compromises, it seems inevitable that both sides of the negotiations will stipulate a wish list of demands before ultimately finding an acceptable middle ground. This could be in the form of new trade agreements and a migration policy supported by the public.

Some commentators are also suggesting that Donald Trump's win may lead to a more pragmatic consideration of the UK's place in Europe, and also put pressure on European leaders to deal a moderate hand. European leaders are aware that Brexit and the vote for Trump illustrate that there is a huge proportion of discontented voters who have had enough of political 'elites' and the EU machine is certainly viewed as one by many disaffected countries in Europe. There are general elections in the Netherlands, France and Germany in 2017.

Despite worries that Brexit could dissuade overseas companies from investing in the UK, Nissan's confirmation that it will build two new models at its Sunderland plant has demonstrated that the Government is prepared to step in to support British manufacturers. Such assurances should help to encourage key industries to stay in the UK rather than relocate elsewhere. We may not have details of Nissan's agreement, but for now at least, Theresa May seems adamant that the UK is very much 'open for business'. Big infrastructure projects such as Hinkley Point and Heathrow have also secured government support in recent months. Of course, softer factors such as time zone and the English language will also prove critical in helping London to retain its position as the financial services capital of Europe.

As we look ahead to the coming months there is much to be positive about. To the envy of European neighbours such as Greece, post-referendum Britain is still a politically stable democratic nation with a government that has never defaulted on its debt and a central bank that is ready to act.

Uncertainty has engendered innovation throughout history, so only time will tell if we can rise to this particular challenge. ■



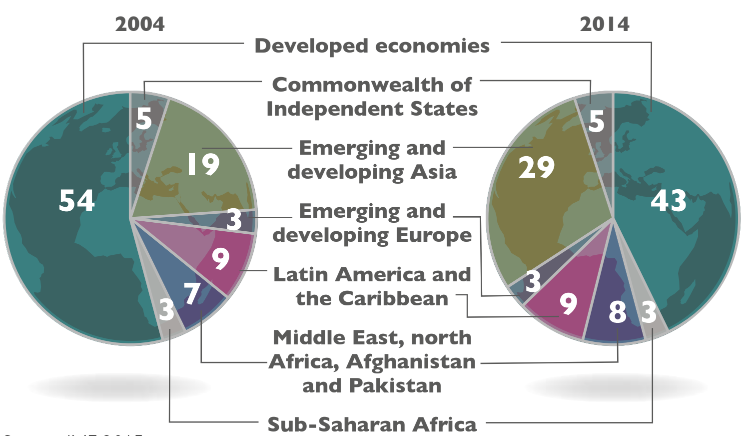
Looking East: A World Beyond Brexit

It's official – 'Brexit' has been named as the *Collins Dictionary* word of the year for 2016. A 3,400% upsurge in usage has propelled Brexit to the top spot, ahead of 'Trumpism' and 'hygge' (the latest lifestyle trend to emerge from Denmark)

This result is hardly surprising given the prominence that 'Brexit' has had across both traditional and social media throughout the year.

Although we do not wish to downplay the magnitude of the referendum, it is also important to retain a sense of perspective.

Share of world GDP
Based on Purchasing Power Parity (US$)



Source: IMF, 2015.

The world has not stood still while we reconsider our relationship with the European Union. Global trends set in motion well before the 23rd of June have not paused because of the decision of 65 million people on a group of small islands in the north Atlantic.

In his latest book, *Easternisation*, FT commentator Gideon Rachman articulates arguably the most significant of these global trends. The book's core thesis is that the global economic and political centre of gravity is moving further East. Driven by the twin motors of favourable demographics and globalisation, Rachman envisages a century shaped by a rejuvenated China, and its interactions with the rest of the world.

In the context of this reorientation of economic and political power, it is vital that

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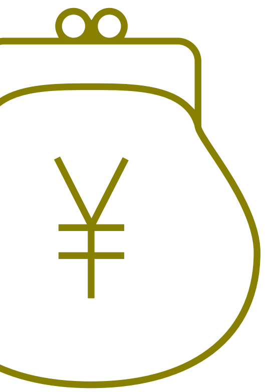


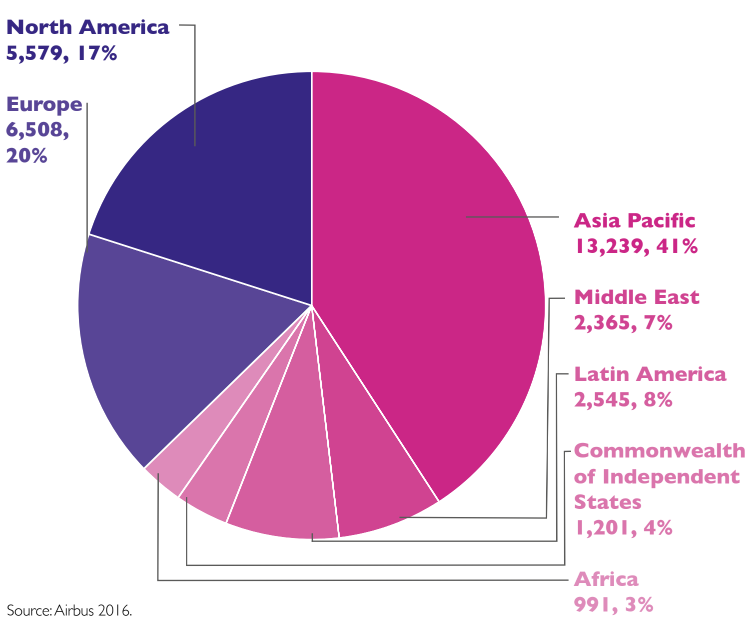
investors retain a global mindset. The so-called 'emerging' markets, including China, will continue to present opportunities, irrespective of whether the UK is part of the EU or not.

Understanding emerging markets

Investors tend to categorise countries at the core of world affairs as being 'Developed' and at the periphery as 'Emerging' despite the fact that the latter contribute a greater share to global gross domestic product (GDP) than their developed counterparts.

It is not always clear how to define an emerging market economy. For example Taiwan, a country at the cutting edge of technological processes, has less debt, lower unemployment and higher GDP than Portugal. It is however classed as emerging, whereas Portugal, a world-leading cork exporter, remains part of developed market indices.

Forecast Aircraft Delivery Demand by Region 2016 to 2035



Source: Airbus 2016.

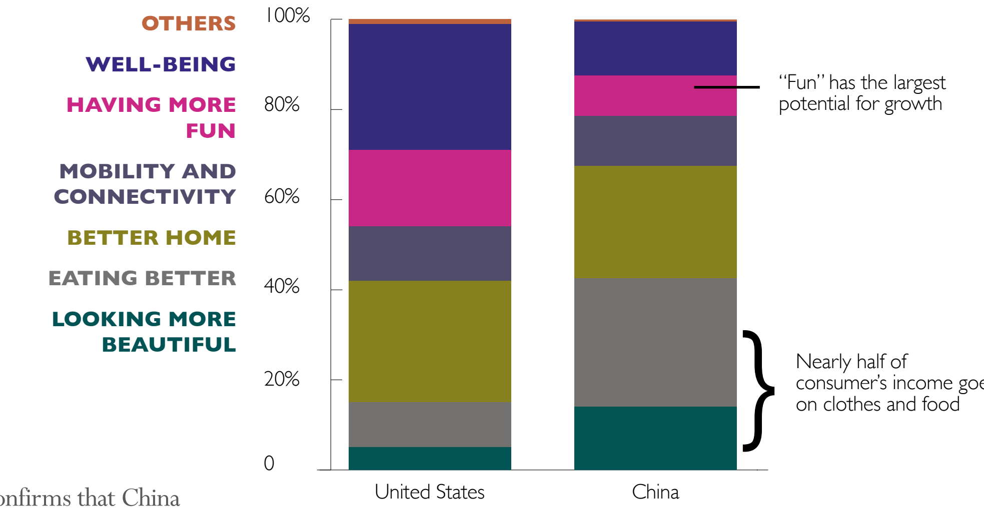
The three biggest drivers for growth in these emerging economies are:

1. **Infrastructure:** For example roads, railways, power and mobile telecoms. China has just finished the sixth ring road around Beijing and is about to start on the seventh with plans to merge Beijing with neighbouring urban areas to create a "supercity" of 130 million people, greater than the shrinking population of Japan. A decade ago, China had no high speed rail network and now has more than the European Union.

2. **Political reform:** The recent election of Narendra Modi as Prime Minister of India is driving enormous change to encourage business growth, improve corporate governance, open up banking to the whole population, allow and encourage overseas investment inflows previously seen as a threat to inefficient indigenous businesses, and clamp down on endemic corruption. India is now forecast to grow faster than China.

3. **Growth of the consumer:** This will be the biggest contributor in the long term. Real incomes are rising fast in emerging markets at typically between 5% and 10% annually. China has 770 million working people, of whom 146 million are regarded as middle class urban consumers earning an average US$11,700 annually, while at the other end of the scale, 387 million of the population are rural working class earning an average of only US$2,000 on an annual basis. (Source: China NBS, CNN Politics, Goldman Sachs).

What people want



Source: Euromonitor, CEIC, Goldman Sachs. 2016

The countries of the world have never been as clearly split as the labels indicate. However, in our view, as a group it is those currently labelled as 'emerging', that will from here drive the greatest growth the world has ever experienced. IMF data confirms that China became the world's largest economy in 2014 surpassing the United States that had enjoyed this status since the 1870s.

Investing in emerging markets

As tens of millions in countries such as China, India and Indonesia move from the country to the city, the disposable incomes of their respective populations rise and they become consumers, moving up the value scale, from basic food and clothing to more discretionary items such as cars, holidays and eating out.

A comparison of China with the United States demonstrates the changes that take place in consumer habits as an economy becomes wealthier. At the lower end of the value scale people strive to dress to "look more beautiful" and to "eat better", while further up the scale they can afford to "have more fun" such as eating out and holidays, along with looking after their well-being, for example, by going to the gym.

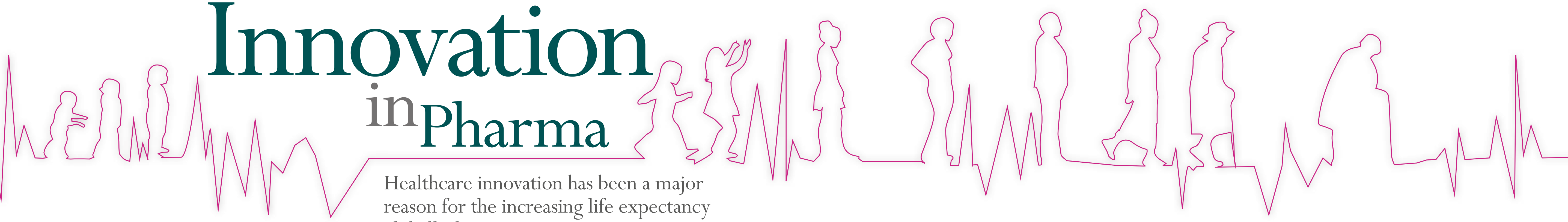
Consumer focused businesses are obvious beneficiaries of this, from mobile phones, to restaurants, to gaming, and luxury goods such as watches, handbags and premium spirits. A leading driver of this is the internet, with China already the world's leading online market place by volume and where Alibaba is the dominant player and challenging Amazon for overall global size.

Travel is a huge area of growth and the number of new aircraft deliveries in emerging markets is around double that of developed markets. Major beneficiaries of this include airlines, aircraft manufacturers, aircraft leasing companies, hotels and branded luggage producers such as Samsonite. UK listed Standard Chartered Bank is now in the process of negotiating a joint venture in the aircraft leasing market with a Chinese state-owned company.

There is no doubt that the number of world-leading emerging market companies including Alibaba (China), Samsung (South Korea) and Taiwan Semiconductor will grow. However, companies based all around the world will benefit from this, including many in the UK such as: Bunzl, supplier of catering, tableware and hygiene items to hotels and restaurants; Diageo, which produces beverages including premium spirits; and Smith & Nephew, which specialises in wound management, orthopaedics and sports medicine, which are important for well-being.

Emerging market shares have performed very strongly in 2016 after a number of challenging years, yet it is impossible to forecast what 2017 as a standalone year will bring. There will always be bumps along the way not least political ones, however, consumer-led economic growth is here to stay in emerging markets. ■

EMERGING MARKET SHARES HAVE PERFORMED VERY STRONGLY IN 2016



Innovation in Pharma

Healthcare innovation has been a major reason for the increasing life expectancy globally, but costs are rising

Human beings today generally live longer and healthier lives than at any point in history. Life expectancy has almost doubled in the developed world in the past 100 years due to factors such as rising incomes, better education and cheaper food, as well as long periods of relative peace. The most significant driver has, however, been the unprecedented advances in healthcare.

These cures and treatments have come with an associated increase in costs – most European countries spend around 10% of GDP on healthcare and the dysfunctional US system is now at 17% of GDP, or $10,000 per person per year. How are politicians and the industry balancing the ceaseless growth in demands and the related growth in costs?

A century of innovation

The early 20th Century was a period of transformational innovation in medicine. In the 1920s, Dr Frederick Banting was the first person to use insulin as a treatment for diabetes - a condition which had been fatal up to this point. Of equal importance was the inadvertent discovery of penicillin in 1928 by Alexander Fleming. Eventually mass produced during the Second World War, this first antibiotic would go on to save the lives of millions and open up an entirely new field of medicine.

The post-war years saw an acceleration of important medical breakthroughs. Vaccines meant that killers such as polio, tuberculosis and tetanus have been largely consigned to history in the developed world. Cancer survival rates have doubled on average in the past 40 years. And innovations to help lower blood pressure and cholesterol such as Pfizer's statin, Lipitor, have seen a reduction in fatalities from heart disease – still the number one cause of death in the West.

The innovation drought

Despite all these innovations and continued rises in Research and Development (R&D) spending, the pharma industry suffered an innovation drought in the first decade of the 21st Century. Between 2005 and 2010, the average number of 'new molecular entities' approved by US regulators was just 21.8. To put this decline in context, there were as many as 53 new drugs approved in the USA in 1996.

The drought in innovation coincided with a number of successful drugs coming off patent. This resulted in a 'patent cliff', where big pharmaceutical companies lost market exclusivity on some of their best selling treatments and failed to develop new drugs to offset the decline in revenue. Share prices in the healthcare industry stagnated before declining sharply towards the end of the decade.

The biotech boom

In recent years, we have seen a revival in the prospects of the healthcare sector, spearheaded by an innovative category of drugs know as biologics. While traditional drugs are chemicals synthesized from other chemicals, biologics are derived from living cells. They have the potential to offer more targeted treatment than conventional chemical drugs but tend to be much more expensive due to the complex manufacturing process.

This new category of drug has proven extremely lucrative for the healthcare industry. AbbVie's Humira, a biologic medication used to treat rheumatoid arthritis, generates revenues in excess of $10bn a year. The next big leap forward which the industry is pursuing is gene editing – the ability to insert, delete or replace parts of a human's DNA, potentially curing a series of diseases related to fundamental faults in an individual's genetic make-up – this will not come cheap, however.

Political risk

Despite the excitement surrounding the potential of biotech and gene editing, the healthcare share index has been relatively weak following increased focus on the industry linked to a Tweet from Hillary Clinton in which she pledged to combat the high cost of prescription drugs in the US, sparked by an egregious price rise on an HIV drug. Pharma companies bounced strongly after Donald Trump became President-elect.

In response to this, the healthcare industry cites the high levels of investment they make in R&D and the time it takes to get a product to market. Indeed, almost half of all corporate research and development spending in Britain this year has been carried out by the pharmaceutical and healthcare industry.

More conflicts over pricing look certain as governments and insurers battle to contain rising healthcare costs from an ageing population.

Looking forward

Better education and prevention will surely remain important – for example, the falling rates of smoking – but demographics are on the side of the pharmaceutical industry and despite the innovations of the past 100 years, there are still a huge number of unmet needs. As such, the companies best placed to succeed are those that can offer genuine cures where there are currently none such as dementia and many cancers, those developing new antibiotics and those which offer effective treatments which also serve to reduce healthcare costs.

Prevention, in the form of new vaccines, is an extremely cost effective way of dealing with the misery of malaria, dengue fever and meningitis, for example, and should eliminate cervical cancer in a generation for a few tens of pounds per patient. Cost savings are designed within devices such as Smith & Nephew's new replacement knees which have fewer steps to install, shorter recovery times and last longer. These are selling well due to the cost savings they bring.

In summary, the healthcare industry has huge opportunities ahead, but healthcare systems around the world are increasingly asking them to help reduce overall costs as part of their innovations. ■

OF THE 13,000 IDENTIFIED DISEASES WHICH COULD AFFECT A HUMAN, ONLY AROUND 500 ARE CLASSED AS CURABLE. MANY EVEN LACK A DIAGNOSTIC TEST

Is global infrastructure spending about to increase dramatically?

Infrastructure spending is expected to be a policy tool to support economic growth

As more developed economies appear to have reached the limit of desired monetary policy (i.e. rate cuts and quantitative easing), it is likely the focus will change to fiscal policy. President-elect Trump has committed to significant infrastructure spending, and is likely to enjoy bipartisan support from Congress with his plans. Unshackled by a loosening of austerity policy, the UK's Chancellor of the Exchequer, Philip Hammond, is likely to take advantage of low borrowing costs and announce spending programmes in the coming months.

The UK Government has committed to invest over £100bn (via a mix of public and private investment) by 2020. However, this is dwarfed by global needs, as Citigroup estimates that global infrastructure spending could be as much as $58.6 trillion over the next 15 years - 60% of which will be required to meet emerging market needs.

Circa 1.5 billion people around the world have no access to electricity. One billion are without safe drinking water and over 2.5 billion are without access to basic sanitisation.

AUSTERITY AND DIVERSIONS OF CAPITAL HAVE LED TO A FALL IN INFRASTRUCTURE SPEND AS A PERCENTAGE OF GDP; THIS WILL SOON REVERSE

The UN suggests there will be an increase in the global population of 1.5 billion people over the next 20 years, largely within emerging markets, so there is an even more pressing need to start addressing the situation now. Infrastructure can be split into four broad areas:

- **Transportation:** Rail, road, air, airports, maritime and ports
- **Telecommunications:** Fixed line networks, broadband networks, mobile networks and satellite networks
- **Energy:** Including electricity generation, transmission, distribution, storage; oil and gas, upstream activities, refining, conversion, transportation; and distribution and storage, as well as coal mines, nuclear facilities, renewable assets, etc.
- **Water and sanitisation:** Assets such as water treatment facilities and distribution networks, waste water collection and treatment, sanitisation, irrigation, and potentially broader waste collection and treatment.

The above sectors cover 'hard' infrastructure, but there are also further social areas, such as schools, hospitals, care homes and social housing.

A GDP boost

If done well, infrastructure spending can help boost demand in the near term, but more importantly, the improvements help to meet longer-term needs. The International Monetary Fund (IMF) suggests that for advanced economies, an increase in the GDP value of public investment spending by just a percentage point has the potential to raise output by 0.4 percent in the same year, and by 1.5 percent four years later. The impact is greater when growth is weak.

An example might be the New Suez Canal which has added a new 35km-long second shipping lane and expansion of a 37km-long section in the existing canal. The enlarged capacity now allows ships to sail in both directions at the same time over much of the canal's length. Ship waiting time has been reduced from 11 hours to around three hours and increased the canal's capacity from 49 to 97 ships a day. The $8bn project took one year to complete and involved 400 private companies and 25,000 workers.

Not all projects might meet both short- and longer-term needs of the broader community. The Three Gorges Dam in China is the world's largest hydro project, however longer-term benefits are harder to assess by the physical impact it had on the region - it displaced more than 1.2m people and, due to its reservoir length of over 500km, 13 cities, 140 towns and 1,350 villages were flooded. The overall project was plagued by corruption, spiralling costs and environmental impacts.
In the UK, we are familiar with the endless battle over increased runway capacity around London, which in itself leads to long, expensive delays. The latest decision for Heathrow has prompted the resignation of a high profile MP and further protests and delays seem likely. The UK Government is also likely to take time weighing the long-term economic benefits and the opportunity and social costs of HS2.

A pressing need in emerging markets

The big conundrum is that emerging market countries are least likely to be able to afford the fiscal expansion required to fund these projects. The private sector may be able to provide some novel solutions in some areas – something Vodafone, with its significant emerging market presence, has latched on to, as connection and communication is vital to allow economies to develop at a reasonable cost. Vodafone has recently signed a deal with Inmarsat. It is believed to be the first of its kind, where a mobile phone network has signed up to use Inmarsat's global satellite broadband network in order to provide connectivity to harder to reach parts of the world.

ENVIRONMENTAL AND SOCIAL COSTS ARE A VITAL CONSIDERATION

Private financing

Infrastructure tends to offer long-term stable cash flow and income streams, usually with inflation protection built into contracts. This type of long-term return profile is particularly attractive to pension funds and insurers, particularly after many years of low interest rates. This means that these sectors have the potential to fund some of this spend, which has previously been covered by government bodies. There are a number of ways we consider investment in infrastructure on behalf of our clients: direct equity investing in companies likely to be awarded contracts or supplying materials, or through funds that specialise in infrastructure investment.

Some funds may not be immediate beneficiaries of this new spend, as many shy away from primary building risk, although they would benefit from the opportunity to buy or manage new projects once complete. These assets can also provide diversification benefits to portfolios. ■

Virtual Reality

No longer fantasy, Virtual Reality has incredible potential to change the way we play, communicate and learn

'The future is made of virtual insanity'. Who can forget the prediction made by Jamiroquai in their 1996 hit? Whilst the music has surely stood the test of time, the concept of virtual and augmented reality that they railed against has never really happened, despite being constantly touted as the next big thing in technology. After many false dawns, there are signs that 2016 was a breakthrough year for the technology world but will it be a revolution, and how far will it reach beyond gaming?

The huge rise in the processing power of semiconductors and screen resolution has resulted in cheap handheld devices such as smart phones which are perfect for virtual reality (VR). The games industry has jumped on these and launched a series of games and devices to exploit the new possibilities. 2016 saw Nintendo introduce Pokémon Go, where players could interact with virtual characters that appear around them via their mobile phones. This was a phenomenon, with 500m downloads in the three months after launch. Headsets from Sony and others have taken the technology further and put users right inside the games they are playing.

Are there any downsides to society? As well as distracted players bumping into things, the games might cause people to retreat into virtual worlds; however research by Stanford University did find Pokémon Go users walking 25% more than non-users, so it depends on the game and how it is played.

Gaming represents a small part of the potential for this technology, with many industry fields exploring the possibilities it offers.

Beyond gaming

If you were in Sweden during the Rio Olympics you would have had the opportunity to watch over 120 hours of the Olympics in the 360° virtual reality format. In the UK, Sky – fresh from the success of 'Westworld' which is set in an augmented reality amusement park populated by androids (spoiler: the androids go bad) – has a new virtual reality studio. The firm launched its 360° video virtual reality app in October 2016, with an initial 22 films available. It expects to grow the content available rapidly across sports, movies, news and entertainment, from F1 racing, through 'visiting' Tutankhamun's Tomb and following the English National Ballet's production of Giselle.

To offset the concern that VR will have people locking themselves away in a lonely world of make believe, social media giants such as Facebook are using it to bring people together in that you can join your friends in an artificial or re-created location, and inevitably take selfies to post to social media to show off to everyone else.

Training and development

Industrial applications already in use include Formula 1 racing teams and aircraft pilots training and testing developments on highly realistic simulators. Going forward, there is also huge potential amongst many highly-skilled, safety-critical areas such as nuclear engineering, weapons and bomb disposal, and the training of surgeons. Even non-critical industries can benefit as, for example, welders could be trained by VR, which means money doesn't have to be spent on materials to practise on, and the trainees can repeat the task as many times as they need to. Some of these applications are already in development.

Sales and marketing

Companies are also finding that VR can be used as a powerful sales and marketing tool, to allow them to engage with their customers in new ways – with the customer becoming an active participant instead of merely a spectator. A client can experience the architect's new building, rather than simply viewing a 3-D model, and understand how the building will work and make changes before building starts. Hotels or travel agents can provide VR guides to visitors.

A VR headset could act as a virtual concierge, showing clients places they could visit. In E-commerce the customer can 'see' how a new piece of furniture will fit in their house and car buyers are able to configure and test out their top-end car model without leaving the showroom; and Marriott Hotels have a 'teleporter' which lets users step into a booth, wear an Oculus Rift headset and visit downtown London or a beach in Hawaii, and also allows users to feel wind in their hair and sun on their faces.

Empathy – the emotional power of virtual reality

The Za'atari Refugee Camp in Jordan is home to over 80,000 Syrians fleeing war and violence. Half of these are children. Clouds Over Sidra is the story of a 12 year old girl who has lived there since the summer of 2013. The film follows her to school, to her makeshift tent and even to the football pitch.

This is the first ever film shot in virtual reality for the UN, using the medium to generate greater empathy and new perspectives on people living in conditions of great vulnerability. Its powerful capacity to allow anyone on a global scale to experience life within a refugee camp has the ability to inspire the message of hope among not only the millions displaced but also those motivated to act.

VIRTUAL REALITY CAN ACT AS A TELEPORTATION DEVICE TO ANYWHERE IN THE UNIVERSE

Data demands

It is early days for many of these applications and it is difficult to know whether the mass market will embrace VR but early signs are good. It is too soon to say who the winners will be but we do know one thing that has already started to increase – use of data. As anyone who has ever had their iPhone borrowed by their child to play Pokémon Go will know, these games drain your battery and bank balance in equal measure. ■

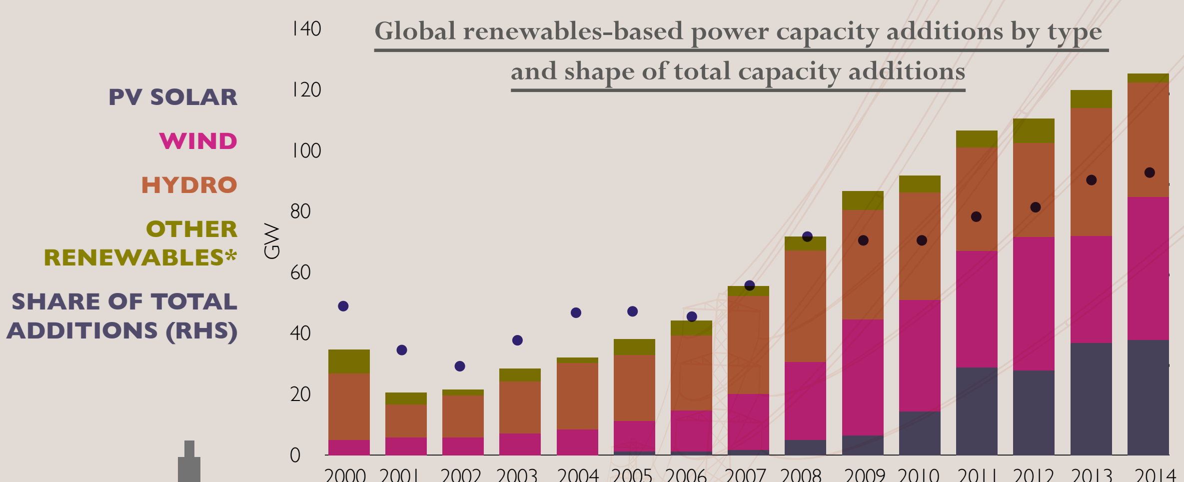
Power ~~For~~ To the people

The traditional model of power generation is changing fast due to technological advancements in distributed generation and battery storage

Distributed generation
Distributed generation (DG) means electricity that is produced at or near the point at which it is used. DG often uses small-scale technologies and consists of modular (and often renewable-energy) generators offering a number of potential benefits - lower-cost electricity, higher power reliability and security with fewer environmental consequences than traditional power generators.

Levelised cost of electricity
The *levelised cost of electricity (LCOE)* is a measure of a power source which attempts to compare different methods of electricity generation on a comparable basis.

Grid parity
Grid parity occurs when an alternative energy source can generate electricity at a LCOE that is less than or equal to the end consumer's retail price. Reaching grid parity is considered to be the point at which an energy source becomes a contender for widespread development without subsidies or government support. Since the 2010s, grid parity for solar and wind has become a reality in a growing number of markets, including Australia, several European countries and some states in the US.



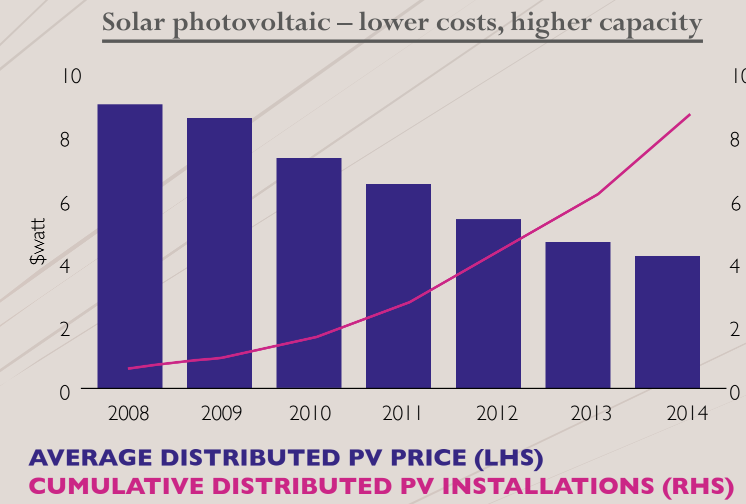
Note: *Includes geothermal, marine, bioenergy and concentrating solar power.
Source: IEA,2015.

Are we close to a game changer?
Despite the already phenomenal growth in renewable energy capacity (see chart) the game changer is likely to be advancements in storage technology. While much of the present renewables capacity has been installed as the result of environmental policy and targeted reductions in CO2 emissions, an obvious weakness of renewables is their intermittency and consequential unreliability for base load, or for when the power is actually needed – what happens when the wind doesn't blow (or blows too much) or when it is night time? Storage not only allows renewable power to be used when the demand is there, but it can also be used to charge electric vehicles overnight. A virtuous circle has already developed whereby improvements in the efficiency of, and cost reductions in, renewable energy generation make battery storage more attractive, and vice versa.

The two most popular forms of renewable power generation, wind and PV Solar (Photo Voltaic solar panels which convert sunlight into electricity), are experiencing cost reductions which are already making grid parity a reality when electricity is being generated. The cost of onshore wind energy declined by 65% between 1988 and 2014 owing to economies of scale, technology innovations and operational and maintenance improvements. Onshore wind now generates energy at a price where it can compete with fossil fuels – the levelised cost of onshore wind is estimated to be below €0.05/KWh versus coal at €0.049/ KWh and gas at €0.041/KWh2. The likelihood is that this trend will only continue due to technological improvements and productivity gains.

Roof top solar, much like onshore wind, has continued to see significant cost declines. The average photovoltaic panel (PV) price has more than halved since 2008.

Image: Shutterstock



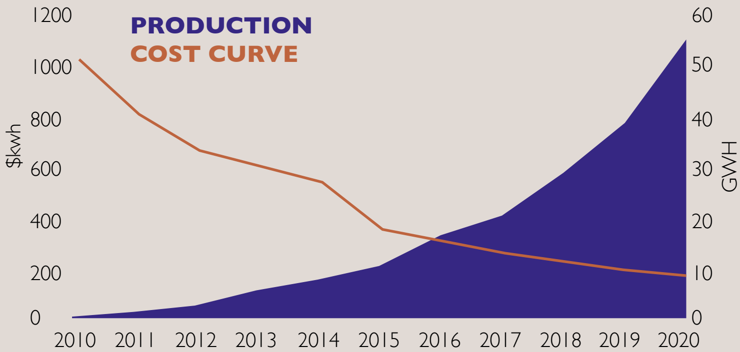
Source: IEA,2015.

But the real tipping point comes when the cost of distributed (non-grid) renewable generation **plus** the costs of storage is equal to or below grid prices (grid parity). And the good news is that similar to renewables, the level of investment into lithium ion storage has seen prices decline almost 65% from 2010. Tesla's Gigafactory is currently producing batteries at $190/Kwh with an expectation of a 30% reduction coming from economies of scale, reduction of waste, a closer supply chain, vertical integration and optimising processes. This reduction firmly places the cost of batteries within the range of 100-150/kwh which is the level at which batteries become truly viable.

ONSHORE WIND NOW GENERATES ENERGY AT A PRICE WHERE IT CAN COMPETE WITH FOSSIL FUELS

Where do the opportunities lie?
Tesla is taking a joined up approach being both a leader in EV (Electric Vehicles) and battery storage technology. But it is not just companies such as Tesla that may win out. Johnson Matthey is well positioned in this space as such a business fits with its core competencies. Providing battery materials to manufacturers is a high technology business and requires a company to deliver a consistent high quality ▷

Lithium ion battery cost curve and production



Source: NextEra Energy, 2015.

product that it effectively guarantees. Recall risks are very important (just look what happened with the Samsung Galaxy Note 7), and so the barriers to entry to be involved in the space are high.

INVESTMENT OPPORTUNITIES WILL UNDOUBTEDLY OCCUR IN A VARIETY OF AREAS

Investment opportunities will undoubtedly occur in a variety of areas such as auto manufacturing, power generation, electronics, software, advanced materials, contract manufacturing, and project development and finance. Existing companies will be forced to adapt their business strategies to accommodate this new technology. New companies will emerge that make, finance, apply and operate storage assets to help electricity grids, vehicles and buildings work far more reliably and cost-effectively while greatly reducing unwanted environmental impact.

Will smart grids avoid gridlock?

Renewables will play a dual role in our energy generation in the future – larger scale projects feeding into the grid and smaller distributed generation, both with or without associated storage. Both large and small scale generation may require fundamental changes in the management of the grid, owing to both the volatility in supply from larger schemes and to allow surplus power generation from distributed smaller scale installations to be fed back into the wider grid.

Already some Californian solar plants have to be switched off during the sunniest hours to prevent them overloading the electrical grid. Because of this, the sunshine state is looking at modernising its grid, combining it with more flexible generation sources such as natural gas plants (versatile and one of the cleanest types of fossil fuel generation) and more energy storage options such as the world's largest lithium ion batteries which are planned for Los Angeles, in order to balance the grid through the day.

California, the US's most populous state, is being seen by many as leading the way in its use of renewables and has recently announced that its last remaining nuclear plant is to close.

"We want to prove a couple of things - one is that you don't have to choose between the economy and the environment, that we can do both," explains Fran Pavley, a state senator who wrote the legislation that sets the 2030 emissions target for California. "If we can model that this can work, other states will adopt it," she added.

The US election may have changed things – Trump has a stated intention for the US to become energy independent. This does signal more enthusiasm for 'dirtier' forms of energy, such as coal and oil, however, that's not to say that these issues will mean that this energy revolution will stall – it is more likely that it will just mean it will take longer to get to a satisfactory balance. ■


ADAM INVESTMENT BIOGRAPHIES

Our investment team is responsible for establishing our views on economies and asset allocation.

Dickson Anderson

HEAD OF ADAM INVESTMENT

Dickson has over 25 years' experience in senior business leadership roles within financial services in the UK and Europe. Prior to joining Adam he held positions with Franklin Templeton, Scottish Widows Investment Partnership and Robson Rhodes, as well as investment trust directorships.

Cameron Glasgow

DIRECTOR

Cameron is responsible for managing discretionary and charity portfolios and is a member of the Adam Proposition Board. Cameron has over 18 years of investment experience.

Kay Bendall

DIRECTOR

With more than ten years of investment management experience and a research background, Kay manages portfolios for private clients and trusts. She also has a key responsibility for research and is a member of the Adam Proposition Board.

Stuart Dickson

DIRECTOR

Stuart has 19 years' experience as an investment manager covering Japanese equities, global healthcare and technology stocks. He runs portfolios for private clients and charities, and is a member of the Adam Proposition Board.

Susan Boyd

EXECUTIVE DIRECTOR

Susan has over 25 years' investment experience, managing private client and institutional portfolios. In addition to her own client portfolios, Susan has responsibility for client service across the Adam investment client base and is a member of the Adam Proposition Board.

Mark Ivory

EXECUTIVE DIRECTOR

Mark chairs the Adam Proposition Board, and has over 15 years' experience managing private client and charity portfolios in London, Melbourne and Edinburgh. His primary role is to oversee the investment process and manage client portfolios.

Allan Cameron

DIRECTOR

Allan manages both individual and charity client portfolios. He is also responsible for the research and recommendation of collective investment funds. Allan has over 16 years of experience as an investment manager.

Ross McPhail

ASSOCIATE

Ross assists portfolio managers with the running of client funds and has responsibilities for researching both Direct Equities and Collectives. Ross recently passed his CFA Level 1 exam and has completed the IMC qualification.

Anna Croze

EXECUTIVE DIRECTOR

With 13 years' experience in institutional and wealth investment management in London, Nairobi and Edinburgh, Anna heads up our research team. She runs the AIM Listed Portfolio Service and sits on the Adam Proposition Board which shapes our investment strategy.

Ken Wilson

DIRECTOR

Ken has over 28 years' experience in private client investment management and advice, managing portfolios for a wide range of clients all over the UK. He previously held senior positions with Turcan Connell, Edinburgh Fund Managers and Alan Steel Asset Management.

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