

In Focus Special Edition: Investing for Innovation



October 2021

What does the next 10 years look like?

Alan Budenberg, Senior Investment Consultant, talks to Will Hobbs, CIO, about why the next 10 years might be exciting from the perspective of innovation and why it pays to be invested during such times.

Alan: We know that productivity, humankind's seemingly endless ability to make more output from a given set of inputs, is the driving force of medium- to long-term returns from a diversified portfolio. This is so much so that you and the team often argue that we should ignore everything else! Nonetheless, the question I'm often asked at the moment by clients is whether crises can be good periods for such innovation – people are forced to find efficiency and adopt new technology, where previously they might have been a bit reluctant?

Will: Yes, this crisis is a good example as you know, Alan. The multiple technologies that we have needed to relocate work during this pandemic have been coalescing for decades. Breakthroughs in areas such as reliable laptop computers, video conferencing tech, high-speed internet and even smartphones meant less individually than they came to mean collectively in this pandemic from a productivity perspective.

There is some precedent too actually. Somewhat weirdly there has been a long-running scrap between academics about whether or not the 1930s was the most technologically progressive decade in US economic history. This is the same 1930s which played host to one of the worst and most protracted economic downturns in US economic history, remember. As with today, you found that previous far-flung breakthroughs from preceding decades, from cracking the periodic table to widely available electricity, organised to facilitate a step-change in efficiency over the decade. I think there is certainly an element of necessity being the mother of invention as you suggest.

You can also argue that recessions and crises are sometimes helpful in cutting away the dead or dying corporate flesh, in the process helping to free up the more productive businesses/sectors to play a greater role. The idea being that if there is a finite amount of resources to play with in the world (from workers to financing), you want your most efficient and dynamic businesses from the frontier sectors commanding them to get the best productivity outcomes.

I think with reference to this crisis in particular though, there is this key interaction between living standards and productivity. There is a link here to revolutions past but also potentially an important difference. We know that life expectancy (at birth) has increased by around 30 years in much of the developed world since 1900 and by more in many emerging market countries (Figure 1). We can also link this happy statistic to the rapidly evolving technological context and what that has meant for the availability of nutrition and prevalence of disease. Some have even argued in the past that cause can run the other way – from healthier humans to more productivity. This makes sense if you think about it. Innovation comes from us. The more of us there are, replete with food and education, the more sources of potential innovative breakthroughs you have. This can certainly be argued for the all-important first industrial revolution for example – there was a surge in nutrition in the 1730s, thanks to a run of bountiful harvests in the UK. Some make the link between this and the birth of a cohort of British innovators who would grow up to change everything for everyone (Figure 2)¹.



Will Hobbs
Chief Investment Officer



Alan Budenberg
Senior Investment Consultant

¹ John Komlos, "Nutrition, Population Growth, and the Industrial revolution in England", *Social Science History*, Spring, 1990, Vol. 14, No1 pp 69 – 91

As noted, this story has only become more tangled in this crisis – health and the prospects for the economy are indelibly linked. Some are arguing that this fact may have changed the cost benefit calculation of investment in health technology for example. The result of all this extra attention, investment, and brainpower applied to the area of health could be a surge in life expectancy. The point I think really to get across is that the more of us there are, the better life gets.

Alan: Do these incoming advances that have been so essential to mitigating the effects of this pandemic get rolled up in what is often called 'the fourth industrial revolution'? And I guess within that it would be helpful to be a bit more specific about what we mean by the term 'industrial revolution'?

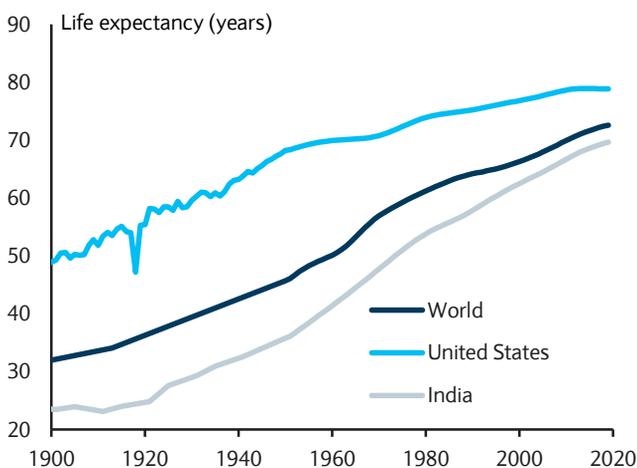
Will: Yes, the concept of industrial revolution is probably a bit misused. I think you can think about it as a sustained quickening in the pace of the change, facilitated by the arrival of what are called 'General Purpose Technologies'. These are things like electricity, the computer chip, and the steam engine that have multiple potential applications. The point is that in the last few hundred years, really since the first industrial revolution, the world has been in a near-permanent state of technological revolution (Figure 1 again); however there have so far been three identifiable phases where this has quickened substantially. The first was really about harnessing steam and water to mechanise production. The second then benefited from advances in steel and electricity to create the potential for mass production. The third centred around the computer chip, with work moving from factories to the offices amidst the march of the 'knowledge economy'. The fourth is essentially ongoing and surrounds, but is certainly not limited to, the application of the digital economy.

I think there are a couple of points to make. First, the more closely you study these revolutions the more they become hard to characterise with a single technological breakthrough. There tend to be myriad overlapping and interacting influences, sometimes taking decades to take shape. Second, it is amazing how the demands on the workforce have changed over this time. Prior to the first industrial revolution in England, it was cottage industry that dominated – essentially family textile businesses. The industrial revolution ripped production out of the home and moved it forcibly to the proliferating factories and the cities they were housed in. These were brutal jobs and humankind paid a short-term price in life expectancy and living conditions for the pleasure. Eventually, the advent of the computer chip started a move from factories to offices. A boon for brains over brawn². Some are suggesting that the incoming revolution in Artificial Intelligence (AI) could further change the skills needed. Empathy and emotional intelligence may begin to trump IQ in terms of valuable traits in the new economy.

Alan: I know this is still a topic of hot debate in economics circles, but what are some of the determining factors in which countries and areas benefit the most from these revolutions? Why did the first industrial revolution benefit Britain so much more than it seemed to the rest of the world, and could it be that China, for example, could really dominate the commanding heights of the fourth industrial revolution to the exclusion of others?

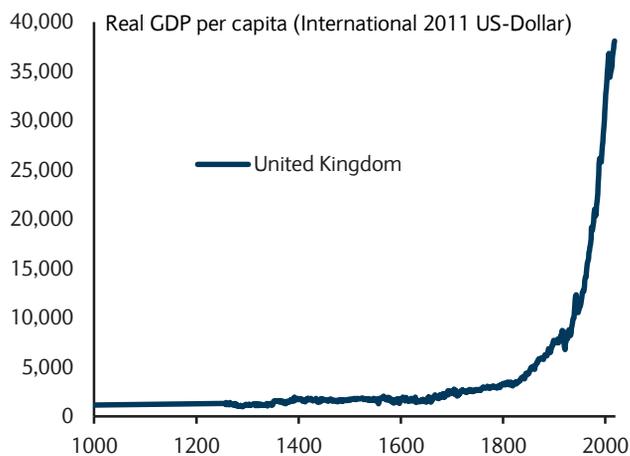
Will: On the UK, there are still loads of different theories here. It's hard to think of an area that has attracted more thought from the economists of the world over the years. One of the more convincing to me revolves around the interaction of a high wage economy (Britain's workers were expensive at the time thanks to the nation's success in textiles in the preceding centuries) with abundant and (relatively) easily accessible coal deposits³. This mix certainly helped to make the pay-out from swapping people for machines very attractive.

Figure 1: Sharp improvement in life expectancy since 1900



Source: Our World In Data.org, Barclays

Figure 2: After millennia of flat-lining, the first industrial revolution sparked take-off



Source: Our World In Data.org, Barclays

²Vox EU CEPR, *Globalisation, automation and the history of work: Looking back to understand the future*, <https://voxeu.org/content/globalisation-automation-and-history-work-looking-back-understand-future>, January 2019

³Robert C Allen, *The British Industrial revolution in Global Perspective – Cambridge University Press, 2009*

However, then and now, I do think there is a really important role for the institutional context. Some academics called Acemoglu and Robinson have written very convincingly on this⁴. Their investigation begins with the weird case of Nogales, a city bestriding the US/Mexican border. There is a chasm in educational attainment, life expectancy, and almost every single meaningful wellbeing indicator between Nogales, Arizona and Nogales, Sonora. The question they ask is why? The answer, convincingly illustrated through these two cities' very different development paths, lies with the very different role the respective states have evolved to play. Within this, it is the ability of a presiding authority to accept the chaos that comes with sustained innovation and productivity.

Entrenched interests, vested profitably in the status quo, tend to find the disruptive potential of innovation and all the labour force and wider attendant organisational chaos, very unappealing (naturally). In the UK, the more visible turn to that necessary check on executive power is often seen coming with the glorious revolution of 1688. There is a famous incident when Elizabeth I refused to grant an inventor, William Lee, a patent for his 'knitting machine' on the grounds that it would make 'beggars' of her people by depriving them of employment that is sometimes seen as illustrative of England (and others) pre-1688.

So history does show that it is possible to miss out on the fruits of these revolutions, because they can be painful and difficult to pick and the benefits can take many years to show up. There are plenty of examples of countries that have managed to ride one productivity surge but failed to repeat the trick. A state of permanent reinvention, with all of the challenges that brings in maintaining a stable social contract, is extremely challenging to maintain. Self-interest can be a potent block on change if executive power is sufficiently concentrated and unchecked.

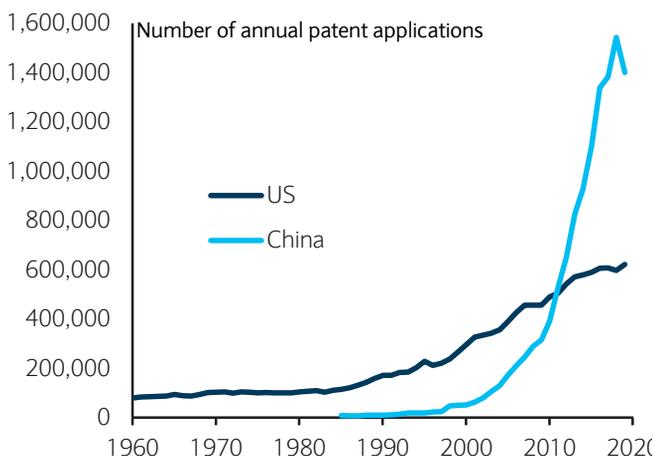
I guess with China, the jury is still out (Figure 3). There are certainly areas of the current technological context where China has a lead. So, the country is seen as being very strong in applications for example – the integration of lots of other complicated tech and systems. One question will be whether Chinese institutions are sufficiently supple to navigate the sustained change that comes with an industrial revolution. One risk is that the more power that is amassed centrally, the more you head down the path of the economically-deleterious entrenched interests discussed by Acemoglu and Robinson.

Alan: And I guess you and the team are always making the point that the real rewards, in terms of investors and more broadly, can often be far from the initial innovation. You always use the shipping container as an example, but what about something from the current context?

Will: Yes that is true. It always seems like the answer has to be to buy a basket of the most exciting sounding technology companies and let the good times roll. However, the rewards to innovation often don't work like that as you point out. I think today you could think of the real winners from a potential wider application of the Messenger RNA vaccine technology. The diseases that could wilt under this new technology have tended to bully emerging world populations, not the already developed. The benefits to life expectancy, growth, and investor returns could be most keenly felt there. You may miss the gains by just focusing on owning the innovators.

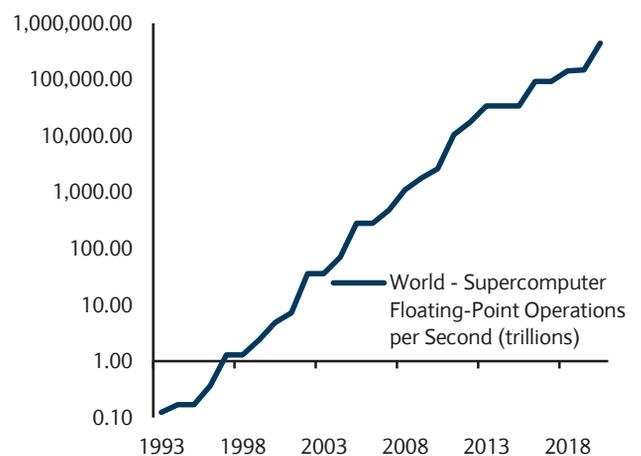
Alan: There is a quote from Bill Gates who argued that: "We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next 10. Don't let yourself be lulled into inaction." So, if we let our imaginations run riot, where could we get to in 10 years?

Figure 3: Is China going to dominate the next industrial revolution?



Source: World Bank, Barclays

Figure 4: Increases in computing power in the last few decades



Source: OurWorldInData.org, Barclays

⁴Acemoglu and Robinson, *Why nations fail – the origins of power, prosperity and poverty* – Profile Books, 2013

Will: If I knew that Alan... I think one interesting area where you are going to see a lot of application is Artificial Intelligence. I think we have to be specific here though. The breakthrough to the kind of AI described in dystopian science fiction, where at the point of ascension the confused robot decides that humankind needs to be tossed in the bin, that is still a long, long way away.

However, within areas like machine learning, the recent advances in computing power have pushed us into more tangibly interesting territory. To your earlier point, this crisis has also given AI a 'battlefield upgrade'. One use I read about the other day is within a hospital with an algorithm reading chest x-rays for signs of Covid-related lung infections, helping medical staff to prioritise efforts.

In many cases, but far from all, you are going to find that artificial intelligence will simply be quicker and better at assimilating vast amounts of information and making a related call than we are. This will significantly increase the efficiency of many processes across a range of sectors. The amazing thing is that an advanced image recognition system takes about a week to train using today's computers. Performing the same number of calculations necessary in some of these applications but using the best workstations available in the early 1990s would have taken hundreds of thousands of years (Figure 4).

In terms of the more speculative stuff, there are some pretty jaw-dropping potential applications if the stories of viable quantum computing capacity being within reach bear fruit. From computational chemistry to drug design to carbon sequestration, you could see previous ceilings of understanding rapidly shattered.

Alan: What about some risks of all of this potential change – what are the lessons from history here? How do governments and regulators, among others, need to respond?

Will: Well one of the main risks, as we've already touched on, centres on this idea of creative destruction. While the economy opens new doors in these periods, it also necessarily closes others. That means jobs and industries are destroyed. Skills that were valuable in a prior economic paradigm are suddenly redundant. The role of the state in such periods is especially tricky. How does one make sure that you are allowing the forces of disruption sufficient space, whilst also protecting your citizens from its worst effects? How do you retain your social contract through this period? I think high on the agenda here should be education and training. Making sure that your workforce is constantly being retooled to best equip it for the ever-changing demands in terms of skills is key.

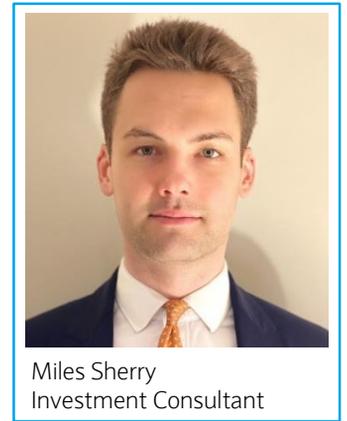
Alan: And what about investors? What does history teach us about these accelerated periods of innovation when it comes to the returns from a diversified portfolio?

Will: I think the most important point is diversify. You and I can banter on about the next technological breakthrough and what its effects might be to our hearts' content. However, the reality is that the next breakthrough could really come from anywhere at any time from anyone. The only logical response to this inherent uncertainty is to make sure that you design your investment net to reflect this inherent uncertainty. Make sure that you have that core exposure to the potential of the world, not just some recently successful part of it. Once you have the world in your hand, you can then garnish it with more specific investments to your heart's content. That overall exposure should help you face your long-term financial future with a little more confidence – the inventive capacity of the entire planet will be working with whatever savings you can spare to deploy, day and night.

Are we ready for technology to change our lives?

Rewind to 2000; around 7% of the world had internet access, today c.50% do¹. Did you ever think you'd listen to music digitally on a phone? Or, consider you'd be able to log into an app via facial recognition and send money to a bank account via a few simple taps of the screen? Was it plausible that, instead of taking your camera out, you'd have one built into your phone with multiple lenses and the images taken would be saved to the 'cloud' and accessible anywhere? Did you think space travel would open up to the public, a movement kicked off on Sunday 11th July, as Virgin Galactic won the race to space? Probably not, but innovation has resulted in our smartphones having c.100,000 times more processing power than the computer which took mankind to the moon, some 50 years ago².

Technological innovation has been a constant theme since the 'Dot-com bubble' and even before it. We may only be getting started though. Who knows what products and services currently unimaginable, might be disrupting our lives in a decade or two.



Moore's Law has powered technological innovation

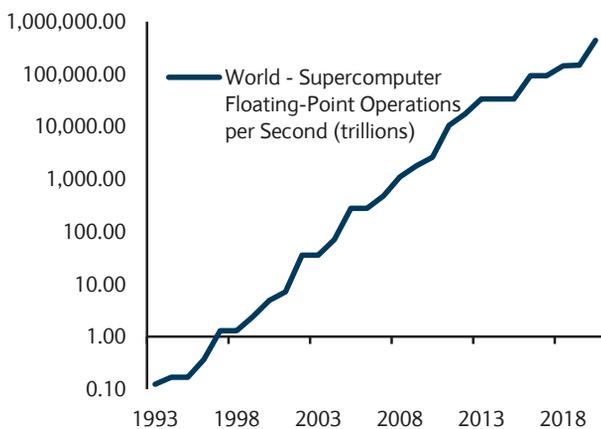
Gordon Moore, the founder of Intel, predicted in 1965 that computers would simultaneously get more powerful while falling in price, at an exponential rate. Every couple of years the semiconductor chips powering our devices have been gaining power while becoming smaller and more energy efficient (Figure 1). Computers have changed from being rare, expensive, and clunky boxes, to ultra-thin laptops and machines considered a necessity. Technology is no longer just about computers though, it's disrupting almost every industry you can think of.

The rise of Artificial Intelligence (AI)

In the past, humans collected data and we largely analysed it ourselves, drawing conclusions. Computers though, are getting as intelligent, if not more intelligent than humans. We generate more data in one hour than we did in the year 2000 and will generate more data in the next 3 years, than over the past 30³.

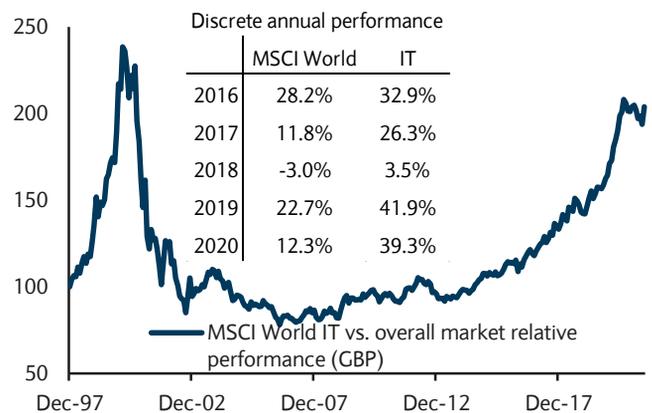
On average, apps on our phones include six trackers from other companies which have the sole purpose of collecting and tracking us. This data is collected, pieced together, shared, and then monetised, fueling an industry valued at over \$227bn a year⁴. Not everyone will be comfortable with this and there are many risks, from data loss to fraud, but equally, there are possible opportunities.

Figure 1: Advancement of semi-conductor chips



Source: OurWorldInData.org, Barclays. Data as of 31st December 2020

Figure 2: MSCI World performance vs. MSCI World IT Sector (GBP)



Source: FactSet, Barclays. Data as of 30th June 2021

¹<https://www.weforum.org/agenda/2020/11/heres-how-technology-has-changed-and-changed-us-over-the-past-20-years>

²<https://www.independent.co.uk/news/science/apollo-11-moon-landing-mobile-phones-smartphone-iphone-a8988351.html>

³https://d1.awsstatic.com/executive-insights/en_US/ebook-eight-predictions-how-technology-will-change-our-lives-in-2021.pdf

⁴https://www.apple.com/privacy/docs/A_Day_in_the_Life_of_Your_Data.pdf

Computers decipher this data and create recommendations without human intervention. Think about how your TV streaming service recommends films based on what you've already watched. Food delivery companies send you targeted adverts at a certain time to encourage you to order from them, based on data showing your prior ordering habits.

AI is disrupting countless other industries. While it may take a few years for the concept to be perfected, autonomous cars will likely be mainstream within the next decade. Education has seen little innovation historically. Up until the pandemic, schools were effectively operating in a similar way to how they may have done many years ago, but the pandemic forced teaching to adapt and innovate. Recent developments have even seen AI being used to watch students through a webcam, to assess their emotions and work out if they are engaged, and then tailor teaching based on these emotions.

Customer service is changing too, many companies now use AI-powered chat systems, which try to solve your question or problem without actually speaking to anyone. Back in 2018, Google even previewed an artificial assistant, which can hold what sounds like a human conversation, to book a haircut.

The Internet of Things

Today, there are more connected devices globally than humans⁵. Technological innovation has led to modern homes now having appliances connected wirelessly to our phones. You can set your heating to come on while you are out, control your oven temperature, and even see who is at your front door, all from an app.

These are technologies already in existence, but the latest wireless 5G technology may lead to further disruption. This enhanced speed will likely lead to an even more connected future world, one which could see the emergence of 'smart cities', where objects such as traffic lights wirelessly connect and interact with autonomous cars, telling them when to stop at a red light. While this brings additional risks, it also enables potential growth opportunities in areas such as cyber security. Cities of the future may change – data can look at footfall and traffic to work out how cities may look in a post-pandemic world.

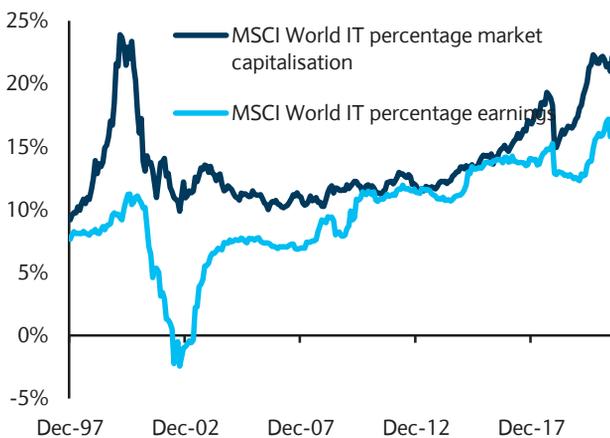
Why invest in technology now?

Technology stocks have had an incredible run over the past five years and rebounded strongly since the 'Dot-com bubble' (Figure 2), so you may think the 'ship has sailed'. Note that past performance is not a reliable guide to future performance. We have spoken about valuations before, but one point to remember is that when compared to 2000, many more companies are now actually profitable – rather than pure 'blue sky' thinking (Figure 3).

This is about so much more than just the few massive companies dominating major indices. New start-ups are constantly emerging and while many will not succeed, some could be the dominant names of the future. One specialist fund manager we work with, Polar Capital, spend time and resource looking for the 'next generation winners' and seek to avoid 'legacy technology', within their Global Technology fund.

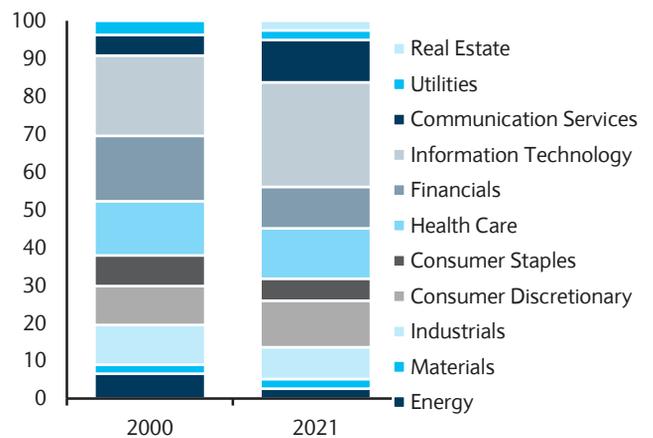
The composition of market indices has hugely changed over the years. The make-up of a market like the S&P 500 will likely look very different in a decade or two, as we see more innovation (Figure 4).

Figure 3: Profits are now more aligned to share prices



Source: FactSet, Barclays. Data as of 30th June 2021

Figure 4: The change in S&P 500 sector weights over time



Source: FactSet, Barclays. Data as of 29th July 2021

⁵<https://www.weforum.org/agenda/2021/03/what-is-the-internet-of-things/>

While computers have become so powerful there is every chance we will find ways to make more use of this power, driving new products and services. Examples include further developments in alternative meat, the financial advice gap being closed, and negative emission technologies. Maybe music festivals will become virtual reality experiences for those who cannot be there in person⁶? The pandemic has also seen forced changes to retail – online grocery shopping as a portion of total grocery sales doubled in a couple of months, from growing slowly for a decade. Robots are starting to fill shopping baskets in custom-built warehouses. Maybe soon drones will deliver shopping, rather than vehicles? Some of this may sound a bit far-fetched, but it's not beyond the realms of possibility.

Quantum computing will likely become mainstream, helping to change our society for the better – think climate change and healthcare improvements. Cloud growth may be set to hugely increase, with data and AI bringing supply chain improvements.

No one can predict the future, but there is every chance the next ten years could be even more exciting than the past, particularly as we innovate and adapt to a post-pandemic world.

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⁶<https://www.weforum.org/agenda/2020/06/17-predictions-for-our-world-in-2025/>

The need for a sustainable future: A catalyst for innovation

Innovation and gains in productivity form the engine room of economic growth and in turn these gains can provide an important source of returns for stocks and thus for diversified portfolios.

Investors often focus on technology and the advancements we have observed over the last several decades. Progress has been staggering, with further advancements in technology, both the known and unknown, no doubt still to come. Perhaps a less well understood area of innovation is the need for a more sustainable economy in the future. Here, we explore how the focus on sustainability provides another catalyst for innovation.

What do we mean by sustainability?

When we consider innovation in sustainability, it is worth considering what this means. There is no singular definition and terms such as Responsible Investing, ESG (Environmental, Social and Governance) and Sustainable Investing are often used interchangeably.

Perhaps it is simply best thought of as investing in a manner that incorporates active engagement and the embedment of these ESG factors, alongside the traditional aim of generating a suitable financial return.

Examples of how companies and investments can be sustainable are shown by the United Nation's 17 goals shown in Figure 1. This shows there are a variety of ways to be sustainable and the potential investment opportunities reflect the breadth of sustainability issues.

These include producing goods and services that contribute to reducing emissions (renewable energy) or to promoting a more efficient and less wasteful society (recycling). Conversely it could mean just being more efficient in how you run your business. Whichever approach is taken, innovation is at the heart of driving solutions to achieving a sustainable economy either by direct impact or in aiding company efficiency.



Ian Aylward
Head of Manager Selection



Dan Hunt
Investment Consultant

Figure 1: UN Sustainable Development Goals



Source: United Nations Sustainable Development Goals

Why is it important?

For companies, sustainability is no longer an option; investors are actively demanding a sustainable approach. If one does not behave in a sustainable manner, then the planet will eventually become an inhospitable place to live and society will become less cohesive. For investors, with the challenge comes opportunity. We need innovation to achieve the UN sustainable development goals.

The issue of sustainability will come into focus in the upcoming 2021 UN Climate Change Conference which is almost upon us. This is more commonly known as COP26 and will be held in Glasgow in November. It represents the first time since the historic so-called Paris Agreement, five years ago, when participants are expected to commit to greater ambitions. Countries are expected to state emission reduction targets but the sponsors are corporates. Importantly, the US is back at the table. At the end of the day, all parties – governments, corporates, investors and individuals – need to contribute. Regulators also recognise this and so there is a raft of legislation – both EU and UK generated – at various stages that is impacting upon investment firms with the aim of improving their behaviours but also in particular, the actions of the firms in which they invest.

What does sustainability look like in practice?

As we have alluded to above, an area of obvious focus for the sustainability agenda is in combating climate change. Here the need for reducing greenhouse gas emissions to a point of net zero is being increasingly quoted by companies and governments. As you can see from Figure 2, within greenhouse gas emissions there are a number of areas where opportunities to be more efficient and reduce greenhouse gases can be identified by businesses. This provides a broad investment opportunity set where skilled managers can identify companies providing solutions and also businesses adopting them, to become more efficient in how they operate. This helps make them more competitive and resilient to stringent regulation in areas such as emissions.

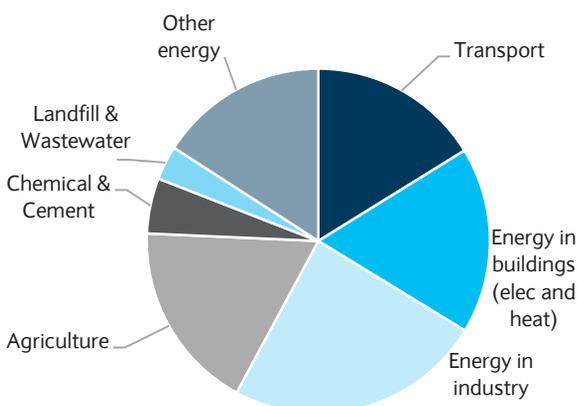
One of the fund managers we work closely with, both directly and within the Barclays Multi-Impact Growth Fund, is Janus Henderson. They have many examples of companies that span a broad range of sustainability themes within their Global Sustainability Fund. When considering investments, they ask: “Is the world a better place, because of this company?”

One of the companies they invest in is Nidec, who manufacture electric motors. Whilst not particularly exciting on the surface, their motors are highly efficient and can reduce power consumption by between 20%-30%. Considering the breadth of use for electric motors they produce (data centres, household appliances, robotics and electric vehicles to name a few), the emissions saved from the adoption of these motors is significant.

Another example is Schneider Electric, a world-leading electrical goods and automation company. Their products and services are designed to help their customers increase efficiency and thus reduce carbon intensity of operations. Their customers range from residential and commercial buildings, utility companies, manufacturers, datacentres and infrastructure.

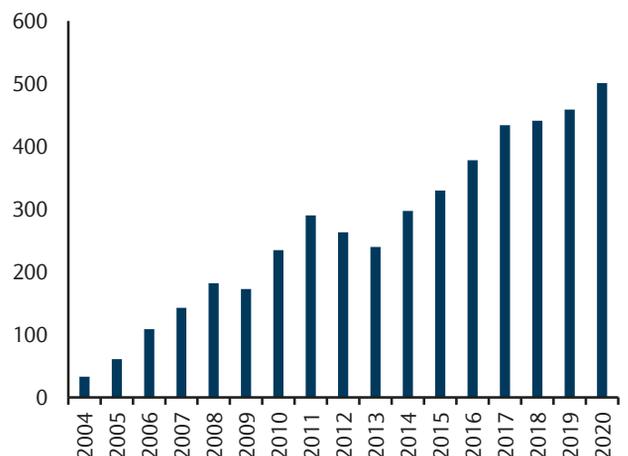
Beyond greenhouse gas emissions and efficiency, there are other aspects of sustainability which are of critical importance to achieve a sustainable future. One example is the need to recycle what we consume and promoting a circular economy. The circular economy essentially means reusing resources and waste products in producing new products for consumption. A well-known company aiming to achieve this is Adidas. Adidas is a leader in sustainable manufacturing and driving the circular

Figure 2: Global greenhouse gas emission by sector



Source: OurWorldInData.org, Barclays

Figure 3: Annual energy transition investment, \$bn



Source: BloombergNEF, Barclays

economy. They utilise plastics that would otherwise have ended up in oceans, in products and are producing 100% recyclable shoes.

Why invest in sustainability now?

The growing commitments being made by governments, corporate awareness on social responsibility and regulatory pressures, point to there being increasing disruption to previous practice. This provides opportunities for many of the industries as there is a powerful incentive to innovate and drive a more sustainable future.

A key difference when considering sustainable investments is that governments will look to provide a favourable regulatory environment to encourage this.

This provides the basis for a broad and exciting set of opportunities for investors spanning a vast array of sectors and geographies, comprised of those companies that can facilitate a more sustainable economy and companies adapting their businesses to be more sustainable through operating in a responsible manner.

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The doctor will see you and your data now

Winston Churchill reportedly said, “Never let a good crisis go to waste.” So, after the pandemic, one of the questions asked is: how will we use the lessons we have learned? And, in particular, in the healthcare sector.

Traditionally, investing in healthcare is considered to be a more defensive part of a portfolio. Much of the healthcare spending is from governments and so revenues are less sensitive to the economic cycle. But does the pandemic change this? Will we see more disruption and change in the sector and should this change our views?

We have seen the start of this investor demand for the sector. More healthcare companies went public during 2020 than they did in the past five years. According to data compiled by S&P Global Market Intelligence, a total of 263 healthcare companies went public during the year – up from 180 in 2019 and the highest number since at least 2015. Gross proceeds from IPO activity also more than doubled year-over-year to \$43.46 billion in 2020.



The healthcare sector has been an expanding sector. Before the pandemic, total health expenditures increased substantially over the past several decades (Figure 1) and has even outpaced the growth of the US economy (Figure 2). And there is a link to the increased expenditure; we can see how this has increased life expectancy (Figure 3) in different regions.

So, to consider if the healthcare sector is ripe for disruption and opportunity, consider how a visit to the bank manager and the doctor has changed over the last 30 years. Back then, if you wanted to borrow money, you visited your local branch manager to discuss a loan. But now, there are many options available both online and in the branch.

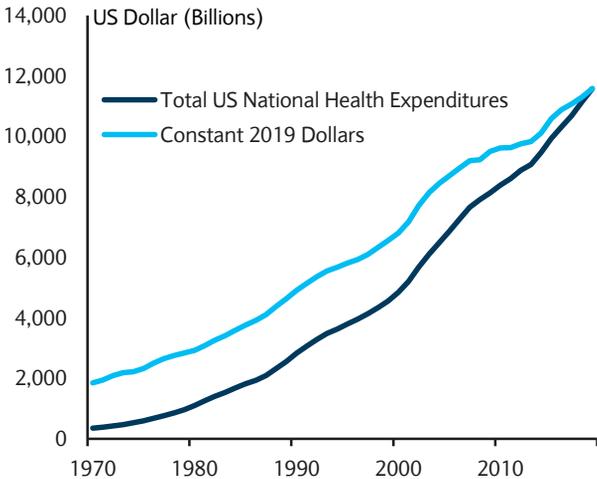
But this has not been the case in the health sector; we have always been very cautious about changes. But aside from the pandemic, there are pressures for the sector to change – an ageing population, technological advances in telehealth, and remote monitoring.

Telehealth has surged under Covid-19

One of most significant changes from the pandemic is how we have accessed healthcare.

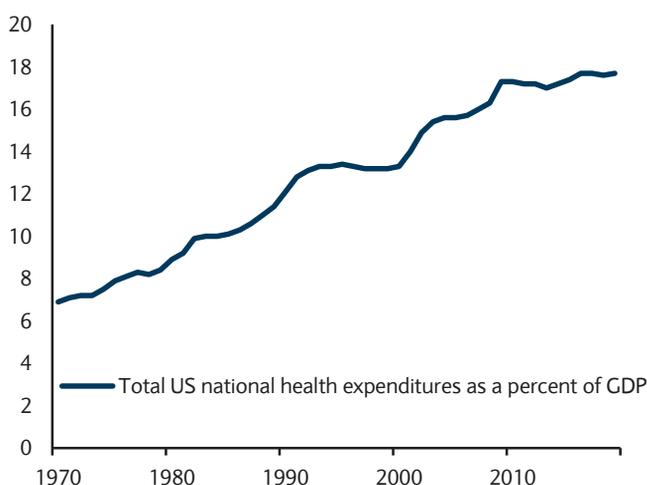
Telehealth, or the remote provision of healthcare, has boomed. McKinsey estimate¹ that utilisation has stabilised at levels 38x higher than before the pandemic and, in the US, this could be a quarter of a trillion-dollar industry.

Figure 1: Before the pandemic, total health expenditures increased substantially over the past several decades



Source: Health System Tracker

Figure 2: Health spending growth has outpaced growth of the US economy



Source: Health System Tracker

¹Telehealth: A quarter-trillion-dollar post-COVID-19 reality? McKinsey

In the UK, 'Attend Anywhere'² – a platform that supports video consultations in outpatient settings – was funded for all NHS trusts, increasing the ability to provide healthcare services remotely.

Some hospital trusts have also been trialling virtual wards to continue to support people outside of hospital. Virtual wards involve providing care virtually in a person's own home depending on their particular needs, coordinated by a team of healthcare professionals.

Many companies are seeing the possibilities of delivering these services. Again, consider the possibilities and innovation by comparing this to financial services. In the same way that you now automatically receive alerts regarding the balance of your account and transactions, in the future you may receive alerts based on data from your smart watch. 'The doctor will see you now' may pop up in an alert on your app in response to data from your device.

Technology meets healthcare

The healthcare opportunity has not gone unnoticed by the large technology firms. And it is not difficult to consider why many of the technology companies have large shares of their respective markets; the healthcare industry represents an attractive opportunity.

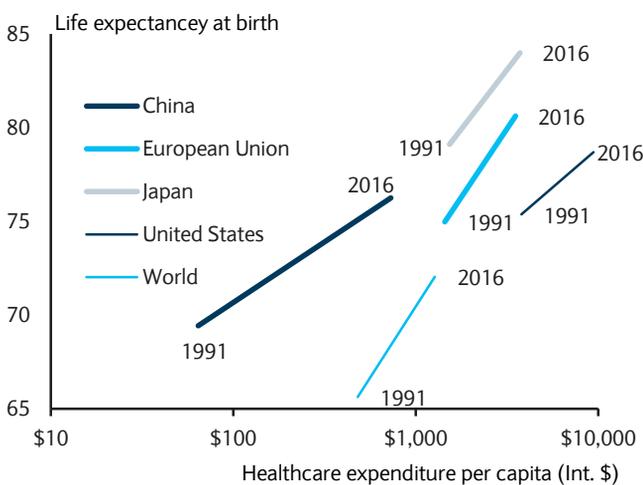
The Organisation for Economic Co-operation and Development (OECD) estimates global healthcare spending as a share of gross domestic product (GDP) is projected to rise to from 8.8% in 2015 to 10.8%³ in 2030 (Figure 4). IHS Markit estimate this to be worth \$8.3 trillion. Certainly large enough to provide a significant opportunity or diversified income stream for the big tech companies.

When Tim Cook, CEO of Apple, was asked about Apple he said: "Health will be its greatest contribution to mankind." Apple Healthcare is developing both hardware and software for medical professionals. A new feature of the Apple Watch is providing a virtual coach monitoring food intake, exercise, steps, and even telling you to move.

Google Cloud recently unveiled a healthcare data engine which can bring healthcare and life sciences data together from multiple sources. Their Google Fit app can analyse all your health data. There is also academic research to consider if search data from Google can predict severe epidemics through search data.⁴

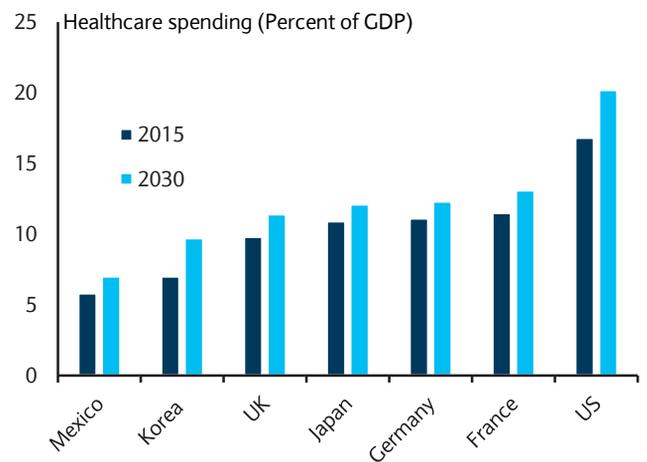
Amazon has also moved into the healthcare market with their purchase of the PillPack delivery service, which gave Amazon the licence to sell prescription drugs in 49 US states. They have also filed a patent⁵ to identify the physical and emotional characteristics of users, as a way of determining our physical or mental health, again considering the chatbot and tele-medicine theme.

Figure 3: How strong is the link between healthcare expenditure and life expectancy?



Source: Our World In Data

Figure 4: Healthcare spending outgrowing GDP globally



Source: OECD

²Nuffield trust impact of covid-19 on the use of digital technology

³OECD Health Working Paper No. 110, Health spending projections to 2030

⁴Samaras, L., García-Barriocanal, E. & Sicilia, MA. Comparing Social media and Google to detect and predict severe epidemics. *Sci Rep* 10, 4747 (2020)

⁵Google Patents: Voice-based determination of physical and emotional characteristics of users

Artificial Intelligence (AI)

One of the other reasons big technology firms are interested in healthcare is data. To understand the extent of the data Google funded a study in 2018, called ‘Scalable and accurate deep learning with electronic health records’. This study covered 216,000 health records. But when they looked at the records, there were 46 billion data points in total; each patient had 250k data points.

These are big numbers, but with computing power increasing, it becomes easier to analyse this information.

This is happening now. An example is the AI triage project⁶ which was implemented to analyse chest x-rays. During Covid, this was developed to allow doctors to identify lung abnormalities in patients.

Artificial Intelligence has demonstrated impressive results for analysing medical images to identify the potential of diseases. It is this ability to scan and monitor many records – to understand where the disease has occurred – and then identify those patients who may be more susceptible to, or have a high probability of contracting, that particular illness.

AI is moving healthcare away from the traditional route of cure, and towards prevention.

What are the challenges?

Certainly, we will be concerned about what happens with our health data, and there is a responsibility for governments to protect this but also to use the power of the information to make more informed judgements. An example is in India where they are creating National Health IDs.⁷ This will combine privacy with understanding data across the population. Each Health ID will be linked to a health data consent manager. This will be used to seek the patient’s consent and allow for a seamless flow of health information from personal health records.

What does this mean for investors?

There are a couple of observations here. Traditionally, healthcare has been considered a more defensive sector because these companies offer products or services that consumers will need to use at all times. They are less sensitive to the economic cycle.

But the definition of healthcare is expanding, and some of the companies benefiting from the increased focus on health may be in technology and other sectors of the market. It is not just healthcare but also well-being.

Secondly, for some investors, it is not just the usual names which are interesting. Think about some of the companies which will benefit from the disruption to the healthcare sector and innovation which will hopefully change all our lives for the better.

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None of the funds or companies mentioned in this article constitutes an investment recommendation. Past performance is not a guide to future performance.

All investments can still fall in value as well as rise and you might get back less than you invest. We don’t offer personal investment advice so if you’re unsure you should seek that independently. Funds are designed for the long term so you should only consider them if you can stay invested for at least five years. These are our current opinions but the future, as ever, is uncertain and outcomes may differ.

⁶MIT Technology review: Doctors are using AI to triage Covid-19 patients

⁷Government of India National Health Authority

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