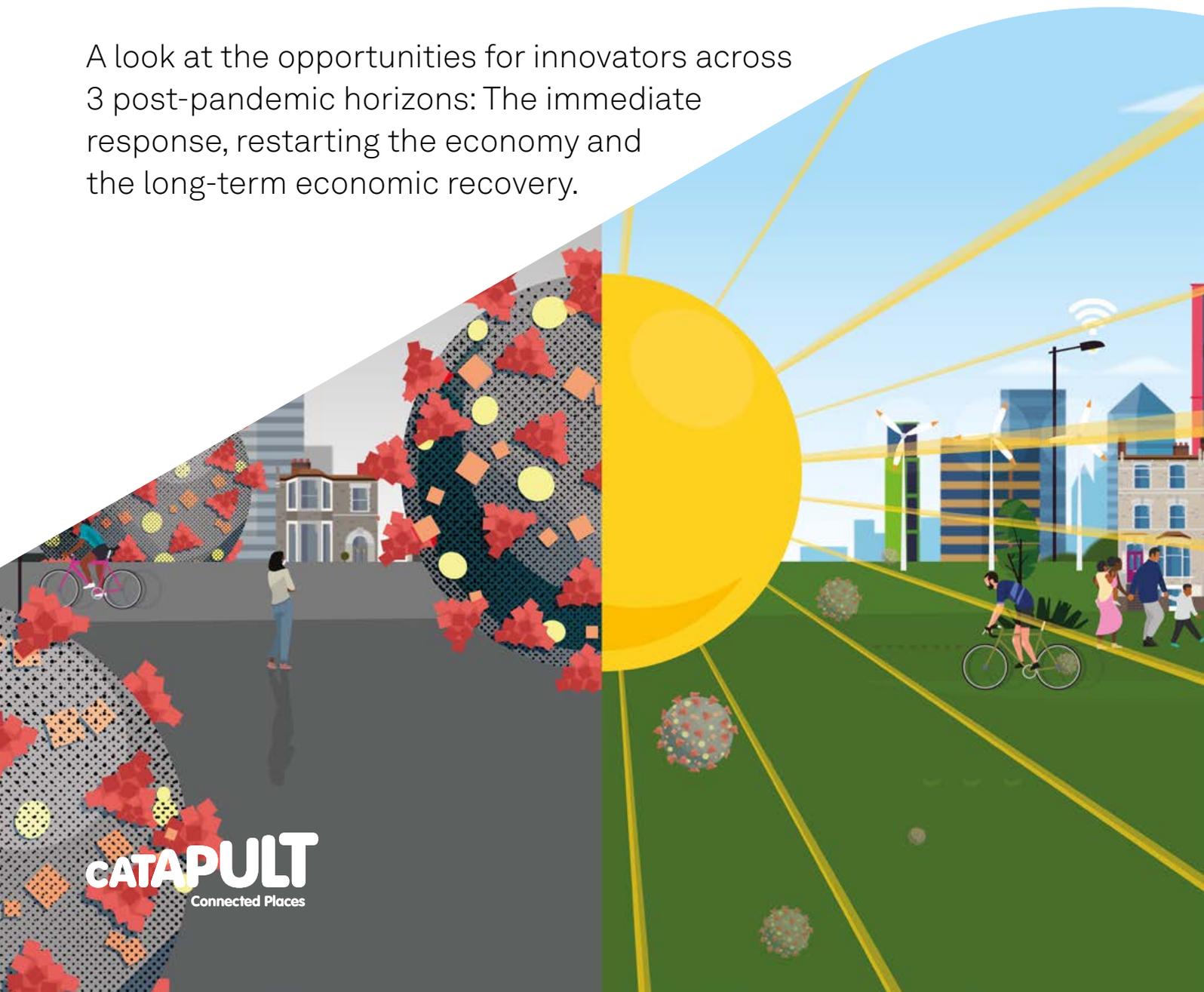
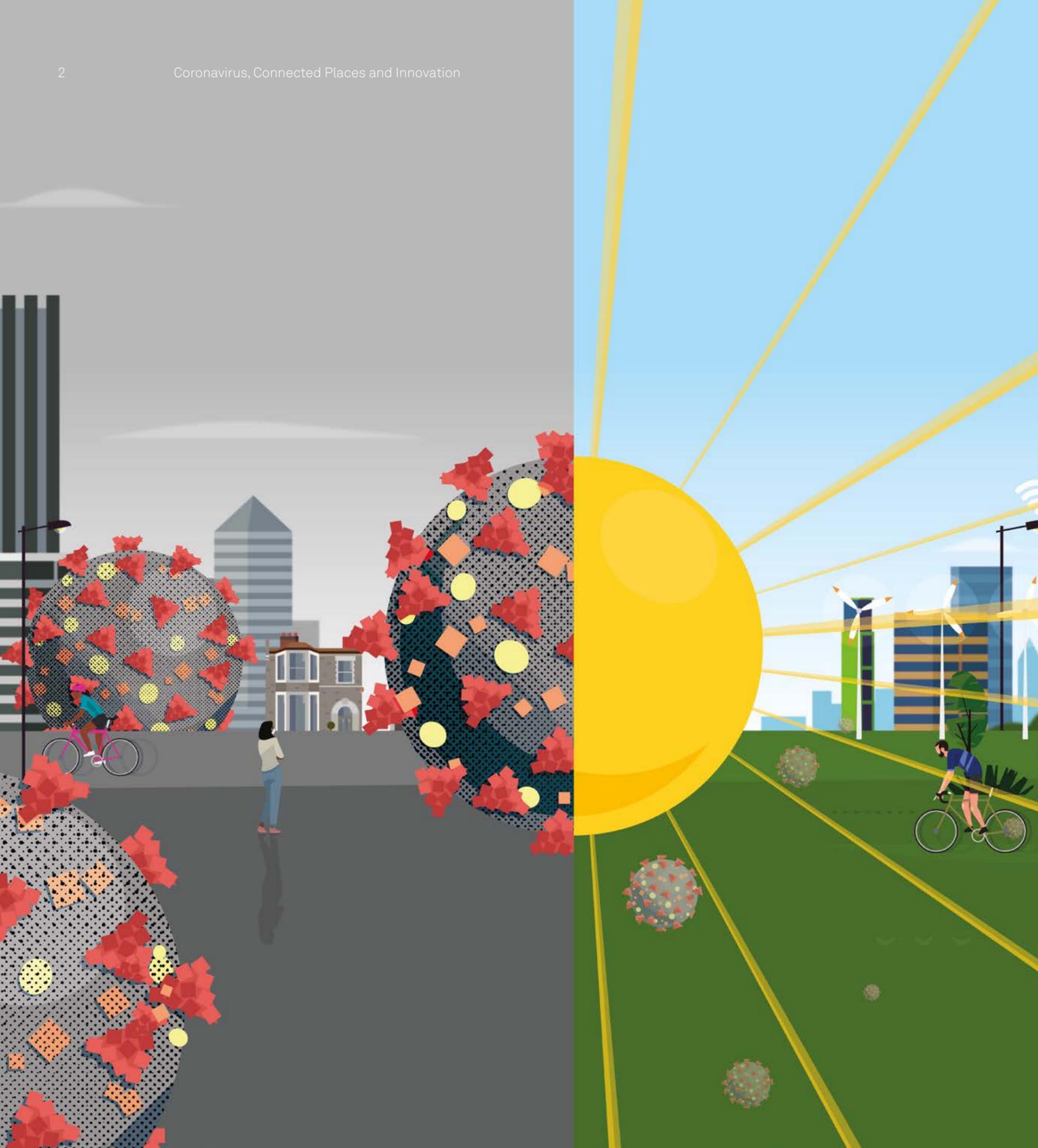


# Coronavirus, Connected Places and Innovation

A look at the opportunities for innovators across 3 post-pandemic horizons: The immediate response, restarting the economy and the long-term economic recovery.





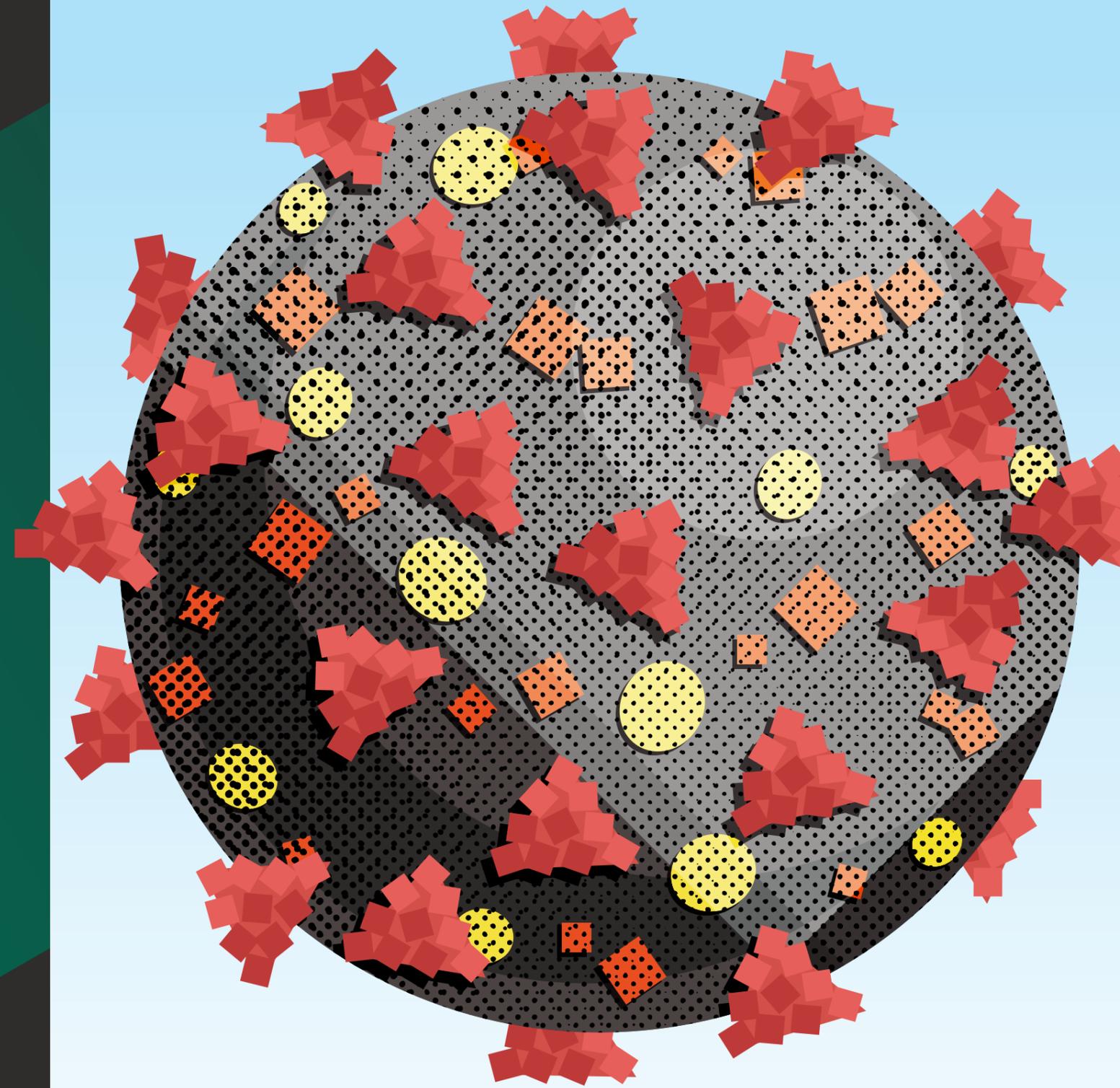
The coronavirus pandemic and COVID-19 have turned our world upside down. The pandemic has been a profound shock to society at a global, national and local level. Governments are struggling to find effective responses. Managing the pandemic and navigating our way to a recovery will require innovative thinking and innovative solutions. Most experts believe that the virus is now endemic in the population, and that the crisis will continue until at least 2021.

\*

# 76%

With **76% of the global population** living in urban areas, our towns and cities are where the future of global society and the economy will emerge. How will we adapt to endemic COVID-19? What are we learning about how to manage? What are our requirements for the future, and what innovation opportunities exist?

To control the spread of the virus, countries have closed borders, restricted travel, closed down education, entertainment and retail, and severely restricted all social activities. Supply chains have been disrupted and economies brought to a standstill. At least one third of the world's population has now experienced some form of lockdown.



# Coronavirus has transformed our world

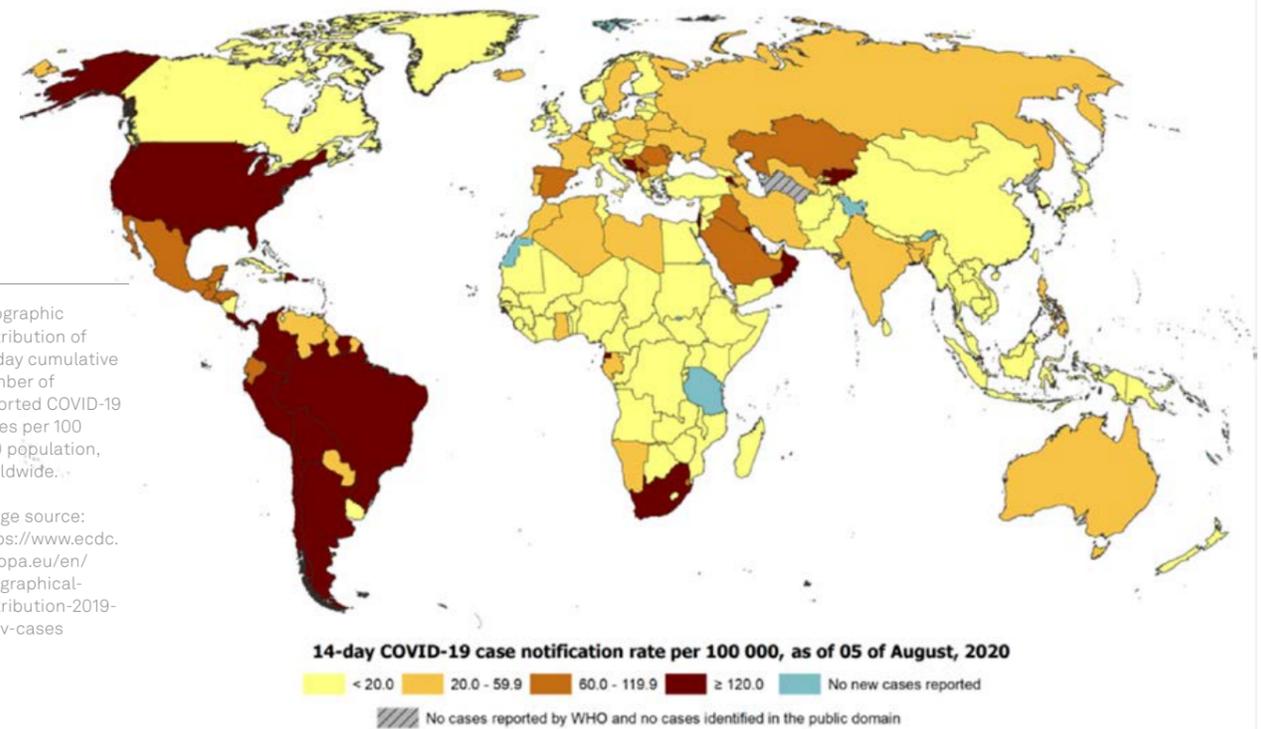


**From the first report to the WHO on 31st December 2019 of an unusual cluster of cases of viral pneumonia in Wuhan, the virus has travelled round the world and infections have exploded. By late January 2020 there were cases in Japan, Thailand and Europe. On 23rd January China instituted a total quarantine of Wuhan and nearby cities.**

To control the spread of the virus, countries have closed borders, restricted travel, closed down education, entertainment and retail, and severely restricted all social activities. Supply chains have been disrupted and economies brought to a standstill. At least **one third** of the world's population has now experienced some form of lockdown.

The effect of the pandemic has been dramatic. By the 28th August, the Johns Hopkins COVID-19 tracker reported **25 million cases of COVID-19 and 850,000 deaths**. The OECD estimates that the lockdowns have immediately cut the **output of the G7** countries by 20%-30%, and that **GDP could fall** in 2020 by 7%-14% even with a recovery.

**The effect of the pandemic has been dramatic. There have been 15 million cases of COVID-19 and 600,000 deaths.**



The boundaries and names shown on this map do not imply official endorsement or acceptance by the European Union.

Date of production: 05/08/2020

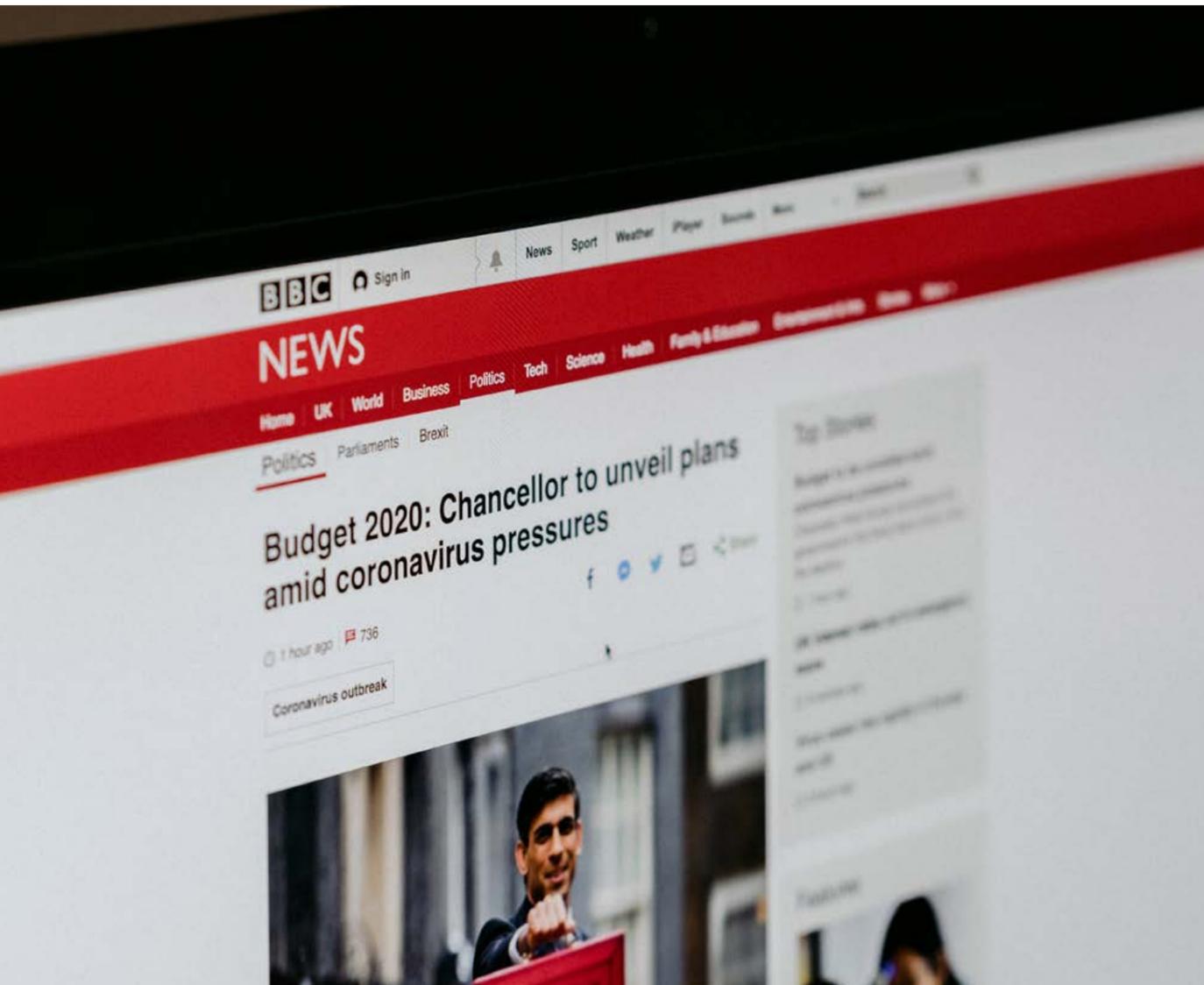


Image credit:  
Photo by Annie  
Spratt on Unsplash

Faced with the deepest recession for a century, governments are expanding public spending to protect their economies from collapse. **Public debt** across the developed economies will increase. Ranging from 6% - 33% of GDP by 2021. The UK has already committed an additional £190bn in spending.

**Unemployment** in the OECD countries has already rocketed back to 8.5%, the same as at the peak of the global financial crisis, and could go higher.

The challenge for society is to manage the pandemic to minimise social and economic damage, and to map out a path to recovery. Both will require new ideas. There will be scope for innovation to tackle the largest and most immediate crisis this century.

# Three horizons for action

We can think about future actions in three time horizons:

- Horizon 1 - the immediate emergency response to the pandemic.
- Horizon 2 - the early steps in restarting the economy. What happens in the gap between tight lockdown and having a long-term solution? As we try to get the economy and society working again, what we need to do?
- Horizon 3 - what are the long-term opportunities for the economic recovery? What must we change to conquer coronavirus or adapt to it?

Each horizon has its own lessons, and its own opportunities for innovation.



1. Response



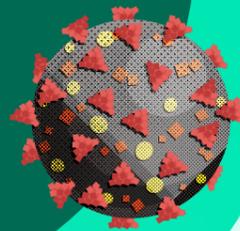
2. Restart



3. Recover

# Horizon 1 – the immediate response

# 1



## What have been the immediate effects and responses to the pandemic?

**As lockdowns and travel controls were brought in to slow the spread of the virus, there was a sudden breakdown in supply chains. People responded by panic-buying, stripping supermarket shelves of staples. However, after the initial panic, the supply chain responded. There were no absolute shortages of most goods, they were just in the wrong place to meet demand.**

Supply chains have proved more robust than was feared, and we have kept people supplied with basic needs. Food is available and we have not run out of most medicines. A rapid increase in online shopping has kept goods moving. In the UK, online orders and delivery have doubled since the beginning of the outbreak.

Personal Protective Equipment (PPE) was in short supply, and there was a scramble to find alternative sources. Not every country had adequate stocks, and not every country could move them to where they were needed quickly enough. Economies based on just-in-time manufacturing and delivery found themselves unable to respond quickly enough in a crisis.

But again, ingenuity found solutions. Large companies like **Airbus** could convert some of their production capacity for PPE and distributed manufacturing and 3D printers have proved they can contribute agility and flexibility to disaster response. Teams of volunteers have been sewing protective masks, and social media has shared instructions for DIY protection.

Airbus manufacturing sites in Spain have joined forces to produce visor frames using 3D printing, providing healthcare workers with PPE equipment in the coronavirus pandemic.

Image source: <https://www.pesmedia.com/coronavirusairbus-additivemanufacturing-070420/>



One of the most remarkable responses to the pandemic is a concerted global effort to find a vaccine. As of 28th August, the World Health Organisation (WHO) reports **33 candidate vaccines** in clinical trials, and another 143 in preclinical evaluation. Collaboration between universities, the private sector, governments and public agencies is driving the research forward at an unprecedented rate. The scientists and the medical profession are proving that under pressure they can move extremely quickly. Going through the multiple stages of development and testing in months, not years. It has been called the **Manhattan Project** of our times.

The lockdown and social distancing requirements have closed places of work. This has led to a dramatic increase in the number of people working from home; about half the UK workforce in June. Many more people are using online collaboration tools like videoconferencing. We have been on a rapid experimental journey as we learned how to make virtual meetings effective, and people are surprised at how well they work.

There are gains and losses in these new ways of working. People seem to be generally more productive working from home, but losing social contact can inhibit creativity and problem-solving.

The National Health Service has switched to online consultations to control infection risk and maintain social distancing. **Telehealth** has at last broken through many of the barriers to mainstream use. The British Medical Association reports that **90% of General Practitioners** would like to see online consultations continue once the pandemic is over.

Image credit:  
Photo by Red Dot  
on Unsplash



Perhaps the most visible marker of the changes happening in Horizon 1 is empty streets. **Pedestrians and cyclists** have been reclaiming roads suddenly cleared of cars, vans and trucks, and pop-up cycle paths have been appearing everywhere. UK cities have reported a 75% increase in cycling. In cities all over the world, people have noticed the improvement in air quality.

Despite problems, society and economies have responded remarkably well to the pandemic challenges. We have delivered solutions at a pace considered impossible before coronavirus. The solutions may be partial, flaky, and held together with duct-tape, but they have been delivered. The pandemic has shown that many of the barriers to innovation are “molehills masquerading as mountains”. If the need is sufficient, we can overcome the barriers.

But the speed and flexibility of the responses comes at a price. It is like an athlete going deep into the red, accumulating oxygen debt at a pace that is unsustainable. We are stretching many critical systems and services beyond their capacity, and lactic acid is building up in society’s muscles. Eventually we will be unable to go on.

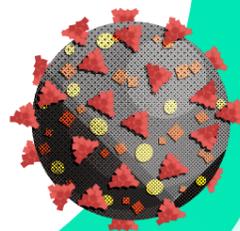
We will need to reorganise to recover, and that means fresh approaches and new thinking.

Perhaps the most visible marker of the changes happening in Horizon 1 is empty streets. Pedestrians and cyclists have been reclaiming roads suddenly cleared of cars, vans and trucks, and pop-up cycle paths have been appearing everywhere. **UK cities have reported a 75% increase in cycling, whilst TfL experienced a fall to just 5% ridership during the height of lockdown.\*** In cities all over the world, people have noticed the improvement in air quality.

\* <https://tfl.gov.uk/info-for/media/press-releases/2020/may/tfl-announces-plan-to-help-london-travel-safely-and-sustainably>

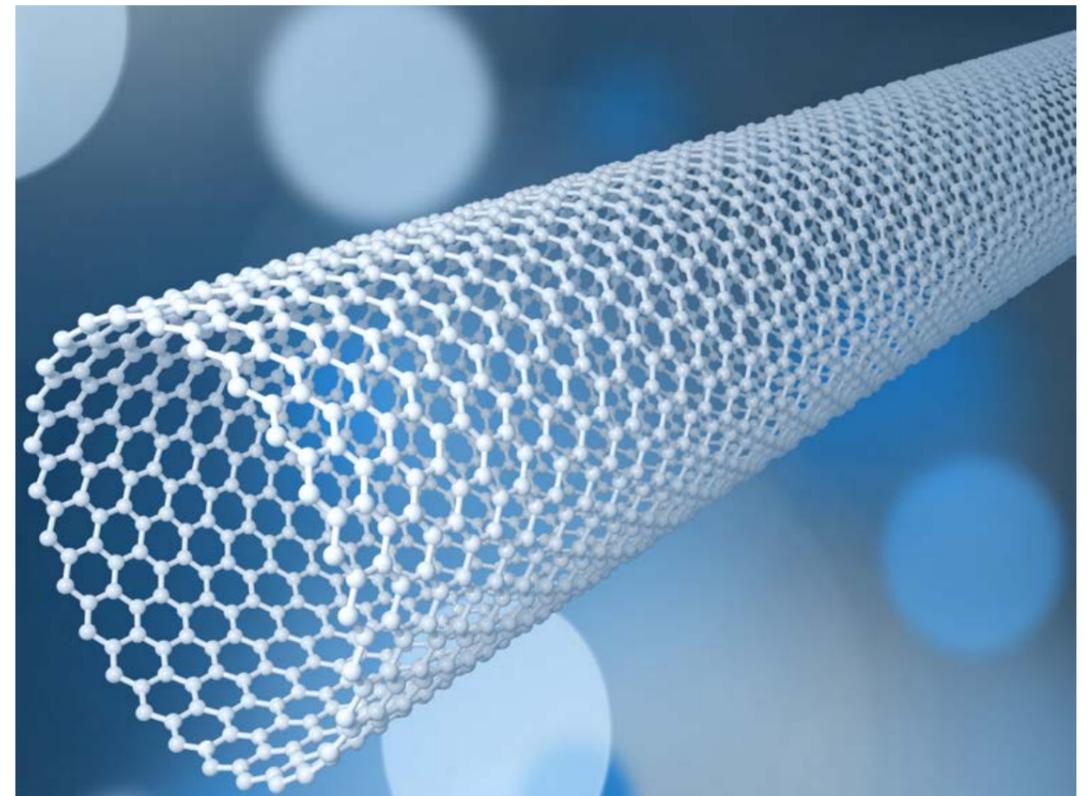
# Horizon 2 – restarting the economy

# 2



Diagnostic tests for COVID-19 could soon include carbon nanotubes.

Image credit: Shutterstock



**There is an intermediate stage between immediate crisis management and a long-term solution to the pandemic. This is Horizon 2, the early and tentative steps in easing the lockdown and returning to normality before we have adapted to an endemic virus.**

The key feature of this phase is that we are working with our existing infrastructure. There is not enough time to make substantial changes, particularly to physical infrastructure, and we must work out how to use what we have more effectively.

We must have reliable and universal test, track and trace systems to remove restrictions safely. The best results so far are in countries where there are fewer concerns about privacy, and where governments can throw significant human resources at the problem. Countries like **Korea**, with recent experience of SARS, have been the most successful.

The testing regime must be able to handle very large numbers of tests and be accurate and fast. Swab tests have proved difficult to scale up and centralised testing has been slow. Biomedical scientists are working flat out to develop tests that can be reliably self-administered, and **at least a dozen innovative approaches** are in development. Everything from pregnancy testing-like dipsticks for saliva to masks with built-in coronavirus sensing.

Besides the work on vaccines, there are thousands of trials underway looking at **treatments and preventative measures** for COVID-19. Researchers are trawling through libraries of existing drugs and treatments, looking for antivirals and immune modulators that might reduce the risk of infection or the severity of the disease. Anything that makes COVID-19 less dangerous, or quicker to recover from, reduces pressure on health systems, allows a quicker response to local clusters, and safe easing of restrictions. These tests are not only identifying effective therapies but eliminating those which do not work like hydroxychloroquine.

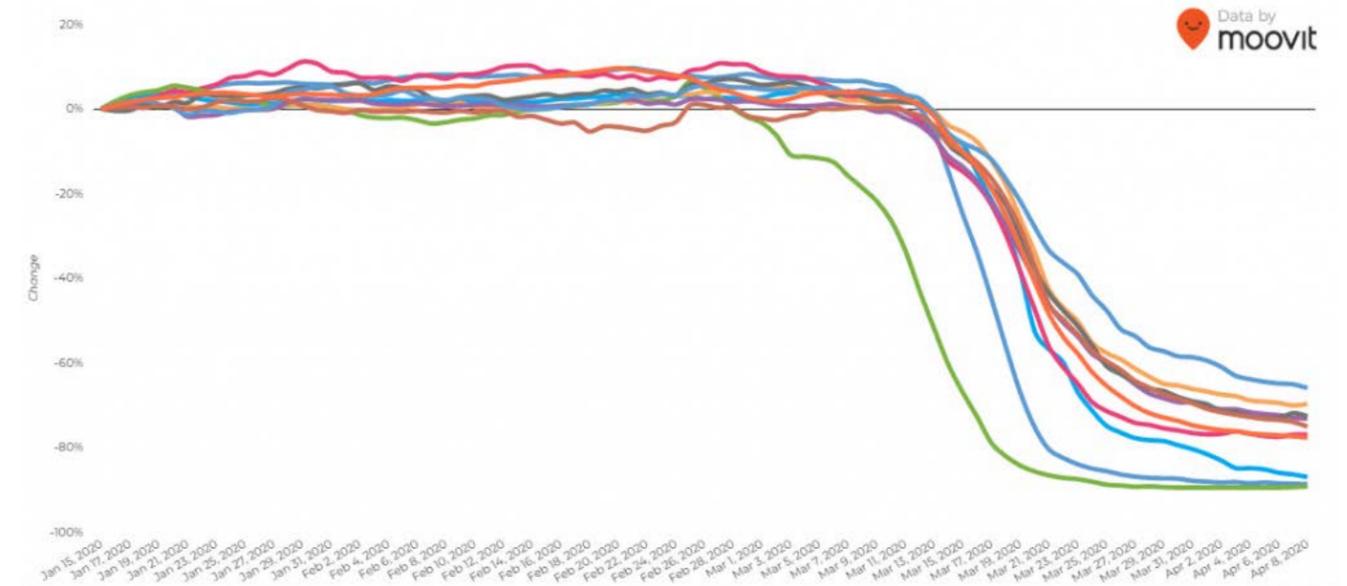
## Working from home also raises questions about how a business discharges its responsibility to provide a safe working environment? How do we do remote ergonomics and health and safety? Is there an opportunity for a one-stop service to help new home-workers create a practical and safe working environment at home?

With many more people working from home, cyber security will be a huge issue. Millions of people who been previously office based will need excellent broadband access and speeds, secure cloud operations and secure access. Sectors such as finance have traditionally relied on isolated networks and control of physical assets to manage risks. Now they are dealing with a distributed network. Workers may be **unfamiliar with risks** such as public Wi-Fi networks, working in public spaces, loss of equipment or credentials, using personal devices which may not be secure, or malware and phishing attacks. What products and services exist to help businesses? And what can be done to support individual workers, the most likely security weakness?

Working from home also raises questions about how a business discharges its responsibility to provide a safe working environment? How do we do remote ergonomics and health and safety? Is there an opportunity for a one-stop service to help new home-workers create a practical and safe working environment at home?

The pandemic has badly affected transport systems, particularly public transport. Passenger numbers for public transport in cities around the world **dropped by 70% - 90%**. As we emerge from the lockdown, that raises two questions; how can we prevent a surge in the use of private cars, and how can we make public transport economically viable? **The Government asked Transport for London to keep services running throughout the lockdown to support essential workers. But reduced utilisation through social distancing and fewer commuters means it has been losing £150 million a week. Is this sustainable indefinitely?**

In the short-term, digital scheduling, booking and occupation systems can make best use of the reduced capacity. Integration with test, track and trace systems can reduce the risk of infection. But if we stay in this transition phase for a long time, how will we cope with the additional costs of social distancing and disinfection, and how will we make travellers feel safe enough to return?



Evolution of public transport ridership in select cities around the world between January and April 2020.

Source: Moovit  
<https://blogs.worldbank.org/transport/protecting-public-transport-coronavirus-and-financial-collapse>

Reinforcing the existing trend towards active travel and micro-mobility can bridge part of the gap. The recent approval of **rental e-scooter trials** in the UK is one attempt to increase active travel and reduce the use of internal combustion engines. It may help to balance the reduced public transport capacity.

To make active travel work, we need integrated travel systems. Information Systems that enable the traveller to work out the route that suits them best. Scheduling systems that make sure that different legs of the journey connect. 'One-pass' tickets that cover flexible and multimodal journeys. Integrated travel systems are possible, but they are not yet routine.

Different countries are thinking in different ways, and different cities have different requirements and environments. In some cities we are seeing the return of the private automobile. In others, such as **Paris and Milan**, an alternative vision of how transport will work in the future.

To avoid the risk of infection, people are looking at ways of moving to a 'no-touch/no-hands' approach. Systems like **Ultraleap** use ultrasound fields, which sense hand gestures and the position of a user's fingers. This can be used for contactless access control, PINs and the operation of information kiosks, ticket machines etc. Face recognition is being used more widely for access control, and we are already seeing thermal cameras in public spaces and building entrances to monitor for symptoms of COVID-19.



Image credit:  
Photo by CoWomen  
on Unsplash

**Co-working spaces** have suffered during the pandemic. With big open-plan areas and a large transient population of users, they have proved good places for viral transmission. That has been bad news for a lot of suppliers, but if they can survive, they could be long-term winners. With the dramatic increase in working from home, many companies are abandoning or reducing permanent offices and thinking about how to allow home-working teams to get together for regular meetings.

As we develop socially distance offices, will we return to the 'cube farm' to provide separation protection? Or will there be other innovative solutions to create safe workspaces? Or will there be other innovative solutions to create safe workspaces? New designs and layouts that can manage infection risk, like the **6-Foot Office**.

We can tweak some things in our current office stock for safe working. No hands access and control, one-way routes, desk spacing and screens. Other changes are much more complicated because they are part of the building structure. We cannot simply change ventilation systems to prevent spread of droplets and aerosols. It is not just a matter of better filters; it is a major, potentially structural upgrade.

What we are seeing in Horizon 2 is an acceleration of trends already visible:

- more working from home and less formal office space
- more online shopping and less business for the High Street
- more contactless payments and less cash
- more concern about air quality and more interest in active travel - walking and cycling

“We started the 6 Feet Office Project with the ambition to get the world safer and back to work sooner. We believe that a safe and healthy workplace is at the centre of what’s next in business.”

Jeroen Lokerse

Head of The Netherlands, Cushman & Wakefield

# Horizon 3 – the longer term economic recovery



# 3

**There are two distinct possible futures for COVID-19. In one, we solve the problem. We find a vaccine, achieve herd immunity, or the virus just fizzles out. In the other, COVID-19 is endemic, and we must learn to live with it. We develop better treatments and perhaps need annual vaccinations. We are forced to restructure society and our economy to prevent or manage outbreaks.**

We all hope for a solution, but having to live with coronavirus long-term is a real possibility.

Which of the changes we are already seeing look to be permanent, and what are the implications?

The switch to online shopping has been dramatic and fast. Taking an existing trend and speeding it up. What does that mean for our High Streets? If many shops, particularly the large general-purpose shops, vanish forever, what can we do with the space? How can we use the buildings? One suggestion is that High Streets evolve from pure retail spaces to a much more mixed economy. Council offices, lawyers, doctors and dentists were once commonplace on the High Street. Could we see these 'must visit' locations return with more residential accommodation in the mix? For many of our towns and cities, High Streets have been the focus of the community. How will that develop?

Even if many businesses continue to use centralised offices, the trend to working from home will persist. Many companies, particularly those with many knowledge workers, foresee much more remote and home-working than they had planned. There is **push-back** to that from both companies and workers. Social interaction between workers is reduced, and that can inhibit social cohesion, teamworking and the capacity for creativity and problem-solving. It can also be psychologically very difficult for many people. Despite the problems, the attraction of a reduced commute, and the savings on expensive central office space, mean that a higher level of remote working will be with us for the foreseeable future.

How do we make that work for employers and employees?

Many people have commented on the trend towards 'shoebox' homes in the UK. We have seen a 20% decline in the average size of new homes from the 1970s to today. How do we fit safe, comfortable, and acceptable working spaces into modern homes? How do people separate work life and home life? We already have a problem with many workers being 'on call' 24 hours a day. We need new tools, new solutions and new business models.

Even with more of us working from home, there will still be larger shared buildings. Offices, factories and warehouses, leisure and entertainment centres etc. if the coronavirus is still around, these will need major changes to ventilation and other systems to avoid infection. How will we change the design of new buildings? How we retrofit existing buildings?

One way to maintain social distancing is to need fewer people for an activity. **Robotics and automation** are already a key part of the evolution of manufacturing. Future factories could well employ fewer people, and they could be more spaced out. It is obvious that the manufacturing industry can automate, but can that be true of the service industries?



Photo by Franck V. on Unsplash

With a stagnant and ageing population, **Japan** has been working for a long time on the use of robots in personal service. They are particularly concerned about supporting older people and have been developing robot nurses, robot assistants and robot pets to provide companionship.

PWC published a report in 2018 looking at the **impact of robots and automation** on the UK economy. They saw three waves of change. First, further automation of simple tasks in the early 2020s. In the late 2020s, a second wave augmenting human capability with clerical and decision support and robots for manual tasks. And then in the mid-2030s autonomous systems with large-scale automation of physical labour and intelligent problem-solving in the real world. One third of current jobs could disappear through automation by the mid-2030s, with the biggest impact on those with lower educational attainment.

The pandemic could accelerate this trend and raises tough questions about how we handle lifetime learning, and the expectation that most of the population need paid work. Perhaps this will trigger more experiments with a Universal Basic Income.

A final trend for long-term change is the improved air quality that citizens have experienced during the lockdown. In one estimate we have seen a 40% reduction in NO<sub>2</sub> pollution and a 10% reduction in particulate pollution in Europe. That has led to 6000 fewer new cases of asthma in children, 1900 avoided emergency hospital visits and 600 fewer preterm births. Once the public has experienced this improvement, will they accept a return to the old situation?

If not, we can expect to see political pressure for a very rapid transformation of all forms of transport to ultra-low pollution, if not zero carbon. The existing trend towards electric vehicles could dramatically speed up. We may see alternative last mile delivery systems, like **electric cargo bikes**, taking over from the huge numbers of small 'white vans' moving packages around our towns and cities.

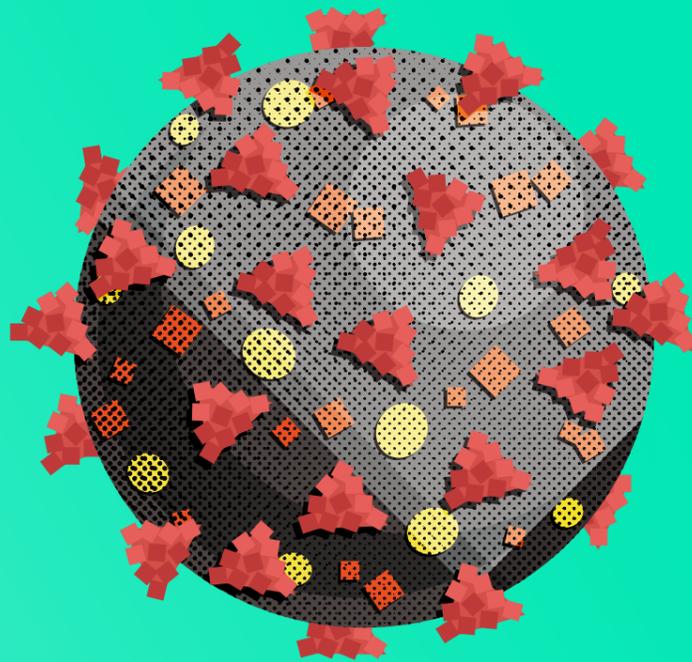
Our cities may reconfigure over time to reduce emissions and increase quality of life. **The '15-minute cities'** movement is working to create neighbourhoods in which you can access all of your basic day-to-day needs within a 15 minute walk of your home. Major cities such as Melbourne, Ottawa, Detroit and Paris are looking at the benefits, and it was a key part of **Anne Hidalgo's** campaign for another term as Mayor of Paris.

These are radical changes, and it will be some time before we know whether they can be realised. Already, the window of opportunity to sustain the changes that have happened is closing. The momentum behind cycling and other forms of active travel and micro-mobility could fade as governments push to get their economies working again.

Photo by Murillo de Paula on Unsplash



# Where does this leave us?



There are multiple innovation opportunities in each time horizon:

1

## 1. Horizon 1 – Response

Horizon 1 is about the emergency deployment of existing solutions. The innovation will be in clever ways of combining solutions and finding new applications.

2

## 2. Horizon 2 – Restart

In Horizon 2 we are stuck with the infrastructure we have now. The challenge is to make best use of it. That suggests digital innovation in the foreground as we work out how to reconfigure our assets. Working out how to live with an endemic virus will drive large amounts of biomedical research. Searching for vaccines, treatments and preventative therapies.

3

## 3. Horizon 3 – Recovery

In Horizon 3 there are divergent scenarios depending on whether or not we get control of the virus. In both cases we are likely to see investment in infrastructure to make it suitable for new needs. There is also likely to be strong growth in automation.

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For more on innovation in the age of COVID-19 and the market opportunities that this pandemic has created or accelerated, please take a look at our **Post-Pandemic Places Innovation Brief**, <https://cp.catapult.org.uk/case-studies/innovation-brief-post-pandemic-places/>

## About Connected Places Catapult

Connected Places Catapult harnesses UK innovation to accelerate the adoption of new ideas and technologies to help create connected places for a more productive and greener future. We operate at the intersection between public and private sectors and between local government and transport authorities.

Our focus is on connecting businesses to cutting-edge research and technologies in order to spark new possibilities and accelerate the creation of innovative products and services which will deliver improvements to the way we live, work, play and travel – and grow the UK economy in the process.

For more information please visit [cp.catapult.org.uk](https://cp.catapult.org.uk)

This report was written by Richard Miller, Associate Director for Connected Places Catapult.

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