FOR THOUGHT

Build better

What can be learned from the COVID-19 pandemic to construct a resilient, innovative and prosperous future for all.

BRITISH SCIENCE ASSOCIATION

A report for leaders in business, science & research, policy and civil society

About *For Thought*

***For Thought* (formerly the Huxley Summit) is a unique thought-leadership programme from the British Science Association and partners. It offers leaders from business, policy, science and civil society a forum in which to discuss the key scientific and social challenges facing the world in the 21st century.**

To tackle these challenges – whether they are pandemics, climate change, cyber security, the future of cities or food security – requires partnerships between science and the rest of society. *For Thought* brings together diverse voices to address these complex issues and turn discussion into action.

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About this report

This report is based on conversations, evidence and ideas discussed at a series of *For Thought* roundtables and events for leaders in business, science & research, policy and civil society, held during February and March 2021. These discussions took the COVID-19 pandemic as a starting point to explore how science, research, innovation and technology could be used to deliver a more equitable, sustainable and prosperous future for people and the planet.

The recommendations span the three main themes of our discussions (resilience, innovation and environmental prosperity). They take the form of some immediate Calls to Action and some more medium-term Calls *For Thought*, which require focussed attention from leaders.

The statements and recommendations are the views of the British Science Association and reflections on what we have heard in the preceding discussions, and do not represent those of the participants or sponsors of For Thought unless explicitly stated.

Roundtables and events in the *For Thought* series

- How can leaders in business, science and government rebuild societal trust to create resilient societies? (Roundtable, 10 February 2021)
- How do we stimulate growth in technologies that don't yet really exist? (Roundtable, 15 February 2021)
- What can governments, scientists and industry do to better prepare for and respond to future shocks? (Roundtable, 23 February 2021)
- Innovation in a crisis: what can we learn from the COVID-19 pandemic? (Roundtable, 25 February 2021)
- Getting to zero (Roundtable, 2 March 2021)
- Changing consumer behaviour in a changing climate (Roundtable, 1 March 2021)
- Building resilience (Event, 10 March 2021)
- Innovating for the future (Event, 17 March 2021)
- Creating environmental prosperity (Event, 24 March 2021)

Foreword

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The past year has been defined by a single crisis: the COVID-19 pandemic. It has been a shock not only to individuals who have experienced illness, the loss of loved ones and the impact on their jobs and livelihoods, but to governments, businesses and science organisations who have had to adjust and adapt under pressure as they lead the global response.

Back in November 2019, the British Science Association brought together 350 leaders in business, science and policy to discuss "Collaboration in an uncertain world: The role of science and innovation in addressing complex challenges". Three months later the concept of collaboration in an uncertain world was tested to breaking point as individuals and societies were faced with some of the most complex societal and scientific challenges since the Spanish Flu and the Second World War.

At the time, speakers discussed the challenges of climate change, tech regulation and the role of innovation. These challenges have not receded; in fact they have intensified and in many cases been amplified by the current crisis. Yet, tackling the pandemic and its wide-reaching impacts has become a dominant focus of governments, businesses, and scientists alike. Now, we need to urgently address those challenges and ensure that we are better prepared for future crises.

Early in the COVID-19 pandemic, there was a sense that we were all in this together. Yet as it has unfolded, the pandemic has shown the opposite to be true; it has demonstrated how interconnected we are regardless of wealth or social standing while exposing the underlying inequalities at the heart of our society.

We have all experienced the pandemic in very different ways depending on the reserves and resources we had access to at the start.

There is emerging evidence of the economic and social impact of the pandemic on young people which suggests that those aged 12-24 years are one of the worst-affected groups, particularly in terms of the labour market and mental health outcomes. Moreover, young people from the poorest households, or from the UK's ethnic minorities, are up to twice as likely to have lost their job. Growing intergenerational inequality must be addressed in order to build trust in future decision-making.

The increased public awareness of our codependency and these glaring inequalities – as well as the demonstrable power of science to improve all our lives – offers possibilities, too. We have a once-in-a-generation opportunity to tackle inequality, reappraise how we value our key workers, and consider how we organise our food system, decision-making processes and the way we prepare for future crises.

The worlds of business, policy and science have the power to bring about change. But leaders must view the large societal shifts needed from a whole systems perspective. The challenge for leaders in business, science and policy, however, is in how they can create long-term value when politicians are elected for five-year terms, most research grants run for three to five years and the average tenure for a Chief Executive at the top 2,500 global companies is five years.

We can only build better if we work together across industries, sectors and states. To that end, in early 2021 we facilitated discussions between some of the most influential people in the UK and beyond. The conversations and ideas discussed during the series of roundtable discussions and events, and outlined in this report, provide a path towards a more equitable, prosperous and resilient future for all.

Executive summary

Between February and March 2021, ***For Thought*** convened six online roundtable discussions and a series of three online events for leaders in business, science and policy.

These conversations addressed some of the most complex and pressing issues we face today, ranging from what we can learn from the pandemic to how we use that knowledge as a springboard to innovate and build a fairer, more equitable society. The overall aim of the events and discussions was to consider three key questions: "How can we build resilience?"; "How can we innovate for the future?"; and "How can we create environmental prosperity?"

Across the events, a number of consistent themes emerged. Our participants – whether from science, government or business – all honed in on a handful of powerful topics. These form the basis of a blueprint that will help leaders to learn from the COVID-19 pandemic to build a resilient, innovative and prosperous future for all.

To do this, we must build better...

TRUST

Perhaps most critical of the cross-cutting issues that came up again and again is trust. Leaders in business, science and policy, in governments and in corporations are trusted to different degrees by the public. Our participants considered what makes people trustworthy: those political leaders perceived to have managed the impact of the pandemic well – such as New Zealand Prime Minister Jacinda Ardern – have been "consistent and calm", transparent, authentic. How do we build trust, create a future generation of trustworthy leaders and trusted, purpose-led organisations?

SYSTEMS THINKING

The need for whole systems innovation and leadership came up repeatedly during the discussions, as did the need to adopt a multi-dimensional approach, and shift focus from benefits of short-term actions to investing in sustainable, long-term solutions. To achieve this complex structural rebalancing requires trustworthy leadership (within business, policy, science and civil society) if we are to successfully tackle future crises.

RESILIENCE

The need to improve our preparedness for recurring disasters – through both

infrastructure and societal resilience – was also an important theme. We are facing an onslaught of future crises: loss of biodiversity and ecosystem collapse; impacts of climate change; cyber security; and new pandemics. In addition to mitigating risks, we must invest in adapting our systems and practices and the critical infrastructure that society relies on.

RESPONSIBILITY

Part of the national conversation around how we innovate and prepare for the future rests on who has responsibility. The issue of who does what in society emerged in a few of the discussions, including the idea of enabling individual responsibility and the need for greater regional distribution of investment and resources.

COLLABORATION

There is a need for greater collaboration between public and private sectors, and across borders and industries too. This will require data sharing, and trusted evidence and insight to formulate an action plan. A global crisis requires a global approach and as such, how we harness technology and data sharing is of the essence.

EQUALITY

Within all of these discussions, our speakers identified inequality as a considerable threat both to our ability to fully and effectively innovate, and to tackle future crises successfully. Structural inequalities in the UK were a feature of all roundtable discussions and events; the sense that we need to rebuild a society that reduces and eliminates poverty, and addresses health and social inequalities, came through strongly from all speakers.

The current pandemic offers an opportunity to build better. Citizens are expecting a fairer, more sustainable society, and largely accept that things cannot go back to how they were before the pandemic.

To fully embrace this once-in-a-generation opportunity for positive change and to equip ourselves with the necessary tools to successfully tackle future crises will require all sectors of society to work together towards a common cause.

The key recommendations that follow set out how leaders in government, business and science can take action now to address some of these challenges. Meanwhile, questions that call for thought from leaders over the medium-term are outlined at the end of each chapter.

Where possible, we have sought to identify initiatives and examples - from relevant areas of research, innovation, policy and business practice - to help make action against the recommendations more relatable. We hope that this will stimulate *For Thought* participants, partners and other stakeholders to provide further examples over the coming months.

Key recommendations

The *For Thought* discussions have tackled some of the most complex and pressing issues facing the UK and the world today: how to build a resilient and sustainable future, and the role of science, research and innovation in delivering that aim.

The BSA is calling for leaders from business, policy, science & research, and civil society to take action now on a range of topics to build a better future for all.

1. **Put future generations at the heart of our institutional and systems decision-making**

2. **Share benefits of research and innovation across different communities**

3. **Create a long-term leadership coalition to deliver the UK's Net Zero ambition**

KEY RECOMMENDATIONS

1 Put future generations at the heart of our institutional and systems decision-making.

The pandemic has highlighted the short-term nature of much of our Government decision-making. Policy-makers are constrained by electoral cycles and the need for instant impact, which encourages short-term thinking.

Meanwhile, scientists and business leaders also work within systems that discourage longer-term thinking and that fail to take into account the impact that decisions made today will have on current and future generations. To enshrine intergenerational equality and longer-term thinking into the decisions that leaders make, we call for:

- **The UK Government** to legislate for a Future Generations Act to require public bodies, businesses and science & research institutions to think about the long-term impact of their decisions and enable them to work with people, communities and stakeholders to address persistent societal challenges, such as poverty, health inequalities and climate change.
- **Businesses and science & research institutions** to create Future Generation Advisory Boards to undertake impact assessments, listen to the voices of younger generations to build long-term economic, social, and environmental value into the decisions they make for new products and services and consider the needs and aspirations of generations to come.

KEY RECOMMENDATIONS

2 Share benefits of research and innovation across different communities.

The successful collaboration between science & research institutions, businesses and regulators to create a COVID-19 vaccine in just 260 days has demonstrated the global power of innovation.

New technologies, products and approaches such as artificial intelligence can help tackle some of the greatest challenges facing society such as climate change, antimicrobial resistance and ageing, but they also have the potential to deepen existing inequalities. We call for:

- **The UK Government** to support the COVID Recovery Commission's call to create at least one new globally competitive industry cluster in every region and nation of the UK by 2030 (2021). Moving to a "place sensitive" approach could see private and public research and development investment expanding beyond the Golden Triangle of Cambridge, London and Oxford.
- **Government, businesses, and science & research institutions** to support and invest in diverse innovators of the future. The UK's STEM workforce is deeply unbalanced – only 27% female and just 12% from ethnic minorities – and only one in three UK entrepreneurs are female (BSA, 2020). A "place sensitive" approach to the creation of new industry clusters must have equity and inclusion built in.
- **Leaders across Government, science, business, and civil society** to define the UK's global leadership goals post-G7 and COP26. The pandemic has demonstrated the importance of international collaboration and diplomacy to tackle future global challenges – COVAX, which provides global equitable access to a COVID-19 vaccine, is one example to build on. The UK has previously wielded its diplomatic power successfully on issues such as antimicrobial resistance, raising it to a global stage when international agencies had not taken the lead. Britain's exit from the European Union and the considerable recent cuts to the UK aid budget will make it harder to establish this role in the coming years. How can the UK use its strengths in science, diplomacy and business to support and lead global discussions?

KEY RECOMMENDATIONS

3 Create a long-term leadership coalition to deliver the UK's Net Zero ambition.

Although the shock of the COVID-19 pandemic has distracted governments, businesses and scientists somewhat from tackling the largest global challenge of our time – climate change – even as evidence of the urgency of the situation has continued to grow, it has helped societies refocus on issues beyond the purely economic.

The pandemic has underlined the need to act and offered an opportunity for a "reset". While commitments to a "green recovery" continue to roll in, the UK has legislated for a world-leading climate change target to cut emissions by 78% by 2035 compared to 1990 levels and to be net zero by 2050.

Business leaders, policy-makers, scientists and communities must now come together to create a clear path through the next three decades to create a fair, equitable, resilient, safe and prosperous future. We call for:

- **The UK Government** to form a UK Net Zero Delivery Board – based on an idea first suggested by Cambridge Zero (Allan et al, 2020) and inspired by the success of the 2012 Olympic Delivery Board. We suggest that the Delivery Board should be composed of a coalition of leaders from business, policy, science & research, and civil society tasked with delivering and guiding the UK's Net Zero targets. We recommend that the Delivery Board should:

  - Form a cross-sectoral coalition of regulators to incentivise consistent, systemic change.
  - Protect citizens and consumers from greenwashing (for example, by regulating price comparison sites and green advertising) and create clear guidance on how to communicate lifestyle changes and choices that are relevant and achievable for different communities.
  - Build a common agreement of how to practically implement a just transition and recovery. An inclusive innovation policy could play a key role.
  - Enable organisations to implement the recommendations of the Task Force on Climate-Related Financial Disclosures and introduce requirements for climate votes at AGMs as well as leveraging stakeholders to push for a clear carbon tax to help businesses invest for the future.
  - Consult citizens – especially those from communities and industries most affected by the climate crisis and/or the transition to low-carbon – on policy decisions using quantitative opinion data in combination with participatory approaches and public deliberations such as the Climate Assembly model.
  - Support and incentivise scientists and climate experts to engage with businesses, the media, policy-makers and community groups across the UK.

Introduction

The COVID-19 pandemic has been the defining global shock of our time. It has exposed inbuilt weaknesses within society but also demonstrated that rapid change is achievable. The pandemic has fundamentally changed how citizens, organisations and states perceive risk and questioned who we trust.

The UN Department of Economic and Social Affairs has called the pandemic a "human, economic and social crisis" that "is attacking societies at their core" (United Nations, 2020). COVID-19 has demonstrated how precarious some human-made systems and infrastructures are to unexpected shocks.

The impacts from this pandemic have leapt from sector to sector and crossed state borders. While many individuals and communities have been heavily impacted by the pandemic, there have been opportunities for corporations and governments to lead with integrity and empathy creating unlikely collaborations and alliances to overcome global challenges.

Since the financial crisis of 2008, there have been calls to rethink the resilience of human-made systems. Resilience in this context is the ability to withstand an unexpected shock, adapt to changing conditions, and recover positively from the experience. The pandemic has reinvigorated calls to build more resilience into our systems, businesses, governments and society and review the 'social contract' between states and citizens to work towards a safer, more equitable and prosperous way forward for people and the planet.

Against a backdrop of the third national lockdown in England – which was mirrored in the nations of the UK and in other countries across the world – *For Thought* hosted six online roundtables, attended by 80 leaders from the worlds of business, science and policy, and three online events, attended by nearly 250 leaders.

The diversity of leaders ranged from the Youth Mayor of Oldham to the Chief Executive of the Met Office, and from the former UK National Security Adviser to the Chair of the National Grid. We challenged them to reflect on lessons from the first 12 months of the pandemic to discuss how to build resilience at an individual, organisational, national, and international level, and tackle potential future global shocks from natural disasters to food safety and technological disruption.

In the three chapters that follow, we explore some of the key discussions and insights that arose from these conversations and pose questions that call for thought from policy-makers, scientists and business leaders about what we can do to better prepare for and respond to future crises.

CHAPTER 1:

Building resilience.

We live in turbulent times. Aside from coronavirus, we face the challenges of a fourth industrial revolution, globalisation, climate change, ageing populations, urbanisation and more.

Before the COVID-19 pandemic, the UK was thought to have one of the most sophisticated horizon scanning-contingency planning systems in the world. Pandemics appeared high in all the classic lists of major risks, the Government even acknowledged that "pandemic influenza is one of the most severe natural challenges likely to affect the UK" (DHSC, 2020) and the UK Influenza Pandemic Preparedness Strategy (DHSC, 2011) formed the basis of our response to COVID-19.

Yet in many crucial ways, we weren't prepared. Care home residents – some of the most vulnerable people in our society – found themselves exposed, personal protective equipment was in short supply and the NHS had little spare capacity and was in danger of becoming overwhelmed. These were not Acts of God.

At a *For Thought* roundtable in February 2021, Dr Tolullah Oni of the University of Cambridge highlighted that resilience – or a lack of it – is the result of leadership decisions. "While some of the challenges that the COVID-19 pandemic thrust on societies were unforeseen," she said, "we must recognise that the impact of the crisis was due to intentional choices made by leaders and institutions. We knew that if a pandemic was to hit, inequality was going to play a major part in different individual outcomes."

In 2016, the government ran Exercise Cygnus, involving 950 ministers, officials and civil servants role-playing how the UK would respond to a flu pandemic. The report into the exercise – not published until October 2020 – was blunt in its assessment: "the UK's preparedness and response, in terms of its plans, policies and capability, is currently not sufficient to cope with the extreme demands of a severe pandemic that will have a nationwide impact across all sectors" (DHSC, 2020).

If a global pandemic was not a surprise, why then were we not better prepared? Certainly, it is not practical to prepare for every eventuality as public expenditure is limited. But there is a more fundamental truth here: policy-makers find it hard to build long-term, risked-based thinking into the shorter political cycle.

This has been an ongoing weakness for decades, says Professor David Alexander of UCL. "I rather think we have to face up to the fact that there have been grave deficiencies in the response to most major emergencies over the last 20 years," he told the *For Thought* roundtable. "I include in that the London bombings, the 2008 floods, the Manchester arena bombing, the Grenfell Tower fire and, to cap it all, coronavirus. This indicates that we need some serious change. That is a labour intensive and time-consuming process but it is needed very quickly."

So how can we learn from the current shock to create an effective warning mechanism and build resilience – the ability to anticipate, absorb, recover and adapt – into our systems and organisations and the way our government and businesses are led?

Change, uncertainty and long-term challenges are not exceptions – they are the norm. We live in a highly complex and interconnected world where failure in one location, network, technology or industry can rapidly spread across traditional regulatory boundaries or national borders. Ports are a perfect example: they act as gateways between multiple interdependent industries, networks and jurisdictions and require collaboration and whole-systems thinking to ensure they are resilient (Button et al, 2021).

As the complexity and interdependence of our systems increases, we need a generation of sophisticated and courageous leaders capable of embracing uncertainty and moving beyond *what* we do in response to a crisis, to address the bigger question of *how* we respond.

The World Health Organization-commissioned Independent Panel for Pandemic Preparedness and Response (IPPPR, 2021), which evaluated the world's response to the COVID-19 pandemic, was damning of leaders for doing too little, too late. The panel, chaired by Helen Clark, former prime minister of New Zealand, and Ellen Johnson Sirleaf, former president of Liberia, found "weak links at every point in the chain" and pointed to inconsistent and underfunded preparation, concluding that "global political leadership was absent".

Failure to recognise how one crisis can quickly lead to others – and the need for a systemic approach to the pandemic - was something Gabriela Ramos, Assistant Director-General for the Social and Human Sciences of UNESCO, drew attention to during the *For Thought* discussion.

> **"The health crisis has turned into a major economic crisis, and is turning again into a huge social crisis. This confirms that social, economic, political and environmental systems are intertwined and that a crisis like the one triggered by COVID-19 - or those that may follow in the future - need to be addressed through coordinated sets of policies. This requires enlightened leadership."**

Rick Haythornthwaite, the former Global Chair of Mastercard and Chair of Ocado, took this point further. "Developing joined-up mechanisms for recognising, communicating, and cascading threats, and bringing together these systems with effective leadership is crucial. Artificial Intelligence, cloud computing, analytics and 5G are all allowing us to build very complex risk and opportunity systems and develop recommendation engines from these." As a result, the decentralisation of decision-making and action is now possible in a way that could not be done before. Political leadership must be attuned to the positive and negative consequences of this technology for it to be used most effectively.

In the world of national security, there is already a clear chain of communication linking warning with action: the National Security Secretariat provides policy advice to the National Security Council where

ministers discuss national security issues. Meanwhile, the Joint Intelligence Organisation provides intelligence assessments for the Prime Minister and Joint Intelligence Committee, and policy-makers across government. This early warning system works well. Yet there is no real equivalent for civil contingency planning: this needs to change.

Seth Schultz of The Resilience Shift told *For Thought*:

> **“There are no easy answers to truly complex problems. We need leaders who will make the decisions that will enhance the resilience to future shocks of our infrastructure organisations, natural environment, our communities.”**

Arguably, trustworthiness and transparency are the most fundamental elements of successful, resilient leadership in a crisis. And yet trust cannot be conjured up once a crisis has started – although it can be lost very easily.

One need only look at Japan’s handling of the radiation leak from the Fukushima nuclear power station caused by an earthquake and tsunami in 2011. The Japanese government was slow to acknowledge the scale of the disaster and release information to the public. As a result, trust in both the government and the country’s nuclear and scientific community was damaged. There are parallels here between the Japanese response and that of some countries during the current pandemic – for example, the UK Government’s lack of clarity around its early goal of herd immunity.

Leaders in different fields are trusted to different degrees. Reported levels of UK public trust are high for scientists (82%) and engineers (89%), but very low for politicians (15%) and government ministers (16%) – although civil servants score better than their elected colleagues (60%). Business leaders (33%) also have work to do (Ipsos Mori, 2020).

Of course, perceptions of trust shift depending on many factors: politicians have appeared alongside scientists at press conferences (perhaps hoping to borrow trust from them at key moments in the pandemic), and leaders from all arenas have had to work together this year, which may also have swayed opinion at times. Between spring and autumn 2020, trust in both politicians and scientists fell (BSA, 2020).

For Thought participants felt that political leaders who have been perceived to have managed the impact of the pandemic well – such as New Zealand Prime Minister Jacinda Ardern – have been “consistent and calm”, transparent and authentic. This echoes philosopher Onora O’Neill’s three components of trustworthiness – competence, reliability, honesty (2018) – and work by the Royal Society on trust in science (2012).

In order to command public confidence, which is essential to implementing difficult but necessary actions, leaders must establish and maintain trust. To do that, they must have honest discussions with the public about risk, and be open about the costs and inherent trade-offs of all these complex decisions.

Naturally, politicians do not like to talk about negative consequences, but where they have been straight with the public about what is and isn't known, and why they are taking the decisions they are, the response has been positive. A prime example was the daily televised Downing Street briefings at the start of the pandemic in which politicians and scientists set out the need for a lockdown and answered questions from the media and the public responded with high compliance. This openness must be extended to raise awareness of the likely consequences of future crises and build our resilience.

When the COVID-19 pandemic struck, individuals, organisations and countries alike were unprepared for the challenge because they lacked the slack (or reserves) required to face it. At the start of the pandemic, more than one in three individuals across OECD countries were financially insecure: "While they are not poor based on conventional income thresholds, they do not have enough financial assets to keep their family above the poverty line for more than 3 months, should their income suddenly stop" (OECD, 2020).

To be resilient, any individual or organisation requires "slack" (that is: redundancy, flexibility or spare capacity). While this lack of financial resilience puts these individuals and their families at greater immediate risk of suffering from unforeseen shocks, the slack within a system can be seen as more than purely economic. The OECD's Well-Being Framework outlines four, equally important, forms of capital or resources for future well-being: Natural (ecosystems and biodiversity); Economic (man-made and financial assets); Human (knowledge, skills and health); and Social (shared values and institutions) (2021).

The balancing of efficiency with slack has been an ongoing project for the past three decades and often is in tension with the UK's stagnant productivity, which is 16% below the average of the rest of the G7 countries (ONS, 2016). Leaders must take this opportunity to reconsider how we measure resilience, the trade-off between efficiency and in-built slack, and how we build up greater reserves of all forms of capital.

At a societal level, how these resources are distributed will influence which parts of society are most resilient and how prepared the society is as a whole for future crises. Those with less slack – with fewer reserves and experiencing greater inequality – will suffer most. Conversely, a more equitable society will benefit everyone.

This inescapable truth has become acutely clear during the pandemic as recognition has grown of the important work done by people in often low-paid jobs: cleaners, porters, bus drivers, supermarket workers and carers. The current crisis has highlighted the interdependence and codependency of all members of society regardless of wealth or social standing and seen people in these low-paid jobs rebranded as "key" or "essential" workers in the eyes of the public yet still officially termed low-skilled.

Analysis of UK Government data showed that 14.5m people were in poverty – including around 31% of all children – at the start of the crisis (Hetherington, 2021). Meanwhile, the Education Policy Institute (EPI) concluded that attendance rates during the pandemic "appear lower for more disadvantaged areas and pupils" (Sibieta, 2020).

Some of the most disadvantaged areas of the country experienced the highest rates of infection, which in turn led to an increased loss of learning time compared with less disadvantaged areas. This inequality can only contribute to further inequality in the future.

The hardest hit communities need help now, but looking to build a more resilient society in the long-term requires a more equitable social contract. This needs to address current intergenerational inequality as well as taking into account all members of all communities today and their future children and grandchildren. For part of the solution, we can look to Wales.

Wales is currently the only country in the world to have legislated to protect future generations with the Well-being of Future Generations (Wales) Act 2015 (National Assembly for Wales). The Act sets out seven well-being goals that public bodies must work to achieve. These goals are:

- A prosperous Wales
- A resilient Wales
- A more equal Wales
- A healthier Wales
- A Wales of cohesive communities
- A Wales of vibrant culture & thriving Welsh language
- A globally responsible Wales.

To achieve these goals, the legislation outlines five ways of working that include collaboration, integration and balancing short-term and long-term needs. How we bring about a cultural change in our leaders and systems' leadership, and incorporate some of the aspects of the Welsh act into UK-wide legislation, needs careful consideration.

In February, in his first keynote speech as Director General of the Confederation of British Industry (CBI), Tony Danker pointed to the "triple shocks" of the pandemic, Brexit and climate change as providing an opportunity for business, government, and society to join forces to build a safer, more resilient and fairer society. He likened the challenge to the situation that faced the UK in 1945 and invoked the postwar reconstruction that reshaped society, rather than the response that followed the 2008 financial crisis.

It's a view that was echoed by Professor Sir David Omand, former Director of GCHQ and the first UK Security and Intelligence Coordinator, at the *For Thought* event in March: "There are many circumstances when we don't want to bounce back into the shape we were before. We have to learn. After the old electricity transformer built on the floodplain is shown to be vulnerable to flooding, relocate it on higher ground. You need to apply that principle across society. The Government's 'build back better' is not a bad slogan but I prefer 'build better'. We don't need to recreate the old; innovation is about building new and better."

In the aftermath of the pandemic, many of the most pressing issues we face, such as social inequality and climate change, are not new. We have been battling these threats for some time. To avoid repeating the mistakes of the past, the inequalities within our society need addressing now.

CALLS *FOR THOUGHT*:

Building resilience

Some of the questions to emerge from the *For Thought* discussions, which we believe require focussed attention from leaders within the next five years if we are to realise the role of science, research and innovation in building a resilient and sustainable future, are:

A How do we develop a new relationship with risk?

The possibility of a global pandemic had been on the government's horizon for many years, yet the associated risks had not been adequately communicated to citizens, and organisations were shocked by the COVID-19 outbreak. The recent announcement of a "Global Pandemic Radar" (HM Government 2021) that will track COVID-19 variants and provide an advanced international pathogen surveillance network is welcome. But how do we communicate the wide array of risks in a way that enables people to make decisions for themselves and their communities? (Heslop, 2020).

B How do we prepare leaders and build capacity for responding to future crises?

Scientists and policy-makers must focus on preparing their response to future crises. Countries with experience of dealing with Ebola, SARS and MERS – such as Hong Kong, Liberia, Saudi Arabia, Singapore, and Taiwan (Chua et al, 2021) – were noticeably better prepared for the COVID-19 pandemic than the UK. How do we harness the experiences of scientists thrust into the media spotlight during the pandemic to improve reactive communications, train policy-makers to balance contesting evidence from scientists and other experts to make difficult decisions under pressure, and combat misinformation? How do we build capacity and encourage, equip and incentivise scientists to take a leadership role in future shocks?

C How do we embed 'whole-systems' thinking into future decision-making?

Many scientists, business-leaders and policy-makers are constrained by short grant periods, financial cycles or political terms. As a result, there is little incentive to make big structural changes that will result, for example, in the geographic rebalancing of industry or redressing health inequality over the long-term. Yet, evidence shows that the desire among leaders to get back to normal as quickly as possible doesn't match the public's desire for a fairer and more sustainable society to emerge from the pandemic. How do we encourage a longer-term approach across sectors, and broaden the definition of valued capital (to include wellbeing, for example) within our policy-making and business calculations?

D How do we balance the drive for efficiency with the need for 'slack'?

The dominant driving force in many businesses and government organisations is efficiency. Yet to be truly resilient an individual, organisation or country needs the capacity to absorb a shock, rebound quickly and ideally adapt and prosper. Do leaders need to focus on identifying and building 'slack' into their systems and work with leaders across other sectors to better prepare us for future crises? Could the provision of a civil emergencies university allow for less reliance on the military in times of national emergency, encourage the proliferation of academic research in emergency planning into practice and professional development and result in mitigation activities to be in place well before a crisis occurs?

CHAPTER 2:

Innovating for the future.

> “If scientific collaboration can bring a vaccine to the world in 260 days, what can science and innovation do for humanity across some of the other big global issues that we face?”

It was a pertinent question that Ben Osborn, Managing Director of Pfizer UK, raised during the *For Thought* event on Innovating for the Future in March. The scale, speed and nature of the COVID-19 crisis has triggered a level of innovation, agility and inter-sector collaboration rarely seen in the modern world. Among the public, too, attitudes towards science have changed since the start of the pandemic; scepticism in science globally declined for the first time in three years (3M, 2021).

Throughout the pandemic, the UK government has claimed to have been guided by science and scientists. Yet, despite scientists playing a very visible role, a resistant minority of the population remains either agnostic at best or downright hostile towards science and innovation; from suspicions about the 5G network to misinformation about vaccines online, serious challenges remain. Tellingly, the 3M study also found that 32% of people surveyed believe that their lives would not be that different if science didn’t exist at all.

How do we address this mistrust and also harness the dynamism and agility displayed by many sectors to build better, and foster the innovation needed to successfully tackle future crises and the looming threat of climate change?

The Government established the Vaccines Taskforce and created the regulatory and financing framework that allowed rapid vaccine development. Meanwhile, the agility of the Medicines and Healthcare products Regulatory Agency (MHRA) allowed pharmaceutical companies to speed up trials of promising vaccines.

Yet while uncertainty can be a welcome basis for creativity, time pressures and the stresses caused by threats to life and livelihoods do not provide the best environment for innovation. Rather, existing knowledge and innovations are often creatively repurposed under pressure. The innovative tools are already in the box; creative ways of using them are often born in a crisis.

A great example of this is mRNA technology. Although it had been researched for more than 20 years, mRNA technology was in its infancy. An mRNA vaccine was first tested in humans in 2015 by Moderna and was being used by BioNTech to develop cancer treatments but the pandemic accelerated this work (Crow, 2021). It provided the impetus and necessity for the development, assessment and emergency approval of highly effective COVID-19 mRNA vaccines, reiterating that at times of overwhelming pressure, we look to technology already in place which has the potential to contribute to a specific field.

We must start now, innovating so that our toolbox is ready for the next crisis.

Over the past year we have seen numerous adaptations across government, science and business. For example, there has been an unparalleled collaboration between government, the NHS and private companies to share knowledge and data.

One example was that outlined by Dr Mona Bitar of EY during the *For Thought* roundtable discussions. At the start of the pandemic, EY was tasked with helping NHS Northwest and the military set up a field hospital that could receive up to 650 patients per day. It was a project that normally could have taken 14 months to complete yet it was done in 14 days.

"I think the speed and success of this project was not only linked to experience, as this was uncharted territory for us, the NHS and the military, but also due to mutual understanding, interest and trust in one another."

This trust and mutual understanding was apparent in other areas too – for example, researchers had core funding switched overnight to focus on COVID-related work.

Yet while many scientists were able to shift focus and build on networks and expertise developed from MERS and SARS to respond to the crisis, sequencing and tracking variants or developing and deploying new vaccines, other entities struggled.

The UK government – having not had first-hand experience of dealing with MERS, SARS or Ebola in the way countries such as Taiwan, Hong Kong, Liberia, Singapore or Saudi Arabia had (Chua et al, 2021) – was less well prepared. Meanwhile, many sectors were forced to shut down almost completely, and some industries were slow to mobilise to the "new normal", highlighting the need to adapt infrastructure to be more agile.

There is plenty to learn from the experience of the past year and a half so that we are ready for future crises. And there are plenty of threats – and opportunities – on the horizon: climate change, new disruptive technologies and further pandemics among them.

As Sophie Howe, the Future Generations Commissioner for Wales, pointed out:

> **"Prevention is better than the cure, and indeed, very many of the things that we're dealing with now, particularly the aftermath of COVID, were entirely predictable".**

Risk management is particularly important in recognising and understanding these predictable risks. We have done a poor job so far. For example, until then-Chief Medical Officer Dame Sally Davies raised the issue of antimicrobial resistance (AMR) seven years ago, in her CMO annual report on infectious diseases (Davies, 2013) and as chair of the 2013 AMR forum at the World Innovation Summit for Health (WISH), it wasn't on the global political agenda.

"No one had succeeded in getting health risk – beyond AMR and flu – onto the agenda of the world's leaders," noted Sir Harpal Kumar of Grail during the *For Thought* roundtable. "Where is the World Health Organization? Where is the G7 in understanding these risks that could completely cripple the global economy? We've come a long way on climate change in the last five years, but where is the equivalent of

the COP meetings in terms of really identifying the risks in health and getting those on to the agenda of the world leaders so that we don't only think about flu pandemics in the future?"

Beyond recognising and managing potential future health risks, there are big innovation challenges ahead too. Climate change offers opportunities to not only develop technologies for carbon capture and storage, ammonia fuel cells or the safe storage of green hydrogen, but will require Government and the private sector to identify which of these innovations will make a long-term difference and require greater investment.

The UK Government has made a start. Its 10-point plan for a green industrial revolution (2020) aims to mobilise £12 billion of investment (and potentially three times as much from the private sector) to create and support up to 250,000 British jobs and eradicate the UK's contribution to climate change. And in February 2021, the Government announced plans to spend £800m establishing the Advanced Research and Invention Agency (ARIA), which will fund high-risk research that offers the potential for high rewards.

These sound like admirable enterprises, but the Government must ensure that investment is targeted to sectors and regions where it is needed and is likely to succeed. The development and production of the Novavax COVID-19 vaccine at the Fujifilm Diosynth Biotechnologies factory on Teesside and the soon-to-open GlaxoSmithKline plant at Barnard Castle offer promising examples of how such targeted investment might work in the future.

It gets to the heart of the subtle yet important difference between research and innovation. The former is about how we facilitate the creation of disruptive and transformational technologies; the latter is about how we capture the benefits of those technologies to meet the shared challenges of societal change.

This challenge was outlined succinctly during a *For Thought* roundtable by Dr Hayaatun Sillem CBE, CEO of the Royal Academy of Engineering and Chair of the Government's Innovation Expert Group.

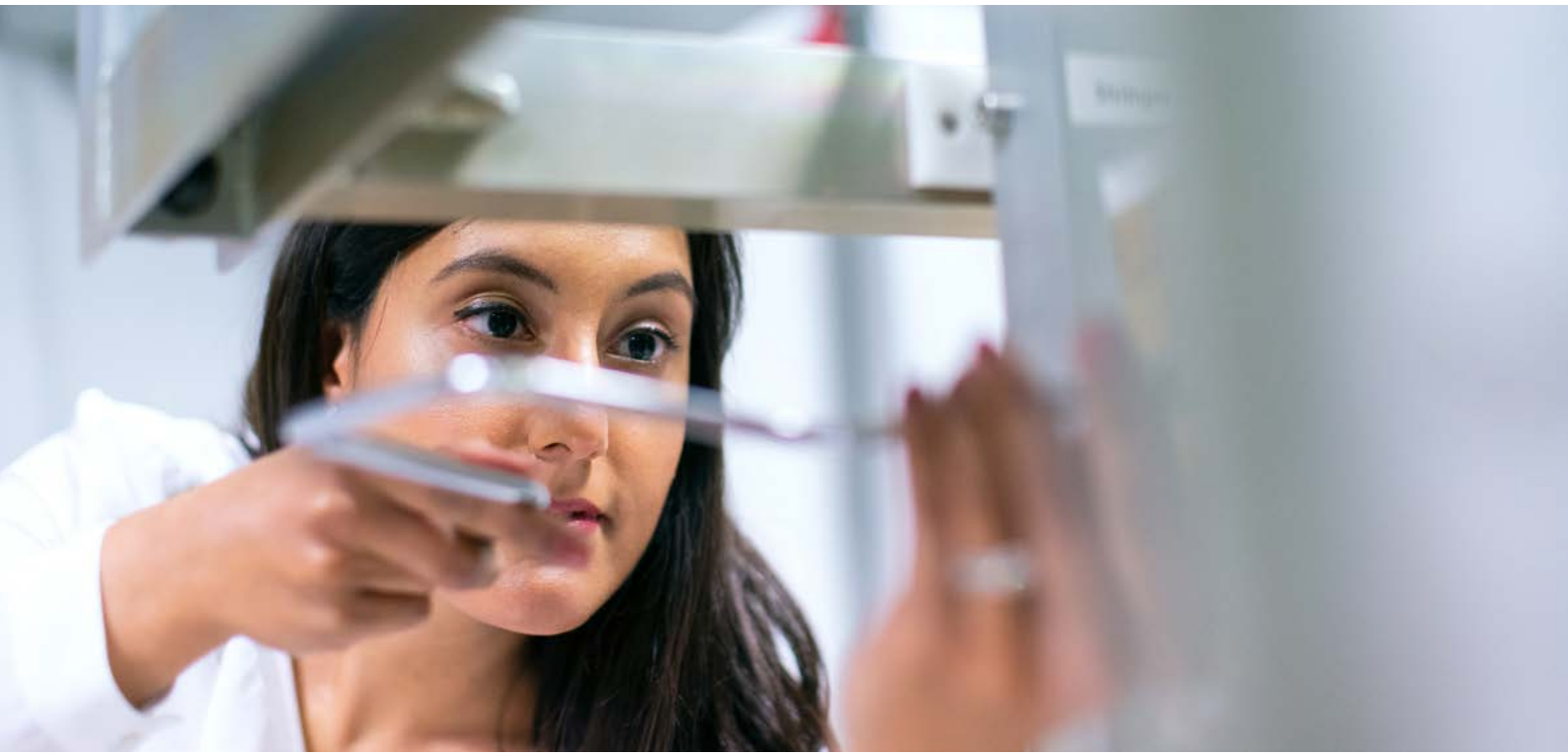
> **"We want to invest in creating capabilities that we might not today be able to envisage, to enable us to do things we might not know will be needed in the future."**

Often called cathedral thinking, we need to take a long-term view that acknowledges that what we start to build today will be continued by others in the future and must be flexible and agile enough to adapt to changing circumstances. To create an environment in which this kind of long-term research and innovation can happen requires an investment in future innovators.

"It is not only important for us to be able to attract and retain talent with the potential to develop world-changing solutions to current challenges, but it is crucial that we have a diversity of people, ideas and approaches within our R&D system," Katherine Mathieson, Chief Executive of the BSA told *For Thought*. "The science and research sector must better reflect our society if it is to tackle all of society's needs, ideas and concerns – now and in the future."

It is a point Dr Sillem also highlighted: "We can't underestimate the importance of people to our innovation performance which is intrinsically linked to the availability of a skilled innovation workforce," she said. The UK has a technical workforce making up a lower percentage of the population than countries like France and Italy. At least two-thirds of people who will make up the UK workforce in the 2020s and 2030s have already left full-time education. They will need further education and training to provide the skills required in years to come, yet as a nation we remain wedded to a linear model of education with limited provision for ongoing learning.

Supporting the current pool of innovators is important, but increasing the general number of potential innovators is fundamental. We need to think much more about talent, diversity and inclusion, argued entrepreneur Lopa Patel at the *For Thought* event, referring to the findings of The Alison Rose Review of Female Entrepreneurship (HM Government, 2019): "Women make up 51% of the population. Yet only 5.6% of women actually own their own businesses in this country, 13% of senior investors are women, and nearly half of senior investment teams have no women on them at all. So even just shifting the dial for women founders, for women innovators, makes a huge impact," she said. "The Rose Review estimated that just by supporting women founders in the UK, we could generate £250 billion for the economy." Equally, the UK's



STEM workforce is only 27% female (compared with 52% of the wider workforce) and just 12% from ethnic minorities (APPG on Diversity and Inclusion in STEM, 2020).

Removing significant bottlenecks in the innovation pipeline would help, but broadening societal engagement and participation in science and R&D to enable skills building and recruitment is key. To encourage and empower more innovators requires enabling more people to be involved in the innovation decision process. Part of the solution could lie with increased community-led research that engages more diverse and often minoritised communities to both produce more equitable outcomes from new technologies and build trust in science.

As Ksenia Zheltoukhova from Nesta pointed out during the *For Thought* event: "Just over a year ago, Nesta conducted a survey of about 4,000 people on public attitudes to innovation. Of those 4,000 people, only 18% – one in five people – thought they had any decision-making power around the innovation process. Only half of the respondents thought they benefit from it, with those from minority backgrounds or on low income much less likely to see themselves as the 'winners' of the innovation process" (Nesta, 2020).

If we prioritise embedding diversity and inclusivity in our innovation culture, we have an amazing opportunity to position the UK as a place with a world-class R&D base where extraordinary talent can thrive in a safe, responsible, trusted and trustworthy environment.

To encourage and enable this new innovation culture, we need to scale up our innovation programmes to an appropriate level of private sector investment. The UK is investing, but not yet at the scale required. In its 10-point plan, the UK Government outlined £230m worth of investment in green hydrogen (BEIS, 2020), yet Germany is investing €7 billion (ECEEE, 2020). In digital technologies, we are also behind. While the UK has invested about £142m into 5G infrastructure and applications, it is not at the same scale as plans in countries such as Germany (Politico EU, 2021).

For too long, the government has not played an active role as a catalyst for investment or setting a framework for that investment. End-stage R&D is expensive. It is the government's role to provide infrastructure that reduces the risk for the private sector to invest. For example, the £130m UK Battery Industrialisation Centre in Coventry is due to open for business shortly and should help industry to test out end-stage research into their use of batteries. This field of research regularly sees incremental changes and improvements; society is looking for a big breakthrough.

The government needs to embrace the bold approach of its Vaccine Taskforce and place some big bets, as it did in the 1960s when it invested in Spango Valley in Greenock, Scotland and helped IBM set up the first computer factory in Europe. This "alliance strategy" identified key partners before investing heavily in them.

Of course, investment and innovation cannot be restricted to the UK; global problems require global solutions. While investing in R&D within the UK, we also need to be building capacity around the world. This global vision must be addressed within the context of Britain's exit from the European Union and the

considerable recent cuts to the UK aid budget, which will make it more challenging but no less important.

In the future, there is a big role for the government in financing risk: creating markets, financing innovation up-front, and creating institutional frameworks that allow collaboration to emerge. Collaboration allows us to reach solutions faster because developments can happen in parallel. A problem-solving culture has emerged through the pandemic. To succeed it must be harnessed.

Central to encouraging and incentivising this problem-solving culture is regulation. The work of the MHRA in the development and roll-out of COVID-19 vaccines is a perfect example of where good, effective and robust regulation can be critical to fostering both timely innovation and strong public trust in a new product.

Equally, good models such as the FinTech Sandbox – an environment that allows innovators to simulate the traits displayed by the production environment in real-time to replicate responses from the systems an application engages with – provide both the ability to experiment in a controlled way within the financial system, and the right sort of climate for innovation, but this is not an approach mainstreamed across every sector.

There is great opportunity here, but it will take collective effort. As the economist and Nobel Prize winner Professor Muhammad Yunus explained during the *For Thought* event: "If you go by the old road, you always end up with the old destination, you have no escape from that. So going back means we are going back to the same destination. If you want to go to a new destination, you have to build new roads, you have to define your destination and accordingly, build a new road. So this is the time to build new roads."

CALLS *FOR THOUGHT*:

Innovating for the future

Some of the questions to emerge from the *For Thought* discussions, which we believe require focussed attention from leaders within the next five years if we are to realise the role of science, research and innovation in building a resilient and sustainable future, are:

A How do we create open-source frameworks?

The creation of collaborative open-source tools could facilitate faster, user-generated innovation and help build disaster resilience through shared data and frameworks. The aim is to introduce consistency and create standards for accurate communication on issues such as recycling and social impact across markets. This would promote transparency and fairness, as well as making it easier to be a responsible citizen. How do we create the frameworks to enable this?

B How do we de-risk innovation?

As demonstrated with vaccine development, this can happen through well-planned frameworks which target public investment in specific fields of innovation. It can also be facilitated through speeding up regulatory processes, as demonstrated with recent clinical trial protocols and evaluation of data, or through increased mutual cooperation between the public and private sector, as we have seen with the increase in data sharing for medical research. What can be done in all sectors to encourage and de-risk innovation? And what role can innovative accelerator funds – such as the Safetytech Accelerator – play in seeding innovation?

C How do we support a long-term vision for skills in the innovation sector?

Innovation in the future requires investment in the present. We need to begin a wide-ranging discussion about how best to target investment in the short term for long-term gain, particularly in early years and school education, to provide the future skill sets our innovation sector will need. How do we prepare people and communities for the Fourth Industrial Revolution and for jobs that don't necessarily exist yet?

CHAPTER 3:

Creating environmental prosperity.

"I think we are in deep trouble," Sir David King, former UK Government permanent Special Representative for Climate Change and now Founder & Chair of the Centre for Climate Repair, told *For Thought*. "Because of the technologies we've introduced in the past – most of which have been based on the use of fossil fuels to provide all the energy – we're in deep, deep trouble."

Many of the climate challenges facing society – CO2 emissions, resource depletion, ecosystem destruction, environmental degradation, microplastics – can be ultimately traced back to excess consumption. From energy to electronics and food to fast fashion, we consume far more than we need.

Yet Sir David is not without optimism: "Science is going to provide the solutions, and I'd favour very much biomimicry, and nature-based solutions," he told the *For Thought* event in March.

We have already come so far; the UK has reduced its emissions by 51% from 1990 levels with very little impact on the way we live our lives (Carbon Brief, 2021). But as Duncan Burt, COP26 Director at National Grid, said at the *For Thought* event, "actually the next 50% is where it gets really, really interesting. This is where the UK can have a huge impact both on its economy and on the world."

Worldwide, 70% of people recognise the threat posed by climate change (LRF, 2019) and, undoubtedly, many UK citizens are concerned about the environment and want to protect it. However, there is a disconnect between attitudes and awareness of the scale of the problem and the potential solutions and our behaviour.

Climate change is a global challenge that requires global solutions. Only by working with the world's largest polluters such as China and the US through dedicated international diplomacy can we hope to solve this complex problem. The UK's presidency of COP26 in Glasgow in November this year offers an opportunity to demonstrate ambition and leadership on the global stage.

It is true that the UK Government has legislated for a world-leading climate change target to cut emissions by 78% by 2035 compared to 1990 levels and to be net zero by 2050. However, there is not yet a clear plan of how industries, sectors and communities can work together over the next three decades to create a fair, equitable, resilient, prosperous and safe future.

There is also an important lingering question: is net zero even the right target? For Professor Duncan Wingham from the Natural Environment Research Council, who took part in a *For Thought* roundtable in March, we cannot ignore other pressing issues. "Carbon cannot be our only target. There are equally important and interconnected challenges we must tackle such as plastic pollution, deforestation and biodiversity loss, and we can't lose sight of this. These challenges will need everyone to change their consumption patterns."

While net zero is a useful target, we need to chart a course through the coming years for different sectors to ensure that we all arrive at the same destination together. As Afsheen Kabir Rashid, Co-founder Director

& CEO of Repowering, a charity that helps communities fund, install and manage their own clean, local energy, said during the *For Thought* discussion: "If we want to get to net zero, we need to bring people with us. It will not be possible to get close to meeting our target without engaging people – that is absolutely key to our future."

This raises big questions. Who draws the path between where we are now and where we need to be? What role can the financial system and non-elected regulators play? How do we make this a conversation about the entire economy, not just decarbonisation? And how do we track our progress, particularly in a global context, over the coming years?

The answer, according to Dr Emily Shuckburgh of Cambridge Zero, lies in what she terms the "Four I's".

- **Innovation** Ensuring that we have in place the policies and structures to support innovation that will be relevant in the next five, ten, 50 years.
- **Infrastructure** Making sure we have the infrastructure in place nationally and internationally in order to deliver a resilient and sustainable net zero world.
- **Investment** Investing both financially, and in skills and workforce capacity, to ensure we have the resources and people to tackle future societal challenges.
- **Institutions** Creating new, as well as supporting current, institutions which work at the intersection of national and local policy, devolving the net zero agenda where appropriate.

Future generations will judge us poorly for how we have responded to the threat of climate change so far. We need to look at everything systemically as the problems and solutions are interconnected. We have the technology, what we need is an overarching plan. The Environment Agency's report "Regulating for people, the environment and growth" (2019) has made a start by setting out the areas that we need to address in England. But there is still much more to do.

Part of good political leadership is acknowledging the inconvenient truths of the climate situation. If the CO2 curve continues to accelerate upwards, then the goal of keeping global temperature rise to 1.5C is long gone. Any agenda that pursues net zero as a goal without acknowledging that we could be looking at a global temperature rise of 4C is irresponsible; we need to pursue adaptation at least as energetically and in parallel with mitigation.

But as Dr Shuckburgh pointed out during the *For Thought* discussion: "We're not simply going to protect ourselves against climate change by building a huge, great flood barrier around the country. We are so exposed to what is happening elsewhere in the world, through our supply chains, through the risks of conflict, through the risks of migration, from diseases emerging elsewhere in the world. There absolutely has to be a global response, both in terms of mitigation – reducing our emissions – and adaptation – building resilience."

The public sector has an important role to play in terms of setting guidelines and establishing goals, yet it cannot work alone. The private sector also has a critical role to play, providing investment and driving innovation.

For the financial sector to drive this transition at the pace we need, we need clarity on forward climate policy, for example a forward carbon price and a set of sectoral paths underneath it that show us the way to go, argues Sarah Breeden from the Bank of England, who has oversight of its work enhancing the financial system's resilience to climate change (2021). The government can help by providing this clarity and by building climate change into the Bank of England mandate.

The green industrial revolution also needs green industrial regulation. Economic, financial, environmental and other relevant regulators need to start working in lockstep and ahead of climate change. So far, not enough collaboration is taking place.

The insurance industry has been calling for change for years – largely because they are responsible for payouts when there is a climate event such as a flood – and is in a powerful position. "We are very substantial asset owners," Jon Dye, Chief Executive of Allianz Insurance UK and Chair of the Association of British Insurers, told *For Thought*. He added:

> "The UK insurance and long-term savings industry owns about £1.6 trillion of other people's debt or stock, and how we behave as an investor can therefore really start to move the dial and you can see there's quite a lot of momentum now around that."

The role of business reaches far beyond finance and the insurance industry. Of the top 100 economic entities in the world, 69 are not countries, but companies (Global Justice Now, 2018). Business must play a leading role in decarbonisation to ensure that we meet the objectives established under the Paris Climate Agreement and elsewhere. Yet of the 41,000 companies listed globally with a combined market value of more than $80 trillion USD estimated by the OECD (De La Cruz et al, 2019), only around 1,400 (about 3%) voluntarily comply with the recommendations of the Financial Stability Board's Taskforce on Climate-related Financial Disclosures (TCFD).

Yet dealing with climate issues now crosses multiple sectors and geographic boundaries with convergence of new technologies in a scramble for decarbonisation opportunities. Many companies are now caught in a trilemma of customer demands for today, capital market expectations for today and tomorrow, and indeed meeting their own shareholder needs on the historic basis of returns. Is this sufficient for them to pilot a long-term strategy that enables them to meet the climate objectives?

"There's significantly more rigour around doing a financial audit than anything around sustainability," Ben Taylor, Global Climate Change and Sustainability Strategy and Markets Leader at EY, told the *For Thought* roundtable. "Many companies have taken a leadership position but they still do it on their own terms and to their own standards, and their own view of what's right and wrong. I think there's going to be a lot of progress on that in the next two to three years. We need more consistency and standards around how companies report on what they do around sustainability."

Business has a very long way to go, and investors should demand that more progress is made. The UK can, and should, lead the way. Of course, alongside government and business, there is another very powerful group that is often overlooked: the public, in their roles as voters, consumers and citizens.

While the 50% reduction in emissions on 1990 levels has been achieved largely through the decarbonisation of our electricity network, behavioural and social change is now critical in reaching our climate targets. The Committee on Climate Change notes: "Breaking with previous messaging to households to make small and easy changes, high-impact shifts in consumer behaviours and choices are needed that are consistent with the scale of the climate challenge, build optimism and commitment, and give weight to new ambitious narratives that inspire wide public participation" (Carmichael, 2019).

According to Professor Lorraine Whitmarsh from the University of Bath,

> "They estimate that about 60% of the changes needed to reach net zero will require at least some consumer behaviour change."

Although the public is not averse to making changes to their behaviour and lifestyle – at least in principle – they want support to do so. A report by the Committee of Climate Change (2020) found that 93% of assembly members agreed that as lockdown eases, the government, employers and others should take steps to encourage lifestyle change to be more compatible with reaching net zero.

While big shifts such as homeworking have been adopted during the pandemic and look set to continue, some behavioural shifts will be easier to manage than others. One example is in the supply of heat into domestic and commercial properties. The current debate is around whether to electrify everything or to use hydrogen. However, the lesson from the past decade is that it is not just about a technology change. Switching from a traditional gas to an electric system requires a significant behavioural change on behalf of the consumer in the way they think about and control the heating of their home.

Perhaps part of what is needed is a shift in the language we use to define our roles as individuals within society. "We shouldn't call anyone a consumer, because if you call them a consumer, it gives them the inclination to consume," says Rachael Rothman of the University of Sheffield. "Whereas if you call them a citizen, it gives them responsibility for their actions."

At the heart of this discussion around responsibility lies the issue of a just transition. One of the biggest risks to progress on both the climate and nature crises is the impact on people. If there isn't enough action to ensure that the transition is just, or that new technological solutions are safe for all, we may get a green transition, but at a cost. A backlash by those excluded from the decision-making process could make it much harder to achieve the pace and scale of change required.

Internationally, wealthier nations in the global north cannot deny citizens of the global south the same level of affluence that they enjoy. Nationally, it calls for more diverse voices – and particularly those of young people – to be included, as Nero Ughwujabo, former PM Special Adviser on Social Justice, Young People and Opportunities, pointed out during the *For Thought* discussion: "I think part of the problem are the structures we have globally; the decision-making structures have strategically excluded young people. I don't think we can say it's happened by mistake, leaders are good at talking about the importance of young people but they do not provide opportunities for young people to take centre stage."

Although there are technological and financial solutions that can be brought to bear on the problem of climate change, a bigger challenge remains: how do we get to net zero in a way that benefits everyone? That is the question leaders must grapple with if we are to solve the biggest crisis we face today.

CALLS *FOR THOUGHT*:

Creating environmental prosperity

Some of the questions to emerge from the *For Thought* discussions, which we believe require focussed attention from leaders within the next five years if we are to realise the role of science, research and innovation in building a resilient and sustainable future, are:

A How can leaders be enabled and encouraged to lead from the front?

Is it time for leaders to take personal responsibility and rise to the challenges and threats we face by exerting their own bold, ambitious leadership targets instead of waiting for regulations? Can leaders use their representation on management committees and non-executive boards of businesses, government organisations and charities to put climate change and sustainability issues on the agenda and push their organisations to go further, faster over the next five years?

B How do we create a citizen- and community-driven agenda?

The evidence shows that individuals have power as consumers, but they also have largely untapped potential as citizens and within communities. Leaders should be engaging with citizens to understand how they can feed into the decision-making process at a stage at which they can affect the change they desire in their environment. Equally, there needs to be a discussion about how individuals can reframe their engagement within society, shifting from being consumers to active citizens.

C How do we ensure that the race to Zero does not hamper progress towards other environmental challenges?

There is a risk that carbon becomes our most important target, at the expense of addressing issues such as plastic pollution, deforestation and biodiversity loss. These challenges will require large-scale consumer behaviour change, enabled by high-profile advocacy, clear communications, continued research and innovation, and business support in creating products and services that meet these needs for all of society, not just those who can afford to make eco-purchasing choices.

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