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Sustainability and internationalism: driving development in the 21st century

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1. Introduction

Our lives and livelihoods face profound threats from unmanaged or badly managed climate change; for many they are existential. Our current paths of growth and development are unsustainable. At the same time, we are seeing, in many countries, growing discontent both with internationalism and with the prevailing order at home. Yet we also have in our hands an immense opportunity: we can now see how to embark on a path of strong, sustainable and inclusive growth that could both drive and be driven by the transition to the zero-carbon economy. Further, this new path to growth and development can also be at the core of the delivery of the Sustainable Development Goals (SDGs) and the fight against poverty.

This new approach to growth and development can offer a much more attractive, fulfilling and dynamic way to live and produce, environmentally and socially as well as economically. If we recognise the nature and severity of these threats, commit to working together to combat them, and embrace this special opportunity, we could rebuild the spirit of internationalism and common humanity which helped generate the global collaboration that was the driver of growth and poverty reduction across much of the world in the years after the Second World War. Action can create political will and political will can create action.

These are the two main theses of this lecture. First, the new way of growth can deliver the zero-carbon economy and the SDGs and, further, the pursuit of these objectives itself delivers sustainable and inclusive growth. Second, such a strategy both requires, and can help create, a new internationalism. For each of these theses the two-way causation is fundamental.

Success will depend on the strength of our ideas, on the practicality of the actions and policies proposed, and on our understanding of the economic and political processes at work. These in turn require analysis of the highest quality across the whole range of disciplines from economics, politics and law to technology and science. And success will also turn on leadership and commitment from the highest offices to the grass roots. We all have our roles to play, but the academic community, a place for ideas, analysis and collaboration, including across generations, is of profound importance. Now is the moment to show the power of ideas and their foundation in serious analysis.

We do not start from a blank sheet. Far from it. We already have the extraordinary international agreements on the SDGs, made at the United Nations in New York in September 2015, and on climate, at the COP21 conference of the United Nations Framework Convention on Climate Change in Paris in December 2015, with more than 190 countries committed to each. And we have growing recognition, from powerful examples and from academic study, that there is a way forward to achieve these goals that is both sustainable and inclusive. There is momentum in innovation, technologies and policies. But the urgency is intense; we must accelerate. We have to act and to study at the same time.

To understand where we can and must go it is important to look back on how we got to where we are today. Thus I begin with the remarkable advances in incomes, health and education of the last seven decades, together with the environmental stresses they have brought. Second, I examine the growing discontent with internationalism, and with the elites within countries, that has arisen notwithstanding these successes. A central cause of the discontent lies in the tensions of mismanaged structural change and such discontent could be an important obstacle to future change. Third, and this is the main part of my story, I examine the nature and scale of the greatest of our global challenges, climate change, describe the key elements of the new approach to growth and development that must be at the core of our response, and analyse the policies that can unlock it. I try to show how the necessary political will and internationalism can be generated.

No one can pretend that tackling these huge challenges will be easy. But it is possible – and leadership, ideas, and the demonstration of what can be done are together crucial to success.

2. How the world has changed, the role of ideas and internationalism in driving change, and the implications of that change for climate, environment, oceans and biodiversity

Those looking back at the end of the Second World War saw a disastrous three decades with two world wars and a great depression. It was surely clear that the inability to collaborate internationally was a key element in the cause of these catastrophes. A new spirit of internationalism was built, with the development of multilateral institutions, global forums for discussion, and an emphasis on political and economic responses to problems, rather than force. These were the years of the creation of the United Nations, International Monetary Fund, World Bank and World Trade Organisation. They saw the Universal Declaration of Human Rights and the beginnings of what would become the European Union. Reconstruction was at the top of the collaborative agenda, together with the building of frameworks and institutions that could foster growth and reduce the likelihood of conflict and instability. However, the fact that one country was dominant, the USA, was an important element in how the story unfolded.

Since the end of the Second World War, and in the era of these institutions, we have seen extraordinary achievement in the improvement of life expectancy, education, and income (see Table 1), and to some extent democracy and human rights. We have seen rapid and large falls in global poverty and falls in global inequality in health and education. Things really have improved on many dimensions. These fundamental advances have been interwoven with a set of profound changes in the structure of the world economy and society, including: a fundamental shift of the balance of economic activity towards the emerging market and developing countries; increasing interdependence across regions and nations, including through trade, investment, finance and the movement of people; fundamental technological change; and rapid population growth, along with increasing life expectancy.

Table 1. Changes in global development indicators, 1960–2015

Development area	Indicator	Year		Source
		1960	2015	
Income	GDP per capita (constant 2010 US$)	3,737	10,636	World Bank (2018a)
Health	Life expectancy (years)	52.5	72	World Bank (2018b)
	Infant mortality (per 1,000 live births)	103	31	World Bank (2018c)
Education	Literacy rate (% of people aged 15+)	60.7%	86%	World Bank (2018d)
	Average years of education	3.2	7.7 (2010)	Van Zanden et al. (2014)
Poverty	Share of population living on less than US$1.90 per day (2011 PPP)	42% (1981)	10%	World Bank (2018e)
Population	Billions of people	~3	~7.5	World Bank (2018f)

Note: Global averages or totals of available data in the period. Data not available for all countries.

The period since the end of Second World War has seen advances in achievement on a scale, breadth and pace unique in human history. It constitutes a magnificent tribute to what can be achieved with peace, collaboration and reasonably sound policies. These advances have occurred

across the globe but have been particularly strong in emerging market and developing countries, including in Africa, although there the pace of change has been slower than for some other regions.

Since 1945, world population has risen by a factor of around three (from roughly 2.5 billion to over 7.5 billion) and income per capita by a factor of around four. Total output has thus risen by a factor of around 12.[1] That growth has largely been powered by the burning of fossil fuels. The scale and nature of this growth has led to intense pressure on the global commons and ecosystems. Across a range of environmental indicators, we have seen severe damage to the atmosphere, biodiversity, oceans, forests and landscapes. The increase in the weight of human activities on the environment has been immense and unprecedented.

The emission of greenhouse gases and other pollutants has been on a huge scale. Annual emissions of carbon dioxide (CO_2) from the energy sector increased from around 11 gigatonnes[2] (Gt) in 1960 to around 35 $GtCO_2$ in 2016 (Global Carbon Project, 2017). As a result, the concentrations of carbon dioxide in the atmosphere have increased from around 315 parts per million (ppm) in 1960 to over 400 ppm today, a level not seen in millions of years. These emissions and resultant concentrations have caused average global surface temperatures to increase by around 1°C above pre-industrial levels, taking us to the edge of the experience of the benign Holocene period of the 10,000 years or so since the end of the last Ice Age. That was the period in which our civilizations developed, with settled agriculture and the growing of grains, together with the storage and surpluses that permitted a whole new range of activities. And it came with the development of towns and cities.

Air pollution is a major cause of illness or death, and 97 per cent of cities in low- and middle-income countries do not meet World Health Organisation (WHO) guidelines on air quality (WHO, 2018a). The poorest and most vulnerable are the most adversely affected. But the problem is not confined to developing countries. Around 40,000 people per annum die from air pollution in the UK (Royal College of Physicians, 2016),[3] about 20 times the number of deaths from traffic accidents (see Department for Transport, 2018). The WHO estimates that across the world around 7 million people a year die from exposure to indoor and outdoor air pollution (WHO, 2018b) and that is probably an underestimate.

At the same time as we are emitting greenhouse gases and polluting the air, we are degrading the natural ecosystems that regulate and create many of the environmental conditions for development. The oceans currently absorb, and store, around a quarter of annual CO_2 emissions, but this is leading to increased acidity and lower oxygen concentrations. While around 1960 there were less than 50 sites that were measured to be below the thresholds delineating them as hypoxic (that is, without enough oxygen in the system), in 2018 there were over 500 such sites (Breitburg et al., 2018). Ocean acidity has also increased by around 26 per cent since the Industrial Revolution; this is having profound impacts on coral reefs and fisheries that sustain the livelihoods of millions of people around the world (IGBP, 2013). In the last two decades we have seen a number of ocean warming events involving global coral bleaching and we risk losing all our coral (Hughes et al., 2018). When this is combined with the over-exploitation of fisheries and increasing levels of plastic and other pollution, we must now recognise that the oceans are under profound stress.

Landscapes and forests, which absorb about 25 per cent of annual greenhouse gas emissions, are also under intense and sustained pressure, from agriculture, harvesting and urbanisation. Over the last century, forest cover has decreased dramatically, with the rate of tropical tree cover loss reaching a high in 2016 (Global Forest Watch, 2018). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2018) estimates that more than 75 per cent of land is substantially degraded.[4] Whole swathes of forests, including the Amazon, could

1 See my Fulbright Lecture of June last year (Stern, 2018b).

2 One gigatonne is equivalent to 1 billion tonnes.

3 More recent estimates are still higher. See Lelieveld et al. (2019).

4 This is defined by IPBES (2018) as a state of land which results from the persistent decline or loss in biodiversity ecosystem functions or services that cannot fully recover unaided within decadal time scales.

collapse at temperatures that are possible over the coming century, with profound effects on greenhouse gas emissions and the climate and weather systems of the world.

Biodiversity, which is central to the functioning of ecosystems, has been hit particularly hard. WWF (2018) estimates that up to 58,000 species are lost each year, with vertebrate populations declining by 60 per cent since the 1970s. Insects are also under severe stress; Sánchez-Bayo and Wyckhuys (2019) estimate that up to 40 per cent of the world's insect species are threatened with extinction in the coming decades due to current pressures on habitats and the intense use of pesticides, fertilizers and other chemicals, as well as climate change.

In spite of the pressures on the environment, many of the positive forces in development will likely continue in the short to medium term, particularly those associated with human capital, technology, and faster growth in emerging market and developing countries than in developed countries. However, in the medium and longer terms the deteriorating environment, climate and oceans could disrupt and reverse the great development achievements we have seen.

We must now put sustainability at centre stage. This was recognised internationally in September 2015 at the United Nations, when more than 190 countries committed to the Sustainable Development Goals, the SDGs. These replaced the Millennium Development Goals, put together at the end of the last century, in which environment appeared but was not at centre stage. The adoption of the SDGs reflects the growing understanding of the great stresses arising from the nature of the growth path we have followed.

It is important at the outset to be clear about the meaning of sustainability. Formally, it is to offer to future generations opportunities at least as good as those available to the current generation, assuming that those generations behave towards those who follow in a similar way. That does not mean that what we leave them has to be identical to what we had, but that it should, altogether, offer prospects at least as good.

The assets we leave future generations will include physical capital, human capital (including health and education), natural capital (including water, land, forests, biodiversity and oceans), and social capital (including cohesive societies, and strong and trustworthy institutions).[5] Increasingly we recognise that we should analyse investment or disinvestment in terms of changes in each of those assets. Clearly it makes little sense to invest in physical capital which is destructive of human capital (by damaging our health), or our natural capital (by polluting water, destroying forests or degrading land and oceans).

In section 4 of this lecture, I will examine how we can build sustainable growth and development.

3. Rising discontent with internationalism and with elites

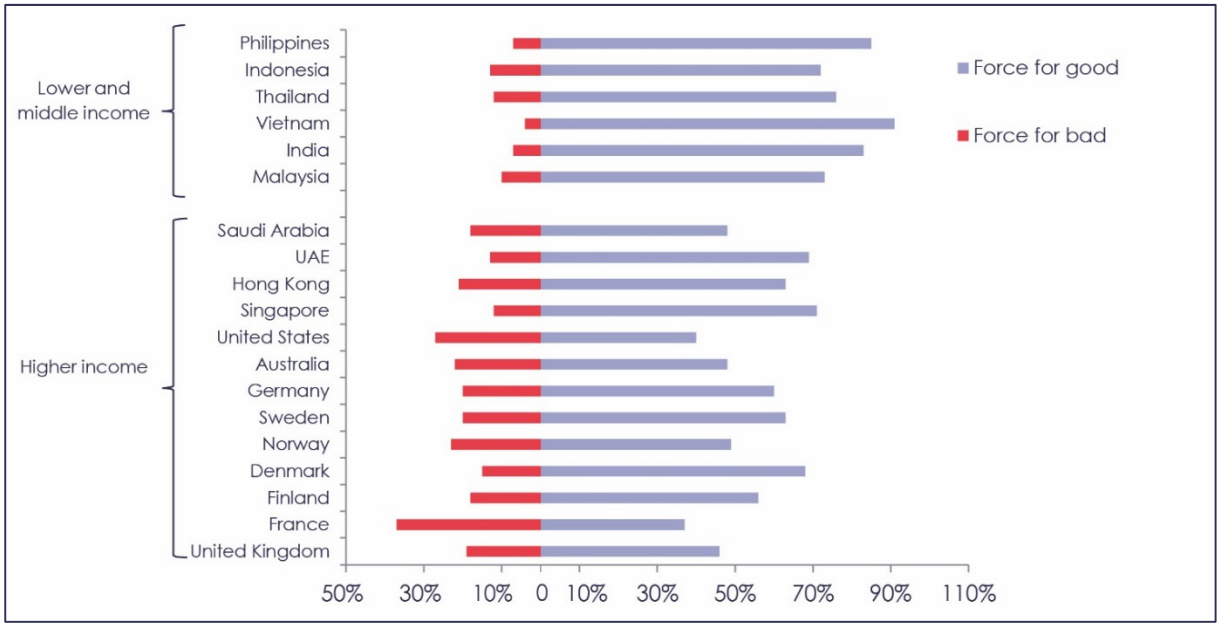
As I have argued, many of the immensely impressive positive outcomes of the previous decades have in large measure been fostered by the international economic order and global collaboration created after the Second World War. Many countries that achieved independence or liberation in the two or three decades following the end of the war have also taken national actions that have fostered real progress. A major factor in these successes has been economic policies, macro, structural and micro, which, for all their defects, have been much better than in the inter-war period.

Notwithstanding the extraordinary achievements described here and their source in internationalism and some broad policy improvements, there is rising discontent with internationalism, particularly in developed countries (see Figure 1) – and with 'elites'. In developing countries, globalisation is overwhelmingly seen as a 'force for good'. In developed countries, support is less enthusiastic; larger numbers of people in the developed world see globalisation as a 'force for bad', and a significant number of people are undecided. After the Second World War it

5 Some of my India friends have suggested that we should add 'spiritual capital', including how we understand ourselves and our roles and duties.

was the developed countries that were the champions of more open trade. But in spite of their successes, the international structures and the ideas associated with them are now being challenged.

Figure 1. Perceptions of globalisation



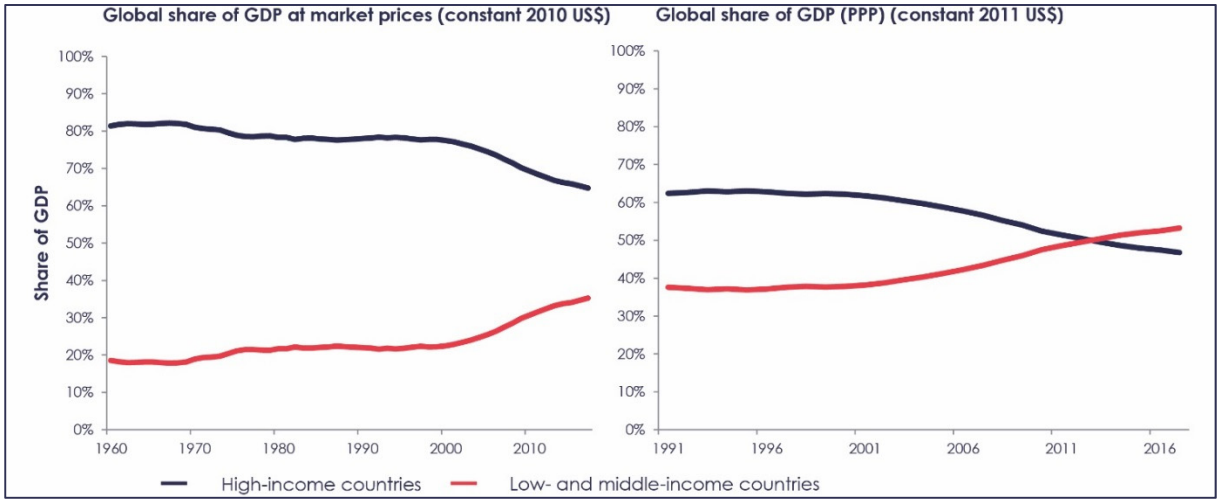
Source: YouGov (2016)

The discontent is not confined to internationalism and it is not only in rich countries. There is also, across the world, anger with the established order within countries. It is important to examine the nature and origins of this discontent. Responding to it matters greatly both because it raises issues of social justice and because it can be an obstacle to much needed policy initiatives.

Developing countries

The structure of the global economy has changed profoundly with the rise of emerging market and developing countries. The developing countries are catching up. This is clearly evident in the share of global economic output (see Figure 2). In terms of GDP measured by purchasing power parity (PPP), the emerging market and developing countries overtook the developed around 2012. The rise of China in the last four decades has been at the core of this change. Its economic achievements in this period have been remarkable and unique in economic history.

Figure 2. High-, low- and middle-income countries' share of GDP



Source: World Bank (2018a, 2018h)

Similar trends to those in output and income are seen in human capital. In primary education, school completion rates have remained around 95 per cent since 1970 for developed countries, while developing countries are now approaching rates of 90 per cent, compared with 70 per cent in the 1970s (World Bank, 2018d). In developing countries, average life expectancy rose from 47 years in 1960 to 70 years in 2016, while it is currently around 80 years for developed countries.

While there is still a long way to go, in most relevant dimensions the developing world is closing the gap on the developed. In sub-Saharan Africa, the advance has been slower and the gap is larger, but there has been real progress: life expectancy rose from around 40 years in 1960 to 60 in 2016 (World Bank, 2018b). These achievements should not, however, reduce our focus on the severe challenges, stresses and problems that remain in these countries. Poverty and inequality remain deep and difficult issues. Creating sufficient employment opportunities for the young will not be easy and failures here carry real risks for the stability of society; young people aged between 15 and 24 account for 60 per cent of all unemployed people in Africa (OECD, 2012). Crime and insecurity, often experienced through corruption and violence, are major issues. Developing countries score the lowest in the Corruption Perceptions Index produced by Transparency International (2019), with scores for sub-Saharan Africa substantially lower than for Asia and the Americas. Developing countries in the Americas and Africa also consistently have the highest rates of violent crime (United Nations Office on Drugs and Crime, 2018). Insecurity and violence are of immense importance for so many in the developing world. There is persistent poor quality in education systems, limited access to healthcare, low quality or limited housing, and exposure to air, water and soil pollution which kills many millions each year.

In both developed and developing countries, for reasons which vary across countries, there is a dissatisfaction with governing elites. We have seen in many countries the prospering of politicians and political parties offering populist[6] and simplistic 'solutions' to complex political, economic and social challenges. Positions often include being 'tough on crime', 'rooting out corruption', or promising to seize and redistribute assets. Leaders that offer such promises include the current president of the Philippines, Rodrigo Duterte, who, on the campaign trail in May 2016, stated, "Forget the laws on human rights. If I make it to the presidential palace, I will do just what I did as mayor. You drug pushers, hold-up men and do-nothings, you better go out. Because I'd kill you" (Reuters, 2016). In Brazil, recently elected president Jair Bolsonaro made tackling crime by any means possible a key element of his campaign, stating, "A policeman who doesn't kill isn't a policeman" (quoted in Pinheiro-Machado, 2018).

For some, concerns for the environment are often portrayed as barriers to growth and development; or it is argued that managing them adds costs that countries cannot afford, or be expected to carry. For example, in Brazil promises have been made by Bolsonaro to reduce protection of the Amazon in favour of other interests that are seen to support economic growth (e.g. agriculture, mining or timber [Phillips, 2019]). In many other countries, among them Kenya[7] and Indonesia,[8] some still see coal-fired power stations as viable, low-cost options to develop electricity supplies, regardless of the environmental costs of either local air and water pollution, ecosystem impacts or global contribution to greenhouse gas emissions. And these positions fly in the face of increasing evidence from around the world that even without carbon taxes or subsidies on renewables, solar and wind, including storage, can produce electricity more cheaply than fossil fuels. This kind of position was an obstacle to climate agreement at COP15 in Copenhagen in 2009, although by the time of Paris, COP21 in 2015, there was an increasing realisation not only of the immense damages of unmanaged climate change, but also of the great attractiveness and effectiveness of the low-carbon transition. I take up that argument later in the lecture.

6 Where populist refers to the definition provided by Team Populism (2018): https://populism.byu.edu/App_Data/Publications/Guardian_Methods_Memo.pdf

7 See 'Why Build Kenya's First Coal Plant? Hint: Think China', *New York Times*, 27 February 2018: https://www.nytimes.com/2018/02/27/climate/coal-kenya-china-power.html

8 See 'Coal-fired plant generates concern', *The Straits Times,* 25 November 2018: https://www.straitstimes.com/asia/se-asia/coal-fired-plant-generates-concern

Some leaders are antagonistic towards the current international systems that underpin global cooperation, often railing against established institutions or oversight mechanisms, including the United Nations, World Bank and World Trade Organisation. These are sometimes seen as being interfering, tools of rich countries, or an attack on independence.

Mistrust of government, portrayal of environmental concerns as anti-development, and hostility towards internationalism could all be obstacles to the change we desperately need. That is why seeing the arguments and actions on climate change and the environment as part and parcel of sustainable and inclusive development and the delivery of the SDGs is so important. Well-designed action on climate change can open development opportunities, not close them down, and that can be true, as I shall argue, in both the short and medium term. In the longer term, attempts at high-carbon development would likely self-destruct in the hostile environment they create.

For developing countries, I am less worried about discontent with internationalism and with elites setting back climate action than I am for developed. For those building their infrastructure later, the attractiveness of new, cleaner, approaches is becoming ever clearer, and understanding that the old dirty route is unnecessary and damaging is growing. If discontent and populism are bred on anxiety about corruption and violence, that would not point to dirty production techniques.[9] And some developing countries are understandably clear and vocal on the dangers of climate change because they already have intense experience of its impacts: the Philippines is a prime example.

Developed countries

While since the Second World War most sectors of society have benefited from economic growth, there have been sectors and locations that over recent decades have felt marginalised or ignored. We have generally, in the rich world, managed structural and geographical change rather badly.

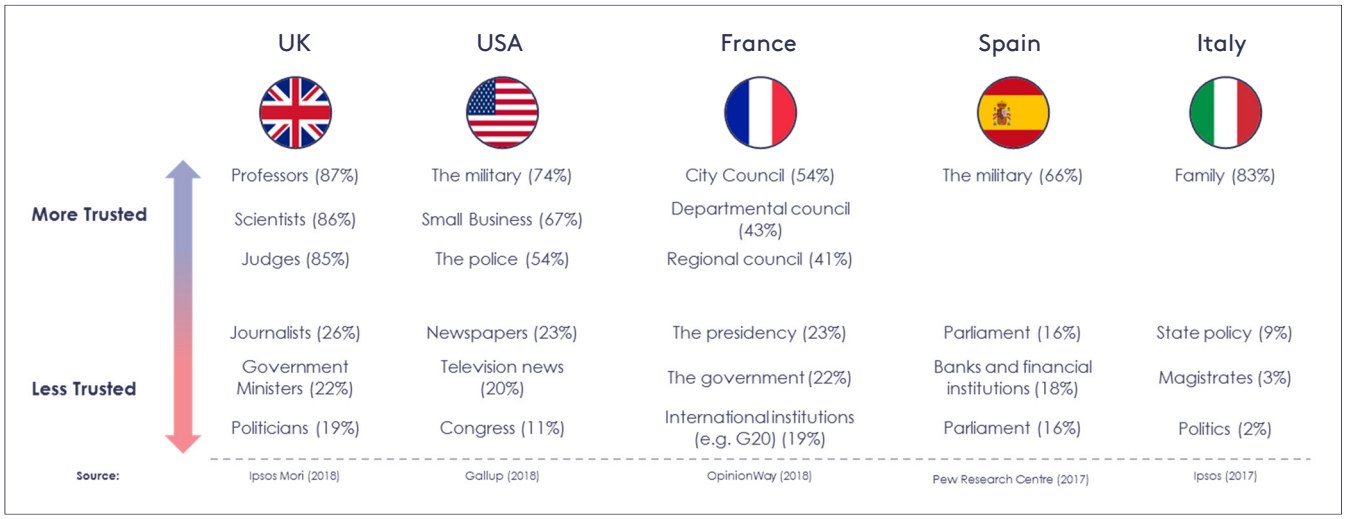
There are three key structural forces at work. As economic growth takes place, there is a switch in relative demands and the share of national output from manufacturing to services. Second, there are continuing advances in labour-saving technical progress; retail provides many strong examples as well as manufacturing. Third, globalisation has changed the international division of labour. All three forces are likely to continue. Although globalisation may have its fits and starts, emerging markets and developing countries are likely to grow faster than developed countries, with consequences for the location of production and patterns of trade.

On top of these secular changes, incompetence in policy and regulation, arising in part from the market fundamentalism of the 1980s and 1990s, led to the global financial crisis starting in 2007/8. The impact has been severe and has lasted at least a decade. The rich world has in many ways mismanaged both secular change and financial stability. It is particular groups in the population, including the less educated and older workers and those in the older manufacturing towns, who have suffered most acutely as a consequence.

It should be unsurprising, therefore, that the resentment in the groups hardest hit by these changes has been intense. There is now deep dissatisfaction and mistrust of elites and the prevailing political class or establishment. They are seen by many as detached, arrogant and incompetent. The mistrust is intense (see Table 2). I note that the trust in professors and scientists in the UK is encouraging for those of us in universities but it also underlines our responsibilities in society.

9 While Bolsonaro made election statements on opening up the Amazon, the core focus of his campaign was on corruption and violence. The fostering of old (and dirty) technologies based on coal was much more central to Trump's core campaigning argument than the Amazon was for Bolsonaro.

Table 2. Trust in institutions in selected developed countries



	UK	USA	France	Spain	Italy
More Trusted	Professors (87%)	The military (74%)	City Council (54%)	The military (66%)	Family (83%)
	Scientists (86%)	Small Business (67%)	Departmental council (43%)		
	Judges (85%)	The police (54%)	Regional council (41%)		
Less Trusted	Journalists (26%)	Newspapers (23%)	The presidency (23%)	Parliament (16%)	State policy (9%)
	Government Ministers (22%)	Television news (20%)	The government (22%)	Banks and financial institutions (18%)	Magistrates (3%)
	Politicians (19%)	Congress (11%)	International institutions (e.g. G20) (19%)	Parliament (16%)	Politics (2%)
Source:	Ipsos Mori (2018)	Gallup (2018)	OpinionWay (2018)	Pew Research Centre (2017)	Ipsos (2017)

Manifestation of these challenges and stresses in politics include the election of Donald Trump, the 2016 Brexit vote, votes for the far right and the rise of the *Gilets Jaunes* in France, and the presence of the far right in government in Italy. Many see their experience in recent decades as an assault on their status, security, identity and dignity. Populism feeds off and into such perceptions and anger.

It is all too easy to blame the rise of China, immigrants, foreigners and the 'other'. But a major part of the real cause of these stresses would seem to lie in long-term structural change in the national and world economy and the failure to prevent crises, together with the mismanagement of both structural change and crises.

We can surely do much better in the management of change than we have hitherto. There is much we can learn, and put into practice, from analyses of past failures. We can educate at school and universities to provide skills that can help prepare for and respond to change. We can provide new skills when dislocation occurs. We can offer finance and assistance to entrepreneurs in areas that are badly hit. We can move activities to areas beyond capital cities, for example as the UK did in moving large parts of social security administration to Newcastle-upon-Tyne. Where people decide to move, we can make it easier for them to do so. And we can provide stronger safety nets for those who are unable to find new opportunities. There is much that the social sciences can do and these should be research priorities. As in so many areas, we must act and study at the same time.

All these should be high priorities for public policy. We can be confident that there will be much more change on the way, including via robotics and artificial intelligence (AI). Mismanaged change not only involves human costs: the reaction to it can make necessary and urgent future change more difficult. Action to manage change and dislocation is not only a key feature of a just and civilised society, it is also critical to our efforts to manage climate change.

Populism in response to anger and discontent is more dangerous for climate action in developed than developing countries. For developed countries, some leaders, Trump in particular, explicitly promise a return to an old fossil-fuel order and manufacturing structures. It is clearly a false promise. It cannot be delivered, and even if it could, it would be a return to a destructive path. We have – as I shall argue – in our hands a new, different and attractive path, but we must and can do better at managing change.

4. The challenges of climate change and the great new opportunities for creating sustainable and inclusive growth

The nature and scale of the climate challenge

At the global level, there are many large systemic risks to development and prosperity. Antimicrobial resistance, risks of cybersecurity and the proliferation of weapons of mass destruction are vitally important examples. All of these challenges require global cooperation and rising to them means rekindling and recommitting to internationalism. In my view, however, the biggest threat to global development and prosperity concerns the climate because of the potential magnitude of the threat and the urgency of required action. The impacts of mismanaged climate change would be immense, wide ranging, felt by all and could put development into reverse. And they will amplify the potential damage from other global and systemic risks. Further, collaboration and action on climate will make it easier to tackle these other challenges.

As I shall argue in the next section, the next two decades will be decisive for climate change. If we dither or delay, the consequences could be devastating and many of the changes will be irreversible. Climate change is caused by us all – and affects us all. The only way it can be tackled effectively is through international cooperation and mutual support. We can and must act together, and quickly. Failure, wholly or in part, could cost lives and livelihoods on a huge scale.

As we work to build this necessary collaboration and cohesion, we must first understand the nature and scale of the challenge that climate change presents. After setting this out I shall present and examine the new growth story available to us in the drive to the zero-carbon economy and how we can work together to embark along this route.

The global commons is under immense pressure, as argued in section 2: including biodiversity, tropical forests, oceans, atmosphere, rivers and soils. We must act on all of these. Climate and the nature of our current economies influence them all, and indeed are in turn influenced by them all. Here I focus on climate and the economy.

The next few decades will likely see rates of economic growth of around 3 per cent per annum; that would lead global output to double in 20 years or so. The urban population will approximately double in 40 years and the area urbanised will likely double in 20. The next two decades of cumulative investment in infrastructure to enable and support this growth, and manage the urbanisation, will likely more than double the existing infrastructure stock, most of which will be new. The design and functioning of towns and cities across the world will be shaped in the next 20 years.

During the next two decades we must cut emissions by at least 40 per cent to have a reasonable chance of reaching the Paris targets of holding temperature increases to well below 2°C above pre-industrial levels, and we must cut much more for 1.5°C. The simple arithmetic of economic growth I have described, plus the basic science of the emissions cuts which are necessary, make it crystal clear that the investments we make in the next two decades are decisive for the future of our planet, and the lives and livelihoods of its peoples. It is vital that we understand the scale and urgency of what we have to do. All too often, people listen to the incontrovertible arithmetic I have just set out, say "yes, of course" and then carry on in the same relaxed way as if nothing had been said.

The commitments, or nationally-determined contributions (NDCs), made in Paris at COP21 in December 2015 for emissions by 2030 (and paths thereto and beyond) would imply that temperatures would be likely to reach 3°C or more over the next century. We have not seen those temperatures for around 3 million years. *Homo sapiens* has been here for around a quarter of a million years. And the last 10,000 years – the Holocene period since the end of the last Ice Age, over which our civilisations advanced so strongly (see section 2) – have seen a reasonably benign plus or minus one degree. We are headed way beyond the experience of *Homo sapiens,* with immense risks. With a rise of 3°C or 4°C it is likely that hundreds of millions, perhaps billions, would have to

move, with real risks of extended, severe and widespread conflict. And the driving forces behind the movement and conflict could not be simply switched off. You could not make a peace treaty with the environment that had suffered such deep damage.

The risks presented by further temperature increases were underlined in the recent Intergovernmental Panel on Climate Change (IPCC) *Special Report on Global Warming of 1.5°C,* released in 2018. It showed that there are real and major risks and damages in the difference between 1.5°C and 2°C, hence underlining the wisdom of the Paris target of "well below 2°C with best efforts for 1.5°C". Indeed, it provides a powerful case for a 1.5°C target.

The differences between 1.5°C and 2°C include: destruction of the coral reefs; substantial reduction in species; more intense extreme events (hurricanes, floods and so on); and an increase in the average length of droughts. Different places will experience different impacts; the poorest are the most vulnerable. Scientists have argued for around three decades that we should see 2°C as a threshold for dangerous climate change; the evidence is building that there are severe dangers at smaller temperature increases than that.

For holding temperature increases to 1.5°C our remaining carbon space is equivalent to only around 12 years of current emissions, and for 2°C around 20 years. For 1.5°C we must go to net-zero carbon by around 2050 and for 2°C around 2070. In either case, we must peak emissions in the next few years and then reduce sharply. We must be very clear on the importance of net-zero emissions. While we are above net-zero, concentrations rise and temperatures rise. The stabilisation of temperature requires net-zero emissions. The lower the target temperature, the earlier we must go to net-zero.

Delay is dangerous, not simply from the accumulation of current emissions, but also because delay locks in high-carbon infrastructure and future emissions. It is crucial that we understand the scale and urgency of necessary action. But, at the same time, it also vital for action that we recognise the great attractions of the alternative path. That is our next task in this lecture.

The great opportunity: the inclusive growth story of the 21st century

A key factor in the success of Paris COP21 in December 2015 was the growing understanding that the transition to the low-carbon economy offered a sustainable and inclusive route to growth. We set out this argument in *Better Growth, Better Climate*, the September 2014 report of the New Climate Economy (NCE) project from the Global Commission on the Economy and Climate.[10] Then, in our NCE report of 2016, *The Sustainable Infrastructure Imperative*, we demonstrated the centrality of sustainable infrastructure to this new growth story, also showing how investment could be brought forward and financed. That report also showed that sustainable infrastructure was at the core of the delivery of the SDGs. It is surely clear that water, energy and transport have vital roles to play in health, incomes, education, inequality, gender, environment, urbanisation and so on, all key dimensions of the SDGs.

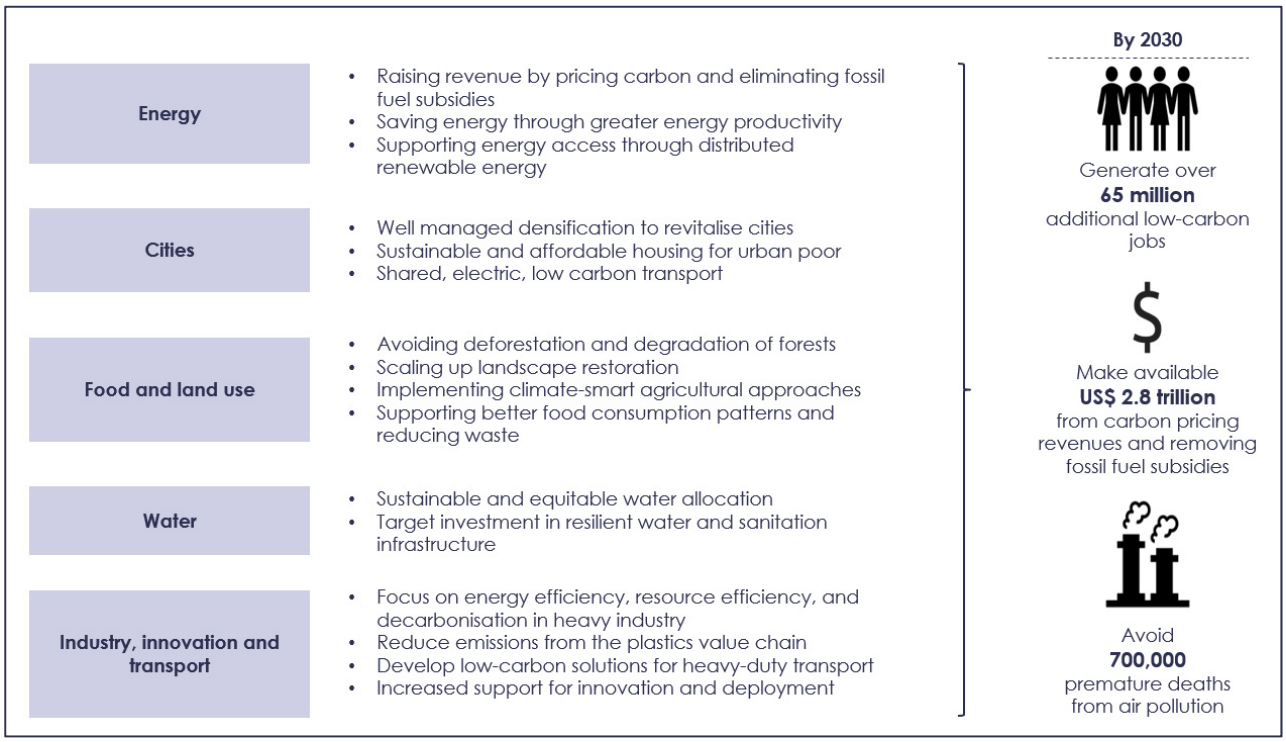
These arguments around the new growth story were further developed in the NCE's report of September 2018, entitled *Unlocking the Inclusive Growth Story of the 21st Century*. The argument goes way beyond the idea of the possibility of decoupling growth and climate action. Climate action is the route to sustainable and inclusive growth. And it goes way beyond the *Stern Review*'s statement that the cost of action is much less than the cost of inaction. That argument is still stronger now than it was then, but we now see the move to the zero-carbon economy in a much more dynamic way. It has at its core a much more attractive path of innovation, investment and growth than we have followed in the past.

The new NCE report examines and sets out immediate action and investment in five areas: energy, cities, waste, food and land use, water and industry. By taking the actions to drive systemic change in these sectors to set the world along this new path it is possible to generate over 65

10 I have co-chaired the commission since its inception in 2013.

million new jobs, and avoid 700,000 premature deaths because of reduced air pollution, by 2030 (see Figure 3).

Figure 3. Summary of actions from the New Climate Economy (2018) report



The possibilities illustrated in the NCE analysis and modelling illustrate the great potential economic and social benefits of the new path. But beyond the modelling, and more generally, we can see the growth argument as follows. Investment, particularly in infrastructure, boosts demand and sharpens supply in the short to medium term. For the medium term it unleashes waves of innovation and discovery. In the long term there is no feasible high-carbon path: it would self-destruct in the hostile environment it would create. This is *the* growth story of this century. And because the modelling in that report is conservative about future technical progress, it may underestimate the economic and social benefits of the new path.

We have seen over the last dozen years, for example, in electricity, transport, materials and digital management, that if we embark on a new path we can learn very quickly. The *Stern Review* was published 12 years ago, one year before release of the iPhone. Who would have thought then that solar and wind would become cheaper sources of electricity in many parts of the world than fossil fuels? Who would have thought that the heads of all the major motor companies would be talking of the end of the era of the internal combustion engine? Who would have thought of Uber and the digital-enabling of sharing of capital equipment? Who would have foreseen how powerful digital techniques can be in the design of energy systems and city management? Who would have foreseen the dramatic opportunities from better materials in construction? I could go on, but clearly we have momentum across a whole range of innovations and technologies. There is a foundation for the acceleration we need. Given that past policies have been modest at best and nevertheless have unleashed dramatic change, we can speculate that stronger policies will bring even starker change. But we must constantly remind ourselves that the speed of change is too slow.

A major part of building this new economy will be cutting waste and wastage, and creating a much more efficient use of all resources, including energy. There is tremendous potential to improve efficiency in all countries. The wasting of food, water and energy is outrageous in its scale: wastage is everywhere. One part of changing this story of waste will be the so-called 'circular

economy', where products and their components are designed to be reused or recycled and we radically reduce the resources that they embody.

Fostering innovation and investment with urgency and scale is crucial. But so too is managing dislocation and distribution within countries. We must learn from the past mistakes described above. As I argued, we can and must understand how the mismanagement of past structural change occurred, its consequences, and how we can do better. The transition to the zero-carbon economy is just one strand, albeit an important one, in the radical economic changes that lie ahead. In many ways the management of change from the transition to the zero-carbon economy will be easier than some of the others, such as robotics and AI, because it offers so many work opportunities right away and it embodies a social purpose that is increasingly widely shared.

In the international system, the poorest countries will need strong support from the international community to carry through the necessary investments, even though these investments are very attractive in themselves. It can be argued that there is a right to development: people have a right to the opportunity to work to improve their livelihoods. It is part of a notion of common humanity. Injustice is a right denied. The rich countries have an obligation, given their past histories, to cut emissions strongly themselves, to share technologies, and to provide aid and finance. Otherwise they are denying basic rights to others by acting in a way that curtails their opportunities and by failing to take account of having done so in the past.

Climate justice is a key concept here, both because it matters in itself but also because perceived injustice will inhibit action. There are questions of justice across peoples and nations. There are questions of justice within nations in managing transitions. There are deep issues of justice across generations. The young people of the world are demanding action and they are right to so do. Some of the ethical issues around climate action are examined in Chapters 5 and 6 of my book *Why Are We Waiting? The logic, urgency, and promise of tackling climate change* (Stern, 2015).

The policies

The world is awash with savings. There is a huge array of valuable investment opportunities along the new path. The challenge of policy is to translate the investment opportunities into real projects and programmes and bring the right kind of finance, on the right scale and at the right time for these investments.

We start by highlighting some important favourable conditions. Political direction has been provided by international agreements and commitments. Rapid technological change, learning-by-doing and economies of scale have fostered change that has provided the evidence that many clean, low-carbon activities can be carried through at lower cost than conventional dirty, fossil-fuelled alternatives. Further, we are in a period of historically low real interest rates, which is likely to continue for some time. There is surely sufficient finance that could be used to invest in the transition, when currently around US$ 8 trillion is invested in sovereign debt with negative yields (Carson and Mogi, 2018). There is over US$ 80 trillion in global assets under management (Willis Towers Watson, 2017), but policies, incentives and structures are such that it is not yet reaching the places where it is most needed. There is clearly a mismatch.

In thinking about policy to foster the new investments and their finance, we must recognise that there are multiple substantial and relevant market failures, beyond those associated with the emission of greenhouse gases, albeit that particular market failure is the one we should highlight first. To tackle these multiple failures we must use a collection of different, but mutually reinforcing instruments. I would emphasise six key policy areas to tackle the important market failures: (i) pricing or regulating greenhouse gas emissions; (ii) managing risk in flawed capital markets; (iii) supporting research and development; (iv) facilitating key networks (power grids, transport, recycling/reusing...); (v) providing increased information to consumers and producers; and (vi) creating instruments and systems to tackle related externalities, including for the reduction in air pollution.

Climate policy towards market failure is so much more than a carbon price, important though that is.[11] Various forms of regulation, including for efficiency standards, can be very powerful in bringing change: think how effective the European ban on incandescent light bulbs has been in pulling through LEDs, which are now far cheaper than a few years ago and very much more efficient. In a world with uncertainty and economies of scale, there are powerful arguments for standards in providing the clarity and confidence necessary for innovation and investment. Investing in research and innovation in both public and private sectors will be crucial to the sustained and rapid change we need in so many different areas.

Policies should not only be sound in relation to tackling these market failures. They should also be clear and credible. Government-induced policy risk, including chopping and changing unpredictably, is deeply damaging to investment whether it be green or otherwise. Investment involves commitment over time.

Circumstances change and good policies promote learning and diffusion. So policies will change over time. But, the collection of policies should be 'predictably flexible'. That is, policies should include clear, transparent mechanisms and processes for review, communicated in advance. For example, policies to encourage new technologies could be phased out as diffusion and cost-reduction take place, but the criteria that guide review should be set out ex-ante. The quantity and quality of the investment will be determined both by the soundness of policy and by the credibility of government action. We have to get the collection right. And it has to be set in the context of a clear sense of direction.

Policies to manage dislocation, as economies undergo fundamental structural change, should be much closer to the heart of the subject of economics than they have been (as I argued in my paper in the *Journal of Public Economics* [June, 2015], in honour of Tony Atkinson). Policy on climate should include the fostering of a just transition.

Further, economists would be wise to reflect on their role in the market fundamentalism of the 1980s and 1990s and the long-term damage that fundamentalism has brought. That includes the financial crisis, the rise of inequality, erosion of cohesiveness, the unnecessary deterioration of some of our built environment, and the destruction of so many of our natural assets.

Mobilising the financial sector (and reconciling with the real economy after its divorce)

Finance is a crucial aspect of policy to realise this new development story. Investment in infrastructure alone will involve around US$ 80 trillion or more over the next 15 years or so. Much of it will take place anyway and any increment to make the infrastructure sustainable is likely to involve only a few trillion more over this period (see NCE, 2014, 2016, 2018). To meet the SDGs and the climate goals all such investment has to be sustainable from now. We must develop the tools, processes and policies that make it so. Interesting examples of useful instruments include the Green Investment Principles (Jun and Gifford, 2018), which aim to integrate sustainable infrastructure decisions into China's Belt and Road Initiative.

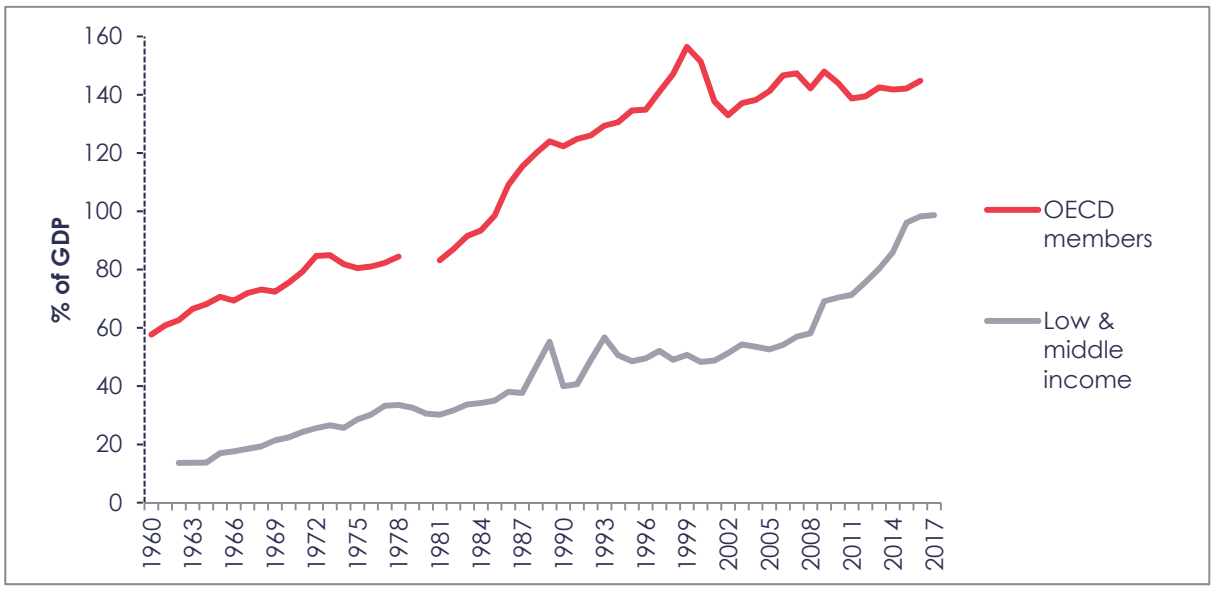
Alone, the public sector will not be able to raise sufficient finance for the scale of investment necessary. Unlocking private sector finance will be crucial. Aid and the international capital markets also have crucial roles to play. In July 2015 there was an important UN conference, which is sometimes overlooked, in Addis Ababa, on financing for development, which laid out the importance of putting all these sources together in a constructive way. Increasingly, for example, there is, and should be, pressure on the multilateral development banks (MDBs) to increase their so-called private-sector multipliers. Indeed, the MDBs have a crucial role here in the reduction, sharing and management of risk, via their presence, which itself reduces risks arising from government behaviour, via policy work, through the range of instruments they bring, including guarantees, long-term loans, equity, and through their ability to bring in a range of partners and

11 The use of carbon price revenue is an important issue, but I will not pursue it here. Protection of the poorest, ideally through direct transfers, should be a priority.

share risk. Working to enhance the private-sector multipliers of the MDBs was a key recommendation in the Report of the G20 Eminent Persons Group (2018).

A major problem in recent decades has been that the finance sector has become divorced from the real economy (see Figure 4). Finance has become a dominant sector in and of itself, rather than playing its 'notional' role (beloved of standard economics courses) of intermediation between savers and investors or its role in risk management for insurance, pensions and so on.

Figure 4. Domestic credit to private sector (share of GDP)



Source: World Bank (2018i)

The division of finance from 'real investment' fosters asset bubbles and a focus on short termism in equity markets, and places dysfunctional pressures on chief executives. Indeed, Paul Polman pointed out in 2018, when still CEO of Unilever: "Short termism has crept into everything. We have become slaves to the financial markets – you can't solve the world's problems based on quarterly returns" (quoted in Green, 2018). This places pressure on investors, or corporations to act without due consideration for the impacts of their operations on the environment or wider society, particularly over the longer term. And it results in an unwillingness to take risks through innovation or investment, which may have longer-term pay-offs. There are also profound influences of this divorce on sectors that are critical to people's lives, livelihoods and sense of community, particularly in relation to housing and house price inflation (see, for example, Turner, 2016).

Policymakers should work to bring the finance sector back towards the real economy. Examples of how to do this could include imposing higher capital requirements on banks, increasing reserve asset ratios or adjusting risk weightings to reflect social, not private, risk (Turner, 2016). Regulation of house value to loan ratios on housing is a further example. Such reforms could help enhance investment and growth, bring greater stability, reduce inequality, and lower discontent with an elite that is seen as incompetent and self-serving.

In developing countries infrastructure investment is often inhibited by high costs of capital associated with perceptions of economic and political risks. Development banks and international financial institutions have a critical role to play in bringing down the cost of capital. In particular, MDBs can participate in early stage risks and help take new ideas and projects through the difficult initial stages of the investment cycle. Working with the private sector and governments, they can support innovative projects, demonstrate good examples, and support their scaling up.

Increased information could be a key element in scaling up radical change. The propositions and processes suggested by the Taskforce on Climate-related Financial Disclosures (TCFD), initiated by Mark Carney as chair of the Financial Stability Board and led by Michael Bloomberg, could play a powerful role. The idea is to help investors in financial institutions to understand how they are

exposed to climate risk, including risks of stranded assets as the world becomes more serious on climate policy. A young person investing in a pension plan has a right to know whether her or his savings are being invested in the dirty technologies of the last century or the clean technologies that will drive growth in this century. The former are far more risky. Increasingly the evidence is growing that companies that behave more responsibly in relation to the environment have better risk-return profiles. They attract better employees, more thoughtful investors, and customers who want to know more about the supply chains involved in what they buy. Currently, however, these disclosures are voluntary. Expanding the TCFD and soon making it mandatory could have a major influence on shifting understanding of the attractiveness of the more modern forms of investment and the riskiness of polluting technologies.

Let me note here the potential role of so-called disinvestment. AP4, a very big Swedish pension fund, gave, under the splendid leadership of Mats Andersson, an early demonstration of how to do it. They looked at each sector, assessed the climate and other responsibilities of each of their holdings in that sector, sold the worst one and explained why. That provides powerful incentives to improve behaviour and look at supply chains as well as the nature of the industry. That is smart disinvestment and much more likely to be effective than some of the crude forms sometimes advocated. And we note that, unsurprisingly, the risk-return performance of AP4 improved.

Building the political will

Political will is essential to unlocking the opportunities of the new growth strategy. Building political will is a task that has to be taken on analytically and directly. Let me note briefly some of the lessons from the processes that led to the Paris Agreement. I have been at all the COPs since 2006. There are a number of factors that made Paris COP21 a success in 2015, whereas the experience of COP15 in 2009 was much more problematic (although the Copenhagen Accord was the foundation of the agreement at COP16 in Cancun one year later).

First, Paris was carefully and skilfully prepared over the preceding two years, with crucial roles played by France under Laurent Fabius and Laurence Tubiana, by the UNFCCC under Christiana Figueres, and by Peru, in the Presidency of the preceding COP (20), under Manuel Pulgar. The preparation for Copenhagen had been a shambles. Second, the United States and China, under Presidents Obama and Xi, showed real leadership by announcing their emissions plans together in Beijing, one year ahead of Paris COP21. Third, the mechanisms of the NDCs were 'bottom-up', with each country determining its own emissions plans and targets, and the implausible pretence that 'legally binding targets' for levels of emissions could be enforced was dropped. Fourth, much of the developing world now recognised both that the sheer numbers on emissions meant that they had to make radical cuts and that these reductions are entirely consistent with growth and poverty reduction. This was in strong contrast to Copenhagen in 2009, when many developing countries saw emissions reductions as a potential obstacle to development. China and India were key to this change in perspective. Fifth, there was a further increase in the recognition of the potential magnitude of damage from climate change. And sixth, there was increasing recognition across all nations that the transition to the zero-carbon economy could be a powerful driver of growth that was not only sustainable, i.e. lasting, but also strong and inclusive.

In terms of coming together to tackle a common threat, there are interesting analogies at both the national and international levels. The UK was a much more cohesive and positive society during the Second World War than it was before, and the performance associated with that cohesion and sense of purpose was, on many fronts, remarkable. And in the months following the global financial crisis, the world came together, under the UK's G20 Presidency in 2008, to create the biggest fiscal expansion in history and the accompanying expansion of monetary policy. Even George W. Bush became an internationalist with the G20 crisis meeting he called at the end of 2007.

Political will is a resource that can be built and renewed but it must also be fostered and nurtured. Let me briefly sketch the different contributions that different players in society can and should offer. I pay particular attention to academics.

- Political leaders should be leaders. They should understand that the remarkable advances in the past decades, in understanding, in political agreements and in technology, have given both a platform for action and a requirement to respond.
- Increasingly, many more business leaders are speaking up for a longer-term and more responsible view of investment and outcomes. They are becoming much more focused on their role in relation to society and the environment. In this context, Colin Mayer has a useful definition of the role of the corporation: to find profitable solutions to the problems of people and planet. That is in sharp contrast to the naïve views of Milton Friedman, who saw the responsibility of the firm as simply and exclusively to maximise profits for its shareholders. That is market fundamentalism in its raw and simplistic form and is deeply damaging.
- Cities and their governments are recognising that when capital is mobile, ideas are mobile and labour is mobile, then economic activity moves to places that are attractive to be. The design and management of cities and towns will in large part determine the future of the planet and its peoples. Urban areas contribute around three-quarters of output and emissions, and that fraction will rise. They are the loci of extreme pollution and congestion – but they are also the places where people come together to create ideas and action. Coordinated standards and procurement, for example, could bring rapid change and cost reduction.
- Non-governmental and community organisations can and should make their voices felt still more strongly. More and more of our development institutions such as Oxfam are rightly bringing climate and sustainability to centre stage. Action on climate not only protects the most vulnerable in the coming years, it can also promote development and reduce poverty now.

Let me turn to our role as academics.

- Be creative and analytical on strategic directions. Set out the options and examine carefully their attractions or otherwise. A successful realisation of the new and sustainable approach to development and growth requires collaboration across all disciplines.
- Be clear and strong on the risks we face. Reticence is not rigour. It can be negligent.
- Engage in public debates much more clearly and intensively than we currently do. We have an obligation to share ideas much more broadly and to engage with society as a whole; it funds us, after all. We must learn to be much more clear and understandable. The trust that is shown in academics carries responsibilities.
- Think carefully about whether we are tackling the right analytical issues in the right way. Economists, in particular, should remember, as I have described, the great damage that has come from the market fundamentalism of the 1980s and 1990s. How markets fail, the dynamics of processes of change, and how these processes can be guided and managed should be at the heart of our subject. Our failures as economists during those decades are part both of misguided policies and of perceptions of the incompetence of elites.
- Encourage the young: they are of special importance here. It is their future. We have seen recently in the action of schoolchildren that they are on the move. That is enormously encouraging. Young people starting out on their working lives can choose their source of energy, their mode of transport, their diet, their pensions and their politicians. If I think back to the 1960s, we students were focused on civil rights, the Vietnam War and Apartheid. Many would argue that the social and political movements of young people did indeed make a difference. Climate and the environment should now be at the top of the agenda of young people. They have a right to be angry and I hope they insist on action. In universities we must provide an environment where they can learn, think and engage on these fundamental issues – and where their teachers listen.

- We must show internationalism in our values and show openness to ideas and people in our daily activities. We must surely welcome academics from many countries into our universities, support an international student body, and teaching and researching in other parts of the world. And we should insist that governments do not put arbitrary barriers in the way of such interactions and collaborations. Let me offer one recent and relevant example of international collaboration: in January we created a Global Alliance of Universities on Climate Change, working on an initiative of Tsinghua University in Beijing. Cambridge and LSE, I am happy to say, were part of the first group of universities.

5. Concluding remarks

It is serious research that has demonstrated the immensity of the threats from climate change. And increasingly, direct experience, even though the future risks are far greater than the impacts we are now seeing, is showing us the nature and potential magnitude of the risks we are running. It is research and innovation that are showing us how to respond. We can identify the policies that can unlock the new growth story and we can show that we have the finance and technology to make a rapid start. We will learn along the way – and we should design and analyse action so that we do.

We have growing political recognition of the need for action. There is real momentum as countries, sectors and technologies change. But we must be very clear that we are not moving fast enough. The power of ideas is essential to the acceleration we need. Misconceptions, mistrust, confusion and vested interests are the greatest obstacles. Indeed, as Oreskes and Conway (2011) and others have shown, the vested interests deliberately create confusion and doubt. It is our duty as academics to be clear, analytical and strong on the risks and on the policy issues. This is not the time for inhibition.

It is up to our generation to rise to these challenges and to determine whether this will be the best or worst of centuries. I am very optimistic as to what we can do. I am deeply worried as to whether we will act in time. It is the duty of us all to work to foster the acceleration that is so vital to our future. Leadership and political will are of the essence. Acting together on climate can help rebuild internationalism and that internationalism can help tackle climate change. The drive towards the zero-carbon economy will generate strong inclusive growth and that growth can take us not only to a better climate but also to the delivery of the SDGs. Leadership can take us into strong virtuous circles. Public understanding and pressure can drive leadership.

Ideas change the world. They can play a crucial role in creating the acceleration we need. These two decades are decisive for the future of our planet. If we rise to the challenge of climate, our ability to tackle other global risks will be so much stronger. This is a moment for universities to come together and lead. That is why I salute the initiative of Cambridge and its Vice-Chancellor in launching this series and why I am so happy to give the inaugural lecture.

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