

# 1 INTRODUCTION

It can't go on like this. The concentration of carbon in the atmosphere is marching on relentlessly, adding two parts per million (ppm) every year since 1990, remarkably even during the lockdowns in the pandemic years. Coal, oil and gas still make up 80 per cent of the world's energy, the same as they did back in 1970. Global temperatures are already up over 1°C; 1.5°C will probably be crossed at some stage in this decade, and the pathway points towards at least 3°C. No serious progress on climate change has been made despite thirty years of trying.

The story on biodiversity is more complex, but every bit as bad. The rainforests are diminishing and, in some cases, burning. Parts of the Amazon are now net emitters of carbon. The oceans are more acidic, the great rivers polluted and there has already been an insect Armageddon. On current trends, one of the great extinction events of geological history is well under way.

These are the facts, neither optimistic nor pessimistic. They are the result of the great economic expansion mainly since 1900. Fossil fuels made it possible to feed a global population that increased from 2 billion to now 8 billion. This expansion made us all consumers, and we all bought into and became dependent upon a continuous increase in gross domestic product (GDP). The diesel and petrol engines replaced horses, sail and even steam engines. Tractors, and fertilisers, produced by the Haber Bosch process, transformed agriculture. Plastics have become ubiquitous. Cars became a part of everyday life and flying

around the globe reached the masses in developed countries. Electricity, generated mainly by coal, transformed both industry and domestic life, and gas heated homes. At the end of the twentieth century, the energy-intensive internet, smartphones and laptops began to usher in a whole new way of working, aided by robots, and genetics have already yielded the ability to manipulate the very stuff of life.

Most of human economic consumption (and most pollution) has happened since 1900, and most people have lived since then too. For thousands of years, the human population was small and vulnerable to famines and plagues, and economic growth barely existed until the eighteenth and nineteenth centuries. Life was short, nasty and brutish for too many people who lived before 1900. Nature kept populations in check.

All of this great fossil-fuel-driven economic growth has yielded great benefits: longer healthy lives, better food, better housing and, in the developed countries, a standard of living unimaginable for all but the very rich in previous centuries.

Not everyone of course has benefited: the two world wars left millions dead, and murderous regimes like Mao's China and Pol Pot's Cambodia killed lots of their own people. Poorer countries suffered from the legacy of colonialism, and there were terrible famines, like that in Darfur in the mid-1980s, yet by the end of the twentieth century poverty was in general retreat. A global Malthusian nightmare of mass starvation was avoided, as food production kept pace with population growth. Eight billion are better fed in 2020 than the two billion were in 1900.

This extraordinary transformation in both population and economic prosperity is now largely taken for granted. There is a lot to like about this. Extending further the great twentieth-century benefits to the fast-rising populations in Africa, India and to those caught in the middle incomes of China, the Middle East and much of Latin America is an obvious and understandable aspiration. By 2050, Nigeria's population alone will have doubled and probably be larger than that of either Europe or the US. Why shouldn't Nigeria's prospective half a billion people live like those in the developed countries do now?

The promise of the endless progress often seemed too good to be true, and scratch below the surface of the consumer nirvana it has created, and which we continue to vote for, and doubts emerge. Are we all really so much better off? The inconvenient truth, the first of

many, is that all of this has come at a terrible price to the environment. Those green facts will not go away. The twentieth century was one that pushed nature back hard. Chemicals killed the pests and diseases, and in the process destroyed much of the insect life. Rivers and lakes have been grossly polluted. Rainforests retreated. Biodiversity declined. Extinctions mounted. The twentieth century was a great boom for us as consumers, but it also created the prospect of an unfolding environmental disaster. It had costs, and we are now beginning to face its environmental price.

It is now pretty clear to everyone that the current pathway is not sustainable. What follows, if this is true, is that it will not be sustained. It can't go on and it won't go on. There will be an environmental reckoning, and it has already begun to materialise, whether or not there are dramatic tipping points to come. The twenty-first century might have inherited all the technology and wealth built in the twentieth century, but it has also inherited all the environmental consequences too, neatly summarised in the facts of climate change and biodiversity loss.

We face a stark choice. We can either act now and head off further damage, or we can live with the consequences as and when our economic way of life is no longer sustained. The former opens up the possibility of transforming our economy into the sustainable one now, by tackling our problems head on. It is an exciting prospect for humanity. The latter takes us over the cliff like the lemmings, with all the suffering and damage that might bring. Billionaires might fantasise about moving to another planet, or at least retreating to a special bubble for the very rich to enjoy whilst the rest of humanity struggles to cope. For the rest of us (and for them too), there is no Planet B.

This book sets out the main building blocks of the sustainable economy – what the economy would look like if we lived within our environmental means. It answers the question: how could we get onto the sustainable path when the general population is more concerned with getting from today to tomorrow, affording what are now seen as necessities and doing as much consuming as possible? Unwilling to face up to the costs of Covid and its lockdowns and furlough schemes; unwilling to pay the higher costs of energy? Most of the world aspires to live like Americans and Europeans (or at least the better-off ones). People in developing countries want to eat more meat, drive their own cars and have broadband, clean water and air conditioning. The Americans

and the Europeans do not want to sacrifice their consumption to help the developing world. On the contrary, they want more. Transfers of money are pathetically small, and even these are widely resented.

Turning around climate change, getting out of that 80 per cent dependency on fossil fuels, is a very big ask. Doing it in just over twenty-five years, by 2050, is a transformation without precedent in economic history. Halting the destruction of biodiversity is, if anything, an even bigger challenge, especially given where the biodiversity that is left actually is – in Brazil, the Democratic Republic of Congo, the countries along the Mekong and the great free-for-all vastness of the oceans. It is not hard to look at the lives of ourselves and those around us and realise that we can't go on like this, even with lots of new technologies, consuming ever more of the one planet we have.

Reorientating our economic approach to life does not mean that consumption is unimportant, that it does not matter whether we can meet our needs and that we cannot have more economic growth. That is the mistake many environmentalists make. They say that economic growth caused our problems, and we *therefore* should move to a no-growth economy to make things better. It can easily lead to a kind of arcadian nostalgia, a desire for the simpler life, forgetting many of the hardships that went with it, and especially for the poor.

There is something to be said in favour of this kind of low-impact, off-grid lifestyle, but what it neglects is the great human capacity for ideas and the creation of new technologies. It is these that enable each generation to build on the shoulders of the knowledge created by the previous generations. It allows us to decode the genetics of the coronavirus and develop a vaccine in a matter of days, and head off a repeat of the tragedy that the Spanish Flu caused towards the end of the First World War. It allows the internet to deliver to us huge access to knowledge, information and social contacts that could feature only in science fiction just a few decades ago. It gives us the science to be able to understand the causes of climate change and how ecosystems work. Human progress is not an evil to be stopped in its tracks. Sustainable economic growth will enable future people to be better off, in the sense of having better assets, more knowledge and in the process a better understanding of how to manage and sustain our world. But it must be sustainable, a genuine enlightenment.

To this must be added an element of humility. Instead of forecasting the future and tweaking the economic interventions to keep

the economy on its maximum growth pathway, it would be better to admit, despite the great scientific advances, just how ignorant about the future we (and especially economists) still are. Instead of trying to make people, especially future people, happy, we should try to achieve a humbler objective: to ensure that we pass on to them a set of assets at least as good as we inherited, so they can choose how to live their lives armed with the wherewithal to do so.

The fundamental building block of the sustainable economy is us, as *citizens*, as members of a society with rights and obligations to each other, and who must cooperate together for the economy to work and for our lives to be fulfilled. We are entitled to inherit from the last generation a habitable world, and we are obliged not to make it worse for those who follow us. That is the overarching principle of the sustainable economy, to which other secondary principles (the ‘polluter-pays’ and the ‘precautionary’ principles) are added.

For us as citizens to participate in society and the economy, we need a stable climate, a thriving biodiversity and infrastructure networks. We need the knowledge embedded in ideas, science and technologies. We need to have access to health services, education, and we increasingly need a broadband connection, as well as affordable access to clean water, sewerage and rubbish disposal, reliable electricity available on demand, and roads and railways and airports. Take away any one of these and the citizens are vulnerable to being excluded from society and the economy.

All of the above come in *systems* – the natural, physical, human and social capitals. All comprise assets. They are the more important primary assets. Of these, the natural assets, what nature gives us for free and what makes life on this planet the wonderful cornucopia of opportunities that these provide, are the most important. Without natural capital, nothing else is possible. These natural assets come in two sorts: non-renewable and renewable natural capital. Our modern economy is based upon the non-renewables – things like oil, coal, gas and iron ore – and increasingly on nickel, lithium, cobalt and copper (used for wind and solar generators and in batteries for electric vehicles). These are all extracted from the earth’s crust. Once burnt or refined or purified, they provide energy and materials that literally build our world. There is a good reason why the last 200 years have seen the world population go from less than 2 billion to 8 billion. It is called coal and oil and iron ore and the other core minerals.

We overwhelmingly depend on these non-renewable natural capital assets. We always will. Our generation is extracting and, in the case of fossil fuels, burning them without much regard to what will be left for future generations, and without any serious regard for the pollution that is a by-product of their use. Few realise that the new low-carbon technologies will take mining onto a whole new and vast industrial scale.

In the sustainable economy, we can go on using up these non-renewable natural capitals, provided we compensate the next generation for the fact that we have had the benefits that they cannot have (because these capitals have been used up) and we deal with the pollution their extraction, refining and use cause. The fact that we are a very long way from meeting these conditions does not mean they cannot be met. We could have national sovereign wealth funds to provide compensation to the next generation, and we could deal with the pollution. But mostly we do not, and that means that we need to change our unsustainable ways quickly. Turning from oil, gas and coal to cobalt, lithium, nickel and copper is not an escape from these responsibilities, but so far there is no evidence that we are compensating future generations for their depletion or dealing with the major pollution caused by mining for these 'low-carbon' minerals.

Renewable natural capital is even more important. It is alive, the stuff that nature will keep on giving us for free as long as we do not deplete it so that it can no longer reproduce itself. Think of the cod and herring swimming around in the North Sea, the Atlantic and beyond. We have been eating them for millennia. In the sustainable economy, the catch is capped so that the fish stocks remain at a healthy margin above the thresholds that would tip them over into the non-renewable category, even to extinction.

Behave selfishly, campaign for bigger and bigger fish quotas, and deplete the stocks too far, and then it is not just that there will soon not be any fish and chips, and kippers, but all future people also will not have these. The value of renewable natural capital is open-ended. People in 100,000 years' time could enjoy cod and herring, provided we treat these fish as assets-in-perpetuity and refrain from the sorts of reckless and destructive practices that are prevalent in modern fishing. Mega industrial trawlers now extend the destruction to deeper waters, stripping out fish stock wherever they still remain.

This open-ended value adds one further dimension to the sustainable economy. Nature does not come in discrete bits and discrete

species. Everything in nature depends upon everything else. Unlike the claims of conventional economic theories, based upon discrete and atomistic consumers ('agents' in the economic literature), and discrete bits of capital which can be substituted at the margin for each other, the great renewable natural capital systems of the rainforests, the soils (with much more carbon than the atmosphere), the river catchments and the oceans are integrated ecosystems. They cannot be substituted for anything else.

The sustainable economy is starkly different from that of conventional economics, whose views we are exposed to every day, from the politicians and industrialists who are what Keynes called the 'slaves of defunct economists'. The primary assets, with the exception of the non-renewable natural capital, are all assets-in-perpetuity. They need to be maintained and, in many cases, not only be restored but also enhanced for us and the next generation to thrive. They are the essential building blocks of the sustainable economy and the state they are in is what politicians and the public should all be talking about, and what we should be worrying about.

With these assets in good shape, citizens are able to choose how to live their lives because the systems give them the capabilities to do so. Future citizens are enabled to be free to choose. To make these choices, citizens need these assets-in-perpetuity. They cannot do without them.

Basing the sustainable economy on citizens opens up a very different vista. Instead of GDP and the cash-based national accounts which tell us very little about the underlying state of the primary assets, the sustainable economy needs very different accounts. Accounts should answer the question as to whether the economy is on a sustainable path, and whether current consumption is consistent with leaving the next generation with a set of assets at least as good as those we inherited. GDP won't tell you this. Conventional economists look at the flows of goods and services, the flows of expenditures and the flows of incomes. The sustainable economy starts with the balance sheet of the assets and asks how well the stocks of these assets are being stewarded. In the example above, it is about the *stocks* of fish, not just how many we are catching. The former can be declining while the catches are going up, increasing GDP.

These accounts are anything but boring. Accounts shine a torch on what is going on. There should be a continuous updating on

the state of the primary building blocks of the economy, an exercise that is more like William the Conqueror's Domesday Book than estimating GDP. Accounts should tell us every year how well we are doing in sustaining the primary assets. The balance sheet should be net of maintaining the assets, of any spending necessary to fix damage to the climate, to biodiversity, to the energy systems and to other core utility system networks *in perpetuity*. These costs of maintenance should be a charge to the nation's current account, analogous to a business's profit and loss account.

What might look like an arcane accounting detail has really radical implications in the sustainable economy. What is left for us to spend now is *net* of having first made good any damage we have done. If you own a house and have neglected to fix a hole in the roof, you will not pretend that you are better off and can spend more because the money has not been spent on fixing the roof. On the contrary, your house would be worth less; you would in effect be eating up your capital, mortgaging the future for the benefit of your spending today. Try constructing your own household balance sheet and see how few assets you have to fall back on. That is what we have been doing at the national and global scale in not paying for the capital maintenance. We have not been maintaining our personal or our national capital.

Proper accounts for the sustainable economy result in a very different set of national budgets. Imagine if finance ministers presented sustainable accounts. These would show the state of the primary assets, and would include an item on the current account subtracting the monies needed to properly maintain the value of the assets on the balance sheet. The amount of capital maintenance required for the hospitals, schools, railways, energy systems, water and broadband to prevent any deterioration would be subtracted, as would the more general cost of the environmental damage to natural capital. What is left would be a lot less for governments and us to spend. It would be a sobering collision with reality.

The sustainable economy treats debt very differently. Across most developed countries, finance ministers are borrowing to pay for both current spending and for capital maintenance (where it is being done at all). In the sustainable economy, the purpose of debt is to finance new enhancements *after* the existing assets have been properly maintained. The next generation gets the debts and the new *additional* assets to match, so they are at least as well off. At present, they get

both debts and the degraded assets. All of the above is also true for you and me. Borrowing to spend, armed with credit, is a dangerous path to follow.

The next generation is properly respected in the sustainable economy, and the accounts tell us whether we are making sure that they will have the assets that provide the capabilities for them to choose how to live their lives. They keep us honest. The enhancements they get, which will include a significant amount of new knowledge, ideas and technologies, increase their opportunities, and they incentivise us to look to increase these because they pay for these if they are genuine enhancements. We borrow from them, and they get to repay the debt. This is why economic growth in the sustainable economy is possible. The accounts tell us if we are over-consuming and messing up their inheritance.

The investments in enhancements need savings to back the debts. Savings must equal investment. Saving is forgone consumption. The sustainable macroeconomic economy sets up the framework within which this is facilitated. A glance at where we are now tells us we are a very long way from this pathway. Interest rates have stayed well below inflation for the last quarter of a century, incentivising spending and borrowing and disincentivising savings and investment. It is no accident that productivity growth rates are widely exceptionally low and, in the absence of the incentives to save, the debt has had to be partly monetarised through quantitative easing (QE). It is not accidental that printing money has led to inflation and it is no accident that it has resulted in greater inequality. None of this is consistent with the sustainable economy.

It would be painful to get onto the sustainable macroeconomic path. We would have to pay for the capital maintenance, and we would have to save for the investment. Together, these are two big whammies to our current consumption, and together illustrate how far we are living beyond our sustainable means.

There is one more hit our consumption has to take to get onto the sustainable path. An obvious requirement is that pollution is internalised in the economy by making polluters pay. Following the polluter-pays principle would be another very radical departure from the status quo. Today's pollution is typically paid for by the polluted, who get the costs in terms of dirty air, poor-quality rivers and pesticides in their food. They are often the poor. In almost all major economies, farmers

are subsidised to pollute, and expect to get subsidised fuel, and even subsidies to own land. The 'ask' of government by farming lobbyists is that farmers should be paid to provide public goods, paid to husband the carbon in the soil, paid to reduce nitrate run-offs and even paid to store water for irrigation. In effect, farmers claim the right to pollute, and if they are to take the environment into account, they want to be paid to do so. The fishing industry looks to be compensated for any loss of fishing grounds. At the global scale, Brazil expects to be paid not to cut down more of the Amazon rainforest.

This is all the wrong way around. If polluters pay, the relative prices of polluting goods and services go up, and those of the less-polluting ones go down. The price of fossil fuels goes up, as does the price of beef raised on cleared Amazonian forests and the price of palm oil from the cleared South East Asian rainforests. The price of local food becomes relatively cheaper than the price of food flown around the world, as the transport costs to the environment are added in.

Why then don't we make polluters pay and internalise these costs, and thereby make the economy more efficient? The answer reveals yet another inconvenient truth: the ultimate polluters are you and me. Companies do not produce stuff for the fun of it: they do it for profit, and profits come from selling stuff we demand. Whilst it is convenient to pretend that it is all the fault of dirty businesses and for activists to glue themselves to the doors of big (Western) companies and the banks that finance them, it is best to bear in mind that these businesses are selling petrol and diesel to us, and the petrochemicals industry is making the plastics and synthetic materials for the clothes and shoes we buy. The act of buying this stuff is the act of causing the pollution that its production entails. All that 80 per cent fossil fuels is for you and me.

With this further inconvenient truth in mind, it is hardly surprising that voters resist carbon taxes and increases in fuel and aviation taxes, wanting to have all this stuff but not wanting to pay its full costs. Yet by sidestepping our responsibilities as citizens, the pollution costs do not go away. Worse, whilst demanding that companies clean up their acts, we do nothing much to curtail our own polluting habits.

This is where it gets personal. To see how this would work for you, try drawing up a diary of your daily spending and divide it up according to your best guess of its environmental impacts. To get to the sustainable economy, now try rewriting it excluding the polluting

stuff: the petrol, diesel, heating gas and oil, the palm oil, the plastics and the cardboard, and the non-renewable energy used for all the IT gadgets. If you use cryptocurrencies, try to work out how incredibly harmful they can be.

What the polluter-pays principle does is to go behind that spending and helps to change it. It puts us as citizens at the heart of the economy and at the heart of addressing climate change and biodiversity loss. That beef from Brazil, that palm oil from Malaysia, all that polluting stuff would now cost us more, and in some cases a lot more. We might not completely stop buying the polluting stuff, but we would use a lot less of it.

The inconvenience of us being the polluters goes deeper. It means that, because we are not paying the full costs of the stuff we consume, we are all living beyond our sustainable means. It means sustainable consumption will have to be lower, even if it can rise over time as sustainable economic growth builds on the basis of new ideas and technologies. We can get better off, but only from a lower sustainable level, one that internalises all those pollution costs in your diary.

This gives us the three big adjustments to our consumption: deducting the costs of capital maintenance so we are not consuming our primary capital assets; setting aside savings to fund investment; and paying for the pollution we cause.

Together, these require a very significant adjustment, and the burden would be most acutely felt by the less well-off. That means that social justice has to play a big part in the transition to the sustainable economy. Making sure that future generations have general access to the core systems, to health and education, to the body of knowledge and ideas, and to the natural environmental systems will not be enough to ensure that everyone has sufficient capability to choose how to live their lives. They will need enough income to spend on private goods and services, a problem that the switch from an unsustainable to a sustainable consumption path will exacerbate, given the scale of the claims already on current consumption, and the fact that pollution will be priced into the shopping basket. The sustainable economy embeds social justice within it, and social justice will be essential to the transition from here to there.

The way this is usually dealt with is through social security systems, funded by taxation. There are means-tested benefits for the

poor and progressive taxes on the rich. But there are several obvious and well-known problems with these conventional approaches to social justice. They can undermine the incentives to work, inhibit contributions to the sustainable economy and lead to unemployment, and, despite the costs, still leave a lot of people in poverty.

The alternative is to break the link between wages and benefits. Flexible wages give people the incentive to work at whatever wage rates clear the market. Universal basic income is an idea that seeks to make this break. It does this by giving all citizens a sufficient income and therefore eliminates poverty. In the sustainable economy, this would be on top of the access to the core system assets, and together these would deliver social justice, so that all citizens have the capabilities to participate in society.

The obvious problem is that it would be (very) expensive. Eliminating poverty is never going to be cheap. Yet this, too, can be addressed pragmatically. It can have a high cut-off point, to exclude the better-off to whom the basic income will not make any difference to their choices. It becomes a universal safety net for the least well-off. A second constraint can be created by tying the level of basic income to the performance of the economy as a whole. The basic income could be a dividend on the national balance sheet, and so add a second advantage. Citizens would now have a direct stake in the economy, and the basic income has to carry only the costs that the economy can bear as a result of its productivity performance over time. A national fund, backed by the national balance sheet, provides a means to the end of the relief of poverty, and it does so in a way that leaves the economy on a sustainable path. Most or all get a pay-out from the fund, and the pay-out is only what can be afforded without jeopardising the prospects of the next generation.

The sustainable economy now has its core assets and these are properly maintained. It has enhancements that are paid for by borrowing, and savings equal investment. Polluters pay, so that the economy is efficient because all the costs are internalised. Social justice is achieved by providing both the assets and a modified form of universal basic income based on a national dividend.

That leaves regulatory structures and the constitution. The institutions of the sustainable economy will need to be underpinned by a systems regulatory framework and by a constitution that embeds the principle to leave the assets in at least as good condition for the next

generation and embeds the rights and duties of current and future citizens. The tyranny of the current majority needs to be limited by giving the interests of the next generation constitutional protection.

You might by now be thinking that whilst it may be interesting to know what the sustainable economy would look like, and how big a departure from the status quo it might be, its uncomfortable implications are going to deter anyone from seriously following its design. That may well be the sad fact about our politics and our generational selfishness. It might even be a true representation of human nature. But, in thinking this, the conclusion that follows cannot be escaped, and cannot be repeated too often. If you recognise that the current way of doing things is unsustainable, then you also have to accept the conclusion that follows: *it will not be sustained*.

The consequences of global warming do not go away because we refuse to address its fundamental causes. Our current path leads to nasty carbon and biodiversity crunches. The difference between now and earlier generations is that these crunches are getting closer, and we know it. It is within this century that quite a lot of the consequences will be felt, within the lives of our children and grandchildren. It is getting ominously close. This might not be 'our last century' as some alarmists have predicted, but there is nothing inevitable about the human species escaping the extinction that has already hit 98 per cent of the species that have ever lived. The rules of the sustainable economy tell us what we need to do. We can do it now and head off the worst of what is coming because of the actions of our selfish generation; or we can be forced onto the sustainable economy path later. A key difference is that the latter is almost certainly going to be a lot more painful than the former. Nature, of course, doesn't care one way or the other. Unsustainability has to end. How it ends remains to be seen.

Which brings us to the upside of the sustainable economy. It is not all doom and gloom, and reduced standards of living. In the sustainable economy, we probably will ultimately end up better off because the things that are valuable get valued. Better-quality air, better-quality water, better-quality seas, less global warming and more biodiversity are all really quite nice. Much of what we buy is not necessarily what we might really want if we thought about what it is doing to us. Do we really want to be obese, have less healthy lives and a painful old age? Do we really need to go to packed beaches strewn with litter through ever-more-crowded airports? And do we really need all the stuff the

advertisers get ever better at targeting to us? Being sustainable can be quite liberating.

The point about our environmental crises is that we are all in this together. Just tackling climate change will require an economic transformation on a scale never seen in economic history, from an overwhelmingly fossil-fuel-based economy to one that is very different, within the space of a couple of decades or so. Rising to this challenge will be bracing, but it will also be exciting and packed with new ideas and technologies, and could bring with it the sort of social cohesions that past threats such as wars have brought. Keynes, writing in 1940 about *How to Pay for War*, proposed a switch from consumption to investment for the war effort. We need a switch from consumption to investing for our natural environment on a similar scale now. It was done then, and it can be done now.