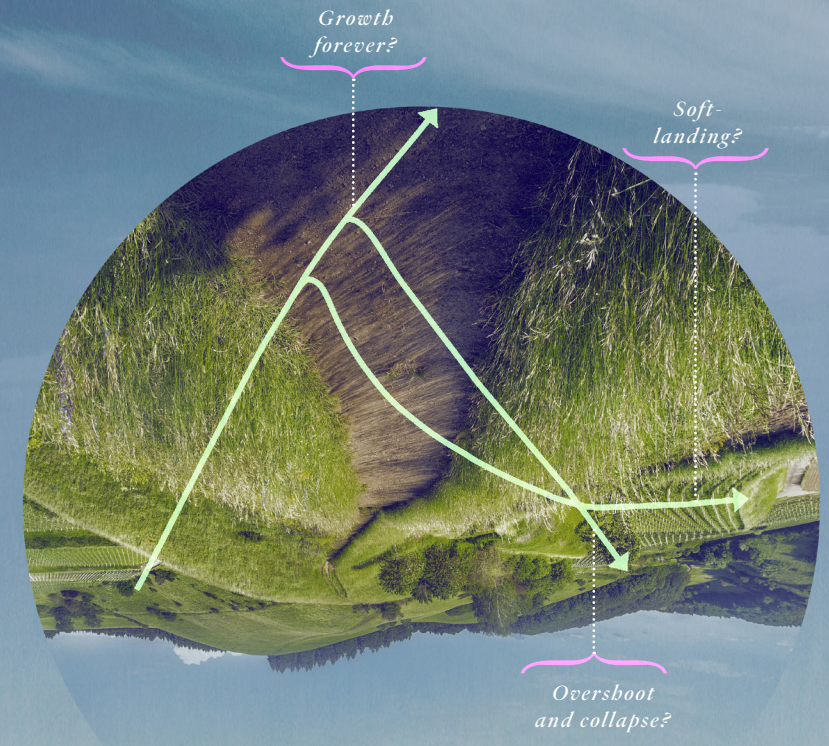




THE SOFT-LANDING: RE-VISIONING CIVILISATION'S FUTURE

Rick Boven

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RICK BOVEN

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FOREWORD

The world's people are consuming more resources than the earth can provide sustainably. Our climate is changing, we are struggling to protect and restore the ecosystems people rely on for food and other resources. Continuing harmful activities at a scale that is unsustainable is causing deterioration of our physical environment. If that was allowed to continue for long enough, the accumulation of environmental damage might become large enough to threaten civilisation itself.

These are big problems and solutions are being developed. But the remedies are not yet being deployed quickly enough or at large enough scale to reverse the environment's deterioration.

We need new ideas to help us better protect our environment so it will support the economy in the future.

Rick Boven's book helps us to look at the environment in a different way. He explores the paradigms, theories, beliefs and

values that guide our behaviour. He identifies ideas that were dominant and very useful during the 19th and 20th centuries but have now become obstacles to protecting and restoring the world's environment.

The book proposes different ideas that we could use to think about the economy and the environment. If more of the world's people understood the risks from environment damage, then more people would demand that leaders implement policies to operate the economy in ways that reduce damage and protect our civilisation's future.

Many ideas from different sources are woven together to reveal our civilisation's place in history, explore our future possibilities, and reveal what everyone can do to contribute to a safer future. The soft-landing is a proposal to target aligning the amount of environmental damage caused by the world's economy with the capacity of the environment to support it.

If more people understood these ideas, then it would be easier for leaders to get support for policies to deliver a safer future environment, a stronger economy over the long term, and well-being for the world's people. The result would be a faster and more effective response to the big environmental issues that we face.



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PREFACE

As a child I learned about the achievements of the ancient Roman civilisation. I asked myself why did their civilisation collapse, if they were so successful? Later, I wondered what would happen to us.

Curiosity and a desire to understand how the world works led me to study social sciences, becoming a social researcher, a teacher of research methods, and a consulting statistician.

Founding a technology firm led to studying business and then a long career as a strategic management consultant.

Obsolete paradigms were often the root cause that led our clients to ask for help. I learned how to help large organisations adopt more useful paradigms, to identify and implement strategies to reverse their decline, and to organise for ongoing success.

Lifelong study of history, science and technology, caring for nature and concern about growing environmental issues led me to ask myself if the world's inability to respond effectively to environmental challenges might also be a paradigm problem.

To answer that question, I began what would become a ten-year journey to complete a part-time PhD in environment management, starting in economics, transitioning through management science and completing in environmental science.

That thesis work helped me to understand what was going on, but diagnosis by itself is unsatisfying for a strategist. It is of no practical benefit unless it is followed by strategy and implementation.

During the years I worked as a strategist, I spent some of my time trying to help others understand the environmental challenges the world faces. I gave talks, influenced leaders, and led a think tank where I developed strategies to influence state policy in the domains of innovation, economic development, social issues, and environment management. More recently my work has been concentrated in providing advice to businesses, governments and NGOs on strategies creating or responding to technology driven disruption, and strategies to navigate interactions among

business, investment, regulatory, social, and environmental issues.

Changing the thinking and direction of business and government leaders requires paradigm change that is usually relatively straightforward because the organisations have a common understanding of what success looks like, their leaders are well-motivated to achieve that success, and the paradigm changes required are about the means to achieve success.

Changing the way powerful people think about the environment is much harder because it requires changing entrenched beliefs and values that are supported by a dominant paradigm that locks people into thinking in a particular way.

I gave up trying to influence change directly. I realised that I needed to explain the changes the world needs in a compelling but easily understood way. This book is the result.



INTRODUCTION

How will civilisation's future unfold?

The subject of this volume is the large strokes being painted on the canvas of history, larger than the megatrends and technology breakthroughs that occupy much of futures thinking. The argument made is that the big picture of the 21st century will be qualitatively different from the preceding two centuries and that the difference has important implications for the next few decades.

It is widely believed that humanity has unlocked a technological treasure chest that will allow Earth's people to continue indefinitely on a growth path towards the futures anticipated in utopian science fiction. That belief is easy to adopt because it paints a rosy picture of the future with ongoing technological advance and ever-growing economies delivering the continuing increases in the standard of living, life expectancy, and well-being that have been defining features of the last two centuries.

That dominant paradigm is built on the foundations of successful technological innovation and neoclassical economics. It has established economic growth as the principal societal objective, the guiding principle for policy, and the most important criterion used to judge the success of leaders. The pre-eminence of the dominant paradigm is supported by compelling evidence from more than two centuries of success and continuation of economic growth as the 21st century proceeds.

An opposing view claims the Earth's people are facing important challenges which threaten that dominant vision of uninterrupted growth. The alternative view highlights the finite scale of the Earth and emerging environmental constraints as evidence that ongoing and safe growth should not be assumed. A few voices highlight connections between increasing environmental constraints and recent economic and political instability in some of the countries that are struggling.

Proponents of those two views are competing to guide the management of our future.

Which paradigm more closely explains humanity's 21st century circumstances matters because a mismatch between societal management strategy and feasible futures would be

costly. Continuing to pursue growth if ongoing growth is not feasible would risk civilisation-threatening economic failure, disruption, and environmental damage. Changing course to prioritise sustainability when such a change is not needed would be costly too, potentially reducing material well-being for many people.

Whether today's leaders recognise it or not, humanity's collective leadership faces the question of whether the impressive growth of the recent past can be extended through the 21st century. That question cannot be answered within either of the paradigms because each paradigm provides its own answer, and those answers are "yes" and "no". It is difficult to see the shape of something when you are inside it. A means must be found to test the paradigms against one another in a way that does not depend on the assumptions and arguments of the paradigms themselves.

The argument that follows offers an assessment and proposes a change of direction. The most fundamental issue addressed is "what should we believe about our future?" Constructing an understanding of our future possibilities depends on ideas and evidence from a wide range of sources. No single theory or data point can resolve the issue.

The conclusion reached is that the dominant paradigm

being used to manage the economy-environment interaction does not equip us well to understand and manage the world's current and future circumstances. Many of us scoff at the incorrect paradigms used by civilisations that preceded ours and yet have the hubris to think that our civilisation is the one that has got it right, and so it will persist.

Today, human society comprises one connected civilisation. We can communicate with one another relatively freely, and most of us are connected to the Internet. Ideas, genes, and parasites are being exchanged across the world. We have mutually dependent trade relationships and global organisations. There are sub-civilisations like “western civilisation”, and there are pockets of people who are more distinct or separate, but we have established a single global civilisation.

When we consider the management of civilisation's future, we are engaged in societal management strategy. Considering societal management strategy triggers an important question that is not asked often: is there some best way to manage a civilisation that can be discovered, and once discovered, can be applied universally to deliver great outcomes? Or does the optimal societal management strategy vary according to circumstances?

Strategy is built on three important foundations: purpose, the definition of success, and diagnosis of the current situation.

Purpose is the first important foundation. Civilisation is a good thing because people who live in civilisations are safer and healthier, live longer lives and have more material consumption.

There are many threats to the future of civilisation, including nuclear conflict, a global-scale natural catastrophe or a pandemic. The threat of interest here is from over-exploitation of the environment, which is a concern because over-exploitation and collapse have been a cause of many past civilisation failures. A civilisation collapse would have severe adverse consequences for people living today, for future people, and for the world.

If we think civilisation is a good thing, then we could choose a purpose for societal management of ensuring the continuity of a thriving global civilisation.

The second foundation for strategy is understanding what success looks like. For the analysis which follows, success will mean a sustainable civilisation that delivers safety, health and well-being to the people who live in it.

Diagnosis is the third important foundation of strategy. Diagnosis is often too superficial to guide strategy development.

For example, we might identify climate risks and then quickly conclude that we should “de-carbonise” the economy. Identifying a goal like de-carbonising and some available or future technologies and calling that a strategy is not enough to get the job done. It may be important to understand the obstacles to de-carbonising and how they might be overcome.

Once the purpose is understood, we know what success would look like, and we have a sound diagnosis, we can develop the strategy. A strategy is a special kind of plan; it is a plan to reallocate effort and resources to achieve success in the future.

The argument in this book uses four lenses to diagnose the Earth’s current circumstances and develop a high-level strategy that will establish conditions to increase the likelihood of the continuation of our civilisation.

The four lenses are environmental observations, our place in history, co-evolution of ideas, behaviours and outcomes, and implications for management.

The environmental observations are important departures from sustainability which signal trends that will threaten the future of civilisation if they continue. A revised interpretation of our place in history provides a theoretical foundation for a

proposed new paradigm. Understanding how our ideas co-evolve with behaviours and the outcomes we experience reveals how people can act to protect our civilisation.

Management ensures actions will be taken to deliver the future outcomes we prefer.

How the world’s people will navigate and manage our way to a successful future civilisation should be the big strategic question for us all. An important complication is that many people today do not feel they have an obligation to act individually to improve outcomes for the communities and societies they live in, preferring to focus instead on improving outcomes for themselves and their families.

The book offers a diagnosis and concludes by offering a high level, high potential strategy to reduce the environmental risk to civilisation. The strategy is high level in the sense that it indicates what needs to happen and how it can be made to happen but does not specify the detailed implementation steps. The strategy is high potential in the sense that it identifies a way to get back onto the pathway towards a successful future for our civilisation.

Environmental observations

Environmental scientists and activists identify and highlight many environmental changes that threaten humans, other animals, plants, and the ecosystems we all depend upon. These changes take many forms, but there are three high-level environmental threats, each of which, if they proceed as scientific opinion expects, might challenge the continuation of growth, and threaten the existence of modern civilisation.

The first threat is from changes in the atmosphere, which threaten climate stability, agricultural productivity, built infrastructure and ecosystems. The second threat is from the global population and the world's economy becoming very large relative to the resources available. The third threat is from the decline of the quantity and quality of the ecosystems that support human life.

Various responses are offered to counter claims that these three threats are existential for our civilisation. The environmental issues might not be as serious as the scientists claim, technological solutions might emerge that will overcome the threat, or actions in the future might counter the threat or avoid the consequences.

Logically, the Earth is a finite resource, so growth cannot continue indefinitely. However, we might be a long way from the limits, or they could be very close.

Uncertainty about the magnitude of the environmental threat, the potential for technological solutions and the expectation of stronger societal responses in the future makes it difficult to predict how the future will unfold.

Our place in history

Today's future is embedded in a much longer history. If we could understand the shape of that history, that might help us understand what we should expect in the next few decades.

Centuries ago, mainstream thinking saw history as the unfolding of events in relatively static societies and environments. History was presented mostly as the stories of leaders who competed in a relatively stable world.

The idea of continuous and unending progress is a relatively recent theory about history. The received wisdom from historical accounts written during the 20th century was a story of continuous growth driven by advances in technology and social organisation. Interruptions such as the "dark ages"

were caused by invasions of barbarians which disrupted civilisations and temporarily delayed progress.

That 20th century view of history is embodied in the continuous growth models of neoclassical economics, where the factors of production, capital and labour are used to provide output for current consumption and for increased stocks of capital and labour. The productivity of the factors of production is increased by improvements in technology. In conventionally applied mainstream neoclassical economics the environment does not constrain aggregate economic growth, by assumption.

Our willingness to take actions now to protect future outcomes depends a lot on what our theories about history lead us to believe about the possibilities. If we believe the strong global growth trend of the last 200 years will inevitably continue indefinitely, then we are likely to be confident that technological changes and future responses will ensure that all will be well for modern civilisation.

Contrary to the 20th century historical stories about European civilisations, historical civilisations often collapsed. Almost all the important bronze age Eastern Mediterranean civilisations collapsed between 1200 BCE and 1000 BCE.

Western Roman civilisation declined and then collapsed in the 4th and 5th Centuries AD, after damage to grain-producing land, first in Italy, then in the Nile Valley and then in Africa. England's population declined dramatically between 1300 and 1400.

More recent accounts, informed by environment analyses of these events and many others, provide a picture of economic and population growth driven by food technology advances being deployed within abundant environments, growth to a scale that more than fully exploits the environment, and then collapse that is caused by scarcities of important ecosystem services, often accompanied by, or triggered by climate change.

Will the future of our civilisation be different? What if there is a pattern in history that might inform our thinking about our future?

The historical record looked at through the lens of this question shows cycles of advancement, overshoot, and collapse, not only for human populations but also for populations of other animals.

The prevailing modern view is that we can be confident that our civilisation will not collapse because our discoveries of technologies and other forms of knowledge will ensure higher and higher levels of consumption and well-being. Does our technological prowess make us qualitatively different from

the civilisations that preceded us? Or do structural, historical processes imply that we are heading towards a collapse too?

The argument presented in Part 2 offers a story about the world's history which accommodates environmental constraints along with the recent rapid growth fuelled by technology. That alternative paradigm, together with evidence on the state of the global environment, implies that the scale of our modern economy is growing beyond the capacity of the environment to sustain it, exposing modern civilisation to an increasing risk of collapse.

Co-evolution of ideas, behaviour, and outcomes

If we conclude there is a material risk that the scale of the modern economy could overshoot the capacity of the environment which supports it, then we might want to intervene to change humanity's course and reduce the risk. Intervention requires a theory of how purposeful action might alter the course of history.

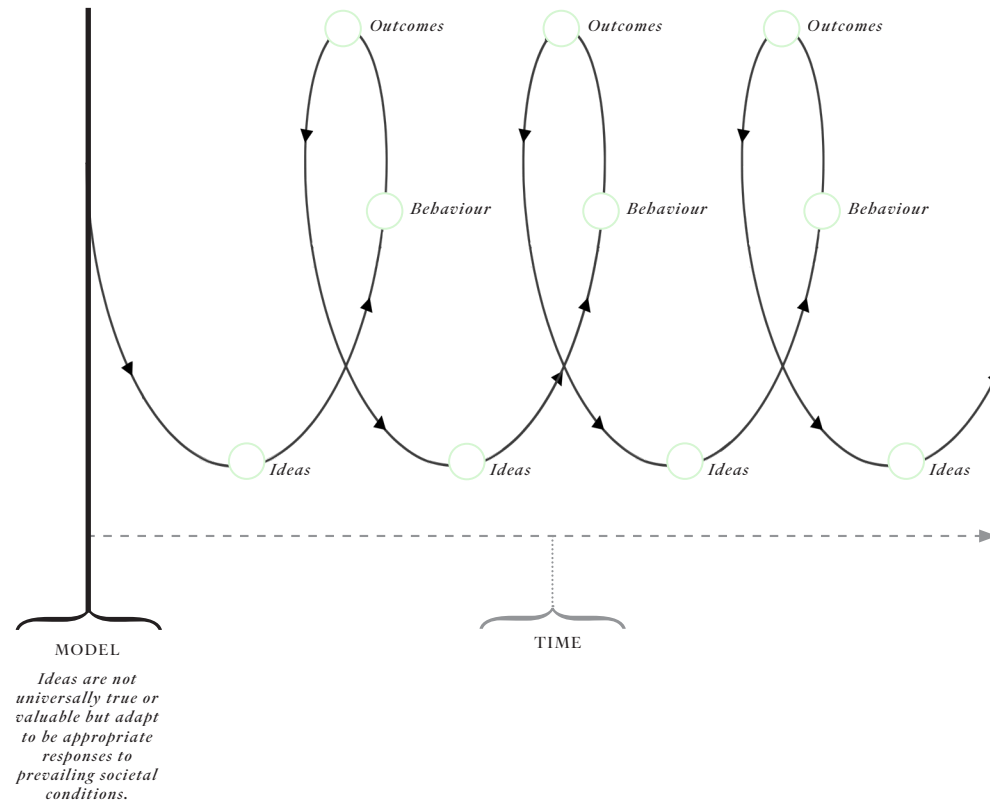
There are many ideas that explain how history unfolds. At one extreme, there are traditional beliefs that often imply that history is inherently difficult for humans to influence because everything that happens is predetermined or is controlled by a supernatural being or beings.

At the other extreme, there are more modern views, influenced by the thinking of Kurt Gödel and the arguments of Karl Popper, which imply that anything can happen, that futures offer infinite possibilities, and that our future will unfold in a way that cannot be predicted or influenced.

If either of these extreme views about our future is adopted, then there can be no place for deliberate interventions by individuals or groups of individuals that could materially alter future outcomes.

The idea that humanity might avoid threats to our modern civilisation requires adoption or development of a nuanced theory of historical change, one that allows human preferences and actions to influence future outcomes.

The potential for purposeful intervention requires a model of societal change that allows for ideas to change in response to societal circumstances. The simple model proposed here says that ideas drive behaviours, and behaviours drive outcomes. People observe outcomes and change their ideas, changing their behaviours and their outcomes in a continuous adaptive process. In the model, ideas are not universally true or valuable but adapt to be appropriate responses to prevailing societal conditions.



Prevailing societal conditions are a result of recent history. When the world's economy was relatively small, around 200 years ago, technological innovations increased the output that could be obtained from the environment, creating huge growth potential. Now the economy has become large relative to the environment, and continuing growth is making the economy even larger relative to the capacity of the environment to support it.

If the environmental damage is really a threat to civilisation there are three possibilities. It may be decided that intervention

is unnecessary so we will continue to follow the course towards collapse, intervention may be needed and successfully promote a change of course, or intervention may be attempted but unsuccessful.

Only the successful intervention possibility responds effectively if there is a need for action to reduce the risk of collapse. It seems obvious that changing ideas would be required to change the course of the world. What is less obvious is which ideas should be changed and how.

Management

The processes that are increasing societal risks are not new. What is new is a kind of perfect storm comprising the magnitude of the environmental challenge, the steepness of our continuing growth and environment damage trajectories, and the strength of currently dominant ideas: the paradigms, theories, values, and beliefs that hold us on the growth trajectory.

Recognition of increasing risks by many people is producing widespread responses designed to protect the environment. Despite widespread and increasing efforts, the responses so far fall a long way short of what would be required to shift modern civilisation onto a low-risk trajectory.

Our choice, as individuals, communities, societies, and humanity, is either to remain on the current path, continuing to compete in the 20th century GDP growth races, or to attempt to shift onto a new path where we seek a different goal.

Recognition of the need for change by some of the Earth's people has not yet established the scale of change required to reduce the risk of overshoot and collapse to an acceptable level. If the difficulty arises because those whom we would normally rely upon to lead change are not managing to reduce the risk enough, then we need to find another pathway to a management solution.

High-quality diagnosis of the situation and of the obstacles to success are essential foundations for a civilisation-protecting strategy, but diagnosis is insufficient by itself. The interventions that will deliver success must be identified too, and they must be implemented.

Proposed solutions such as “protect the environment”, “decarbonise the economy”, “become sustainable”, or “keep global warming below 1.5 degrees Celsius” are not strategies. They are goals. Another way to put it is that they are aspirations intended to guide and motivate change. They include an implied missing step which is “and then a miracle occurs”. The miracle

hoped for is that articulating the goals will somehow cause the actions that will lead to the desired outcomes.

A strategy is a special kind of plan. It is a plan to be successful at something important, or to achieve a highly valued goal. Plans can only deliver valued goals if they are well-designed and are implemented.

Shifting our civilisation onto a course to match the scale of the economy with the scale of the environment requires the same three steps that are required to resolve any environmental issue: identify the changes required, develop a means to ensure the changes, and then act.

The first step identifies physical or “technical” solutions. Technical solutions directly affect the physical world and involve technologies, economic activity, human behaviours, and environmental outcomes. Many technical solutions have already been identified by scientists, engineers and others who understand how the physical world works.

Second, activity changes to implement the technical solutions must be launched via policies or other interventions that can change behaviour. Economists, policymakers, behavioural scientists, and activists have identified incentives, regulations and

motivations that could alter the choices of the decision-makers whose activities influence the adoption of the technical solutions.

Third, the policies must be implemented, so changes happen. Failure to implement policies that would ensure the technical solutions are deployed is the most important reason that environmental damage continues today at a scale that increases risks.

There are three principal types of actors in modern societies who might implement changes to ensure the environment can continue to support the economy: businesses, governments, and people. Each type of actor faces important obstacles that have so far prevented them from taking sufficiently vigorous action.

The solution, which follows from the argument so far, is a strategy to facilitate the management of the communication of selected ideas so that the obstacles faced by each type of actor are overcome. Overcoming those obstacles should empower the actors to act so that changes in behaviour today will alter future outcomes, reducing the risk of civilisation collapse.

Politicians, marketers, social media entrepreneurs, commentators and missionaries exert influence deliberately to get the outcomes they want. The world has become a place where contests among ideas are common. Often the promoters

of ideas are insincere, seeking personal or sectional advantage.

Idea change is gentle but powerful, and it can be used ethically to improve future outcomes for the world's people.

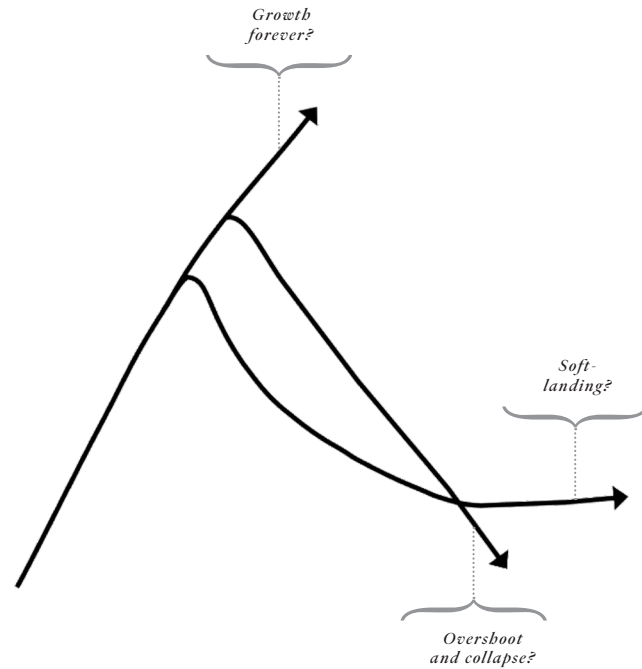


The chapters that follow offer an explanation of the world's circumstances, propose idea changes to reduce the risk that civilisation will collapse, and show how those idea changes can be achieved.

The argument should not depend crucially on any single fact or facts. It is a rearrangement of what is already well-known to form an argument for a change of direction for modern civilisation.

The text is written to be accessible to the general reader and does not require a specialist understanding of the subject matter. The content used is conventional within the subject domains it is drawn from. Sceptical readers are encouraged to test elements that appear wrong or contentious.

The conclusion draws the ideas together to propose a paradigm change, a strategy, a means to implement that strategy, a vision for a safer world, and a practical and simple proposal for action by every person who is willing to help.



PART 1:

EXISTING IDEAS

Chapter 1:

*SCARY
SYMPTOMS*

Climate change threatens

Modern civilisation was built with fossil fuels. Prior to industrialisation, animals, wood, wind, and water provided energy for transport, smelting and milling. Human and animal labour provided food. Once industrialisation accelerated around 1800, the demand for energy increased, and coal was exploited. Technology was developed to use coal, and later oil and gas, to provide energy for modern transport, industrial processes, and agriculture.

Burning fossil fuels releases carbon dioxide, which is the most damaging greenhouse gas. Agriculture and industrial processes release greenhouse gases too, notably methane and nitrous oxide. Increasing the concentration of greenhouse gases in the atmosphere reduces the reflection of incoming heat from the sun back into space and warms the Earth.

The scale of atmospheric change is large. So far, the increase in the atmospheric concentration of carbon dioxide is equivalent to about half of the pre-industrial concentration.

Climate change is a natural process. Climate changes during the last few million years have swung from ice age conditions to warm periods like today. The warm periods were usually shorter than the current 10,000-year warm period that has allowed the emergence of agriculture and civilisation.

Rapid warming towards temperatures beyond recent planetary experience is making it difficult for nature to adapt, and that creates risks because the world's people are still dependent on nature for food, clothing, and shelter.

Temperature increases are changing planetary conditions in several ways that will increase the temperature further. More water and heat in the atmosphere, shrinking arctic ice and the release of trapped methane are effects of warming which contribute to further warming. These and other positive feedbacks identified mean that once the warming trend becomes established, the Earth is likely to warm even more, and the warming trend is likely to become more difficult to reverse.

The world's leaders have become concerned about growing

risks from not being well-prepared for climate change. Many of the Earth's countries have formed agreements to move towards policies that will limit the temperature increase to not more than 1.5C since pre-industrial times. Increase above the target is estimated to create unacceptable risks.

Warming is already around one degree. Further warming is inevitable because there is a lag between the time greenhouse gases are emitted and the warming that results. Many scientists have concluded the 1.5C target can now only be achieved by actively extracting carbon from the atmosphere.

Increasing global temperatures evaporate more of the water that is present on the land, leading to an increase in droughts. Higher temperatures over oceans increase the water temperature, which increases evaporation and then rainfall over land. Along with increases in average temperatures and rainfall, there is an increase in the frequency of extreme events.

When global temperatures rise, some forested land becomes dryer, so forest fires become more frequent and damaging. Forest removal for agriculture, by timber harvesting and from wildfires exposes soil to increased risk of erosion. More intense rainfall runs quickly off the exposed land, causing more severe floods,

which erode productive land and damage infrastructure.

A warming planet melts glaciers and icecaps, disrupting river flows, altering ocean currents, and increasing sea level. Increasing sea level threatens coastal cities and plains.

The climate changes observed so far are faster and larger than most models predicted, and the effects of climate change are more damaging than predicted. Further, new evidence is mostly of discoveries of more severe climate change mechanisms and effects. There is little good news coming from scientific discoveries.

Stable temperatures and regular weather patterns are important for agriculture and civilisation. The climate forces that are being unleashed are not only causing regular and predictable changes. They are leading to climate instability which harms wildlife and threatens food production.

A tipping point occurs when a trend or series of smaller changes causes a larger change that may be irreversible or difficult to reverse. The Earth appears to be approaching several climate tipping points.

One example of a tipping point in the climate system seems to have been reached a few years ago. Increasing temperatures and melting of the arctic ice cap have warmed the arctic rapidly. The

warming arctic weakens the polar vortex, a rapid air circulation that drives northern hemisphere weather systems. A weakening polar vortex slows weather circulation, so cold air stays in one region for longer, causing more intense cold weather. Warm weather systems also slow, causing more heat to accumulate, increasing the frequency and severity of heat wave events.

The effort to reduce climate change is not yet enough to slow and reverse the threatening climate trend.

Given the science and our experiences so far, it seems there will be much more effort required to reduce greenhouse gas emissions than many countries and businesses are planning for, or there will be a lot more change in the Earth's climate than is being prepared for, and likely both.

Emerging scarcities

During the 19th and 20th centuries, people on Earth lived in an age of abundance.

Population growth was made possible by adoption of more productive agricultural methods and technologies, initially accelerating in England after 1750 and then diffusing throughout the world. A large increase in food productivity reduced famine,

improved nutrition, and lowered mortality rates. The population grew by a factor of about eight times between the beginning of the 19th century and the end of the 20th.

Increased agricultural productivity reduced the proportion of the population needed for food production, so many more people could live in towns and cities.

People who were no longer required to produce food provided labour to grow the industrial economy. Fossil fuel energy, advances in technology and more available labour combined to increase production of consumer goods and services. Consumption per person also grew by a factor of about eight times during the 19th and 20th centuries.

Today's globally integrated industrial economy is more than 50x larger than the world's economy was in 1800. The world's people have accumulated wealth in many forms, including housing, transport infrastructure, and factories of many kinds.

Many potential resources are abundant in nature. Technologies developed to gather or extract those resources convert the potential resources into actual resources.

For example, a fisher may use fishing-net technology to gather fish at the seashore. The fisher's productivity is limited

by the resource stock near the shore and the quality of the net technology used. Offshore trawler technology innovation can convert an inaccessible wild fish population into a productive fishery stock that did not exist before the trawling technology became available.

Rapid advances in a wide range of technologies meant that increases in the effectiveness and efficiency of resource extraction methods could maintain growth of supply, usually accompanied by reducing extraction and logistics costs per unit produced. Growing markets provided profits that were reinvested in increased capacities and better technologies. The global economy grew, and real prices fell.

Once the rate of extraction grew large enough, though, the resource extraction or environmental damage exceeded the self-replenishment and self-repair capacity of the local environment. The local environment's stocks or productivity declined.

Local constraints were relieved by trading with others, substituting another resource or adopting new technologies. As locally available resources were depleted, more distant, less accessible, and lower quality resources were exploited. Lower quality land, deeper mines, undersea oil wells, and more distant

fish stocks replaced more accessible local resources that were damaged or depleted.

Now, the scale of the global economy is causing scarcities of some of the most important environmental inputs.

Fresh water is essential for agriculture and industrial processes. Economic growth increases the demand for water, reducing river flows and depleting aquifers. Pollution from agriculture and industrial processes is reducing the quality of fresh water too, increasing costs for treating and transporting water. There are many technologies that can improve water use efficiency and quality, but the current expectation is that pressure on water supplies will continue to increase during the next few decades.

A growing food supply will be required to support the large increase in the global population that is projected for the next few decades. Food supply depends on agriculture, and high agricultural productivity depends on an adequate supply of irrigated water.

Agriculture also requires high-quality land. During the last few decades, nearly 1% of productive agricultural land has been lost or degraded each year by urbanisation, transport networks,

erosion, salination and desertification. That lost land has been replaced by new land being brought into production. Total land in cultivation globally has remained approximately constant, with food supply increases being driven mainly by increasing yields.

Most of the world's food comes from cereals, mainly rice, wheat, and maize. Increases in cereal yields have been achieved largely by increasing average yields toward the maximum biologically achievable yield for each cereal type. Maximum yields for cereals are not increasing much, so there are diminishing returns for cereal yield growth, and the growth of average cereal yield is expected to slow.

With slowing yield growth, more land may be needed to sustain and grow food output, but there are no longer large quantities of high-quality reserve land to bring into production. Much currently unused land is unsuitable for agricultural production or is in forests or protected wilderness areas.

Climate change is expected to increase food production potential in many places, replacing some of the lands on coastal plains that will be lost to sea-level rise. Overall, however, climate change is expected to put downward pressure on food supply during the next few decades, especially in the more densely populated and less affluent tropical regions.

Switching consumption from meat and dairy to cereals, fruit and vegetables is expected to increase the amount of food that can be produced from the same quantity of land. Industrial food innovation offers the potential for food production from a wider range of nutrient inputs.

Energy is essential for modern agriculture, for the manufacture of fertilisers, for transport of agricultural inputs to farmers, for operating farms, for shipment of food to distant markets, and for storage. Energy is required for industrial processes and for the transport of industrial goods and people.

Increasing recognition of the risks from climate change is contributing to a shift from fossil fuel burning to much lower cost and lower emissions forms of electricity generation, notably wind and solar. Many countries have high population densities and lack abundant low cost and low emission energy resources relative to their population sizes. Those countries will find it difficult and costly to transition away from fossil fuels.

When the world's economy was small, and technologies were simple, many of the resources extracted from the environment were usually replaced by the environment's own self-replenishment and self-repair processes. The environment could

replenish stocks of many resource inputs by having biological populations grow again and replenish pollution capacity by allowing pollution to disperse or change into harmless forms.

Now the economy has grown, and we are dispersing harmful chemicals very widely, so the economy's draw from the environment is reducing the environment's capacity to replenish itself. Instead of the environment being a mostly benign repairer of the economy, it now competes with the economy for nutrients and other resources that are becoming scarce.

The trend in the cost of resources depends on the balance between the pace of emergence of resource constraints that increase the cost of extraction and transport versus the pace of improvement of the extraction, production, and transport technologies.

Some of the real price reductions observed for many resources during the 19th and 20th centuries have been reversing recently, signalling that scarcities are emerging and growing.

Apparently, the world's supply challenge now is to deploy technologies to increase resource availability, slow resource depletion and reduce environmental damage fast enough to supply the inputs needed for the expected growth of the world's population and economy.

Food Production is Damaging Ecosystems

Ecosystems are communities of plants, humans and other animals, and other micro-organisms which interact with one another and with their non-living environments. Maintaining biodiversity is an important condition for ecosystem health, which is, in turn, an important foundation for human survival and well-being.

Ecosystem services are benefits people obtain from participating in ecosystems. The value of ecosystem services, largely provided outside of the measured economy, is large relative to the value of the measured global economy.

The natural world humans still depend on has evolved over hundreds of millions of years. Evolution occurs as species adapt to naturally occurring changes in the environment, with periods of relative stability allowing for the co-evolution of species. Co-evolution establishes intricate ecosystems where species specialise and become more interdependent. Rapid changes can break the beneficial connections within communities of species, disrupting ecological stability, threatening biodiversity, and triggering periods of rapid evolution.

Humans have been influential participants in ecosystem evolution for a very long time. More than two million years ago,

meat was introduced to early humans' diets, and within half a million years, most of the Earth's carnivore species were extinct. That large-scale extinction appears due to the failure of many carnivore species to compete effectively with humans. More recently, the arrival of humans in the Americas at the end of the last ice age was accompanied by extinction of most large mammal species in both North and South America.

The impacts of humans are not limited to species extinction. For example, over-use in Neolithic and ancient times transformed much of the Mediterranean region from a heavily forested land with high-quality soils to the dry, rocky, and less productive landscape that is widespread today.

People are now having a much bigger effect on global ecosystems. Extinctions get a lot of attention, but declining populations within species and disruption of ecosystems seem more threatening than the count of extinctions. Habitats are being lost to urbanisation, agriculture expansion and climate change. The quality of the remaining habitats is being degraded by pollution. Most of the large wild animal biomass on the land and in the oceans has been destroyed in the last two centuries. Insect and bird populations are declining.

Food producing ecosystems are expanding output to support

the growing human population, while most other ecosystems are being damaged.

Ecosystem damage is reducing the size and quality of the resources that provide important ecosystem services people depend on. Ecosystem services in decline include fish stocks, wild foods, productive land quality, water supply and quality, species diversity including crop varieties, pollinators, and natural buffers against extreme events.

Ecosystem damage is diverse and may have local, regional, or global effects. For example, increased precipitation, glacier melt and deforestation in the Himalayas washes silt loaded with nutrients down rivers, causing flooding and high nutrient concentrations in the nearby ocean. High nutrient concentrations near river-mouths caused by silting and fertiliser run-off reduce oxygen availability in the water, resulting in the loss of local marine life and increases in jellyfish populations.

As biodiversity declines and ecosystem damage proceeds, the ecosystem services that humans depend on are being threatened. That would not be a major problem if people could migrate to live somewhere less damaged or find another way to secure ecosystem services, as people often did in the past. Today, however, there are

few habitable places available for affected people to migrate to, and there are limited viable substitutes for many ecosystem services. Essentially, the scale of humanity creates a global risk that did not exist when the population was much smaller.

The vulnerability of human populations is increased by dependence on advanced technologies that are essential to maintain the human food supply. Cereal crops depend on continuous plant-breeding programmes because the hybrid seeds used do not breed true. The productivity of agriculture depends on machinery and supplies of energy and fertilisers. There is currently no easy alternative to maintaining the industrial agriculture systems which provide the food people need, but the scale and damaging impacts of those industrial systems degrade the ecosystems people depend on.

Continued rapid expansion of the global economy will place increased demands on ecosystems that are already in decline. The scale of interference with natural ecosystems is already so large it would be unwise to rely on natural processes to remedy the damage being done.

People now manage many of the world's ecosystems. Pollination depends on managing bee diseases. A stable climate depends on decarbonising the atmosphere. Fisheries depend on

regulation of catches, managed breeding, and establishment of protected breeding zones.

Unfortunately, ecosystems are difficult to manage because they are complex and ecosystem management is embedded in socio-economic arrangements. Global and some national targets for large reductions in ecosystem damage have been set, but those targets are not yet supported by credible and funded action plans.



Chapter 2:

*DAMAGING
PROCESSES*

Transition to the industrial era.

Appropriately responding to our environmental challenges requires an understanding of human history that explains why environment constraints are emerging now and allows anticipating the possible impacts on humanity's future. More specifically, the question is whether the observation of emerging and apparently threatening environmental constraints signals a temporary challenge to progress that will be easily overcome or something much more threatening.

In a conventional view of human history, progress has been continuous, with a recent acceleration, and has been driven by a flow of technological improvements. However, that implicitly continuous and gradualist view does not adequately account for the pattern of changes in the human population during the 20,000 years since the peak of the last ice age.

The size of the human population, like the population of other animals, is limited by the available supply of energy in the form of food. The amount of food energy produced from a unit of land has changed markedly during human history. When humans were hunters and gatherers, food production, and therefore population density and the population itself, were constrained by the food energy content of forest, coast, savannah and tundra, and the technologies used to locate, gather, and process food.

Starting around 10,000 years ago, an important shift in food technologies began, with agriculture and herding of domesticated animals developing in several places and then spreading widely. Cultivation provides much more food energy per unit of land than the fruits, vegetables, roots, and animals that hunter-gatherers could harvest. Transitions of agricultural technology were accompanied by rapid increases in population densities.

The shift to farming greatly increased the productive capacity of each unit of land. Environment capital depends on the capacity to extract resources from the physical environment.

Reduced mobility allowed more frequent births and bigger families. Less mobile populations with higher population densities, larger communities and more infrastructure had more

incentive to defend their land. As local populations grew too large to be supported by local resources, new communities were established on suitable nearby land. Agricultural technologies spread and gradually improved. Cities developed, allowing greater specialisation, and many other new technologies were discovered, developed, and disseminated.

Despite technological development, the global population grew slowly during the era of traditional agriculture, which lasted until the end of the 18th century. Population growth was limited by the amount of land suitable for agriculture and the productivity of the technologies used to farm that land. Less than 10% of the population lived in cities, and a large majority of people remained engaged in agriculture.

The start of the 1800s saw a rapid increase in population and productivity. There were four important drivers of the changes. First, the improved agricultural technologies increased population densities, and people migrated to cities for employment in manufacturing.

Second, the use of coal and then other fossil fuels became widespread. Increasing pressures on the supply of wood for fuel, shipping and construction had created shortages which

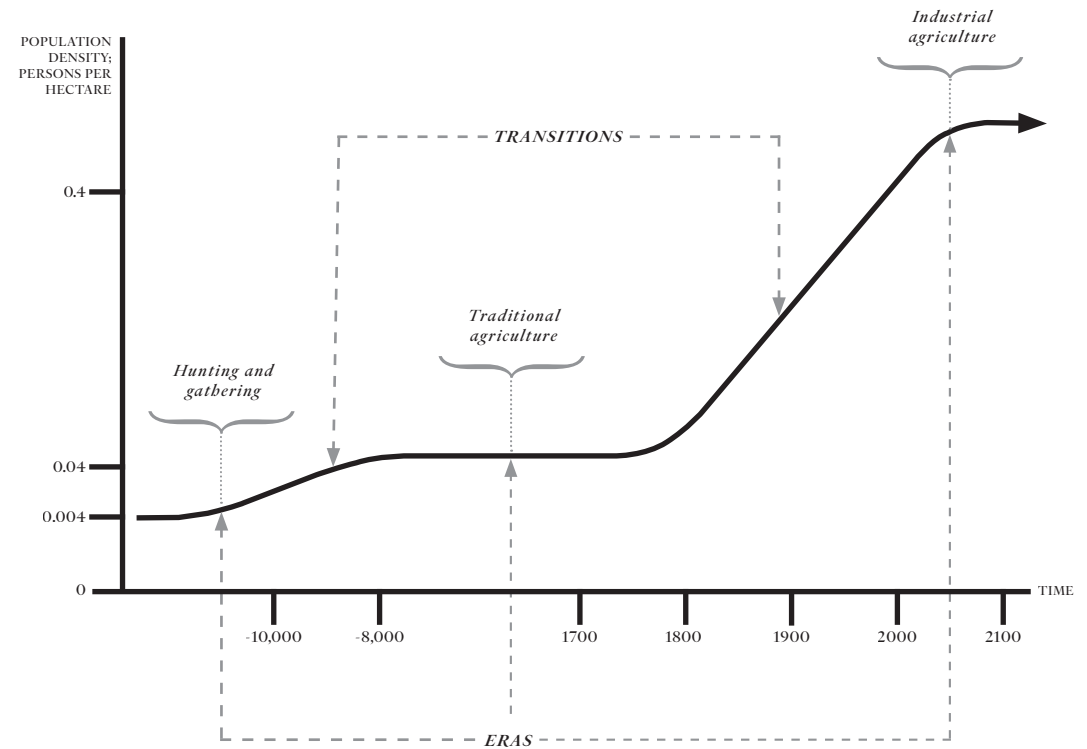
stimulated the use of coal as an energy source. Adoption of the steam engine and then the internal combustion engine meant each worker could produce a lot more output. The use of fossil fuels in farming had a dramatic impact, allowing the output of a single farmer to be multiplied many times, as human and animal labour was replaced by farm machinery.

Third, importing resources from other parts of the world and exporting manufactured goods provided benefits from scale and specialisation, further increasing output, and contributing to the accumulation of capital. Improved agricultural and transport technologies allowed farming of less productive and more distant land.

Fourth, scientific and technological innovation, which had accelerated during the eighteenth century, meant resources could be combined in diverse ways to produce goods and services not available previously. Transfer of technologies to less developed countries spread rapid population growth across the whole world.

Looking at the history of population growth since the last ice age reveals that the conventional view of continuous progress is problematic. Progress does look continuous when we focus on the last 200 years but not if we look back over the last 15,000 years.

What is apparent over that longer timeframe is that rather than generalised and relatively continuous improvements in a wide range of technologies driving population growth, breakthroughs in food technology play the dominant role.



The record shows two long periods of relatively slow population growth and two periods of faster growth. The rapid growth periods, 'transitions', happened because important food technology innovations temporarily remove constraints on food supply. Once the population grows to reach the constraints

imposed by land availability and quality, and the food technology used, then the population stabilises, and humanity is in an ‘era’.

That implies the world will soon enter another era when population stabilises or grows only slowly, constrained again by land availability and quality, and food production technology.

The ongoing rapid growth of population signals that the world is still in a transition. Emergence of environmental symptoms of climate change, resource scarcities, and ecosystem decline signal that the transition is coming to an end.

That implies the conventional understanding that we are living in the “industrial age” is a misunderstanding of our present circumstances. A more informative statement is that we are living near the end of the transition to the era of industrial agriculture.

Environment constraints return

For much of human history, populations were relatively stable, limited by constraints on the local availability of important environmental resources. During the last two centuries, technological advances have reduced environmental constraints, unleashing a rapid growth phase.

The Earth is large but finite. While technological advances

made a rapid increase in economic output possible, important physical and biological limits remain. The emergence of global environmental issues during the last few decades signals that the global economy is now drawing on environmental resources at a large enough scale to be bumping up against limits imposed by the total size of the Earth's environment.

At the beginning of the growth phase, the scale of many human activities was so small that environmental consequences were unimportant or quickly repaired. Trees were replaced, minerals were abundant, animal populations recovered, and pollution was insignificant relative to the capacity of the environment to accommodate it.

As output grew, in some places the scale of environment damage eventually became larger than the environment's self-repair capacity, so the local physical environment began to be harmed. Natural resource stocks declined, and pollution accumulated.

Early in the transition to the industrial era, the large potential productivity of the environment, relative to the economy's draw from the environment, provided “headroom”, allowing relatively unconstrained growth even though damage

to the environment was accumulating. The scale of economic activity was still small relative to the scale of environmental resources available and the potential to absorb or disperse pollution, so growing use of environmental resources had no important economic consequences.

As growth continued, aggregate headroom reduced and eventually was fully used, so resource depletion and environment damage began to have more serious economic effects. At first, the economic costs were small and much smaller than the economic benefits from the activities. Economists refer to economic damage to others caused by environmentally harmful activities as “externalities”. An example is when uncontrolled agricultural or industrial pollution reduces a fish stock downstream, harming the interests of the fishery operators.

Continuing to grow activities that are environmentally harmful can eventually reduce the productivity of an environmental resource so much that the harm caused to those affected by the environmental damage is greater than the economic benefit from the activity.

If the economic harms from activity were all borne by the person or business carrying out the activity, the activity

would stop because the costs to the actor would be greater than the benefits available. Often, however, the indirect costs of environmental externalities are delayed, experienced by other people, and shared widely, so they do not deter the actor causing the harm. That harmful but persistent situation is called the “tragedy of the commons” in the economic literature.

The “prisoner’s dilemma” is a special case of the tragedy of the commons. The prisoner’s dilemma arises if the economic cost to each business or person carrying out the activity become larger than the benefit each gains. People conducting the activity continue because they want the benefit from the activity, and they will suffer the costs of continued activity by others regardless of their choice to act or not act.

Over time, as the transition to the industrial era proceeds, economic growth causes loss of headroom, then externalities, and then tragedies of the commons and prisoner’s dilemmas. Continuing or growing activity if there are externalities, a tragedy of the commons or a prisoner’s dilemma damages the environment even more.

The damaging activity may stop eventually because rising input costs deter the person or business from carrying out the

activity or because new regulations protect the environment.

Following input cost increases or regulation, production might move to another location where the environment's capacity is greater, so output growth can continue. Eventually, though, if the damaging activity continues, the Earth's scale limits the available locations for that type of activity.

Technological innovation may allow a switch to a less damaging substitute, which allows growth to continue. If the new technology used for the activity still causes damage, avoidance of the growth constraint is likely to be temporary, lasting only until the damage accumulates sufficiently in the new location. Growth will be sustainable long-term only if the new technology reduces the environmental damage to a level below the self-repair capacity of the environment.

The current situation of the Earth is that many important economic activities are causing environmental harm. The aggregate scale of environmentally damaging economic activity is becoming large relative to the capacity of the environment.

The growth and persistence of environmentally damaging economic activity are causing the scary symptoms which signal that the world is nearing the end of the growth phase.

Overshoot grows

The global population is projected to continue to grow, and societies are competing and collaborating to increase consumption per person. Rapid economic growth is expected during the next few decades despite growing threats from environmental damage.

Climate change threatens. Many resource costs are increasing. Ecosystems are deteriorating, and biodiversity is reducing. Pollution is accumulating.

If the environmental analysis indicates that the growth phase should end soon, but the world is committed to a strong economic growth trajectory, then what will happen during the next few decades?

Rapid global economic growth could continue if the increasing environmental difficulties do not affect the economy much. The damaging effects on the environment might be more than offset by technologies to increase productivity, reduce damage, and restore the environment.

Improving environmental outcomes is still much less important than wealth growth as a motivator for technology innovation. Damage-reducing technologies and policies are not yet being developed and deployed fast enough to reverse the deterioration of the environment.

In the long run, the economy cannot be larger than what can be sustainably supported by the capacity of the environment. If current economic growth trends persist for long enough, with continuing environmental damage, then eventually, the environment will no longer be able to support the economy. Growing the economy further will increase the threat to the economy from environmental constraints unless effort is redirected to developing and deploying technologies and policies that increase the productivity of the environment and reduce damage.

An indication of the sustainable size of the world's economy can be developed using ecological footprint analysis. That analysis estimates, for each country, the amount of land that would be needed for sustainable production supporting the population with current consumption per capita with the current technologies. The land required for each country's consumption is added up to get an estimate of the total amount of land that would be required to sustainably operate the global economy.

Ecological footprint analysis estimates that around 1.7 Earths would be required to sustainably support humanity with today's technologies and living standards. If current trends continue, around two Earths would be needed to operate sustainably in 2050.

The main drivers of overshoot are the accumulation of carbon dioxide in the atmosphere, largely driven by energy consumption, and the requirement for cropland to feed people.

The world is already in "overshoot" because the scale of the economy, driven by population size and consumption per person, is much larger than what can be sustainably supported by the environment. On this measure, the world, in aggregate, has been operating unsustainably since around 1980.

Overshoot is possible because the economy can, in effect, borrow temporarily from the future by depleting the future productive capacity of the environment to provide resources for current output. Continuing to harm the environment to maintain and grow the economy causes the scary environmental symptoms of climate change, scarcities, and ecosystem decline.

If that situation continues, then eventually there must be an adjustment to bring the scale of the economy back into alignment with the capacity of the environment to support it. That realignment may take the form of an economic collapse.

Overshoot followed by collapse is not unusual. Temporary abundance of food allows animal populations to grow beyond the long-term capacity of their environments to support them,

and then the populations collapse.

Environmental historians have found overshoot and collapse frequently happens to human communities and civilisations too. Populations expand to make full use of the available resources and then over-exploit their local environments. Over-exploitation increases vulnerability to environmental shocks. Climate change often contributes to or triggers the collapse of civilisations. Examples include the Sumerians, the bronze age civilisations of the Eastern Mediterranean, Rome, the Mayans, and the Khmers.

The scale and momentum of population growth, scarcity of accessible and fertile unused land, climate change, and the whole-of-world scope make overshoot especially dangerous now. A combination of much more environmentally efficient technologies, reduced consumption per person, and a lower population would be needed to bring the economy's size and the environment's capacity back into balance. Operating the world's economy beyond the capacity of the environment to sustain it is further damaging the environment and so reducing the environment's potential carrying capacity.

Jared Diamond, in his book *Collapse: How Societies Choose to Fail or Succeed*, describes several past collapses and identifies

factors which contribute to collapse. Two of his conclusions are that collapses are often associated with environment overshoot and that the responses of societies can affect the outcome.

In these circumstances, it seems prudent for the world to have a comprehensive plan to reduce overshoot and avoid collapse. Long term, it would be prudent to keep the scale of the economy below the sustainable capacity of the environment to support it so that there is some headroom to provide resilience to respond effectively to expected and unexpected shocks.

The world's actual plan seems to be to continue to grow the global population and economy and to respond tactically to environmental issues as they arise. Priorities and the current trajectory are still away from rather than towards global aggregate sustainability.

A smooth, managed process that gently brings the economy's size and the environment's capacity into alignment would deliver a "soft-landing", avoiding or reducing the harms that would be caused by economic collapse.



Chapter 3:

*FLAWED
EXPLANATIONS*

Planetary and historical processes

Managing today's society to avoid future risks requires an adequate understanding of the historical processes taking us from the past, through the present, and into the future. If the forces driving historical changes are misunderstood, or people believe they cannot anticipate future trends, then efforts to avoid future risks are likely to be weak.

The modern world is very different from what is described in most history writing, so it seems reasonable to suppose that history cannot teach us much about how to manage the future. Furthermore, the popular understanding of history as a sequence of events means that it appears to lack a large-scale structure other than the received wisdom of continuous progress. That contributes to the reluctance of many people in modern societies to look to history for insights to help guide management of the future.

Importantly, when history is considered at all, recent history tends to dominate our collective understanding. The 19th and 20th centuries did not have widespread environmental constraints, and most of the history that modern people understand was written during those centuries. As a result, the role of resource constraints in driving societal evolution has been largely ignored in our explanations of the recent and distant past. Only in the last few decades have environmental historians offered accounts that feature the environment in explanations of historical phenomena.

Important philosophical arguments have further strengthened the prevailing view that the future cannot, and should not, be predicted and managed. In the 1930s, Kurt Gödel proved that mathematical systems are open, which means that they cannot be completely described by a set of principles, and by implication that other complex explanatory systems which can be described by mathematics are also open. The implication is that understanding is always incomplete, and therefore there are always more possibilities beyond those already understood.

Karl Popper applied this kind of thinking to social science in his influential book *The Poverty of Historicism*. He argued that history results from the choices made by people, which

cannot be foreseen, and by extension, that the future cannot be predicted from the past. These theorists' ideas have helped to establish widespread beliefs about the futility of trying to forecast and manage the future.

The rapid technological advances of the 19th and 20th centuries reinforced popular understanding of unlimited possibilities. These advances provided innovations that had much greater impacts than expected, such as the steam engine, electrification, computers, and the Internet. In the absence of a widely understood theory of history that provides guidance about likely future conditions, there is a default belief that the future will be an extension of the past, with occasional surprises from unexpected beneficial technologies.

These mindsets reduce our ability to respond to environmental threats. For example, in 1972, the Club of Rome group warned that unless humanity changed course to slow population and industrial growth, there would be serious trouble within 100 years. Their work was savagely criticised by economic and policy communities, which misunderstood and rejected the warning. By 2000 there was a widespread and incorrect belief that evidence of uninterrupted growth since 1972 had discredited

what was by then widely misrepresented as a failed near-term prediction rather than a long-term warning. That incorrect belief added to the narrative that the future cannot be predicted and that we should not act to manage the environment.

If historical processes were only influenced by human affairs, then freedom of choice might take us in unpredictable directions, as argued by Popper. However, as environmental historians have shown, civilisations often grow to, and then beyond, the sustainably available environmental resources, and then a climate or other shock causes decline and collapse.

It is possible to reconcile these theoretical positions by regarding human activity as a force that can influence the unfolding of history. Instead of following the pattern of growth, overshoot and collapse that is common for animal populations and past civilisations, people have the option to make active decisions to avoid overshoot.

In this way of thinking, human affairs co-evolve with large scale natural processes that limit historical possibilities. The reasoning implies that, in the absence of human intervention to change the course of history, our future may be threatened by climate change, resource scarcities, and ecosystem damage.

That would produce nasty surprises as powerful forces interact in a perturbed human-natural system to bring consumption back below the sustainable level.

Most modern people expect that if change does come, it is likely to come gradually. Experience of the last 70 years of steady progress and growth combines with a wider bias towards gradualism to lead us to expect that future changes will be slow and steady. Darwin thought that evolution was a measured process taking place over very long periods. Similarly, climate modellers usually present smooth warming curves.

Examination of the past tells a different story. Historic, evolutionary and climate records reveal patterns of punctuated equilibrium with long periods of slow change broken by short periods with large changes. Contrary to popular belief, it would be unusual if the forces already unleashed by humanity's rapid growth phase do not cause other large-scale changes that will disrupt the modern growth equilibrium.

Instead of heeding lessons from the work of environmental historians, climate scientists, and groups like the Club of Rome, most people continue to prioritise growth, unconcerned about the increasing risks. Misunderstanding of the patterns

of historical and planetary change processes contributes to humanity's choice to pursue further growth in circumstances where growth is increasingly dangerous.

The emergence of the Covid-19 pandemic was a surprise for many. Devastating wildfires, floods or droughts are usually surprises. Abrupt, large scale climate change or widespread food shortages would be surprises. These are all surprises because modern people tend to assume that their future is assured as a continuation of the relatively stable recent past.

The idea that the future is boundless and too complex to predict also increases the barriers to taking actions to safeguard civilisation's future.

Growth economics

Modern economics plays a large role in influencing how societies make decisions, especially decisions affecting efficiency and growth. Countries that grow successfully provide better living standards for their citizens. They are better able to defend themselves from others who might wish to take their resources.

In the mainstream economic model, growth results from using technology to transform capital and labour into output.

Output is used for current consumption and to increase stocks of capital and labour. Better technologies and growth of stocks of capital and labour produce output growth. Human populations grow, and people consume more.

As an academic discipline, conventional modern economics has been hugely successful. Many of today's leaders are trained in economics, and it is difficult to become a government leader without supporting the main prescriptions of modern economics. The political process establishes rules to encourage growth and to allocate consumption and wealth to those who provide labour, capital, innovation, and entrepreneurship.

The mainstream economics applied by policymakers, politicians, and business managers to promote economic growth is not the specialist environmental and ecological economics that pays attention to environmental damage and limits.

In most applied growth economics, the important constraints on growth are the availability of labour and capital and the rate of technological improvement. The environment is made into an unconstrained stock of resources and waste sinks by the usually implicit assumption of "free gifts and free disposals", which says that resources can be taken from the environment,

and wastes can be disposed of into the environment without limit. Economic actors pay the costs of acquiring the resources and the costs of disposal, but they need not be concerned about consequences for environment stocks or for environment limits. In conventional applied economics, growth can continue indefinitely because there is nothing to impede it.

The most important tools of modern economics were developed during the second half of the 19th century and early 20th century when economies were growing rapidly, and aggregate environmental constraints had become unimportant.

Before then, in "classical" economics, access to environmental resources limited output and was fundamental to economic theory. The important constraints on output were the quantity and quality of land and the labour used to produce food.

After the beginning of the growth phase and once land resources no longer constrained output, environment constraints were dropped from mainstream economic theory. Capital and labour became the only aggregate constraints that mattered.

Economists who observed local environmental constraints extended the conventional theory to accommodate and respond to them. When costs of commodities increase because of scarcities,

economists assume that technological innovation will allow other goods to be used as substitutes. If harmful environmental damage results from economic activity, then policies such as taxes and quotas are prescribed to encourage innovations and substitutions that allow growth to continue uninterrupted.

For as long as the economy remained small relative to the resource production and waste absorption capacity of the environment, these principles of conventional modern economics worked well. There was no need to explain how the growth phase might end.

Now the global economy is growing beyond the capacity of the environment to sustain it, so resource constraints and environmental damage are becoming important again. There is no practical substitute for the Earth's environment as an aggregate, and assuming that resources and waste disposal capacity are available without limit does not make it so.

Environment damage is likely to be recorded as a net economic benefit. The cost to repair environmental damage, for example from storms or biosecurity failures, is usually recorded as positive economic activity and contributes to job creation and measured growth. The long-term damage, for example to

property, infrastructure or to productive ecosystems, is not usually recorded as a negative economic impact in national accounting.

Despite emerging scarcities and growing environment damage, the principal focus of economic policies is still on promoting growth.

An important but not obvious contributor to the persistence of growth as the priority is that modern economics aspires to be a science, discovering universal laws that can be used to improve people's lives. While the laws of science may change through discoveries of better laws, scientific laws are intended to work everywhere and for all times. In mainstream modern economics, each time-period is assumed to be much like those before and those following, and the long term is thought of as the outcome from a series of essentially similar short terms.

Economic cycles may interrupt growth temporarily, but growth is firmly established as the economic goal and is expected to resume after interruptions. History is irrelevant, and the future is a continuous extension of the present. Accordingly, as environmental resources have not been important economic constraints in the recent past, it continues to be assumed that they will remain similarly unimportant in the future.

A second noteworthy reason that the growth paradigm continues to predominate is that many economic thinkers and modern leaders have learned a great deal about economics and much less about environmental science and history. That allows many analysts to continue to act as if environment constraints, and their consequences, are merely small and temporary inconveniences for others.

The investments of academic economists and world leaders in understanding how to grow economies is itself an impediment to change. Economic theory is a difficult subject. Adding the environment as a factor of production and an aggregate constraint makes societal management much more complex. It would require re-learning that may not appeal for established leaders. It implies economic redirection that might be unpopular and difficult.

Regardless of the assumptions and beliefs of conventional modern economists and of the people influenced by them, the environment is finite, and so it must eventually constrain economic growth. That constraint is approaching, as signalled by the emergence of climate change, resource scarcities and ecosystem decline at a civilisation-threatening scale.

Evolving growth constraints

The relative importance of labour, capital, and environmental capacity as constraints on economic output has shifted during the last few centuries. These changes have important implications for the power of different interests within societies and for the importance of managing the environment.

During the era of traditional agriculture, fewer than 10% of the population lived in cities, and most people worked on the land. Availability of suitable land and skilled labour to grow food were the most important constraints on output. Agricultural tools were simple and readily available.

Typically, power was vested in absolute monarchs or an aristocracy, whose responsibilities to their people and interests in the future of their dynasties encouraged long term thinking. Peasants and their descendants were tied to the land, so they looked after the land they depended on. Change was slow.

When agricultural technologies and fossil fuels lifted European agricultural productivity, labour became more mobile, and cities grew rapidly, along with industrial production. During the growth phase of the transition, the proportion of the population engaged in agriculture in developed economies decreased to less

than 10%, and globally the proportion of the population living in cities has grown beyond 50%. Labour and capital became the most important constraints on the growth of output.

Industrialisation and specialisation created many jobs. Labour was an important constraint on output, so many workers were organised, bargained, and sometimes revolted to improve their living and working conditions.

Growing incomes and consumption made life better for almost all people, and growth contributed to returns to capital. The aggregate global environment could be safely ignored because there was still a lot of headroom.

Then, during the last few decades of the 20th century, two very large and continuing trends emerged.

The first trend was that factory automation, and then computerisation of office and sales work, added to the long-running mechanisation trend and reduced, relatively, the amount of labour required to produce, sell, and distribute goods and services. Continued automation of work, artificial intelligence, and robotics is likely to continue the established trend of reducing relative power of workers.

Service and then knowledge jobs grew to replace the jobs

lost to mechanisation and automation, work became even more specialised, and skill requirements increased. The number and power of talented and skilled people increased, their incomes grew, and they accumulated savings, which became wealth, and were reinvested as capital.

The second very large trend is that environment damage is eroding natural capital, which provides many of the inputs to production.

The consequence is that opportunities to exploit readily accessible or low-cost environmental resources for economic activity are less available, creating a drag on economic potential.

Technological innovation and economies of scale reduce the effects of these constraints. Looked at from a global perspective though, the environment has changed from being an apparently unlimited resource to become, once again, an important constraint on production.

From the perspective of several centuries, the most important economic constraints have shifted. During the traditional agricultural era, the important constraints were land and labour. During the transition to the industrial agriculture era, the constraints became capital and labour, because food

technology innovation and colonisation released the environment constraint. As the transition ends, the most important constraints are shifting again to become capital and environment.

Those shifts of constraints are reflected in the evolving power relationships within and between human societies. The power of interests owning capital has increased because there is more capital, capital remains an important constraint on production, and more voters have capital.

The power of labour has reduced because automation and talent have substituted for workers. Political parties which traditionally got their power from labour have sustained their appeal by diffusing their promises to include satisfying the interests of capital and offering environmental protection.

The 19th century contest between capital and labour has been replaced by political contests between parties or leaders that compete by offering better management of the economy to promote the economic growth that supports the interests of both capital owners and workers.

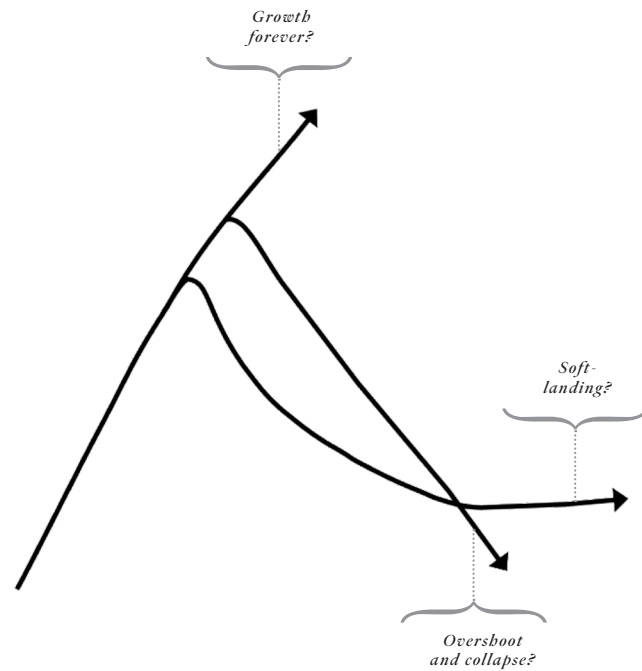
Re-emergence of the environment as a constraint reduces opportunities to grow economies by finding new ways and places to exploit natural capital. That creates further downward pressure

on the demand for low-skilled labour, and it reduces opportunities for profitable capital investment, creating downward pressure on returns on capital invested. Downward pressure on demand for labour and capital increases the shared incentive for some workers and many capital interests to resist environment protections.

Increasing environment constraints, together with the shared incentives of some workers and capital managers to develop the remaining resource-exploiting opportunities, imply the need for stronger power to protect the environment. That power is emerging, but it is not yet strong.

The weakening power of labour interests, the increasing power of capital interests, and growing environmental risks have important implications for the kinds of thinking required to ensure societal success. The ideas that emerged to manage the labour and capital constraints of the 19th and 20th centuries should not be automatically assumed to work well to deliver a soft-landing at the end of the transition.





PART 2:

CHANGING IDEAS

Chapter 4:

*NEW
THINKING*

Different goals

Human activity expanded rapidly during the 19th and 20th centuries, so the world's economy is now consuming at a level that would require much more than one Earth to sustain. The economy has grown from a size where it was consuming the yield on the Earth's natural capital to a size where it is now consuming the natural capital itself. Some current and recent environmentally damaging activity does not yet affect ecosystem services and the economy because of lags, sometimes of decades or longer, between damaging activities and their environmental and economic effects.

Despite increasing risks, the damaging activities continue to grow, partly because most people, including the most powerful, are benefiting in the short term from increasing consumption and wealth, and the overshoot is not yet causing visible aggregate economic decline. Faith in future technologies and future

responses contributes to the motivation to continue to maximise growth and the willingness to increase the size of the overshoot.

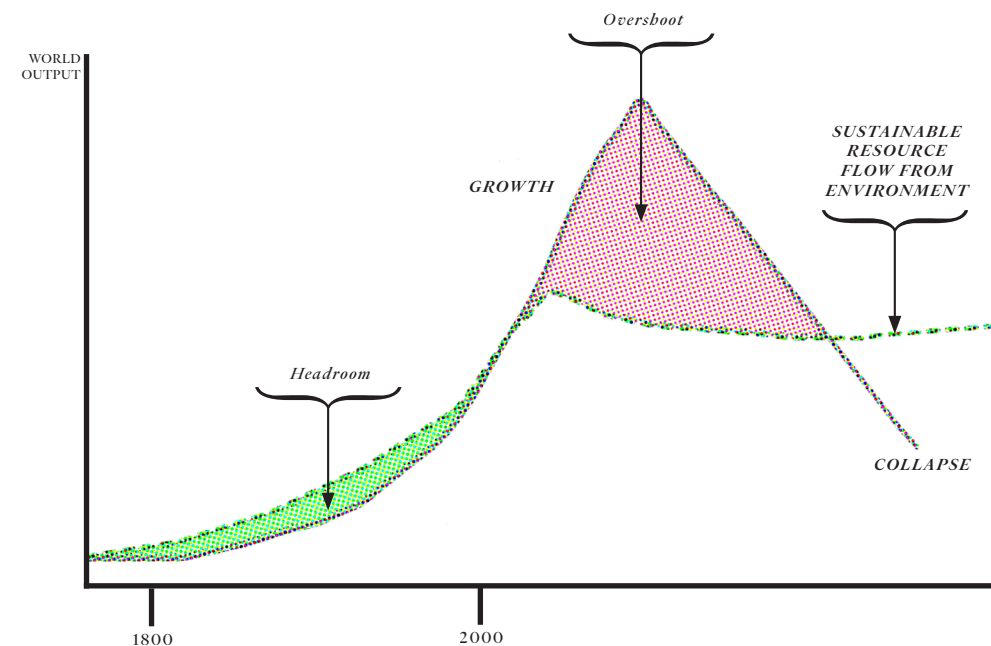
There is not just a short-term trade-off between today's economic and environmental objectives, as is sometimes presented. The more fundamental management challenge is that maximising tomorrow's economic output may reduce the output that will be achievable during the remainder of the 21st century and beyond.

Continuing to maximise economic output growth, with the world's population expected to grow by about two billion in the next three decades might prove safe if the world could deploy technologies that deliver a huge increase in the productivity of the environment. That would require a concerted effort to use environmental resources much more efficiently. Hoping unrealistically for that outcome would advance the world rapidly towards a choke point where the environment will no longer support growth of the economy. Once growth stops, the world's output will be much higher than what the environment can sustainably support and output is likely to begin to decline, initiating the collapse phase.

A collapse which the world is not well prepared for would have widespread effects, likely including disruption of supply chains and social order, widespread famines, more failing and failed

states, infrastructure deterioration, uncontrolled diseases, conflict, migration of climate refugees and a decline of the global population.

Some might argue that would be a good thing, given overpopulation and its environmental consequences, but even if people were willing to accept the personal risks, hardship and loss of life, the widespread desperation likely during collapse would lead to over-exploitation and the degradation of much of the world's remaining environment capital.



Overshoot and collapse happened to many civilisations during the traditional agricultural era. Collapses left their signatures in archaeological, paleontological, and literary

records, in ideas about apocalypse, and in traditions that encouraged behaviours to protect environmental resources.

Before the modern growth phase, many people were multi-skilled, and communities were well equipped to recover from collapse.

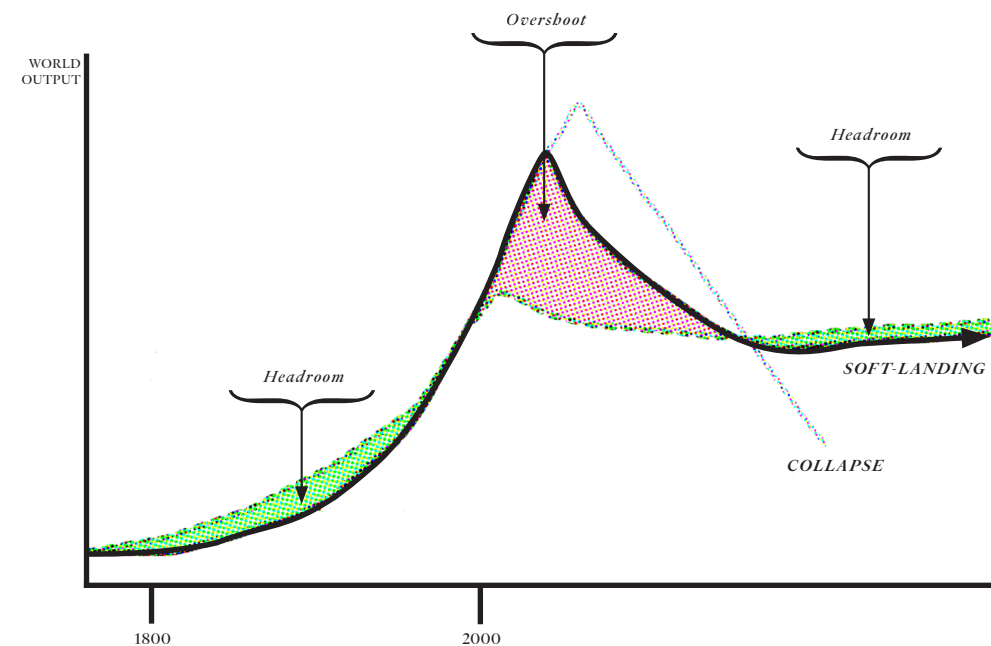
Most of the world's people today are not well prepared for collapse of our modern integrated civilisation. Specialisation of labour means most people do not know how to produce food, build shelters, make clothing, raise animals, or make carts. Resources that people need to survive and thrive are mostly located at a distance. The world relies on production and trade, and both would reduce a lot if there was a collapse.

Loss of technological capability might make it difficult to recover a technologically advanced civilisation. The easily available coal and oil resources that fuelled the development of modern civilisation are largely exhausted. Previously accessible mineral resources are now spread widely in diverse and difficult to manage forms. Large and connected concentrations of the population would be required to re-establish the specialisation and trade that would be needed to rebuild an advanced economy.

The market cannot be allowed to take care of the growing overshoot risk for the simple reason that future people and the

future of nature are not represented in today's markets. Nor do future people, or young people, have much of a say in today's debates about public policy. Overshoot is a global-scale market failure, so large and so unexpected that it is difficult to recognise.

The alternative to continuing to maximise growth, increasing overshoot, and heading towards collapse is to establish a new goal for humanity. That new goal should be to complete a managed shift to consumption outcomes that can be sustainably supported by the environment.



A shift onto a soft-landing trajectory would target a managed, minimally disruptive, and relatively smooth process

to reduce the damage caused by economic activity to a level that can be supported by the environment's capacity.

There should be no expectation that a steady state would follow success in achieving a soft-landing. Population, technology, the economy, and the environment will continue to co-evolve. There will be an ongoing societal management task to keep the size of the world's economy from overshooting the long-term capacity of Earth's environment to support it.

The shift of trajectory will have to be managed to achieve the soft-landing with minimal disruption and harm. It will be a big shift, though, because the world is already in overshoot, the overshoot is still increasing rapidly, and the risk is not yet widely understood.

Management of collapse risk should become a core issue for public policy, with the growth of aggregate consumption being dropped as a societal goal. Instead of pursuing growth, societies should target increasing or protecting the current and future well-being of their people and of nature. Technological and other innovation policies should target increasing well-being and the productivity of the environment and de-emphasise growing consumption and financial wealth.

The quality of economic output will become much more

important, with output that causes environmental damage being reduced. Output that reduces damage, restores the environment, or improves well-being might safely be increased.

Targeting a soft-landing rather than a growth-forever goal is not the radical proposal it might seem at first. It is simply a proposal to bring the size of the Earth's economy into alignment with the capacity of the environment to support it.

Achieving a soft-landing and supporting changes in societal goals will require a widespread shift in thinking by enough of the world's people to change the world's goals, and then effort to mobilise people to make the changes in activity that will deliver a Soft-landing in the least painful way.

Identifying and communicating the change in goals is unlikely to be effective enough by itself. The growth goal is embedded in a wider framework of thinking that must be changed too.

A new paradigm

A paradigm is a framework that structures thinking. It provides foundations for understanding an area of knowledge.

Paradigms are like lenses that influence what people perceive, and they may define what people judge to be important,

correct, or desirable. They are not usually subjected to systematic examination and testing by the people who use them. Instead, they are usually taken for granted. Paradigms affect how people make sense of the world and the beliefs and values they use to make decisions, so the paradigms people use are very influential in shaping the future.

When developed, paradigms are adaptations to specific circumstances, so they may become obsolete if conditions or knowledge change. They may not be useful in all situations. To illustrate, Newton's paradigm for physics is adequate for building a house but not adequate for interstellar navigation.

The dominant paradigm used to manage modern economies was developed during the 19th and 20th centuries when the global economy was small relative to the size of the Earth. Important features of that paradigm include ideas that maximising economic output will maximise well-being and that aggregate environmental constraints can be safely ignored. While those beliefs offered reasonably good correspondence with reality during the 19th and early 20th centuries, they are becoming less valid, and continuing to use those assumptions is exposing civilisation to increasing risk.

Paradigms can coexist. Today, two important paradigms are conflicting with one another. The mainstream economic growth maximisation paradigm remains dominant. It prioritises the economy. Its assumptions imply that economic growth will benefit everyone, that environmental constraints do not create a material risk of overshoot and civilisation collapse, and that technological innovations and policy responses can and will fix problems that might arise.

The competing paradigm, which can be called the ecological paradigm here, looks at the economy as embedded within a constrained environment. The ecological paradigm provides a lens that helps us recognise that economic growth is causing environment overshoot.

Proponents of the two paradigms often talk past one another. While they may think they disagree on issues of fact or policy, their fundamentally different conceptions of the economy-environment system limit their ability to understand each other's point of view. Environmentalists who promote the ecological paradigm view the economy as operating within the environment, whereas the economists developing strategies for continuation of growth consider the environment as a component of the economy.

The emergence of overshoot risk indicates it is time to develop and adopt a new paradigm that integrates understanding of economic and environmental processes. The new paradigm should accommodate the possibility of overshoot and collapse, and it should allow changing societal goals to reduce the newly recognised risks. The new paradigm should facilitate the management of an economy-environment system in a state of overshoot and distress. The paradigm should highlight the importance of both the economy and the environment to future human well-being, and their mutual dependence.

The existing economic paradigm emphasises maximisation of the flows of goods and services produced for current consumption, as measured by GDP. It de-emphasises the decline of stocks of environmental assets, so it downplays acknowledgment that resources which are being depleted will not be available to support future consumption.

The economic paradigm's emphasis on current production and consumption allows many questions about sustainability to be avoided. The environmental consequences of activity depend on the amount of activity relative to the self-repair capacity of the environment and the state of the environment before the activity.

The new paradigm should include both stocks and flows so that changes in the state of the environment are more fully recognised.

Once stocks that can change are included in the paradigm, time becomes important again, and history matters too. In a paradigm where environmental stocks can change, the future is no longer a simple extension of the past, nor is it the accumulation of a lot of similar short- terms.

Ecological economists are using economic methods and bringing in ideas and data from other disciplines to understand economy-environment interactions. They are making valuable progress towards the proposed paradigm and assembling useful tools. Systems of national accounts are beginning to adopt environmental accounting practices that include stocks.

A paradigm that can be used to navigate towards the Soft-landing needs to include people too. It should operate at both the individual actor and the aggregate levels. Micro-level analysis and modelling are required to understand, explain, predict, and manage peoples' choices about activities that determine economic and environmental outcomes. The macro-level analysis is required to identify and manage the consequences of a large volume of economic activity damaging a constrained environment.

Further, people observe the consequences of activities on both the economy and the environment. Their observations may affect the values and beliefs that determine their choices about subsequent activities. In the new paradigm, economic, environmental, and social processes should affect one another. That establishes the ability to understand and manage a co-evolving integrated system where observations of outcomes affect beliefs and values, which in turn affect choices about activities, and by extension, future outcomes. In the new paradigm, history emerges from outcomes influencing ideas, ideas influencing activities, and activities influencing outcomes.

The new paradigm should help policymakers decide among management options to achieve valued economy-environment outcomes. Choices should be based on the assessment of benefits and costs through to and beyond the soft-landing for a wide range of options and not on short term prescriptions from economics specialists whose training limits them to proposing a narrow range of interventions.

Intervention options include providing information, incentivising technological developments, offering education that shifts relevant beliefs, exerting influence to alter what is valued,

adjusting prices to shift demand, prohibiting activity that is unacceptably harmful, and increasing effort to promote changes in ideas.

Adding environmental stocks and flows, as well as time, beliefs and values, increases complexity and implies traversing the boundaries of academic disciplines. Established traditions, strong incentives and powerful professional institutions protect those boundaries. Paradigm change can take a long time, partly because it may require a new generation of thinkers to join incumbent leaders in influential roles.

As environmental constraints increase, the central problem of societal management strategy should shift from output maximisation to achieving the soft-landing. If that shift does not occur quickly enough, humanity risks a collapse of the civilisation. Once collapse becomes established, it might be too late to adopt and benefit from a new paradigm that could help navigate a path to a soft-landing.

Anticipating overshoot risk requires using different ideas to imagine a future that is very different from what is widely expected today. Civilisation is threatened by a failure of imagination, largely because there is a dominant paradigm that has become obsolete.

An adaptive cosmology

Cosmologies are a type of paradigm. They explain how and why the world operates the way it does and the relationship between humans and nature. Cosmologies may explain how the universe came to exist and why events unfold as they do. They help people understand their place in the world and how and why nature provides sustenance and well-being. They guide beliefs and values and provide boundaries for possibilities. They inform us about what maintains the conditions that allow human communities to thrive.

Cosmological beliefs may take the form of religions, with motive force ascribed to a deity or deities, but they do not need to. One person may believe that a deity who created the world controls the unfolding of events experienced, while another may believe that history unfolds in a pre-determined way from the physics of the big bang.

Cosmologies have practical importance for people because they influence the beliefs and values that drive behaviour, and behaviour, in turn, affects the outcomes people experience. Cosmologies are also significant for communities and civilisations because they may contribute to success or failure.

Disputes about the truth of differing cosmological beliefs can lead to conflict.

The truth or falsity of cosmological beliefs is not the immediate issue here. What matters for humanity's near-term future is how cosmological beliefs affect the co-evolution of economy and environment.

The cosmologies of many early agricultural societies, and some modern ones, explain how nature provided the land, weather and harvests that sustain communities. Gods can represent the forces of nature, and many people believe gods may be influenced to provide good conditions for agriculture. The Buddhist world view recognises humans as a part of nature. In Hindu cosmology, animals, including humans, form part of an integrated system where spiritual beings are reincarnated into a series of lives.

In the Judeo-Christian cosmology, it is widely understood that the deity provided the Earth for the use of people. People are much more strongly differentiated from other animals and the rest of nature than they are within many other religious belief systems.

People are encouraged to multiply and to draw what they need from nature. Westerners influenced by Judeo-Christian

cosmologies developed much of modern economic thought. People with the same cosmology lead many European and American countries today, and they lead many of the global institutions which most influence economic development.

If cosmologies can pre-dispose people to think that nature exists for human exploitation, then it is only a short step to the core modern economic assumption that nature provides free gifts from nature and free disposals to nature. Believing that nature provides resources without limit provided Western economies with a competitive advantage over other world views by encouraging more ruthless exploitation of nature.

Protestantism further encouraged the exploitation of nature by establishing the accumulation of wealth as a signal of religious and social virtue. Wealth re-investment accelerated growth.

The expansion of Western civilisations during the 18th and 19th centuries spread Western cosmological and economic thought throughout the world, influencing the way countries are led. The older cosmologies that understand people as a part of and dependent on nature or deities have correspondingly diminished influence on economic management in today's world.

Scientific discoveries and technological advances have

encouraged the expansion of secular cosmologies. Cornucopian “nature will provide” ideas originating from religion reinforced by the hyper-successful growth of modern civilisation have been joined by Panglossian “it will all turn out well” hubris. All these ideas are reinforced by the experience of astonishing technologies and of relatively prosperous and peaceful lives, so far, by a large majority of influential people alive today.

Fatalist and end-of-days beliefs further support the laissez-faire default position that leaves management of the medium-term future as a relatively low priority for most societal and individual agendas.

In principle, we could choose cosmologies that would be adaptive, but for most of us, our cosmology is a paradigm, absorbed during our socialisation, adopted without question, and supported by our social interactions. Our cosmology is not usually something we get to choose.

We may know intellectually that economy and environment are mutually dependent and even that overshoot and collapse have become a threat to civilisation. Deep down, though, our cosmology may make us Panglossian, giving us faith that we will be rescued by a deity or by future technological advances.

If people believe they will be rescued from overshoot risk, they may allow economies to continue to over-exploit nature, confident that everything will turn out well in the end.

Sustainability might be thought of as an emerging cosmology, built on a foundation of evidence-based scientific understanding of how the economy depends on the environment and how the environment is threatened by the current form and scale of the economy. Sustainability implies respect for the environment and consideration of the long-term future. It brings an obligation to act in ways that protect and preserve the environment.

Deep green cosmology goes further by regarding nature as worth looking after in its own right, not only because it is necessary to sustain humanity.

A suitable new cosmology may emerge soon, consistent with sustainability but going beyond it to motivate people to care for and look after nature. That new cosmology could provide deeper meaning and a sense of direction for people as we change beliefs, values, and behaviour. Dominance of a cosmology which encourages sustainability and values nature would be very helpful for gaining commitment to a soft-landing

as the principal medium-term goal for modern civilisation.

Then new challenges will emerge, and people will adapt again.



*Chapter 5:**IDEA
FOUNDATIONS**People who change*

There are many identified technologies and policies which could shift the economy-environment system towards a soft-landing trajectory that are not yet being implemented. Changing the trajectory requires changing behaviours.

Scientists, including neuroscientists, psychologists, sociologists, anthropologists, and behavioural economists, recognise that human behaviour is complex and collectively they have developed a deep understanding of what drives people to behave as they do.

Despite that complexity, mainstream modern economics is based on a simple but powerful explanation of economically relevant behaviour.

An important foundation of that explanation is the 18th century proposition, by Jeremy Bentham, that people are self-

interested, preferring pleasure to pain, and people choose activities that will give them more pleasure and less pain, making them happier. In Bentham's model of behaviour, utility is the net of expected pleasure and pain, and people choose the activities that give them the most utility.

In the 19th century, economists wanted a mathematically sound model of the way economies worked. For the purposes of their modelling, they assumed people acted in ways that would maximise utility from their consumption. Their assumption was recognised then as a simplification that made the mathematics more tractable.

Economists in the 20th century shifted the emphasis from the explanation of economic phenomena towards the management of economies to accelerate growth. Along with that shift in the purpose of economics came a stronger assumption that real people wanted to increase their consumption.

Eventually, instead of these assumptions being used as approximations for purposes of economic analyses, they became guides to policy, and efforts were made to shape economies and people so they would behave in ways that more closely fitted with the economic assumptions.

The assumptions became real. People became more self-interested, markets were freed, economies grew, outcomes for people improved, and the paradigm became entrenched.

Voters chose political leaders who delivered economic growth that provided consumption growth and increases of utility.

While the economy was small relative to the capacity of the environment to support it, everything worked well. But now, in the 21st century, the environment has become an important economic constraint and the assumption that consumption is the only economically relevant motivator has become a problem.

The problem is that a person whose only motivator is consumption is unable to change their motivations. The problem exists in two domains. In the real world, increasing output for consumption has become the dominant motivator, driving the behaviour of people, businesses, and governments. And in the domain of applications of the mainstream economic theory that guides policymaking, people do not usually choose motivations other than consumption. The mainstream economic paradigm has become self-perpetuating.

A theoretically sound model of individual behaviour which could encourage activity choices that would move the world

onto a soft-landing trajectory needs to have at least one other motivation that could encourage reductions of activities that damage the environment. For example, the model might extend to allow the possibility that people are motivated to reduce harms to others, environment damage, or the risk of civilisation collapse, alongside their motivation for more consumption.

The extended model of people that could guide behaviour change should be minimally sufficient in the sense that it is as simple as possible, consistent with being powerful enough to allow the required behaviour changes. There is no need to explain everything about how people behave to understand how to change their behaviour. The model only needs to support changes in behaviours that affect the economy-environment system.

Bentham's utility theory has a descendent, developed during the 20th century, that is fit-for-purpose. It has many forms and names but is referred to here as extended subjective expected utility. Like Bentham, it assumes that people are self-interested, and choose the activities which provide them with the most utility.

Expected utility is subjective in the sense that the expectation is based on the person's subjective judgement about the utility that will result from the chosen behaviour, not the utility that might

be estimated by an objective scientific investigation of the likely consequences of a choice. It is extended, so the person can have other sources of utility influencing choices, alongside consumption.

The model operates by assuming the person understands the behaviour options available and chooses the one that they think will provide the most utility.

Extending the sources of utility beyond consumption is necessary to establish a model of a person who can change behaviour, but it is not sufficient. A person will change only if the drivers of subjective expected utility are also changed.

The subjective expected utility from choosing a behaviour option is driven by the person's belief about what will be the outcome from that choice and the value of that outcome for the person.

Beliefs and values determine choices among behaviour options. Changing behaviour, without changing the options available, depends on changing either the belief about what outcomes will result from the behaviour option or changing the value of the expected outcome from the behaviour option, or both.

The extended subjective expected utility model of behaviour does two things. First, it establishes a way to anticipate the effects of practical efforts to change environmentally relevant

values and beliefs, so it is a valuable tool for managing efforts to change the behaviours which affect environmental outcomes.

Second, the extended subjective expected utility framework extends the simple consumption-driven economic model of behaviour to include other motivations. The extended subjective model does not negate or replace the idea that people seek consumption. Instead, it re-introduces other motivations alongside consumption as drivers of behaviour, and it establishes a robust theoretical foundation for the possibility that people might be motivated to make choices that will reduce environmental damage.

Constructive beliefs

Modern people often scoff at the apparently strange beliefs of people from now-defunct civilisations. People once believed that the world is made of earth, water, fire, and air. People believed that the Earth is flat, that the sun is at the centre of the universe, and that deities can provide resources and change outcomes. People in flourishing civilisations usually assume that their most important beliefs are true, even while recognising that previous civilisations adopted many incorrect beliefs.

For the purposes of this argument, a belief is an expectation that an outcome will follow from an action or series of actions. A self-interested, competent, and consistent person should act in accordance with their beliefs about the likely outcomes from their choices of actions. The actions chosen, once implemented, become a behaviour.

A belief may be helpful or not helpful, accurate or inaccurate, and may lead to the outcome wanted or may not. Having beliefs that improve the likelihood that behaviour will deliver valued outcomes is essential for life success, so people are motivated to learn valuable beliefs. Beliefs are learned from others during socialisation and education, and they may be modified later by interpersonal influence or evidence from information sources.

Changes in circumstances may lead to previously accurate and useful beliefs becoming inaccurate and harmful. Scientists researching climate change, emerging scarcities, and ecosystem decline have provided compelling evidence that the economy-environment system's circumstances now are very different from circumstances during the 19th and 20th centuries.

Despite wide publication of the evidence that environmental conditions have changed, many global leaders and other people

continue to act as if they believe that maximising economic growth will improve their country's economy and their lives, and that overshoot crisis risks are not important. The "growth forever" beliefs came from the 19th and 20th centuries and were well adapted to the growth phase of the transition, but they are now impeding an effective response to growing risks from overshoot.

Some people have not yet heard or have not understood what the scientists are saying. Some people believe the evidence of increasing risk is wrong, supported in their beliefs by misleading information campaigns funded by powerful interested parties.

Others accept that the environmental risks are real but also believe it will be a long time until the environmental damage grows enough to affect them personally. Some of those people are encouraged in their beliefs by the evidence of their own experiences; economies continue to grow, average life expectancies increase, and their own lives are improving.

The experiences of the most influential city-dwellers are of uninterrupted supply of food from supermarkets and of other goods from other kinds of stores. Their day-to-day observations of parks, beach resorts and agricultural production reinforce the belief that all remains well enough with nature. Catastrophic droughts,

fires, storms, floods, and biodiversity crises can be interpreted as unusual events that affect other people in other places.

Many common beliefs contribute to blocking effective responses to growing overshoot risk:

- Some people may accept that overshoot risk is large and growing but expect that future technologies and policies will resolve any issues that might arise.
- Some people may accept that risks are growing but want to avoid the consequences of a change in a direction even more, so they are willing to continue along the current course, hoping for some other solution to emerge.
- Some may believe that overshoot risks would mainly affect other people because they will be protected by their geographic location, or their wealth and power.
- Some may recognise the risks but would prefer that someone else pays the costs for reducing the collapse risk. They may have more to gain than others from a continuation of the status quo, or they may be ruthless free riders, preferring to force others to pay the costs of economic transition.

- Some people may not see any point in acting because they believe that their personal action, or even their whole country's action, would not be enough to make a difference. Their action would have a cost for them, but there would be no noticeable reduction of the overshoot risk.
- Some people may be relying on governments to act when action is required. In modern democracies, many people do not think they have a responsibility for taking actions themselves, having delegated those responsibilities to elected leaders and the skilled specialist people who work for them.

Having only one of those beliefs could be enough to prevent a person from taking action to reduce overshoot.

Beliefs supporting effective responses to growing overshoot risk are not yet strong enough to overcome these and other belief obstacles, so beliefs are not yet delivering their potential contribution to reversing the trend of rapidly increasing environmental damage.

Adaptive values

Values establish what people want, and so they influence choices. Each person has their own values, but socialisation and

pressures to conform ensure most people within a society share many common values. Societal values are sources of utility that are widely adopted and motivate common behaviours.

Values combine with beliefs to guide behaviour. If people value the long-term future well-being of members of the societies they live in and believe there is a high risk of civilisation collapse, then we should expect they would want to take actions to reduce the overshoot.

People who value only short-term outcomes for themselves might believe the overshoot risk is growing but prefer to continue along the environmentally damaging but personally rewarding course. Values matter because they work with beliefs to affect outcomes for societies and for the people who live in them.

Values are most potent when they are widely adopted and are believed to be universally “true”. Modern societies differ in their values, and sub-cultures within modern societies often choose values that differ from the mainstream. The values which are dominant in societies can change.

Consumption has been a very successful value because it motivates behaviours that provide successful people with what they need: sustenance, shelter, safety, social recognition, self-esteem and self-actualisation.

Until recently, the consumption value was well adapted to the world's circumstances. During the last few decades, however, consumption has become a threatening value because it encourages economic growth beyond the level that can be sustained by Earth's environmental resources.

Despite increasing recognition of the threats posed by environmental damage, consumption remains the dominant value in most modern societies. Many people choose to act in ways that deplete the environmental stocks that will be needed to sustain people in the medium-term future, at least partly because they value maintaining the growth of their own near-term consumption.

Values adapt in response to changes in circumstances. During the growth phase, increased potential for economic growth encouraged the emergence of consumption as a dominant value. Recognition of the threat posed by the growth of environmentally damaging consumption now is encouraging the emergence of values that will protect the environment.

Societal values change slowly. Prioritising encouragement of values that protect the environment would help reduce overshoot.

During the traditional agriculture era, religious institutions were the custodians of the cosmologies and societal values that guided behaviour. Social change was much slower than it is today, so values change was slow too. Religious institutions were strongly aligned with political structures, and when values adaptation was needed, religious and secular authorities tended to work together.

Today there is a wider separation between religious and secular authorities, religion has less influence in most societies, and many governments are less willing and less able to influence the values of their people. The other side of greater individual freedom is that religious and other leaders have less influence on values.

“Consume less” is not a very appealing value because it comes with a cost, less consumption. While many successful values take the form of “do not...”, it is usually easier to sell values that are positive, values that deliver benefits to those who adopt them.

The need for changed values to protect the environment is widely recognised. Unfortunately, most arguments that point out the need for change do not propose specific new values or show how new values will be adopted, leaving people unable to

change. In the interests of moving forward, eight values that are positive and would encourage a reduction of damaging consumption are tentatively offered below.

The values proposed should be regarded as illustrative because choices about values that will guide societies are very important; much too important to be completed by one person with only a few iterations. That said, a start must be made so more adaptive values can be identified, improved, disseminated, agreed upon, and adopted.

The first two of the eight values are proposed to re-establish the primacy of nature and restore a long planning horizon.

Live in harmony with nature and with people

counters the modern economic prescription to exploit nature without regard for outcomes for others or for environmental outcomes. Consideration for others encourages development of cooperative solutions instead of conflict over constrained resources.

Be a custodian for future generations

counters maximisation of short-term personal consumption that disregards future environmental consequences.

The third, fourth and fifth values re-introduce restraints on consumption.

Take no more than you need prescribes a shift from wants back to needs as the principal motivators for material consumption.

Contribute more than you take provides the motivation to act in ways that restore nature and develop communities. Damaging consumption will be restrained if people feel obliged to consume less than they contribute.

Avoid superiority aims to remove a source of motivation that has become harmful to the environment.

Competing to get something valuable can be beneficial because competition improves performance. However, if people compete to be better than someone or everyone else, that introduces an additional motivation for an activity that would not otherwise occur, and the extra activity created by that motivation for superiority increases the aggregate amount of environmental damage. Wanting to have the most money, the biggest house, or car, or the most expensive clothing may make

people feel superior, but it motivates consumption that is more than what is required to meet reasonable needs, and that excess consumption is likely to damage the environment.

The last three values encourage behaviours that support collaboration, social cohesion, and well-being.

Treat others as you would have them treat you restores the golden rule. It broadens the range of outcomes that matter beyond personal gain and personal consumption to include consequences for others. As people consider who counts as others, the value encourages wider collaboration. The golden rule protects the environment by restraining people who would otherwise choose environmentally damaging activities that lead to adverse outcomes for others.

Look after your physical and mental health is in everyone's individual interest, and it discourages people from behaving in ways that will make them a burden on others. Having a larger proportion of the population able to fully participate is good for societies too, especially as they make difficult changes.

Learn and teach encourages engagement with societal issues along with the acquisition and transfer of knowledge and skills that will help communities manage economic transformation and environmental constraints. An obligation to teach encourages people to learn and to be responsible members of their societies.

These values might be labelled “eco-values”. People who adopt some of or all these eight proposed values should be more likely to choose behaviours that reduce the environmental damage they cause and more likely to influence other people in ways that will reduce the damage caused by those other people. The proposed “eco-values” are currently much weaker than they could be, values that could quite easily be strengthened, and are values which, if stronger, would encourage behaviour choices that would reduce overshoot risk.



Chapter 6:

*SOCIAL
STRATEGIES*

Changing behaviour

Identifying beliefs and values which would encourage behaviours that would reduce environmental damage is an important step. Achieving actual behaviour change requires means to change the beliefs, values, and behaviours of others. Further, designing effective social strategies to change environmentally relevant behaviour depends on understanding how individuals change and which kinds of changes will have the most beneficial effects. Effort is not enough. It must be well-directed.

Beliefs and values co-evolve with societal circumstances. Ancient beliefs, values, and behavioural rules, presumably informed by year-to-year experiences and lessons from earlier collapsed societies, protected resources from over-exploitation during the era of traditional agriculture.

Some of the beliefs and values that developed during the growth

phase have now become obstacles to achieving a soft-landing.

Four of the seven deadly sins - greed, envy, gluttony, and pride - limited the amount of wasteful consumption by ordinary people in European traditional agriculture societies. Wasteful consumption by a large proportion of the population would have meant starvation and want for many others.

During the growth phase, those four sins were helpful because they promoted growth which was delivering well-being and increasing consumption. Movies and television reinforced the aspiration to live like wealthy or middle-class people in advanced economies, and a long period of growth created the expectation of continued growth of incomes and standard of living.

Individualist values flourish in organised societies when growth is strong, whereas collectivist values are more likely to dominate when resources are constrained.

Reducing greed, envy, gluttony, pride, and consumption competitiveness now would help motivate a reduction of harmful consumption.

The answer though, is not simply to restore the beliefs and values that were adaptive during the traditional agriculture era. Those beliefs and values were adapted to a time when there was

a slower rate of change and no global overshoot. What is needed now is rapid adoption of the beliefs, values and behaviours that will facilitate achieving the soft-landing.

Telling people that they should consume less is unlikely to be effective because it directly conflicts with the dominant consumption value. Explaining that shifting to less environmentally damaging forms of consumption would protect future consumption is more likely to be successful.

Emphasising current and future outcomes for people instead of the quantity of consumption today would help shift assessments of societal progress from quantitative economic growth measures towards measures of well-being and overshoot risk.

Simply telling people to adopt different beliefs and values will not be very effective either. People do not easily accept proposals for important personal changes which are of the form: "you're doing it wrong, do it this way". People are much more receptive to arguments in the form: "what you were doing was right, but circumstances have changed, so now you should change so you can be successful in the future".

Changing ideas is easiest when the change required reinforces what people already value. Existing values can be

redirected so they encourage behaviours that will improve environmental outcomes.

Most people care about outcomes for others; some only for close family, some for people they see as part of their community, some for all of humanity and some for animals or nature. Helping people understand that overshoot and the resulting collapse risk threatens those they care about can provide a motivation for behaviour change.

Most people are not strongly motivated by risks that they perceive to be a long time in the future, so the motivation for change can be increased by helping people understand that near-term risks are increasing and by helping them to understand risks to their children.

Many people already care about the environment, so strengthening that value and helping people understand that some kinds of consumption harm the environment can motivate behaviour change. Strengthening environment-protecting values relative to the consumption value can accelerate changes in behaviour to reduce environmental damage.

A social norm is an expectation about the behaviour of others. Almost everyone cares what others think about them,

so social norms can be strong motivators for behaviour change. Social norms transmitted and enforced the seven deadly sins during the era of traditional agriculture, and the social approval and disapproval of behaviour by others can encourage changes in beliefs, values, and behaviour today.

A personal norm is an expectation that one has of one's own behaviour. People who adopt social norms to gain approval and avoid disapproval may come to believe the norms adopted define the right way to behave, in which case the norms become personal norms too.

People do not always do the right thing, but they do tend to do the right thing. Harmful behaviour can be reduced by strengthening the value of doing the right thing and helping people believe that the right thing to do is behave in ways that do not contribute to overshoot.

Including diverse values that can change and be changed in the theories that guide management of economy-environment policy would better align the theories with the ways real people think and behave. That would provide more powerful theoretical tools to guide and accelerate policy, activist and individual interventions aiming to change the environmentally relevant beliefs, values, and activity choices of others.

Social norms

When leaders and managers seek to influence the environmentally relevant behaviour of others, they can exert their influence by changing the options or by changing the way that choices are made among options. Changing the options can be done by incentives such as taxes and subsidies or by regulations such as prohibitions, limits and required behaviours. Changing choices can be done by influencing a person's beliefs and values to change the way options are ranked or by changing expected behaviour directly.

Social norms are the beliefs, values and behaviours that are expected by other people. Norms may directly prescribe the way people should behave, or they may guide behaviour indirectly by prescribing what people should believe or value. The important feature of social norms is that people adopt the beliefs, values, or behaviours that others expect so they can get approval and avoid disapproval. Norms are established by communication of the expected social approval that will result from expressing approved beliefs and values or making approved behaviour choices.

Norms provide short-cut ways to make good decisions. Instead of each person having to work out what is the best behaviour for

each occasion, people can follow guidance from norms to choose beliefs, values, and behaviours that others have judged appropriate, saving time and effort, and reducing the risk of being wrong.

It may be risky to adopt norms conveyed by others because the adopted norms can be wrong and harmful. Therefore, the most credible sources for acquiring norms are other people who are respected, often parents, peers, teachers, or leaders. A strong relationship or recognition that the influencer's position conveys credibility, power or moral authority increases the likelihood that a person will adopt ideas promoted or offered by others. Less well-credentialed sources might be wrong, or they might be trying to exert influence that could be harmful, for reasons of their own.

Norm transfer can operate via imitation of the beliefs, values, or behaviour of a respected other, or the respected other might deliberately exert influence to promote norm adoption.

Norms are powerful. Social disapproval of behaviours like drunk driving or speeding can be a more powerful motivator than the threat of fines or the risk of injury. Most people spend a lot of time and effort to understand what ideas and behaviours are expected of them. People may spend large sums of money to comply with norms.

Publicity campaigns, such as those to encourage recycling, can establish norms that motivate people to behave in ways that reduce environmentally damaging behaviours. Once people believe recycling is expected and is the right thing to do, they may influence others to recycle too, creating ‘viral’ norm adoption throughout a community.

Societies change direction slowly, in part because of the strength of entrenched beliefs, values, norms, and institutional arrangements that support the status quo. The result is inertia of ideas that makes established ideas difficult to over-turn. That is usually a good thing because it helps protect societies from lurching in risky directions, but it becomes an impediment when adaptive change must be made quickly.

Managing norms to influence behaviour can be very effective in changing behaviours. Marketers spend large sums of money to influence beliefs, values, and behaviours, so customers will purchase products and services. Religious organisations, sports teams and other sub-cultures influence their members too. Norms are pervasive but not always recognised explicitly as able to be changed, even by those who use them to influence others. Often norms are acquired or promoted as ideas that are true, right, or useful.

Other ways to change the ideas that guide behaviour are evidence, a sense of crisis, and leadership. All of these are being used to influence environmentally relevant behaviour, but their combined effect so far is not enough for the world's people to recognise the need for a soft-landing, to target the soft-landing, and to change activities to get onto a trajectory that will deliver the soft-landing.

Evidence of environmental damage and overshoot risk is now widely available. Much of the compelling evidence is contained in scientific reports that are difficult to understand and are produced by strangers. Many people are influenced more by respected others who are close to them and continue to support the established dominant paradigm.

Crisis can be a powerful motivator for rapid change. A sense of crisis is widespread among those who are well-informed about the risks, but those people are not yet numerous or influential enough to drive change.

Leaders are usually important respected others, so they can have powerful effects on beliefs, values, and behaviour, especially if a sense of crisis is established. Leaders' ability to change behaviour rapidly is illustrated by successful efforts to mobilise populations for wars.

Leaders are developing responses to climate risk and other environmental issues, but their actions so far are not enough to get the world onto a soft-landing trajectory, partly because the leaders are prioritising continued short-term growth over overshoot risks. The result is that the incentives and policies that leaders could use to get onto a soft-landing pathway are not being implemented as vigorously as they might be.

Systematic management of norms has great potential for reducing environmental damage, partly because norms have been neglected as tools and partly because the other available tools are not being effective enough.

Collective action

If environmental issues threaten civilisation’s future, the world’s people have a common interest in reducing harmful activities.

However, each self-interested and rational person also has an interest in continuing the consumption activities that benefit them. Some of those consumption activities may damage the environment, causing current or future harm to the person and to others. The harm in total to others from the harmful activity may be greater than the benefit for the acting person.

That situation is known as the tragedy of the commons because the result is an environmental asset being damaged, and people who use the common asset are harmed. Climate change is an obvious example but there are local examples too, such as a river being polluted by industrial discharges or a fishery being over-fished.

A tragedy of the commons may be resolved by collective action, where people collaborate and agree to refrain from the activity.

A “collective action problem” arises when people cannot or do not collaborate to form an agreement that resolves the tragedy of the commons.

The collective action problem is illustrated in the table below. Each person makes a choice between a consumption act and refraining from consumption. The table shows the outcomes

Nine other peoples' choices

	Refrain from harmful consumption	Consumption causing harm
Refrain from harmful consumption	0	0 - 9 = -9
Consumption causing harm	+5 - 1 = 4	+5 - 1 - 9 = -5

Person's choice

for the person choosing, depending on what the person chooses and what the other people choose.

Each person is assumed to have the same choice and the same outcomes, so the table applies to all 10 possible actors. The people are not able to form an agreement.

The acting person gets a benefit of +5 from the consumption that is harmful and nothing if they refrain from consumption.

For each person who acts, the actor and each of the nine other people are assumed to be harmed a little, for a cost of -1 each.

If no one does anything then the person gets 0.

If the person consumes and the others do not consume, then the person gets +5 from the consumption and -1 from the resulting damage, providing a net gain of +4.

Each other person faces the same choice between consuming and not consuming, then they should all want to consume to get that gain of +4.

If the person consumes and the others all consume too then the person should expect to get +5 from the consumption and -10 from the harm caused by the damage, for a net loss of -5

In this situation, regardless of what the others choose, it is better for the person to continue the damaging consumption. If the others continue the damaging consumption, then the person gets -5 from consuming instead of -9. If the others refrain from the harmful consumption, the person gets +4 from consuming instead of nothing.

Each other person faces the same choice so, unless something changes, the damaging behaviour will continue.

The collective action problem may be solved by finding a way to collaborate, for example the Paris agreement, or may be avoided by finding and deploying technologies that allow the activity without causing the damage, for example converting to renewable electricity generation and electric vehicles.

For many kinds of environmental issues, it is very difficult for people, firms, and countries to negotiate credible agreements to refrain from harmful activities, so the harmful activities continue.

The usual response expected is that governments will regulate, but governments are themselves caught in the collective action problem, and have numerous other obstacles impeding effective and timely action to prevent damage.

Some countries have large economic stakes in status quo production or consumption patterns, and some are powerful

or committed enough to avoid agreeing to restraints that will require costly changes or reduce their own near-term economic growth. An important driver of national governments' willingness to cooperate is that restraints on consumption are expected to be unpopular with consumption-motivated citizens.

Norms can provide a powerful additional mechanism to reduce damaging activities. If people come to believe their damaging behaviour will be disapproved of, that can provide an additional source of motivation to change their activity choices.

To illustrate, consider a norm that disapproves of the harmful consumption. If, for each person making the choice, 8 respected others disapprove of the consumption, and the person considering the consumption attaches a value of -1 to each respected other's disapproval, the table changes to the one shown below.

Nine other peoples' choices

		Refrain from harmful consumption	Consumption causing harm
Person's choice	Refrain from harmful consumption	0	$0 - 9 = -9$
	Consumption causing harm	$+5 - 1 - 8 = -4$	$+5 - 1 - 9 - 8 = -13$

Now the harmful consumption is discouraged because introducing the norm has changed the person's best choice, regardless of the actions of others. If the others refrain, then the person will get -4 if they consume and 0 if they do not.

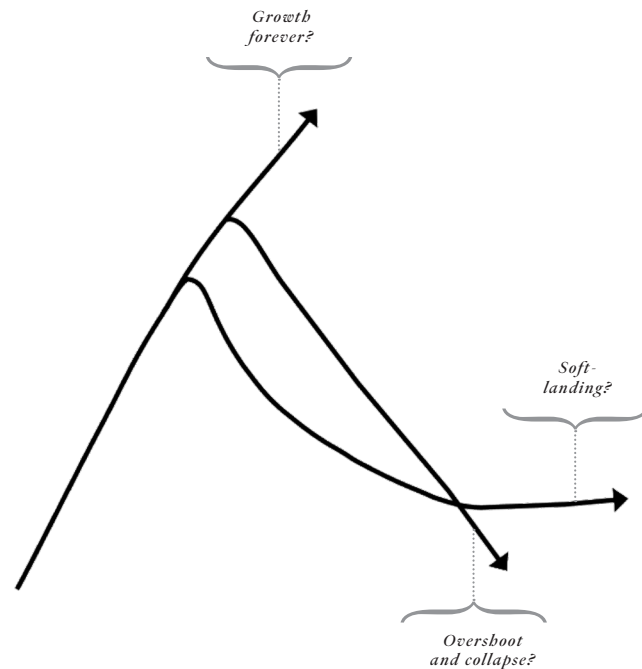
If the others consume and the person consumes too then the person will get -13. If the person switches to not consuming the person will get -9.

All the people are assumed to face the same choice so they should all refrain from the harmful consumption and the damage will be avoided.

This simplified example demonstrates that social norms can provide a powerful mechanism to overcome the collective action problem and accelerate changes of environmentally relevant behaviour.

Norms are under-used as means to reduce environmental damage. Beliefs that collective agreements, policies, and technology changes will be sufficient to solve environmental issues are correct in theory, in the long term, but in practice the changes are not yet happening fast enough to reverse the growth of overshoot.

Social norms can accelerate responses by encouraging people to gently coerce one another, via the threat of social disapproval, to behave in ways that are in their common interest and reduce overshoot.



PART 3:
CHANGING
THE WORLD

Chapter 7:

REDIRECT
SOCIETIES

Empowered leaders

People should be entitled to expect that leaders will solve civilisation-threatening problems. People who are usually talented and well-motivated are elected or otherwise selected for leadership roles. Those leaders have access to the best available research and advice. They have mandates to deploy resources and implement policies, and to influence beliefs, values, and behaviour.

Despite those responsibilities and capabilities, the world's leaders are not yet acting vigorously enough to reverse the growth of overshoot.

Business leaders directly influence production and consumption choices. Their businesses may cause damage themselves; they may buy from or sell to other businesses that carry out damaging activities; or they may sell to consumers whose consumption causes damage.

Businesses thrive in competitive industries by delivering what customers want. Most of today's consumers want to consume more, and the global population is still growing strongly. The shareholders who own and control businesses want to earn more profit. Growth increases profit. Businesses have a common interest in having the economy continue to grow.

Business leaders are meant to act in the interests of their businesses. That usually means they must try to grow profitably.

Changing direction to protect the environment or the future of their children is difficult for business leaders if profits would reduce as a result. Businesses are required to protect themselves against business risks, so environmental regulations that would reduce growth or profits are likely to be resisted by responsible business leaders. Businesses and the organisations that represent them are well-resourced and well-organised lobbyists and influencers.

Despite all that, there are many examples of business leaders supporting environmental regulations. Sometimes the proposed regulations would help a business. Sometimes a regulation would harm a business, but there are other reasons to support it, for example to meet customer preferences or to retain a social licence to operate. Some business owners and leaders have personal

beliefs and values about the environment and enough power to influence their business to act to help the environment and other people, even if there is some cost to the business.

In aggregate, however, as should be expected given their roles and responsibilities within the economy, businesses are not yet leading civilisation towards a soft-landing.

If business leaders cannot be relied on protect us from harm, then what about our political leaders? People expect governments to solve the problems that markets cannot address. There are well-understood policy and regulatory options, but they are not being implemented quickly enough to reverse the growth of overshoot.

Voters want more consumption, so politicians offer economic growth to get elected. Politicians who want to lead change to reduce environmental damage must work carefully to build support for the changes, navigating issues that might lose votes.

Governments that are not being led strongly by people in the direction of reducing environmental damage can be led in different directions. Influence is being exerted by some well-organised business interests, managers of capital, and capitalists themselves, to continue policies that allow profitable but damaging economic activities, and to promote economic growth.

Growth is an appealing goal for many incumbent leaders. A soft-landing would be much more difficult to deliver than growth because many of the most important trends are still heading strongly in the wrong direction.

In these circumstances, ordinary people must exert more leadership in their roles as voters, consumers, shareholders, and influencers. The business and political leaders who we have expected to lead us are mostly followers themselves, led by the preferences of ordinary people. Most ordinary people want more consumption and growth too. Collectively, people are only slowly becoming seriously concerned about the environmental consequences. Few among us understand overshoot, collapse risk, and the soft-landing option.

Deliberately changing the goals and trajectory of civilisation requires a strategy. Analysts and advocates for environmental protections often propose directional changes but do not explain how the changes they propose will be made, usually implicitly relying on businesses or governments to act as required.

Activist organisations recognised long ago that influence must be exerted to get businesses and governments to change. They developed a business model that involves raising funds

from people and using those funds to pressure businesses and governments. Visible efforts and some hard-won successes attract more members, supporters and funding and provide people with the belief that they are doing what is required of them.

Changing the trajectory of our civilisation requires changing what large numbers of ordinary people want.

Unfortunately for us all, the activist model of directly influencing businesses and governments cannot be sufficiently effective because it cannot easily overcome the incentives that lock businesses and governments on their current courses. If activists had deployed more of their efforts towards changing the beliefs and values of ordinary people, we might have been closer to a soft-landing trajectory today.

Businesses, governments, and activists do not look like strong candidates to lead the world quickly onto a soft-landing path.

People themselves are the best option to influence enough other people quickly, so there is enough momentum to lead businesses and governments to change in time for a shift from the overshoot-and-collapse trajectory onto the soft-landing trajectory.

Politicians, commentators, marketers, social media, and missionary influencers demonstrate that influence can change beliefs, values, and behaviours quite quickly.

There are many opportunities to recruit, mobilise, redirect, and empower influencers. Many people would like to find ways to help with environmental issues but do not know what to do. Exerting influence is something everyone can do, and every little bit contributes.

Influencing people who are themselves influential as opinion leaders is very effective. Less effective, but still very valuable, are efforts to directly influence the beliefs, values and behaviours of the ordinary consumers and voters whose preferences lead businesses and governments.

Influencing people to support a soft-landing seems much easier than trying to get people to reduce their damaging consumption. The soft-landing is positive, measurable, actionable by everyone, and in our common interest.

As more people recognise the risk of crisis and how the soft-landing is a pathway to reduce that risk, more people will exert influence and change behaviours, so governments will regulate to reduce damaging activity. Businesses will be

redirected by regulation and motivated to serve customers with different beliefs, values, and behaviours.

Overshoot will reduce.

Intellectual foundations

Setting a societal goal to achieve a soft-landing, building support, and leading governments and businesses are valuable, but not enough to navigate overshoot successfully. In addition, the ideas and theories used to develop plans for the economy should be capable of explaining overshoot and soft-landing and of helping to manage pathways to achieve a soft-landing.

The currently dominant theories provided by mainstream modern economics were developed during the 19th and 20th centuries, while fossil fuel burning, growing global trade, and technological advances produced rapid growth, but global environmental constraints were not yet important. Those theories remain dominant today because they are very useful and widely taught. However, they imply that growth can continue forever.

There are sub-disciplines within modern mainstream economics and other schools of economics that do include environmental constraints in their thinking. However, those

schools of thought are not yet influential enough to redirect the modern consensus that societies should continue to pursue economic growth as their principal goal.

Four core assumptions of mainstream modern economics offer a poor match with the world we live in, and all four influence the practice of applied economics in ways that make it more difficult to recognise and manage overshoot. There may be many other important assumptions that should be changed, but these four are enough to make a strong case for a paradigm shift within the mainstream economics that is used for societal management.

First, modern economics assumes that free gifts of resources are provided from the environment to the economy and that free disposals of wastes may be made to the environment. That assumption positions the environment as an input to the economy and implies that economic activity does not create important consequences for the environment. It also implies that the environment will continue to provide the inputs required by the economy.

Second, in mainstream modern economics, the aggregate scale of the environment is not usually considered a constraint, so the scale of the economy relative to the ability of the environment to support it cannot be important, and so overshoot cannot emerge.

Instead, it is assumed that if some environmental stocks become scarce and so more expensive, then innovation and substitution will ensure that sufficient resources will continue to be available.

Third, the economy is usually assumed to be stationary, which means the conditions within which the economy operates do not change. Stationarity allows development of economic laws that are presented as scientific discoveries operating in all circumstances and for all time.

Prior to the establishment of economics as a distinct discipline during the latter part of the 19th century, it was combined with history within the domain of political economy.

Now history is largely excluded from mainstream economics, and so the idea that conditions might change so that the environment might become an important constraint has been excluded too. In mainstream economic thinking, the long-term interaction between the economy and the environment is in principle no different from the short term. The long term is just further away. Discount rates ensure that long term outcomes do not count very much in economic analyses.

Ignoring the aggregate state of the environment, the relative scale of the economy and the long term when planning means that in

economic thinking there is little need identified for custodianship of the environment to ensure that ecosystem services and resources remain available to support future generations.

Fourth, in mainstream economics, people are assumed to have simple and selfish motivations, principally for consumption. Consumers are assumed to be “sovereign”, so growth that delivers more consumption has become the principal purpose of economic and societal management.

It has become dangerous to continue to assume that people only care about consumption now that growth of damaging consumption is increasing overshoot and collapse risks. Real people care about much more than just consumption, and those wider motivations should be included as drivers of economically relevant choices.

Economic assumptions and theories should be changed and extended to accommodate modelling of an integrated economy-environment system with scale and history, and to explain activity choices by people whose motivations can be diverse and can be influenced to change.

Those changes should allow the incorporation of overshoot and a soft-landing into theoretically sound economic management practice and would provide tools to understand

how influencing individual motivations can support changes in societal goals and behaviour.

These proposed changes, along with others, would make economics more complicated to understand and make economies more difficult to manage. Economics would be more integrated with the environmental and social sciences and the integrated thinking would have enough scope and power to explain and manage the macro changes required to shift onto a soft-landing path. Countries and societies might become more difficult to manage, or less.

An undeclared paradigm war is in progress between a growing minority who would advocate theoretical changes along the lines proposed here and those who believe that applying existing economic theory alongside technological advances will deliver a safe future.

When deciding whether to change these four foundational assumptions of modern mainstream economics and potentially others, two tests should be applied. First, would the proposed assumption changes establish a more useful model of the way the real world works today? Second, would the changed assumptions contribute to policy prescriptions that would produce better

medium and long-term outcomes? According to the arguments presented here, the answers are yes and yes.

If the teaching and understanding of economics does not change, it will continue to provide intellectual foundations supporting the undifferentiated growth strategy that is propelling our world further into an overshoot crisis.

National strategy

The currently dominant goal for almost all countries is economic growth. Despite evidence of increasing environmental risks, most nations continue to pursue success by maximising economic growth, competing with other countries to extract resources, improve productivity, sell goods and services in foreign markets, and earn the income required to purchase imports and grow consumption. It is difficult to be a country's leader today if you underperform on delivering growth.

Leaders expect growth to continue. Many governments have demonstrated that belief by borrowing and investing in circumstances where repayment depends on continuing economic and tax growth.

Once enough people have been influenced to change their values and beliefs, leaders will become more motivated to reduce

environmental risks. Leaders will then face the challenge of directing the mobilisation of people so the world can shift onto a soft-landing pathway. That implies reconfiguration of the economy, so revised goals, performance measures and strategies will be needed.

During the growth phase, GDP maximisation aligned economic, social, and environmental goals by delivering the profits businesses wanted and the consumption people wanted while ignoring the aggregate effects on the environment. Adopting the soft-landing target implies managing the trade-off between economic and environmental outcomes while protecting and improving the well-being of people.

That kind of change goes best when a well-understood measure tracks progress towards a widely agreed target.

A soft-landing is a trajectory, not a single target. Collapse risk will be removed when the environmental drawdown to feed the economy can once again be supported sustainably by the scale and productivity of the environment. That is the point where the overshoot has been removed and some headroom has been restored.

For any year in the future, or for today, the size of the overshoot can be measured as the difference between expected consumption and sustainable consumption.

Expected future consumption can be estimated using existing trends, credible plans, and reliably expected technology.

Sustainable consumption can be estimated as the amount of consumption possible without causing the environment to deteriorate further. It should use expected future technologies and expected future damage to the environment.

The numbers required have been estimated or can be estimated, and accuracy can be improved over time.

Armed with the data, the world's leaders can chart a course to bring the world onto a future trajectory where the size of overshoot tracks towards zero while protecting well-being for the world's people.

The market will not find that course by itself. The market functions well for delivering growth because firms compete to find the most profitable solutions, but the emergence of overshoot is a large-scale market failure. Tracking to a Soft-landing from where we are today is not something that can be achieved simply by adopting a simple single goal and then letting competition determine the means.

The idea of targeting a soft-landing is analogous with the global emissions targets of 1.5 degrees Celsius of warming that is already being agreed among countries. Expected and sustainable consumption can be measured for each country and per capita, in

the same way as current actual emissions and emissions that would be consistent with a 1.5-degree temperature rise can be measured today.

Alongside reducing aggregate overshoot, important specific productive environmental resources must be protected. The quantity and quality of water and productive land, climate, ocean composition and ecosystem health are not easily substituted for. Having abundant land but no water would not work for food production.

Once global targets are set, they can be translated into national goals and strategies that add up to deliver the soft-landing trajectory safely.

National strategies should be consistent with global targeted trajectories, taking account of the actions of others, of industry and business plans, and of consumer aspirations.

Not knowing how the soft-landing intent is translated into action is an obstacle that will be overcome because if the world's people sign up for the soft-landing as a goal, then the effort will turn to who needs to do what to achieve that goal in the most cost-effective and socially productive way. That consideration will include what markets can do and what should be done by other means.

Leaders have many options to redirect effort and change activities towards a soft-landing.

Leaders can redirect innovation effort and discretionary investment towards technologies that reduce environmental damage and increase the efficiency of resource use. Today, almost all private technology investment and a large amount of public innovation investment is motivated by opportunities to make money. That means technologies with the potential for high margins with big volumes are most likely to attract investment. Environmental consequences are of less concern provided regulatory obligations are met.

A technology that is simple and can be imitated easily would earn low margins, is not likely to attract development investment, and would not be promoted by the marketers who are paid to influence people's consumption choices. However, it is low-cost environment-improving technologies which can be imitated easily that the world needs most.

Governments should shift their innovation policies to prioritise reducing environmental outcomes and restoring nature.

Leaders can influence producers and consumers to change their choices to cause less environmental damage. Today both

producers and consumers want more consumption. Producers make choices that increase their profits, and consumers usually choose based on cost, convenience, and the amount of value or pleasure they can get. People could instead make their consumption choices to ensure well-being while minimising environmental damage.

Leaders can encourage or require re-cycling, re-use, or product durability to reduce damage.

Leaders can require people to protect and restore the physical environmental stocks that provide the resources and ecosystem services that people depend on.

If all that is not enough, then leaders can restrict the amount of damaging consumption to deliver the soft-landing. Provided well-being is ensured, that should reduce the risks from collapse. If there is a trade-off required between well-being and collapse risk, that will be more difficult, but it will only be required if action is left too late.

Having the goal of a soft-landing and the levers to pull to reduce environmental damage is not enough. A nation's leadership must also have the acuity to anticipate possible future states of the world, understand how choices made today could affect the future, and develop capability to lead the change of

direction. Acuity, navigation, and agility are essential capabilities for managing the shift onto the soft-landing pathway.

Navigation is challenging because leaders must find and shift onto the agreed soft-landing trajectory while ensuring the well-being of people and resilience.

The need for resilience implies the protection of critical environmental resources, important technologies, and supply chains while maintaining the social cohesion that ensures collaboration instead of conflict during times of change.

Management of overshoot is much more challenging than management of growth.



Chapter 8:

*REALIGN
POWER*

Restrain capitalism

Under the current market-dominated economic system, people are rewarded when they own, discover, or develop resources, sell their skills, or innovate profitably. Monetary rewards are often larger than what is used for current consumption, so some people accumulate wealth in the form of personal ownership of capital assets or resource extraction rights. The opportunity for wealth accumulation encourages people to work harder, develop skills, and innovate to produce more output. Wealth accumulation allows investment in productive capital assets and innovation, which further increases the effectiveness of the conversion of resources into output for consumption.

Saving for retirement by people with lengthening life expectancies has created large pools of capital managed by financial institutions. Wealth accumulation has established a large

and influential population of capital-endowed people whose income, future security and sense of self-worth depends a lot on the growth of their capital. Many very wealthy people in modern societies continue to seek wealth growth long after they have enough to keep them in luxury for the remainder of their lives.

People who are motivated to increase their wealth usually employ other people to manage their capital. Capital managers who lead businesses, banks and investment funds compete to produce the highest possible returns and are well rewarded when they are successful. Capital managers and owners have metrics, incentives, values, and governance arrangements that motivate them to focus on wealth accumulation.

Capital managers are usually able to shift their investments from one form or location to another. That, combined with their tendency to focus on short term monetary returns means that capital managers may pay less attention to the longer-term environmental consequences of their activities. Undefined or undefended environment assets are often available to be exploited and depleted.

Now that the growth phase is nearing its end, less investment in new infrastructure is needed, and opportunities to invest capital in new resource extraction ventures are less available.

That is partly because many of the opportunities to build farms, mines, wells and other extraction and distribution facilities have been taken, but also because of increasing efforts to protect the remaining environment. Governments may regulate to defend environmental assets because people are offended by their depletion. Some environmental assets are defined and privatised, so owners have incentives to be good custodians.

Capitalism has become so powerful that capital owners can sometimes influence the rules governing the political and regulatory processes to protect their interests and opportunities. The owners and managers of capital often employ lobbyists, exert influence, and support political parties to sustain the supply of attractive investment opportunities. They may influence rule-makers and the rules, as well as the flows of information, to promote policies that reduce their labour costs, their tax burdens, and their financial risks. Some capital interests promote policies to avoid restrictions on profitable activities and seek deregulation to create more opportunities.

During the growth phase, capital and labour interests competed for the income generated by production and consumption and supported political parties to promote their

interests. Capital interests have become stronger, and labour interests have become weaker during the last few decades. Most people have direct interests in what they are paid for their labours, and many have interests in capital returns too.

Interests in the environment are longer-term and less tangible.

Green parties have emerged to represent environmental interests but have not yet been very successful at gaining political power. When green parties do win support, their policies are usually adopted by other parties, often the parties supporting labour interests who need to find new adherents because of their weakening competitive position relative to capital interests.

The consequence of these circumstances is that capital interests have encouraged economic growth beyond the sustainable level, creating an environmental debt that will have to be repaid in the future as ecosystems decline and scarcities grow.

Capital is a good thing. Capital is a valuable contributor to production and wealth. Capitalism is an economic management paradigm that encourages wealth accumulation as a measure of self-worth and a source of self-actualisation. Unrestrained capitalism is not such a good thing because it powers overshoot.

What needs to be done? Do not respond positively to arguments that say what is good for capital interests is good for us all. That was broadly true once but there should no longer be an assumption of alignment of interests.

Situations where trade-offs between profit and environmental outcomes are required should be assessed case-by-case. Where economic activity seriously harms the environment, governments have the right and obligation to regulate to protect future outcomes for affected stakeholders.

Capital, property rights, markets and competition should remain as valuable features of sustainable economies. Changes should ensure governments play their proper role as protectors of the natural environment and of the long-term interests of their constituents. That implies establishing credible strategies to return to sustainability, affirming governments' rights and obligations to regulate, and strengthening governments' resistance to the lobbying, cronyism and corruption that can sometimes enable environmental harms in the interests of returns to influential investors.

Values should evolve to reduce the emphasis on greed and de-emphasise wealth accumulation as a societal goal. People controlling capital should be educated to understand their legal

and moral obligations to humanity and to the Earth. Governance regulations should require capital managers to act in ways that protect long term environmental outcomes.

Getting the balance right is important. Capital is needed to sustain people and protect the environment, but capital managers should be influenced to reduce investment in harmful activities.

These may seem tough requirements to place on capital managers, but they need to be understood within the context of an Earth that is already being operated unsustainably, and trends that are increasing the likelihood and consequences of a global economic collapse.

Continuing the current course without change to restrain capitalism risks further concentration of wealth in a few hands and ongoing accumulation of environmental damage. That increases the risk of a public or community backlash that might lead to less well-considered and orderly interventions to restrict harmful activities.

Regulate businesses

Businesses are good. They provide the products people depend on to survive and thrive, and they develop innovations that improve wellbeing. They provide jobs and incomes.

Businesses also manufacture and distribute products and services that cause environmental damage. Economic growth is an important driver of profit growth. Increasing incomes and wealth encourage more consumption. Increasing production and consumption requires more resource use. In aggregate, the amount of environmental damage being caused by business activities has grown too large.

Legislation usually requires that business directors act in the interests of the business, regardless of whether there is a conflict with environmental outcomes, unless they are constrained by regulation. Business leaders are usually not able to sacrifice profit to pursue improved environmental outcomes unless the business can benefit directly or indirectly from the environment's improvement.

Many businesses voluntarily reduce their environmental impacts because it is in their interests to do so. They may need to retain customers, maintain stakeholder support, or keep their social license to operate.

However, voluntary changes will not reverse the overshoot trend quickly enough, given the scale of environmental harms, existing trends, and current motivations. A huge transformation

of business activity is required to get to a soft-landing. To achieve the soft-landing with expected population growth, another two or three billion people will have to be supported by an economy that causes much less environmental damage per person.

There should be no serious dispute about regulation in principle because businesses are already strongly regulated. Businesses must honour contracts, are limited in the ways they may harm competitors and must obey numerous regulations controlling how they treat customers, employees, the environment, and their other stakeholders. They are not allowed to use harmful or unsafe technologies, and they may be restrained from selling their products or services to vulnerable segments of the population, such as young people.

In general, businesses accept that they will be regulated and almost all operate within the law, provided there is sufficient enforcement to encourage compliance.

Opposition to proposals to introduce environmental regulations is common because businesses are threatened by changes that might disrupt the existing industry conditions that allow them to thrive and grow. Regulations that might disadvantage businesses relative to their competitors threaten

profits, so well-managed businesses will usually oppose them vigorously.

Businesses or their associations sometimes argue that whatever is good for businesses is good for us all, and so they should be free to continue to do whatever they do. During the growth phase, that was often valid, but it is less often true now, and everyone should know that.

Business groups might propose that they will self-regulate, or that people will not buy from them if they do bad things, or that their stakeholders will redirect them, and so they should be free to respond to these forces. While there are circumstances where self-regulation or stakeholder pressures might be sufficient to encourage change, each case should be argued on its merits. The record so far is that businesses have preferred to continue their damaging activities, for the sound reasons explained above, so much more active regulation will be required to move the dial as much as is required.

Two conditions are required to deploy stronger regulation to reduce overshoot. First, the scale, rate of growth and importance of the overshoot risk must be more widely understood to provide sufficient motivation and mandate so

governments can overcome opposition and other obstacles to more stringent damage-reducing regulations. Second, the connections between the specific business activities and the environmental damage or risks resulting must be identified rigorously so the regulations can be targeted well and fairly.

The simplest form of regulation is simply to prohibit or limit damaging activities or the resulting damage. Regulations could also compel businesses to transition to operate sustainably, requiring defined programmes for change and the equivalent of audited reports tracking reduction of environmental impacts.

Regulations should also prevent the owners and managers of businesses from walking away from liabilities for future damage. Today, a business could decide to carry out a profitable activity that will or might cause damage later. The tenure of the business managers, directors and even owners might be a few years typically, whereas the damage might only become apparent decades later. Current business leaders might decide to proceed knowing that the damage risk will not be their problem. When the damage occurs, future business leaders might reasonably avoid responsibility by pointing out that the decision was made by others a long time ago. The net result is no one takes

responsibility, and the environment is damaged.

Requiring provisions or ring-fenced accruals of reserves to cover long term damage liabilities, or requiring insurance covering the future costs of long-term damage, would help ensure that the long-term costs are being felt by the short-term decision-makers and would make it less likely that damaging activities would proceed. Similarly, requiring damage estimates for today's decisions and publishing those estimates would mean that current leaders face immediate reputation risk if they approve damaging activities.

Extending the liabilities of owners and directors beyond business failures would also improve incentives to make environmentally sound decisions. Currently, a business can profit from damaging activities and then declare bankruptcy when the costs must be paid, so the costs are avoided. Directors can be held personally accountable now for some illegal or unsafe activities by the businesses they lead, and those accountabilities could be extended to cover environmental damage too.

Businesses and their leaders are likely to strongly object to the increased costs and risks that would result from these kinds of regulations. However, the ability for business leaders to avoid

the environmental costs of their decisions today is a market failure and an important contributor to overshoot.

Regulations should be clear, notified in advance, and businesses should be given time and support to adapt if necessary. Managing the pace of change is critical too because too rapid introduction or poorly developed regulations could risk economic disruption. That said, the scale of regulation must be large enough and the pace of change fast enough to reduce aggregate risk to acceptable levels.

If regulation is left too late, it might become unaffordable. Regulation that closes businesses or leaves people hungry will be much more strongly resisted. Despite that, some types of business must close, and they may or may not be replaced by new, less damaging businesses.

The success of businesses should not be the criterion for deciding about regulation, nor the target rate of economic growth. The tests should be effects on overshoot, on critical environmental resources, and on well-being.

Provided effective protective regulations are in place, businesses should remain free to compete for profits because that encourages efficiency. Businesses should grow too, provided

aggregate damage remains consistent with the soft-landing trajectory, and critical environmental resources are protected.

Equality and cohesion

In societies where people are free to choose what kind of work they do and how much effort they make, some inequality provides a valuable incentive to work and contribute.

In stable mobile societies, people who earn higher incomes and accumulate more wealth can afford to provide their children with education, experiences, connections, and assets to help the children get a good start in their lives as adults. People with lower incomes and fewer opportunities can become trapped in an inter-generational poverty cycle where they lack access to the educational experiences, social capital and monetary resources that make it easier to get high incomes.

Alongside these forces that help the rich to get richer and make poor people poorer, in the last few decades, there has been a structural reduction of incomes for middle-income workers. It took several decades for electronic innovations to have much effect on labour markets. However, in recent decades, computers and communications have substituted for office work, and

automation is substituting for manufacturing work.

The factory and office workers who are most affected by these trends earn in the middle of the income range. Highly skilled workers are in short supply and more able to migrate to countries and places that will pay premiums for skills, so their incomes increase. Lower skilled people are often less mobile because their service work is more tied to their geographic locations, and they usually earn lower incomes. The structural shift of middle-income work to higher and lower-paid jobs has contributed to recent increases in income inequality.

Modern political systems contain powerful forces that can support increasing inequality. Political leaders who need resources to win elections may be financially supported by wealthy people who require tax reductions or other favours in return. In countries where there are large numbers of high income or wealthy people, politicians may win votes by providing tax advantages or other financial incentives to a wider range of higher-income people.

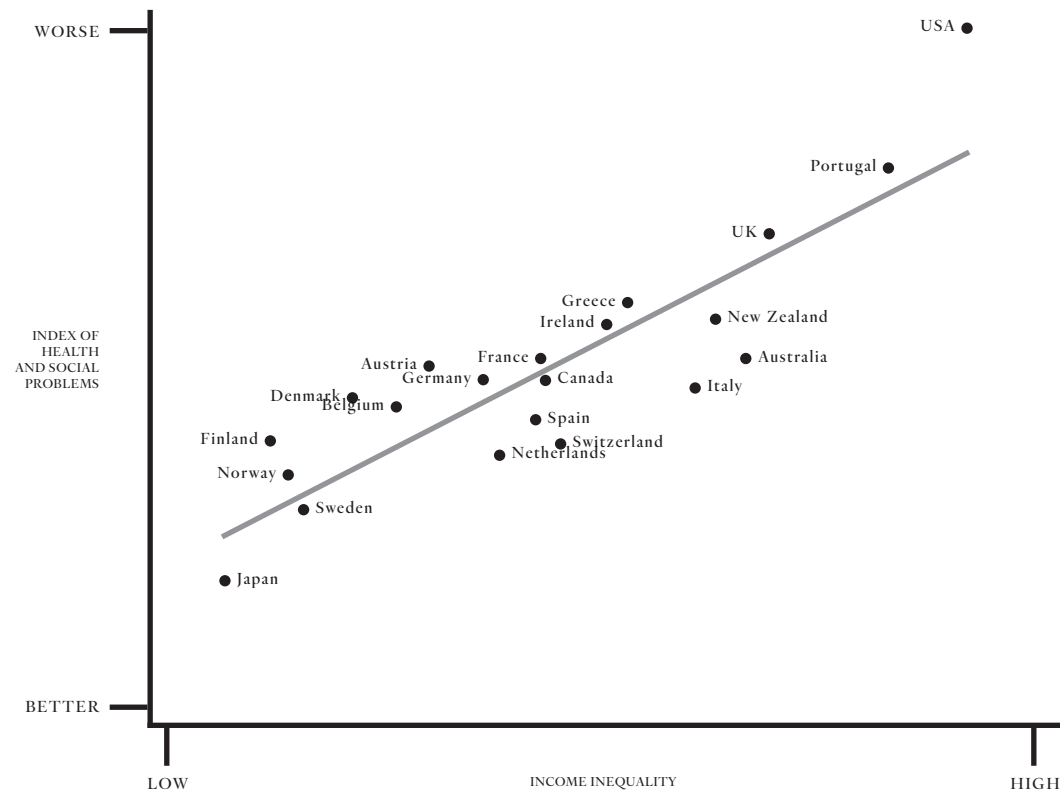
Wealthy people and capital interests have also exerted influence to privatise state activities in many countries. Sometimes the argument is made that privately owned organisations are usually more efficient, which can be valid, but

the outcome is that a larger proportion of the society's activities are operated in the market system. Capital market transactions that move public assets into private hands tend to increase the wealth of those who are already wealthy.

Wealth in modern societies has become highly concentrated in the hands of a few people. Wealth concentration has increased a lot during the last few decades, though the amount of inequality today has many precedents in history.

In countries or times with high inequality, there is likely to be a higher incidence of poverty driven by inadequate incomes. Poverty makes it difficult for affected families to take advantage of opportunities for income improvement. People who do not have sufficient income to look after themselves and their families may be unhappy, and they may become resentful if they feel unfairly deprived relative to others.

A 2010 book, *The Spirit Level: Why Equality is Better for Everyone*, by Richard Wilkinson and Kate Pickett, reported data that showed higher inequality is associated with higher rates of social issues. It is not just an income issue. Inequality itself reduces social well-being. Rich countries are socially disadvantaged by high inequality, not just poor ones.



Despite increasing overshoot, growing difficulties for the world, and increasing inequality, most people have come to expect that their personal material consumption will continue to grow. Personal incomes can grow, even while average incomes do not, because people get older, learn more, and get promoted, and so earnings increase.

Inequality is not directly visible to people, nor are the effects widely understood. Provided needs for sustenance, shelter and security are met, many disadvantaged poor people can experience happy and fulfilling lives.

Now climate volatility, habitat change, damaging microbes, disaster events, and many other harms and threats are increasing. The economic effect is like to be slower growth or decline of disposable incomes. Shifting onto a soft-landing trajectory may itself contribute to lowering incomes, as people reduce some activities because they are harmful. Increased hardship would contribute to growth of mental health and social issues, lowering of social well-being and increased discontent.

Whether from shifting to a soft-landing trajectory or navigating an overshoot crisis, difficult changes lie ahead. In difficult times, people work together to overcome challenges and hardships. The effectiveness of their collaborative effort depends in part on the social capital they have; the respect, trust, sense of unity and mutual reliance that makes teams work well together.

If many of a society's team members are in poverty or are disaffected because they envy or resent others on the team, or their incomes decline, or they think some kinds of people in their society are not on their team, then the team is less likely to perform well.

Reducing inequality could make an important contribution to sustaining incomes for disadvantaged people within societies under stress. It would also help to grow the societal cohesion

that will be needed to achieve a soft-landing, in part by increasing the feeling that everyone is contributing together to achieve an important shared goal.

Inequality is often understood only as an outcome of other policies and so not something that can or should be managed directly. The reality is that societies can choose to set inequality to any desired level by providing free or subsidised education and healthcare, setting tax rates, and making welfare transfers.

More unequal and less cohesive societies will be at greater risk from the stresses being created by overshoot. Reducing inequality and increasing social cohesion would help reduce the risk.



Chapter 9:

*GLOBAL
RESILIENCE*

Population and migration

Having a large population has many benefits. A larger population allows increased specialisation, which increases the range of consumer goods available. Having a bigger market increases production scale, which reduces the cost of goods. A larger population provides more taxes to fund infrastructure and other government services and military strength for defence against others who might want to take land or other resources.

Each person in a population requires food. If resources allow people can also be provided with a wide range of consumer goods and services. The scale of overshoot depends importantly on how many people there are, how much they consume each on average, and how much damage to the environment is caused by each person's consumption. More people living in a fixed-sized country will cause more damage.

United Nations projections indicate there is expected to be almost ten billion people by 2050, and more than 11 billion by 2100, meaning the population is projected to grow by around 40% during the remainder of the 21st century.

Feeding a much larger population will require suitable land, water, fertiliser, and waste sinks. Food supply growth is becoming more challenging because of slowing yield improvements, climate change and the declining availability of high-quality arable land. Populations under pressure may find it more difficult to protect their environments, resulting in a downward spiral where shortages force production methods that damage the environment further, causing further shortages.

Industrial production of food, urban farms and information-intensive farming will help feed many more people provided the nutrient inputs required are available. Already small fish, krill, and insects are being harvested as inputs to human diets, and their removal from natural food chains is contributing to ecosystem decline. Plans for plant matter include carbon sinks, bioenergy, building materials and clearance to provide land for agriculture. The world has an emerging scarcity of materials, including nutrients.

Population growth is an important driver of overshoot growth in less developed regions and countries.

Many of today's migrants are moving for economic reasons, and many are welcomed because they provide low-cost labour for the destination countries and contribute to economic growth.

Increasing migration and growing public opposition are triggering construction of physical barriers between Mexico and the USA and between Bangladesh and India. Migration into Europe from Africa and the Middle East, and via boats towards Australia, causes concerns too, and is being impeded by the destination countries.

More people will migrate as overshoot develops. Growth of the numbers of migrants will cause conflicts, especially if those moving do not have a choice because they need food or security, or they are being pushed by others.

Ancient, forced migrations usually brought people with broadly similar military technologies into conflict, so populations with larger numbers, more desperation or better organisation would have an advantage. Tomorrow's people will have much more dangerous and diverse technologies available, providing the potential for mass destruction of populations and natural resources.

Regardless of the mechanisms, global population decline seems more likely than the increases being projected. Global constraints from overshoot, local collapses of failing states and a managed reduction towards a soft-landing might all play a part.

If the environment is going to impose a medium-term limit on the Earth's carrying capacity, then the soft-landing trajectory might be designed with a combination of reduced damage from consumption, reduced consumption per person and fewer people. If the population is going to grow by 3 billion more during this century, that will imply a very large and most likely impossibly large reduction in environmental damage and consumption per person.

There is another logical possibility, which is that overshoot could continue through the 21st century without triggering a collapse. Given the scary symptoms already being observed, the scale of growth projected, and the damage that would accumulate during another 80 years of overshoot, that seems unlikely, and it is not a plan that anyone properly informed should willingly adopt.

With current trends, by 2050 the global population will be almost 10b, with economic output about twice what will be sustainable and environmental resources in decline. A plan to

return to aggregate sustainability would require approximately doubling the productivity from environmental resources, or halving the population, or halving consumption per person, or a combination of the three.

It seems likely that there will be a long period of population decline, happened during civilisation collapses recorded in environmental history. The root cause of population declines may be an environmental overshoot, but historically they have been delivered via climate changes, famines, wars, and disease.

Recent events that have caused apparently large numbers of deaths did not kill enough people to make much of a difference to population growth. The 1918-21 influenza epidemic and the two world wars of the 20th century killed several tens of millions of people each, but each loss was of only a few percent of the world's population, and none of those crises were sufficient to interrupt the population growth trend.

Despite this situation, many countries continue to encourage population growth, some using direct incentives. Many governments, business, religions, and community leaders fear a near-term loss of the economic vitality provided by expanding populations more than they fear the growing risk of overshoot crisis.

There is less vigorous debate about population policies than one would expect, given the scale of the emerging overshoot crisis. Strong appetite for economic growth and consumption, lack of understanding about overshoot risks, and sensitivities about the use of population influencing methods have left most of the world's countries projecting population growth as an uncontrollable outcome. The consequence of that is likely to be a large contribution from future population growth to the size of the overshoot.

There are large forces in play. They imply future challenges that global leaders and the world's people should be very concerned about.

Globalisation

Trade allows suppliers to sell the resources, manufactured goods, and services that they produce to customers in other countries, provided they can deliver at costs that are competitive with the prices offered by local suppliers and other traders. Income from trade provides funds for purchases of resources, components, products, and services that are produced more effectively in other places. Trading also supports gains from scale and specialisation.

Trading requires a mutual understanding between the traders and contributes to friendly relationships between countries. Long-distance trade has been a feature of the global economy for several thousand years at least.

International shipping, air travel, and communications have contributed to a long period of increase in trade volumes and strengthening relationships, establishing a trend of increasing international connectedness known as globalisation. Migration and capital flows have increased economic integration and interdependence, and tourism contributes further to mutual understanding. Literature, journalism, music, video, and social media transmit knowledge, understanding, values and beliefs, and encourage respect for others and homogeneity of culture. International institutions regulate and coordinate relations between countries and reduce the likelihood of conflicts and wars.

The gains from globalisation are accompanied by some less-appealing features.

Modern civilisation is now dependent on complex and highly integrated supply chains. Computers, cars, and industrial machinery are built from components that flow through many countries on their way to customers. Many countries depend on trade for their

supplies of food, energy, and other essential resources.

While there were many available sources of abundant resources, countries that had large, wealthy markets could take advantage of controlling access to those markets by volume restrictions or charging tariffs. Access controls could be used to provide governments with income and protect domestic industries that were regarded as strategically or politically important.

Wealthy countries with large markets could choose to import commodities and add value before the sale, growing the number of high-quality jobs available in the higher income destination markets and building their capital stocks. Capital could be invested in resource businesses in supplier countries, providing an additional source of income for people in wealthy countries and placing workers in the supplying countries into low-paying commodity extraction and transport jobs.

Low wage countries then accessed the technologies that had been developed in the wealthy countries and built manufacturing industries based on imported technologies and low wages. People in the low wage countries benefited from job and wage growth, though much of the capital created was concentrated in the hands of a wealthy few.

In recent decades, wealthy countries have tended to dominate the international institutions that regulate trade and international investment, exerting their power to protect and grow their advantages. When emerging economies have suffered from periodic economic crises, wealthy countries and international investment institutions have increased their capital stakes by purchases of privatising businesses being sold to repay government debts or of distressed assets being sold to restore business balance sheets.

Now there are many multinationals, governments and local businesses seeking investment opportunities, but there are relatively fewer opportunities because of increasing environmental and market constraints. Demand growth is slowing in most wealthier countries because population growth has slowed, and the incomes of middle and low-income families are no longer increasing as strongly.

People in the less developed economies are still increasing their incomes, but there may not be enough resources on the Earth to allow them to achieve consumption parity with people in wealthy countries. Investors in wealthy countries continue to seek opportunity in emerging economies, but investment risks are increasing.

As growth opportunities reduce, economic competition shifts from a race to win a share of abundant growth opportunities to a fight for fewer available opportunities. Nationalism, protectionism, trade wars and weakening of international organisations results from a shift of effort towards creating local advantage. As each country shifts to advancing its own interests, others must follow, and so the economic benefits from globalisation reduce.

These trends are causing a gradual shift of power away from those who control access to markets and the flows of goods towards those who control the supply of resources and the connections with customers. Powerful countries are moving to secure their supplies via local investments in self-sufficiency and offshore investments in critical resources. Less powerful countries, especially those unable or unwilling to adapt, will be exposed to increased supply interruption risks from the redirection of trade flows and from natural and man-made disasters.

The reversal of the globalisation trend in the economic arena is being translated into a reversal of gains from international connections and understanding, and that reversal is increasing the risks from conflict. Reducing globalisation threatens risk-reducing international collaborations such as those for climate change,

pandemics, water sharing and control of weapons technologies.

There is no solution to the dilemma of whether to reverse or defend globalisation. The solution is to unpack globalisation into two aspects: resilience and collaboration.

Resilience should be increased by reconfiguring supply chains to ensure supply security and robustness and de-emphasise efficiency and cost. Local self-sufficiency, especially in food and energy, should be increased where feasible so that communities and countries are less dependent on the availability of external supplies and monetary resources to sustain their people in tough times. Small scale, household or community food production can be developed. Solar and wind energy are becoming low cost at a smaller scale. Local collaboration will provide the organisation, effort, and resources to increase self-sufficiency.

International and domestic trade, supported by increasingly effective global institutions, should complement local self-sufficiency by ensuring that supplies are available when and where they are needed, especially when disasters occur.

Increasing local resilience should not be at the expense of global collaboration. Collaboration should strengthen to secure the global interdependency and mutual understanding that

will be required to preserve some benefits from trade, ensure international institutions are effective, achieve the soft-landing, and navigate the adverse events of overshoot.

Building local resilience and global collaboration will make it more likely that the world will achieve the soft-landing and less likely that the world will experience a collapse of civilisation accompanied by conflict.

Geopolitics

If the world does not reduce overshoot, the consequences from environmental damage and resource depletion will become an ever-increasing drag on food and other production, and well-being will decline.

Collapse risk arises for civilisations because of vulnerability, and overshoot creates a vulnerability. The collapse process may be triggered or accelerated by a shift in the climate creating famines, by war, or by a pandemic.

As strains from overshoot grow, governments become less able to raise taxes to fund services and economic failures lead to supply chain interruptions. Food and other resource shortages lead to famines, migration, and conflict. Self-sufficiency in essentials like

food and energy increases, reducing trade and global collaboration. Export prohibitions emerge as countries prioritise providing essentials to their citizens.

It is difficult to know in advance how much time remains before the economy's output peak is reached and the collapse begins. It might be decades, or it might be soon.

Historically, the collapse process for civilisations has often been slow, sometimes taking centuries. The scale, specialisation, interconnectedness, and technological dependence of our civilisation might make it more vulnerable to rapid collapse.

When governing becomes more difficult, there is a tendency to concentrate power to empower leaders to get things done. Concentrating power makes it easier and more valuable to usurp that power. There is an increased risk that a tyrant will seize power, or an incumbent will hold onto power for life and attempt to start a dynasty.

As government service deficits spread and grow, communities self-organise to fill gaps. Leaders emerge, and local organisations develop to protect and find the resources communities need. Sometimes the local leaders are called warlords, or their organisations are called militias. Often there is conflict with competing organisations.

Fragmentation of modern societies is not a desirable path. Loss of trade, loss of scale and interconnectedness, and conflict over resources would contribute to the dismantling of local economies and loss of wider economic networks and relationships, risking the establishment of a chain of collapse.

In a 21st century collapse, local organisations are not likely to have the competences and tools required to safely operate or decommission nuclear generators and weapons facilities, chemical manufacturers, biolabs, and aging dams if the corporations walk away or fail. Making these trailing liabilities of modern civilisation the responsibility of poorly connected local communities would bring disaster for us all.

Decisions by the world's political leaders could keep the world on the current pathway towards increasing overshoot and collapse risk, or they could divert the world onto a soft-landing trajectory. In the context of growing overshoot risk, geopolitics focuses on how the world's leadership is organised and motivated to make decisions about how overshoot will be managed.

National governments place a high priority on pursuing economic growth, engaging in the geopolitical game of securing economic advantages from trade and trade policy. It is important

to have an organisation to manage the economy, protect security and provide services to local people and businesses.

However, many of the world's issues are no longer manageable only at the national level. Finance, airlines, shipping, conflict, disease, climate management and disaster recovery require international or global collaboration. Nations participate in international organisations, commission collaborative research, form treaties, and work together to discover and agree ways to achieve outcomes that benefit the participating nations.

Resource shortages require global collaboration to support trade and ensure competences for local management and maintenance of resource stocks. Ecosystem decline has important global collaboration aspects too, including for atmosphere, oceans, fishing, and chemical pollution, but is mostly a national management issue.

The longer-term interests of the world's people, including children and future generations, are aligned with the "interests" of the Earth to prioritise a soft-landing trajectory.

Climate change is the most acute global collaboration issue. There is a long history of countries working together on climate change but falling short of making and delivering

on commitments that would be sufficient to slow greenhouse gas emissions growth. The rationale is often that stronger commitments would not be supported by their people. Leaders of countries usually prioritise their responsibilities to act in the near-term economic interests of their own people because that is what they are usually chosen to do.

The incentive to stay in power is an important determinant of political decision-making. Leaders may want to stay in power because they believe the alternative would be worse for their country and people, because they like being in power, because they can become wealthier, or because they fear the personal consequences of losing power.

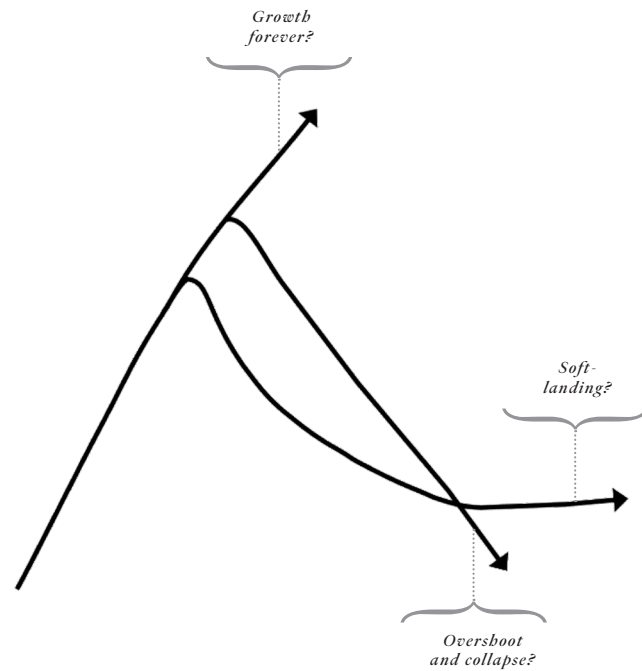
The national leaders' incentives to deliver near-term economic growth and desire to stay in power create a drag on collaborative efforts to improve global environmental outcomes. It would be very risky for the world's people to rely on national governments to agree and implement the strong and timely climate policies that will be required to avoid climate catastrophe.

Part of the solution could be for the world's nations to cede more power over civilisation-threatening issues to a global institution or institutions. That would be consistent with the

community of nations adopting a soft-landing goal, agreeing the pathway to achieve the soft-landing, and then requiring all nations that want to participate as full members of the global community to play their part to deliver the changes. Nations that did not agree or comply might face sanctions from the global community, for example, by trading penalties and limits on technology or other transfers.

Leaders of countries will not find it easy to give up power to global organisations or to form agreements that could require them to do things that are likely to be unpopular with important segments of their own people. Therefore, it is the world's people who must directly demand strengthened global institutions or alternative solutions to protect our collective future. Governments must follow their people, and if people demand effective global collaboration, then governments will follow.

Pluralism should be protected. Pluralism highlights ideas, technologies, policies, or trends that are not in the common interests of the world's people. An informed, open, and ongoing contest of ideas will be needed to identify and agree on what must be done to avoid the looming crisis.



CONCLUSION

The chapters have presented an argument that environmental issues threaten the future of our civilisation, that we are not thinking about these issues in the most effective way, and that changing the ideas of the world's people is required to alter civilisation's course towards a soft-landing.

Paradigm choice

The main task for the world's leaders today is to grow the economy.

A very important question in today's world is: "how can we continue economic growth despite emerging environmental constraints?" This question is framed from the perspective of the mainstream economic growth maximisation paradigm, which provides the dominant way of thinking about the success of modern civilisation. The critical metric within the dominant

paradigm is today's actual rate of economic growth.

The argument here poses a different question about our future. It asks, "how can we protect civilisation from the environmental threat caused by growing economies?" That question is framed from the perspective of an alternative paradigm. The alternative paradigm is identified by understanding the world's environmental history, the current state of the environment, existing trends, and emerging risks threatening the future of civilisation.

The critical metric for the alternative "ecological" paradigm is the risk of civilisation collapse, measured by the size and duration of overshoot. The evidence indicates that the risk is increasing and is likely to continue to increase.

Overshoot could grow until there is an actual collapse or could stop growing and then reduce in an orderly way to restore headroom, depending on what the world's people choose to do.

Paradigms about the economy-environment system affect the future world that people will experience. Paradigms influence economic assumptions and theories. Paradigms and theories affect which beliefs and values are adopted by people. Beliefs and values drive choices about behaviour. Behaviour affects outcomes, and the future is formed from those outcomes.

If the growth maximisation paradigm is the better one, then the world should continue along the current course, growing the economy while ensuring that the environment can continue to deliver what the economy needs. If the ecological paradigm is better, the world should shift onto a soft-landing course, prioritising overshoot reduction to avoid economic collapse.

Testing the ecological paradigm against the growth maximisation paradigm requires descriptions of the two paradigms in forms that can be compared.

The economic paradigm offers an attractive and compelling story of our past, present, and future.

Human society has developed continuously for a very long time, propelled by technological advances, notably including fire, tools, agriculture, writing, cities, medicine, engines, chemistry, computers, and genomics. Along with that development came population growth, trade connections and improved well-being for most people. As population densities grew, specialisation increased the range of products and services available, so non-food consumption grew too.

Economics aspires to be a scientific endeavour, discovering laws about the way the economy works. Ideally, laws are applicable

for all times and places. The implication for those who follow the growth paradigm as if it is a scientific truth is that aggregate economic growth is good for people always, in all states of the world.

Using the lens of the growth paradigm, that is a reasonable conclusion because, at the large scale of recorded history, economic growth has been beneficial, and at the apparently large scale of experience during the last two centuries, recent growth has been beneficial too.

Within the growth maximisation paradigm, environmental issues accompany growth, but they are resolved by technology innovation. River pollution was addressed by sewage systems, timber scarcities by switching to fossil fuel for energy supply, and acid rain by removing sulphur from power plant emissions. The environmental issues being observed now are no different. There are existing and emerging technologies that will address the environmental issues and allow growth to continue uninterrupted. Innovation will overcome existing and future environmental issues. Policies are required to manage the most pressing environmental issues, and these are being developed, agreed upon, and deployed.

That economic growth story is widely understood by the world's leaders and believed by most of the world's influential

people, and it is consistent with the core assumptions of mainstream modern economics. Most world leaders and other informed people would be able to tell a story of the world's growth that is consistent with the growth maximisation paradigm.

The ecological paradigm offers a very different story about the world's development so far and a different prediction for the world's future. It is implicitly understood and promoted in many forms and parts by some scientists, ecologists, ecological economists, activists, and others, whose thinking is informed by the planetary and life sciences.

For those who use the ecological paradigm the civilisation-threatening environmental constraints are anomalies signaling that the growth paradigm has become obsolete as a foundation for understanding and managing the world's future.

A credible alternative paradigm should provide an evidence-based explanation of why the growth maximisation paradigm is no longer well-adapted to our circumstances and understanding of how the world works. It should also provide a pathway to success and a route to tools that can be used to manage our future and deliver good outcomes.

The argument has embedded within it an attempt to provide

a high-level articulation of a version of the ecological paradigm. New paradigms usually include the paradigms they replace as a special case, so they should accommodate the theories and explain the observations of the dominant paradigm.

The ecological paradigm introduced has been explained as an extension of the dominant paradigm to include history, a place for the aggregate scale of the economy relative to the scale of the environment, and the growth phase of the 19th and 20th centuries as a special case.

The ecological paradigm tells a different story of the world's history. Instead of continuous development and growth driven by a flow of technologies, there are long eras where the most important food production technologies are quite stable, and so population densities grow very slowly. These stable eras are infrequently interrupted by rapid growth transitions triggered by discovery and deployment of transformational food production technologies.

The transition from the hunting and gathering era to the era of traditional agriculture is well-documented. Agriculture was developed in several places across the world following the end of the last ice age. An earlier transition, around two million

years ago, seems likely, given there was a shift in diets then to include eating meat and cooking, and an increase in brain size enabled by increased energy availability.

The transition from the era of traditional agriculture to the era of industrial agriculture was enabled by development of fossil-fueled machinery. Following thousands of years of relatively slow growth, the world's economy grew more than 50x in only 200 years. People who were no longer required to produce food developed the technologies, infrastructure and supply chains that established the advanced economy many people enjoy today.

The mainstream economic growth maximisation paradigm was created during the growth phase and did not provide a way to understand overshoot. Nor does it provide guidance about how, or if, the growth phase might end. Implicitly it assumes that growth can go on forever.

The ecological paradigm tells a very different story about the future of modern civilisation.

During a growth phase, like the present one, it is possible to grow economic output beyond the sustainable level temporarily, creating an overshoot.

Eventually, with continued growth, the available physical resource will be insufficient to maintain production, and the economy will reach a choke point. Then the economic output must be reduced to what can be supported by the productivity of available technologies and the capacity of the Earth.

If a society is operated using the ecological paradigm, then that rebalancing can be achieved by switching to a managed soft-landing goal and implementing a strategy to achieve that goal.

The conflict between these two paradigms is important but not very visible, partly because followers of the ecological paradigm do not yet have a single shared understanding of the competing ecological paradigm that they can work together to promote.

When paradigms are in conflict, choosing which paradigm to adopt cannot be based on examining the evidence supporting the two paradigms. The paradigms provide the frameworks within which evidence is chosen, and the paradigms guide interpretation of the evidence.

In the case of the growth maximisation paradigm, evidence of ongoing growth in the assumed stationary and durable economy-environment system “confirms” the paradigm. The same evidence, if viewed through the lens of an ecological paradigm, simply

indicates that the collapse phase has not started yet.

The conventional way to choose between competing paradigms is to find tests where the paradigms make different predictions. The obvious candidate is predictions about the future of civilisation because the growth maximisation paradigm predicts ongoing growth while the ecological paradigm predicts overshoot and collapse.

Waiting to observe which of these two competing paradigms better predicts the future of civilisation is not an option. If the ecological paradigm is correct, but the world's people wait to learn from the experience of continuing with the growth maximisation paradigm, then by the time a collapse begins, it will be too late to change course. This is a “bet-your-civilisation” choice that needs to be made soon.

One way to distinguish the two paradigms is to examine the growth of overshoot. The ecological paradigm predicts that overshoot will increase at the end of the growth phase whereas the growth maximisation paradigm says that ongoing emergence of environmental issues will be addressed by ongoing technological innovations and protection policies so overshoot will not be an important feature of the economy-environment system.

Examination of three environmental issues; climate change, resource scarcities, and ecosystem damage, demonstrates continuing damage to the ecosystems and resource stocks humanity needs to sustain the economy and human well-being.

Oceans, land, atmosphere, and the biosphere are being altered in ways that are making it harder for people to thrive. We now need much more than the resources produced by one Earth to support humanity sustainably and, despite our recent efforts, all these trends are still heading strongly in the wrong direction. Positive feedback effects, tipping points, interactions among the environmental variables, and growing geopolitical instability exacerbate the direct effects and future risks from environmental damage.

The observation that overshoot is large and continues to increase despite increasing effort is an indication that the rate of technology and policy change is much lower than what the growth maximisation paradigm predicts it should be.

The longer historical record could fit with both paradigms depending on how people look at it. Looking through the lens of the growth maximisation paradigm reveals that technological innovation has delivered apparently continuous growth of global

population, consumption per person and economic output. Growth continues today.

Looking through the lens of the ecological paradigm reveals a different story. During the era of traditional agriculture, many civilisations emerged, grew, and collapsed. Environmental historians have documented the important role played by environment constraints in many of those collapses. The experiences of those earlier civilisations imply it would be prudent to manage the future of our civilisation using a paradigm that allows for the possibility of overshoot and collapse.

Another means to decide between paradigms is to form a judgement about which paradigm brings assumptions and theories that match best with what is already known about how the world works.

The growth maximisation paradigm was developed within the recent growth phase to explain and manage growth. It does not attempt to explain the rise and decline of civilisations, and it does not include elements that could explain how the growth phase might end.

The ecological paradigm does not deny growth. It positions the recent rapid growth phase as a transition between eras. Looking through the lens of the ecological paradigm, the

growth maximisation paradigm is applicable as a special case of societal development, occurring when a big technological innovation in food production allows a period of very rapid growth until the environmental constraints return.

Growth maximisation paradigm adherents can argue that the collapse risk will not become a reality for our civilisation because the world's people are innovating, implementing policies, and changing activities to reduce environmental risks. It would follow that risks will be reduced to an acceptable level soon, and therefore growth maximisation can and should continue.

That would be a powerful argument if it could be supported by evidence that an adequate response is emerging or will emerge soon. Innovation, policy introductions and activity change are accelerating, but evidence on scarcities, ecosystem damage and climate change indicates that the planned and currently expected response is not nearly large enough yet to reverse the risk-increasing trends.

In any event, the ecological paradigm acknowledges that innovations and policies will be launched eventually. The difficulty is that obstacles to innovation and policy adoption, including the dominance of the growth paradigm, prevent

change that is rapid enough to reverse the growth of overshoot, creating the conditions for an economic collapse.

Within the growth maximisation paradigm, overshoot is not visible, so the collapse risk is not monitored. Once the ecological paradigm is adopted, the risk from overshoot and collapse becomes a central feature of civilisation's future, and the evidence of accumulating environmental damage is much more ominous.

There is a saying that people are motivated by greed and fear. That is a gross over-simplification, but greed and fear are both strong motivators today. Greed has the ascendancy now, largely because most people do not understand the risks from overshoot. If overshoot risks were more widely understood, the fear of collapse would increase the strength of the response.

Wider adoption of the ecological paradigm would stimulate a vigorous research effort to estimate and publicise the size and trajectory of global overshoot.

There is a logical possibility that a research effort focusing on understanding the world's current overshoot trajectory and the likely effects of expected responses might reveal all is well. It might demonstrate that overshoot is not an existential threat for civilisation, and the world's people may safely continue to

maximise economic growth because expected technologies and policies will soon reduce the collapse risk.

In that event, nothing would be lost. The world could continue along the growth trajectory, and many people would feel much safer.

Continuing along the growth trajectory without evidence of safety is much riskier. If overshoot is truly an existential threat for civilisation, then the world's response would be weaker, and the risk of collapse would be larger than it could be.

Both the growth maximisation paradigm and the ecological paradigm will allow growth to continue if it is safe to grow. The place we must not be is where the collapse risk is high and increasing, and we persist with the growth maximisation paradigm.

The ecological paradigm provides a more realistic explanation of the Earth's near-term future than the growth maximisation paradigm. It offers a more useful foundation of ideas to help restore the balance between the scale of the economy and the capacity of the environment to support it. In today's circumstances, it would be reckless to knowingly continue to use the economic growth maximisation paradigm to assess the risk of overshoot and collapse.

How we think affects the outcomes we will get. The choice of paradigm matters.

From the vantage point of the ecological paradigm, a warning must be issued. If the arguments made here are valid, then our default expectation about the future should be that if our civilisation continues to maximise growth and increase overshoot, then it will collapse.

The growth paradigm supports forecasting good future outcomes based on recent trends, but the ecological paradigm does not offer that comfort.

Adopting the ecological paradigm and accepting the warning implies that a change of direction is needed urgently to reduce the collapse risk to a more acceptable level. The question is how?

Paradigm change

People believe and value what they are socialised and educated to believe and value, and most are strongly influenced by respected others to hold the beliefs and values which are dominant within their culture.

John Maynard Keynes, the eminent economic thinker, wrote that we are all slaves to the ideas of dead economists. His claim highlights the power of paradigms, and of economic thinking.

The economic ideas of dead economists from the growth phase are dominant now, and they underpin the growth maximisation paradigm.

Changing paradigms is not easy because a paradigm organises understanding and frames thinking. If a person's thinking is organised in one way, it is difficult to think in a different way.

People continue to use their existing paradigm until there is a good reason to change. An important step in paradigm change is recognition that the old paradigm is no longer working. There are several obstacles preventing widespread recognition that the growth maximisation paradigm is faltering.

Environment deterioration is gradual and largely invisible, or elsewhere.

A person who is affected by a deteriorating environment will adapt to the specific local challenge but is not likely to identify that event as a signal that their paradigm should change.

The affluent people who are most influential are surrounded by good-looking environments. Affluent people have options to adapt to local environmental issues and to move elsewhere if their local environments are damaged.

That masks the experiences of billions of ordinary people

in poor countries and less affluent regions within other countries. Less affluent places often have higher and more rapidly increasing population densities, more environment degradation, and sometimes failing states, all reducing options and increasing risks.

Globally, it seems that overshoot is having serious effects, but those effects are not yet widely recognised as signals that the growth maximisation paradigm is no longer working as well as it once did.

Scientists who research environmental risks communicate their findings mostly to audiences of technical specialists, peers, and students. Environment issues are usually studied and reported as separate and local events, discoveries, and challenges.

Identifying a future risk depends on having a paradigm which allows recognition of a pattern of evidence that signals the risk. A risk of civilisation collapse in the future is a very abstract concept. Global patterns are hard to discern and only revealed by broad analyses that are often difficult to understand and interpret.

The people who are most at risk are people in the less affluent countries with high population densities, poor people everywhere, and young people. Many of these people are not aware of the risk, though they may be seriously affected by environmental deterioration already.

Some young people are aware of the risks, but collectively young people lack power to effect change.

The most influential people are the high socioeconomic status people in more affluent countries who interact personally with the leaders. Few of them have adopted something like the ecological paradigm.

Understanding is further impeded by disinformation promoted by some people and organisations pursuing wealth creation for themselves.

The result is it is not easy for ordinary people to recognise that the dominant paradigm does not fit well with the evidence.

There is not yet a coherent and widely understood alternative ecological paradigm, explaining overshoot risk and the idea of a soft-landing. That means even if people decide that the current path is not a good one, they do not have a readily available alternative to switch to.

Knowledge is correlated with concern, so with low levels of knowledge, there are lower levels of concern than there would be if there was more understanding of the ecological paradigm, of the evidence about environmental trends, and of the risks from collapse.

For all these reasons it is unrealistic to think that all or most of the world's people are making informed choices about which

paradigm to follow. Only a very small proportion of the world's people will ever understand the assumptions, theories and evidence that form the foundations for the two paradigms competing to frame management of the economy-environment system.

In these circumstances, there is a strong case for informed leaders to step up and lead human society away from the collapse option and towards a soft-landing, or to an alternative pathway to a safer future.

Preparations for war demonstrate that when urgent change is needed, country leaders can mobilise people and redirect effort quickly. Highly motivated leaders ask for behaviour changes to defend the status quo of national interest and economic processes against a widely understood threat.

Despite the challenges of war, mobilisation to fight is an easier message. People understand war. Producing goods, including weapons, is something that people are ready, willing, and able to do. War demands an increase and redirection of effort, not a change of paradigm.

The overshoot challenge is more difficult than mobilising for war because what is required is to re-vision the way we think about our place in history and the rules governing our civilisation's future.

The world's leaders have a variety of positions on environment protection and restoration. Some would prefer that environment protection is subordinated to the needs of the economy. Some support environment action, especially on climate change, but expect that current or future actions, or new technologies will be sufficient to ensure a successful future for civilisation.

It is likely that some understand the existential threat from overshoot.

Leaders may be more confident in their ability to deliver economic growth than in their ability to navigate to a soft-landing. That creates a disincentive to switching to the ecological paradigm and having to learn to manage with unfamiliar theories and tools.

Leaders are not always free to lead their countries to prioritise managing overshoot. A leader may reasonably fear that changing course now would cause opposition from powerful capital and business interests, loss of popularity and risks from trying to force change that is difficult and resisted.

Most country leaders continue striving for economic growth to satisfy the consumption growth aspirations of their people.

Many leaders may be confident in continuing to prioritise output growth because the growth maximisation paradigm

provides them with comfort that the future will have good economic outcomes.

Lack of knowledge and impediments to action can lead to disasters.

In *The March of Folly*, Barbara Tuchman investigated the causes of important government failures in history: failures of leadership to respond effectively to critical challenges. She describes the best practice:

“the overall responsibility of power is to govern as reasonably as possible in the interest of the state and its citizens. A duty in that process is to keep well informed, to heed information, to keep mind and judgment open and to resist the insidious spell of wooden headedness. If the mind is open enough to perceive that a given policy is harming rather than serving self-interest, and self-confident enough to acknowledge it, and wise enough to reverse it, that is a summit in the art of government”. (p. 32)¹

Having examined several historical instances of government failure, Tuchman concluded that governments fail frequently,

¹Tuchman, B. (1984). *The March of Folly*: “From Troy to Vietnam.” New York: Alfred A. Knopf.

and that when they do:

“in the first stage, mental standstill fixes the principles and boundaries governing a political problem.

In the second stage, when dissonances and failing function begin to appear, the initial principles rigidify. This is a period when, if wisdom were operative, re-examination and rethinking and a change of course are possible, but they are rare as rubies in a backyard.

Rigidifying leads to increase of investment and the need to protect egos; policy founded upon error multiple, never retreats.

The greater the investment and the more involved in it the sponsor's ego, the more unacceptable is disengagement.

In the third stage, pursuit of failure enlarges the damages until it causes the fall of Troy, the defection from the Papacy, the loss of a trans-Atlantic empire, the classic humiliation in Vietnam.

Persistence in error is the problem”. (p. 383)

The lesson is that we cannot always rely on leaders being able to put us on a good path. In the present circumstances, leaders may not recognise the risks, or may not be willing to lead their people in a different direction. Or leaders may not be able to overcome opposition from interests that would be harmed by a change of course.

If, as a result, social change is too slow, then overshoot will grow, and the likelihood and consequences of collapse will grow too. If paradigm change could be accelerated, then the soft-landing would become more achievable and a collapse less likely.

Paradigm change is much more likely to be successful if the paradigm conflict becomes explicit, because then logic and evidence will be more likely to sway the outcome.

The strategy

A strategy is a plan to achieve a desirable outcome, in this case reversing the growth of collapse risk.

Sound strategies that are implemented successfully convert possibilities into valued outcomes.

When developing a strategy, it is important to be clear about whose interests the strategy will serve. Modern civilisation

has enabled the creation of a connected society comprising billions of people, and loss of civilisation would threaten their well-being and their lives. The risk to civilisation is a risk affecting the world's people who are living now and in the next few generations at least.

Protecting all the world's people is the right thing to do. People will give up a lot and help each other to change if they believe the outcomes for themselves and their children will be better than they would otherwise be, and that what is being asked for is fair.

Some people would argue for a wider scope that includes ensuring the well-being of sentient animals, all animals, or nature itself. Arguably, a focus on the well-being of all people would require looking after nature too, so a wider purpose would be somewhat assisted by having a goal of well-being for people.

Nature has already been changed, and further large-scale change is inevitable, even if collapse is avoided. Wildlife would be even further harmed during a civilisation collapse, as people searched for food, so if collapse can be avoided, that will provide a better opportunity to protect and restore the wildlife that remains.

The strategy proposed to achieve the soft-landing goal has four high-level steps:

Change ideas. More specifically, adopt the ecological paradigm and accompanying economic theories, beliefs, and values to guide decisions about the management of the economy-environment system.

Use those new ideas to change behaviours. Redirect support for leaders, encouraging them to advocate for a soft-landing and adopt new policies. Change the behaviours of people, so they shift from the pursuit of damaging consumption towards activities that are less damaging and to activities that protect and restore the environment.

Adopt the soft-landing as a global goal, with national strategies aligned to deliver a shift onto the soft-landing trajectory. Develop initial plans to deliver the soft-landing and ensure those plans evolve as new information emerges and circumstances change. Plans usually require articulation first of what will be done and why, and then specification of who will do each action contained within each “what”, and when each action will be done.

Implement the policy and physical changes that will deliver the soft-landing.

The success of each step is dependent on the success of the one before, but progress can be made in parallel.

One important reason why existing environment management is not as effective as it could be is that a lot of effort is going into attempts to develop and implement policy and physical solutions without sufficient effort on the first three steps.

Another impediment is that the people trying to specify and promote strategies are often specialists with expertise in one or more of the domains but identifying and implementing the whole strategy requires integration of strategy elements across technology, history, ideas, social change, policy, economic, and environmental domains.

Global and national soft-landing strategies should ensure sufficient production and availability of food along with an economy that delivers well-being. They should also ensure the protection of critical environmental resources. Identifying the best pathway to achieve those requirements simultaneously will require creative and careful balancing of goals and constraints.

Interventions usually have unintended consequences that may not be anticipated. Therefore, interventions should lean

towards the minimum that is sufficient to achieve a soft-landing.

Markets will continue to have an important role to play, connecting supply with demand, establishing prices, and encouraging efficiency and effectiveness. Markets themselves are helpful, not least because economies that are rigidly centrally planned have not proved durable. What is unhelpful is the pursuit of growth of aggregate activity without enough consideration of the consequences for the future resilience of the environment and the economy.

All that said, achieving the shift to a soft-landing trajectory with acceptable risks will require large-scale changes in the operations of human societies. That is not surprising given that what must be navigated and managed is the end of the transition from the era of traditional agriculture into the era of industrial agriculture.

The changes proposed include:

- Redirect national governments and global agencies, so they commit to achieving a soft-landing.
- Regulate businesses to reduce the impact or level of damaging activities.

Constrain some capital interests to reduce their ability to grow long term risks for short term gains and to restrict their

capacity to change societal rules to increase their power and serve their interests.

- Moderate inequality within and between countries to reduce risks from social upheaval caused by disadvantaged people who become disaffected.
- Lean away from population growth instead of towards it to help slow the growth of overshoot.
- Preserve and develop the global institutions that protect trade and ecosystems, reduce conflict, and mobilise the response to the climate change collective action problem.
- Protect and enhance pluralism to ensure the best ideas are available to deliver long term well-being and to manage risks from efforts by sectional or short-term interests that may threaten efforts that benefit humanity as a collective.

Alternative strategies

Confidence that the best strategy has been identified is often based on an assessment that it will perform well relative to alternative strategies. The soft-landing pathway proposed follows logically from the arguments assembled in text but there

are alternatives that could be chosen instead, either deliberately or because they emerge from the pursuit of different goals.

The simplest strategy alternative to a soft-landing would be to stay on the current path, maximising economic growth and prioritising profit-motivated technology innovation to avoid overshoot and collapse.

Future technologies will allow very rapid growth of environmental productivity so that the growth of the yield from the environment might overtake the growth of the damage from the economy, so growth could be sustained forever.

There are research pathways that might deliver many building blocks for that kind of future. Technologies for molecular transformations of materials, cheap renewable energy generation and storage, and industrial production of foods are emerging, and they should help improve environmental productivity, reduce damage, and restore ecosystems.

The risk is that the combination of nutrient demand, environment damage and resource constraints will choke the economy before the innovation, policy and behaviour changes relieve the overshoot.

Another strategy option would be to prove or assert that

collapse is not imminent, so it will be best to increase efficiency, develop technologies and become wealthier so that future people will be better able to manage the consequences of overshoot.

If it was possible to be confident that the economy's peak is many decades in the future that might be an attractive option. However, from what we know now the peak might come as an early surprise, triggered by an event, and only recognised in hindsight.

Rationales to stay on the current course would make overshoot larger in the short-term relative to a soft-landing strategy. It is not obvious that more economic growth will solve a problem that has been created by too much economic growth.

Given the risks involved and current trends, it would be reckless to stay on the current course without good evidence that continuing growth maximisation is safe. It would be prudent to complete analysis to see where the trajectory of the current trends is taking us. If the future revealed by those calculations is safe, then the world's people can be reassured that there is no need to target a soft-landing.

A different way to stay on the current path would be to assert that collapse is unavoidable or desirable.

The consequences of planning for collapse should be

considered. Beyond the strife, pain and death that would be experienced while the global population declined by a few billion, people might consider what would be left. Dangerous molecules would be more widely dispersed. Pests and diseases would be widespread. Arable land might be severely degraded.

It is widely understood that the future productivity and health of the environment requires active and successful human management now. What should be debated is whether soft-landing is a better way to get there than growth maximisation.

Another strategy option would be for the world's affluent people to attempt to separate themselves from those most vulnerable, building walls and other barriers so the wealthy can experience a utopian technological future while the rest are left behind to experience the consequences of collapse, consigned to misery and early deaths.

Aside from ethical repugnance, that strategy is not likely to be practical. Dangerous weapons and methods are now widely dispersed, and it seems unlikely that an elite minority could protect themselves from organised efforts by others to breach walls, or from the diseases that would proliferate without globally coordinated control efforts.

Another possibility would be a global hegemony established by one country, perhaps the USA or China. That seems impractical for the USA, given its declining relative economic power, and the population seems too small to dominate and control a world with more than 8 billion people. China has a much larger population and a bigger economy, but it seems intent for now to incrementally expand its geographic influence, and it is difficult to see how China could assert itself globally quickly enough, against opposition from the other great powers.

A failed attempt at hegemony might reduce population and economic scale enough to reduce the risk of collapse from environmental causes but would risk becoming only a different pathway to civilisation collapse. A collaborative solution seems much more appealing than one based on conflict.

None of these alternative strategic options seems as appealing as a successful collaborative effort to manage a shift onto a soft-landing trajectory.

Implementation

Sometimes strategy implementation is easy and can be almost ignored during strategy development because competent

people have the knowledge, motivation, authority, and resources to lead and manage the changes.

Many strategies have been developed to solve environmental issues. Often, the strategies highlight technologies that would reduce damage, propose policies to restrict damaging business activity, or propose adoption of less damaging consumption behaviours.

Many of these strategies and plans are unlikely to be successful because they contain a missing, implicit step. They assume a miracle will occur so that the strategy will be implemented. Sometimes the actors are unspecified. Sometimes the actors are identified, but there is no proper consideration of why the actors will act.

The strategy proposed above is no different. It calls for a change of ideas with a missing miracle step required to explain how the idea changes will be achieved.

Implementation is the most important obstacle to achieving soft-landing. A strategy that cannot be implemented is not really a strategy. It is a wish.

The fastest and most effective way to accelerate implementation of the soft-landing strategy would be for the leaders of the world's governments and businesses to change

their priorities so that longer-term resilience is prioritised much more relative to short term growth.

If resilience was prioritised, then government leaders would establish stronger policies to protect and restore environmental assets, encouraging shifts in consumption and production to reduce damage. Those policies would require business leaders to change production and distribution activities to reduce the damage caused by their products and services.

By itself, that would not be a change of direction. It would be an acceleration and strengthening of an existing change trend.

Rapidly accelerating the large-scale deployment of policies to protect the environment does require a change of direction, though. It requires that governments change their principal goal away from maximising economic growth, incomes, and consumption, and instead adopt the principal goal of a soft-landing.

A government that has changed its principal goal from growth to prioritise a soft-landing will exert influence and introduce stronger regulations to reduce environmental damage. Without regulations, businesses will continue to pursue growth, including some harmful growth, because that is what businesses must do to be successful.

In a modern, competitive, unregulated market, businesses must earn income to pay their employees, their suppliers, and the providers of their invested capital. A business that cannot earn enough income will be forced to close. If a business fails, the workers are likely to become unemployed, and the investors will lose capital. Business leaders have strong incentives not to lead their businesses towards failure. Businesses survive if they provide their goods and services in exchange for income that is greater than costs.

Provided income is higher than costs, businesses have a strong incentive to grow because selling more increases income to pay workers, suppliers, and investors, and may reduce the risk of failure.

Businesses are expected to use environmental resources as inputs to generate profits, and it is recognised that there will often be environmental damage as a result. For example, it is recognised that burning fossil fuels increases the concentration of carbon dioxide in the atmosphere, but it is still acceptable for businesses and consumers to burn fossil fuels.

Business leaders do respond directly to strong public opinion and stakeholder preferences because they need a social license to operate. Many businesses are voluntarily reducing their environmental impacts in response to changing public

opinion, but many others are moving slowly, if at all, ultimately because the force of public opinion is not yet strong enough.

If a government decides that there is too much carbon dioxide in the atmosphere, then that government can, and should, regulate businesses or consumers so that the environment is protected. Businesses and consumers will comply with the law provided there is effective enforcement, and that is the way things are meant to work.

Governments are not yet imposing regulations that are strong enough to reverse the growth of overshoot because they are prioritising economic growth, and they are continuing to prioritise economic growth because that is what most people want them to do.

Regardless of their personal beliefs or values, our political leaders are required to follow the preferences of voters and supporters because that protects them from being replaced by others who promise to continue to prioritise economic growth. That is the way a democracy is meant to work, but overshoot risk continues to increase.

The obstacle to rapidly growing public support for more vigorous regulation is that not enough people have recognised that environmental risks are serious and growing and that too many of the people who have recognised the risk are passively

expecting that government leaders will regulate if regulations are needed.

Generally, the world's people are becoming more supportive of changes to reduce environmental risk, but there are not yet widespread calls for much stronger regulation. People are, however, continuing to demand that governments keep growing economies.

Looked at this way, the risk of overshoot and collapse is not principally from climate instability, ecosystem damage and scarcities. It is from the inability to change beliefs, values, and behaviours quickly enough.

An influential and growing proportion of the world's people do understand that overshoot is growing and that there is increased risk. Many are trying to influence the world's political and business leaders to introduce regulations and reduce damaging activities. That direct approach is unlikely to work quickly enough because most people are continuing to demand growth.

What is required instead is for people who already fear the growth of overshoot to change the direction of their efforts. They should communicate to increase the proportion of the world's people who understand that maximising growth is not compatible with reducing overshoot.

The challenge is how to get a critical mass of people to understand civilisation's circumstances and agree that the soft-landing should be the principal goal.

In this respect, many scientists and activists have made an important strategic error by communicating their conclusions, warnings and demands for change mainly to their affiliates and supporters, to businesses whose activities are damaging, and to national leaders who can regulate the businesses that cause damage.

Many country leaders, and other world leaders, are not yet able to lead to manage the environment effectively because, if they did, they would be replaced by other leaders who are willing to offer more growth and consumption to win power.

The proposed implementation strategy is to reallocate personal and activist efforts towards influencing other people, so those influenced people influence more people to build a public consensus that is large enough to lead governments and businesses.

The people who must initiate and propel the change of direction of effort are existing activists and other change leaders who already understand the risks, and people who read arguments like this one and decide to act personally to promote the soft-landing idea and goal. Those people may be thought of as managers of change.

Managers of change will be more effective if they understand the ecological paradigm because that understanding will provide them with accurate and compelling content to communicate to influence the beliefs and values of other people.

Managers' effectiveness will be increased further if they have effective tools for directing and accelerating social change. That implies a further paradigm extension, beyond the ecological paradigm's explanation of overshoot and collapse, into the social domain.

The first component of that paradigm extension is to think of a person as having possible **motivations that extend beyond personal consumption and wealth**, to include caring for the environment, caring for others and for future generations, and whose beliefs, values and behaviours are influenced by the expected incoming approval and disapproval of others, and by what the person believes is right.

That might seem an unnecessary change, except that the economic theory that guides public policy has at the core a person whose only goal is consumption maximisation.

The second component is a **means to influence a person to change their ideas**. Ideas drive behaviour choices, and

behaviours determine economic and environmental outcomes. The most effective means to change a person's ideas is to actively influence their beliefs and values.

Direct face-to-face influence by a respected other person is best. The influencer may signal their beliefs and values in conversation or provide information.

Trying to change a climate sceptic into a climate activist in a single interaction is unlikely to succeed. It is much better to understand what a person already believes and values, then aim for an achievable change of ideas in each interaction.

An apparent drawback of interpersonal influence is that it appears unable to reach very many people. However, if 10,000 people changed the values and beliefs of five people each three months, and each person who was changed then went on to change five people in the next three months, and so on, then all the world's people would be changed in a little more than two years. That is a very simplified illustration of the potential power of influence for social change and the contribution that individual efforts can make.

Social media can have a wider reach than direct influence but is less effective for changing ideas because the providers of information and influence are less likely to be respected than

people in closer personal relationships. Depending on the social media context, the information and ideas offered may be less credible and useful than information provided by a close respected other. People in existing close relationships are usually more trusted because they are more likely to want to preserve and strengthen their relationships.

Once leaders have adopted beliefs and values compatible with the soft-landing goal themselves, and have enough support from their followers and stakeholders, the leaders will become powerful influencers too, using the apparatus of governments and businesses.

Imitation can support influence as a change driver because people often imitate the behaviours of respected others. Contributing to change by setting an example for others to follow is a valuable additional driver of social change. An example is buying electric vehicles, where purchases by a few early adopters in a neighbourhood stimulate other purchases nearby, sometimes putting unexpected pressure on the local electricity supply.

Imitation, while helpful, has limitations because it requires the opportunity to demonstrate the behaviour and may not convey the information that changes beliefs and values.

Receiving consistent influence from a variety of respected sources increases the likelihood of belief and value change, so social change can accelerate once momentum is established.

The third component is **knowledge about how to manage an ideas-change process**. The change process is initiated by managers. Managers then exert their influence to grow the number of managers, and those managers influence other people.

Influencing other people who are opinion-leaders is more effective than influencing others who are not opinion-leaders because opinion-leaders are more likely to pass on the ideas.

It is not necessary to have every influencer understand the paradigm and the strategy. The ideas change must reach at least enough people to mobilise the social change effectively.

There is no need to try to influence country and business leaders directly. Those leaders are difficult to change because many of them have conflicting personal incentives, and they must follow the lead of the majority. Leaders usually make efforts and commit resources to understand what people want. Once enough people have changed their beliefs and values, the leaders will soon follow.

That is a normal process of social change. The proposed implementation strategy uses what works normally and is already

happening but aims to redirect effort, accelerating social change to reverse the growth of overshoot.

Social change is a prerequisite for achieving soft-landing, but it is not enough by itself, and the rest is not easy. Changing outcomes requires scientific understanding, technologies that change the impacts of economies on the world, policies to get less-damaging technologies deployed and adopted, and behaviour change by the world's people.

The fourth component is the **content of the idea changes** that will mobilise people. The ideas adopted should be the beliefs and values from the ecological paradigm, the goal of the soft-landing, and the influencing behaviours that will create the social change to achieve the soft-landing. The ideas should be packaged so that they can be passed on easily, and that is likely to imply customisation to suit different audiences.

One version of the content is offered in the form of a script below. The script provides a narrative about the world's circumstances, proposed actions in response and a vision of what the world will be like once the actions have been taken.

The script will always need updating because understanding evolves, and circumstances change. In response, any influencing script should be subjected to scrutiny and updated frequently.

Many people argue, with good reason, that motivating and mobilising people requires a positive message, one that inspires people to strive towards something much better. That positive, optimistic message accompanies communication of the growth maximisation goal.

According to the arguments being made here, the emergence of overshoot implies that the world may now have a choice between the future in the stars imagined in science fiction or something much less pleasant. Telling people that civilisation faces a risk of collapse is not a positive message and by itself may risk leading some people to fatalism and despair.

People are already becoming fearful though, and people will become more fearful if the environment continues to deteriorate and the best leaders can offer is an implicit “we are doing something, and it will be alright”.

Not telling people about collapse risks to avoid frightening them is an appealing but poor option because people must be informed to create the possibility of the social change that will make soft-landing possible. It is also dishonest and a dereliction of duty by many people who know but are staying quiet.

The script should be neither optimistic nor pessimistic. The soft-landing story should be realistic in acknowledging the risk because recognition of a threatened crisis is motivating, and the script should be positive in showing the way to a better future, advocating action that is worth the effort.

Successful change leadership requires setting the direction, motivating people, and ensuring people are well aligned with one another so they can collaborate effectively.

Some people will change because their behaviour will be influenced directly by social norms. Some will change their beliefs and values, and those changes will lead them to make different choices. Some will accept this script or seek to improve it, and many of those will pass on the ideas. Some will accept this argument in its longer form, which is provided in this document. Some will only change once they have researched the ideas here and confirmed that they are conventional ideas in their domains of origin and satisfied themselves that the ideas are structured to form something worth adopting and promoting.

The script that follows provides a short version of the argument that offers an accessible resource for idea-change efforts.

Economies are built on a foundation of resource extraction, ecosystem services and climate stability. People are fuelled by food, not money.

The growth phase during the 19th and 20th centuries was enabled by technological discoveries that dramatically increased the amount of food and other production that could be supported by the physical resources of the natural world.

Now the aggregate scale of the economy has grown much larger than the sustainable capacity of the environment to support it. The world has entered a period of “overshoot”. Continuing to grow overshoot will increase the risk of collapse of the global civilisation. Overshoot has been an important cause of many civilization collapses in the past.

Climate change, emerging scarcities of resources and waste sinks, and deterioration of ecosystems are symptoms of overshoot. Collapse would take the form of an unmanaged reduction of the world’s economic output and population.

Reducing the risk of civilisation collapse requires a managed effort to bring the global economy’s draw from

the environment into alignment with the capacity of the environment to support it. The outcome of that managed effort should be a soft-landing where sustainability is restored without the disruptive and dangerous effects of a civilisation collapse.

Ideas change is a pre-requisite for achieving a soft-landing. Beliefs, values, norms, theories, and paradigms are types of ideas, and all of them strongly influence human behaviour. The ideas used today to manage the world were developed as an adaptation for the growth phase. Many of those ideas have become counter-productive now that overshoot is large and growing.

The strategy for ideas change is to encourage effort by many people to influence the ideas of other people, establishing a critical mass of public opinion which supports changing the principal goal of global society from economic growth maximisation to achieving a soft-landing.

Even people who are fully committed to economic growth as a single societal objective should support efforts to protect environmental stocks and productive capacity once they understand the risks humanity is creating.

Powerful people who resist change that benefits the world's future simply because it harms their personal short-term income or wealth interests should be encouraged to change their thinking and join in the collaborative effort to achieve a soft-landing.

People will change, becoming less greedy, less focused on material consumption and more collaborative. We will place a higher value on custodianship of the environment that we will leave for our children and for future generations.

We will still be self-actualising people but will no longer be self-actualised by counting our wealth or reveling in our conspicuous consumption.

We will have less desire for things that are shiny and new. We will value what is familiar, functional, and durable. We may value tools and objects for the time they have served, and the histories they accrue as they are part of our lives may lead us to value them more and seek to retain them across generations.

Once enough people have adopted the ideas of the soft-landing, political leaders will change their policies and regulations to deliver the new goals of a soft-landing, custodianship of

environmental assets, and well-being of people. Leaders will move more purposefully to restructure economies. Leaders will more actively educate their populations about the risks and need for change, restrain some capital interests to protect the environment and people's well-being.

Business leaders will change too, to follow the changed preferences of their customers and the regulations imposed by country leaders. There will be winners and losers, as always when there is rapid change. Jobs will be lost, and new jobs will be created. Many of the businesses that are causing harm will oppose the changes.

The power balance among sectors of society will change. The well-being of people and sustainability of the environment will increase in importance relative to the protection of GDP growth, wealth increases for greed-motivated capital interests, and businesses' freedoms to engage in damaging activities. Subsidies for environment-damaging activities will be removed, and damaging activities will be taxed. Technology development priorities and policies will shift.

Global institutions and relationships will be strengthened to

retain benefits from trade and limit conflict as environmental constraints and change strains create difficulties for many of the world's most vulnerable countries.

Inequality between countries and within countries will reduce, social cohesion and collaboration will increase. Policies that encourage population growth will be replaced by policies that reduce population growth. Pluralism will be protected to ensure that sectional interests cannot control or change the rules to advantage themselves over the collective interests of the world's people.

Economic redirection creates risks, and those will have to be managed carefully. The challenge will be to retain sufficient stability during the transformation to sustain people and well-being while building resilience, so there is the capacity to manage through expected and unexpected shocks.

Transitioning will require careful management of the expectations of those affected by the changes, protecting nature while ensuring it remains sufficiently productive to deliver well-being, restraining capitalism and greed, maintaining markets that provide incentives for efficiency

and innovation, redirecting technologies, preserving trade and supply chains, all while balancing the need for strong leadership with retaining pluralism.

The soft-landing will be achieved. The world will be a safer, calmer, fairer and more pleasant place to live.

Once the scale of the economy is brought back into alignment with the capacity of the environment to support it, and some headroom is restored for resilience, pursuing sustainable growth will be safe and beneficial.

Is that a vision that people could sign-up for? Wouldn't it be a lot better than competing for the worlds remaining resources to keep growing until civilisation collapses?

What should I do?

The proposed change of direction requires individual people to act, mainly by exerting influence on others to create enough motivation to change policies.

Why would people do that when they are not acting now? Examination of the current obstacles to action can help explain

why people are not acting now but might become willing to encourage others to support targeting the soft-landing.

The beliefs preventing people from acting to reduce overshoot can be summarised as “no need”, “not me”, “can’t do”, and “no point”.

When considering taking action to reduce one’s own ecological footprint, “no need” might be because belief in the growth paradigm provides reassurance there is no threat from overshoot and collapse. “Not me” might motivate inaction because of a faith that leaders are well-informed and well-motivated and so will act if a change is needed. “Can’t do” might be a reasonable conclusion because people find it very difficult to change their own consumption behaviour when embedded in a social context that expects high consumption and support for the growth maximisation paradigm. “No point” might follow from the recognition that one person’s change of consumer behaviour, or even change by a whole country, would not be sufficient to change the world’s future trajectory.

These four belief obstacles are all accommodated within the soft-landing implementation strategy proposed. “No need” is addressed by the proposed adoption of the ecological paradigm and understanding of the threat from overshoot.

“Not me” is countered by the argument that leaders will act if they are led by ordinary people. Widespread understanding and influence can only be accumulated by the actions of many people.

“Can’t do” is greatly reduced because the soft-landing strategy requires people to influence others. Everyone can contribute by a shift of their own effort to influence others, provided they have a little courage to push the boundaries of some of their personal relationships. Acting to influence others is much easier than making a large unilateral change in one’s own environmentally relevant behaviour. Influencing others is not especially demanding, and people might be willing to expend some effort in the interests of contributing to a better future.

“No point” is not an obstacle because there is a point. When enough people believe the soft-landing goal should be adopted, there will be a change in societal management, and that management change will, in turn, change the behaviour of everyone. Each person will then have incentives, regulations and social supports that will encourage their own behaviour changes.

What people must do to implement the strategy is influence others. We may choose to be managers of the paradigm shift, we may be opinion-leaders and we may be ordinary people able to

influence the ideas of those around us.

For influencing others directly, it may be helpful to have a short “elevator pitch” conveying the main ideas. That pitch might be something like:

“Climate change, scarcities, and ecosystem decline are well-recognised and threatening signals that the world’s economy has grown beyond the capacity of the environment to sustain it.

The economic theories we use to manage modern economies were established within the extraordinary growth phase of the last 200 years to explain how to grow effectively. They do not provide any comfort that the environment will continue to support growth of population and aggregate consumption.

Continuing to maximise economic growth will increase the risk that modern civilisation will collapse, like many past civilisations.

Our children, grand-children and ourselves are at risk from a civilisation collapse because our supplies of food, energy, medicines, and other essentials are dependent on complex integrated supply chains. There is nowhere to hide from the scarcities, disease and conflict that would accompany collapse.

Governments and businesses continue to promote growth because they must provide what people need, and people want more consumption. If people recognised the risk we are taking they would demand changes to reduce overshoot quickly.

The world’s leaders should deprioritise economic growth and prioritise achieving the soft-landing, protecting critical environment resources, and sustaining well-being.

If enough people choose to influence others to change the world’s priorities, then collapse may be avoided.”

If people choose instead to pursue individual self-interest and fail to shift the priorities of the world’s leaders, then overshoot is likely to continue, and collapse will be inevitable. The soft-landing requires collective action based on a shared expectation about the behaviour of ourselves, other people, our leaders, and other countries.

Last words

The argument proposes a change of the world’s direction and a means to implement the change. It offers an alternative interpretation of the place of our civilisation in history, a

rationale for changing paradigm and strategy, a rudimentary practice guide to focus efforts to implement the influence-based strategy, and some proposals for navigating the world's evolution during the next few decades.

The soft-landing story is intended to contribute to reducing risk in three ways: as input to the conversation about economic growth and consumption versus ecology, resilience, and well-being, as a strategy to reduce global overshoot, and as a way for every person to make a meaningful contribution to reducing the risk of civilisation collapse.

In one sense, the conversation is a contest between proponents of the dominant growth maximisation paradigm and those who support the contending ecological paradigm. In a wider sense, it is a way for the world's thinkers and leaders to find the best way to navigate the chokepoint during the next few decades.

The best conversations about the future draw their ideas and evidence from numerous sources, are collegial in style, are evidence-driven, learn from practice, develop over time, and are well-connected with the achievement of important outcomes. That implies there is a lot more to learn about the future and how it should be navigated, and we should not expect that the answers

are all provided by the dominant economic paradigm. Nor will the answers be provided by the argument here, but rather by the conversation that will result if more and more people understand the soft-landing opportunity and develop the arguments further.

The strategy for reducing overshoot is simple and powerful. It is required because the world is not yet changing fast enough to reverse the increasing risk of collapse and because changing ideas is a powerful way to accelerate change. If more of the world's people understand the importance of shifting to a soft-landing trajectory, and those people actively influence other people to influence others, then a chain of idea and activity change will be established. Passing on ideas about the soft-landing to others implements the strategy.

Transmitting ideas can be done by nearly everyone, and if enough people share ideas, then the world changes direction. Getting people to influence others is not easy. But it is much easier for a person than trying to stop climate change or working to save a species facing extinction. It is critically important, and each of us can contribute. If enough people choose to influence others, then it will be effective.

The self-image of most people in today's civilisation is that

our generations are the cleverest people ever. Being clever should extend to being clever enough to avoid civilisation collapse ourselves. Assuming some future people will take care of problems we are creating would be dumb. We might be remembered as the generations that destroyed their own civilisation by reckless and wasteful destruction of the world's natural capital.

If there is a more effective or easier way to protect our civilisation from overshoot risk than what is proposed here, then let us find it and do that. If not, then let us change the ideas of the world's people and follow the path to a soft-landing.

We are all choosing our own future.

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