7 Conclusion: System Threats Should Not Mean Systemic Collapse

This chapter summarises the main conclusions of preceding chapters on the characteristics of the systemic threats facing society and how to deal with them. It notes a shift in thinking among decision makers towards some of the positions argued for by this publication's authors, notably the need to build resilience into important systems; to pay attention to the human aspects of crises, notably the psychological aspects; and the advantages of a systems approach in identifying and prioritising areas of intervention. The chapter looks in particular at health, employment, global value chains, inequality, and the environment.

Introduction

As mentioned in the Chapter 1, the view that the economy is a complex system goes back at least to Adam Smith (Kirman, 2017). Smith's compatriot and contemporary Adam Ferguson examined socio-political complexity, notably the phenomena of emergence and unintended consequences, concluding that "nations stumble upon establishments, which are indeed the result of human action, but not the execution of any human design" (Smith, 2009). Unintended consequences result of course from today's economic decision-making too. The US Congressional Research Service notes that: "As infectious cases began rising sharply in late February 2020, governments took unprecedented steps in March 2020 to lock down social activities to contain the spread of the pandemic, inadvertently creating a global economic recession" (CRS, 2021).

In fact, the idea of interconnectedness of the different systems that affect our lives dominated thinking about society and nature until economics began treating the environment as an "externality". Even the idea that epidemics have to be understood systemically is nothing new. In his series of lectures on *The Philosophy of Nature* in 1830, Hegel shows that to understand an epidemic, you have to understand the interactions between the internal functioning of the human body and the whole of nature outside it, including climate, geography, and history (Bourgeois, 2004).

You also have to understand human psychology, as Steven Taylor warned a few months before Covid-19 struck (Taylor, 2019). Taylor described the mental health and behavioural implications of "severe disruptions of routines, separation from family and friends, shortages of food and medicine, wage loss, social isolation due to quarantine or other social distancing programs, and school closure". Taylor appears to be eerily prescient about everything from panic buying to conspiracy theories, but he simply notes what happened in previous pandemics such as the Spanish Flu in 1918. The Brain Capital Agenda described in Chapter 6 is a response both to the immediate impacts of the pandemic on mental health and a longer-term programme for preparing people to cope with the stresses and take advantage of the opportunities of life post-Covid.

Psychology is also important because the way people describe events to themselves determines how they respond, not just to the immediate crisis, but to future ones. Robert Shiller develops this aspect in relation to economic crises (Shiller, 2019). The Great Depression was due in part to people expecting thing to get worse and acting accordingly – withdrawing money from banks, saving instead of spending, not hiring new employees, for example. Shiller makes another important point – memory of past crises influence present ones. Runs on banks and failures are part of the powerful narrative of the Great Depression, and as the 2007-2008 financial crisis unfolded, both citizens and governments drew parallels with events in the 1930s, and this had an impact on their reactions, prompting massive quantitative easing for instance.

It is only to be expected then that stories that have captured the most attention recently should be reflected in how one considers the future. The latest DTCC Systemic Risk Barometer asked financial market actors what they saw as the most important systemic risks to the sector (DTCC, 2021). Cyberattacks and pandemics are the main concerns. Reinsurers shared the concerns about cyberattacks in the latest survey of how they saw the future, but they think risks related to climate change are more important (Artemis, 2021). There was a similar ranking from people surveyed for the World Economic Forum's *Global Risks Report 2022,* who see environmental risks as the five most critical long-term threats to the world as well as the most potentially damaging (WEF, 2022).

It is important to remember that while the past shapes the present and the future, it is not an infallible guide. The surveys mentioned above, and futures thinking more generally, reflect an argument supported by a complex systems approach: you should not simply extrapolate from previous conditions to plan for the future. A report by Citi explicitly calls for a systems approach, on the basis that "as our world becomes more globalied and interconnected, we have inadvertently built systems which have not just the ability to

transmit those risks across geographies and turn them from local into global phenomena, but which also have the ability to cause further global crises to materialize" (Citi, 2021).

Chatham House brings this approach to climate change, highlighting another phenomenon discussed above – the way a shock to one system can spread to other systems (Quiggin et al., 2021): "Cascading climate impacts can be expected to cause higher mortality rates, drive political instability and greater national insecurity, and fuel regional and international conflict". The main reason the report gives is interconnections between shifting weather patterns, resulting in changes to ecosystems and the rise of pests and diseases, which combined with heatwaves and drought, "will likely drive unprecedented crop failure, food insecurity and migration. In turn, all will likely result in increased infectious diseases, and a negative feedback loop compounding each impact."

We tend to think of feedback as instantaneous, but the multiple time scales operating in complex systems mean that we have to consider the longer term too when trying to forge a resilient response to the Covid pandemic. And given that the systems we are dealing with are adaptive as well as complex, we have to think of how different systems respond to changes in each other. In the following sections, we will look at a selection of domains that have been impacted strongly by the crisis and that will have a major influence on how resilient the next normal is.

Health

The OECD stresses the systemic interactions of health with other issues when it says that the pandemic showed how vulnerabilities in health systems can have profound implications not only for health, but also for "economic progress, trust in governments, and social cohesion" (OECD, 2021a). Better health and health systems produce positive feedback loops with the economic system and the education system. For example, health returns to education increase the total returns to education by at least 15%, and perhaps by as much as 55% (Cutler and Lleras-Muney, 2006). A US study found that 20% of health outcomes are linked to medical care; the remaining 80% stem from interactions with the socioeconomic and environmental systems, and behavioural and lifestyle factors (Hood et al., 2016). Addressing inequality in its various forms, and tackling problems such as homelessness, hunger, exposure to intimate partner violence, adverse childhood experiences, racism and so on would therefore improve health outcomes.

At a different scale, the latest *Lancet* survey on health and climate change warns that the cost of inaction on climate and health will vastly outweigh the costs of acting now (Romanello et al., 2021). The report calculates that rapid decarbonisation could prevent most of the 3.3 million deaths from air pollution that occur each year, the 842 000 deaths associated with excessive red meat consumption, and result in better physical and mental health from higher exposure to nature and more physical activity. The *Lancet* estimates that the monetised value of global heat-related mortality increased by 6·7%, from 0·27% of gross world product in 2018 to 0·28% in 2019; Europe continued to be the worst affected region, facing costs equivalent to the combined average incomes of 6·1 million of its citizens.

To be prepared for the next health shock, such as one linked to antimicrobial resistance, we need a coherent approach. Public funding contributed to every one of the 210 new drugs approved by the Food and Drug Administration from 2010-2016. Collectively, this research involved over 200 000 years of grant funding, totalling more than USD 100 billion (Cleary et al., 2018). Yet the pharmaceutical companies who benefit from massive public subsidies and guaranteed sales still want to keep the IPR on vaccines and the profits that go with it.

There are clearly market failures in drug development. The Rand Corporation estimates that antimicrobial resistance could result in a cumulative loss to the world economy that ranges between USD 2.1 trillion and USD 124.5 trillion depending on the scenario, due to impacts on labour supply and productivity alone (Taylor et al., 2014). This problem has arisen because despite the costs, there is not enough profit in

developing new, low cost drugs to tackle it. Covid shows similar failings. As mentioned in the introduction, funding for research into coronavirus vaccines was cut before the pandemic because there was no guaranteed market for the products (Hoetz, 2020). We have to change the business model, and consider vaccines and other vital medicines as a global public good.

Employment

The pandemic was the great accelerator of a number of trends already shaping labour markets and the workplace. A typical summary of pre-pandemic views on the future of work was published by NASA in 2019: "We live in a time of volatility, complexity, and transition, and it is here to stay. Between technological advancements, demands for re-defined careers and for work–personal life balance, the next decade will see a transformation in the way we work, learn and explore. Sweeping global forces are already reshaping the workplace, the workforce, and work itself." (Skytland, 2019). That same year, a Gartner survey found that 55% of organisational redesigns were focused on streamlining roles, supply chains and workflows to increase efficiency. Writing two years later, Gartner noted that: "while this approach captured efficiencies, it also created fragilities, as systems have no flexibility to respond to disruptions. Resilient organizations were better able to respond — correct course quickly with change." (Baker, 2021).

Digitalisation in its various forms was the main technological foundation of efforts to boost resilience and keep firms operating. The dramatic rise in telework was the most obvious consequence. In Europe, for example, the proportion of workers engaged in telework increased from 11% before the pandemic to 48% during it, with about 40% of paid workhours during the COVID-19 pandemic taking place by telework (WHO/ILO, 2021). While the ability to telework may have contributed to company and employee resilience during the pandemic, in the longer term, a number of questions have to be addressed. According to the OECD (2020a) telework can improve firm performance by raising worker satisfaction and thus worker efficiency, for example through better work-life balance, less commuting or fewer distractions, leading to more focused work or less absenteeism. It is, however, also possible that worker satisfaction decreases due to solitude, hidden overtime, a loss of work-life balance, or an inappropriate working environment at home.

The ability to telework highlighted and reinforced other pre-Covid trends, discussed in NAEC seminars: the rise in what Guy Standing terms the "precariat" (Standing, 2017); and what David Weill calls the "fissured workplace" (Weill, 2018). Standing defines the precariat along three dimensions. First, those in it are being pressured to a life of unstable, insecure labour, in which casualisation is being extended. Second, the precariat relies mostly on money wages, which have been falling in real terms while becoming more volatile and unpredictable; and they are also losing non-wage enterprise benefits (paid leave, medical leave, occupational pensions, etc), which give labour-based security. Third, members of the precariat are losing all forms of rights – civil, cultural, social, economic, and political. Standing argues that universal basic income should be part of any policy response to these issues.

Weill reaches similar conclusions from his analysis of the situation in the US, where large corporations have shifted to outsourcing work to small companies that compete fiercely with one another. He recognises that fissuring - splitting off functions that were once managed internally - has been a phenomenally successful business strategy, allowing companies to become more streamlined and drive down costs. However, he also says that from the perspective of workers, this has meant declining wages, eroding benefits, inadequate health and safety conditions, and ever-widening income inequality.

Gartner (Baker, 2021) expects companies to react to the coronavirus crisis in a similar manner to the 2008 financial crisis, with a focus on expanding their geographic diversification and investment in secondary markets to mitigate and manage risk in times of disruption. However, "this rise in complexity of size and organizational management will create challenges" in addition to the those posed by rising inequality. The WEF suggests in five areas to concentrate on in the post-pandemic recovery: reskilling and upskilling;

supporting the jobs of tomorrow; prioritising redeployment and re-employment; re-evaluating essential work and improving the quality of jobs; and resetting education, skills and jobs systems (Zahidi, 2020). The OECD looks in more detail at how such an approach could improve work and employment in the longer term, arguing that active labour market policies should play a key role in underpinning the economic recovery through helping jobseekers find jobs, making available training for those most in need, and providing comprehensive support to those who struggle most (OECD, 2021). Active labour market policies can also help speed up the reallocation of labour from declining sectors and firms to expanding ones, including through support provided to employers and entrepreneurs.

Global value chains

A digger trying to free the gigantic *Ever Given* container ship that was blocking the Suez Canal became the emblematic image of the supply chain crisis during the pandemic. Speaking of the incident to Foreign Policy, maritime analyst Cormac McGarry said: “we are pouring highly concentrated volumes of our critical supply chains into vulnerable positions, so we are losing the spread of risk. It leaves businesses more exposed to singular, isolated events” (Braw, 2021). The blockage happened because high winds blew the ship off course. This is a known risk, but waiting even a few hours for the wind to drop before entering the canal jeopardises the tight schedules of global just-in-time supply chains. Ships carrying 10 000 containers or more may only have hours to unload their cargo in a given port and pick up a supply of empty containers for ports they will visit later. “It’s an efficient model, saving on storage and inventory, but a fragile one” as Bloomberg remarks (Chellel et al., 2021).

Delays to the *Ever Given*’s 17 600 containers therefore quickly rippled through global supply chains, adding to and aggravating other problems created by the pandemic. Images of container ships waiting offshore to enter lockdowns meant it took longer to process goods once they reached the ports, and once they were unloaded, reduced road and rail capacity due to lack of personnel meant they could not be moved. This reduced the number of containers being returned to manufacturing hubs, holding up shipments, provoking further congestion and causing prices to rise. The Drewry World Container Index reached USD 9421.48 per 40-foot container on 12 August 2021, about 350% higher than a year previously (Curran, 2021). Punctuality suffered too. Before the pandemic, about 80% of container ships arrived on schedule. By June 2021, this had halved to around 40% (Sea Intelligence, 2021). In addition to the blockage of the Suez Canal in March 2021, the closure in May because of a Covid outbreak of Yantian, the world’s third-biggest container port, made matters worse.

The Yantian closure highlighted the fact that despite digitalisation, robotisation and other emerging technologies, people are still needed to make and transport goods. In July 2021, a surge in Covid cases caused Toyota to shut factories in Japan and Thailand, while in Vietnam health officials closed the largest trainer factory in the world (Allen, 2021). Adidas expected pandemic-related losses to total 500 Euros in 2021, while Nike said that the three-month shutdown meant that they lost 130 million units of production.

The increased concentration of supply chains reflects the increasing concentration of global economic power in the hands of large corporations, aided by changes in trade and competition policy in recent decades. While this has been beneficial to the firms themselves, it has left countries exposed to the risks of supply disruption and shortfalls, as we saw with the lack of even the basic equipment needed to deal with the pandemic. Hynes and Lynn (2021) argue for a system of regulation and subsidisation that promotes a rapid but not wrenching de-concentration and redistribution of keystone industrial capacities, such as for the manufacture of semiconductors, chemicals, and other capital-intensive goods and components. They cite the Reagan administration’s moves to diversify supply of computer components away from Japan, and believe that the goal should be to distribute key industrial capacity in ways that ensure that no one natural disaster or national actor can ever disrupt more than a minor portion of the total

supply of any particular vital good or component. They suggest that no more than 25% of the international capacity for any component or finished product be located within the borders of any one nation.

Inequality

Growing inequality of income and wealth is a global phenomenon. Oxfam claims that the wealth of the world's 10 richest men has doubled since the pandemic began, while 99% of humanity are worse off because of the pandemic and over 160 million people have been pushed into poverty (Oxfam, 2022). The World Inequality Report 2022 states that "In 2021, after three decades of trade and financial globalization, global inequalities remain extremely pronounced: they are about as great today as they were at the peak of Western imperialism in the early 20th century. In addition, the Covid pandemic has exacerbated even more global inequalities. Our data shows that the top 1% took 38% of all additional wealth accumulated since the mid-1990s, with an acceleration since 2020." (Chancel et al., 2022).

Gender aggravates inequality, and once again the pandemic made a bad situation worse. Women are on the front line of the "war" against Covid-19, representing around 70% of the health care workforce. They are also the majority in many of the occupations that are the most exposed to pandemic health risks or job losses, such as retail. Figures from the US Bureau of Labor Statistics, for example, showed that at the end of 2020, every single one of the 140 000 jobs lost was a woman's job (Kurtz, 2021), while globally, female employment declined by 4.2% in 2020 compared to 2019, versus a 3% decline in male employment (ILO, 2021). Although there has been some recognition and praise for the role women play, the latest UN report on achieving the Sustainable Development Goals shows not only a lack of progress as regards gender but a regression (UN Women, 2021). The report says that women have not recovered lost jobs and income, so hunger is on the rise, and school closures threaten girls' educational gains. The UN Population Fund looked at the impacts of a six-month lockdown on women and girls over the next decade: 7 million additional unintended pregnancies; 31 million more cases of gender-based violence; 13 million child marriages and 2 million female genital mutilation cases that could have been avoided (UNFPA, 2020).

Ethnicity adds a further layer of difficulty. A European Union Minorities and Discrimination Survey found that Black people encountered racism in the police's attitude towards them, their chances of getting a job and the kinds of jobs they could get, access to housing, and how they were treated in educational institutions. Younger people tended to experience more discrimination and exclusion than older ones (EUAFR, 2018). In June 2020, UN High Commissioner for Human Rights Michelle Bachelet warned that: "The data tells us of a devastating impact from COVID-19 on people of African descent, as well as ethnic minorities in some countries, including Brazil, France, the United Kingdom and the United States… In many other places, we expect similar patterns are occurring, but we are unable to say for sure given that data by race and ethnicity is simply not being collected or reported" (UNHCR, 2020).

In its analysis of the impacts of the Covid pandemic, the US House Committee on the Budget states that: "Decades of stark income inequality have made the United States more vulnerable to economic shocks" (House Budget Committee, 2020). Inequality makes communities less resilient to shocks, and in its proposals for "building back better", the OECD insists that: "recovery policies need to be measured on more than just economic growth and total job creation. Emphasising other elements that improve well-being, such as income, job quality, housing and health is important" (OECD, 2020b). This approach builds on the philosophy of the OECD Centre for Opportunity and Equality (COPE), "a platform for promoting and conducting policy-oriented research on the trends, causes and consequences of inequalities in society and the economy, and a forum to discuss how policies can best address such inequalities" (OECD-COPE).

The OECD proposes a five-point plan to improve resilience by reducing inequalities (OECD, 2021c):

- Support the creation of sustainable, inclusive and high-quality jobs, especially in the green, education, health and wider care sectors.
- Support wide access to high-quality green and sustainable jobs to benefit firms' productivity, improve the mental health and well-being of workers and their families, and provide society with the skills and services needed for sustainable economic growth.
- Strengthening mental and physical health promotion and prevention to allow people to lead productive and fulfilled lives.
- Use a whole-of-government approach to raise the well-being of disadvantaged children and young people.
- Restore trust to reconnect people and the institutions that are meant to support them.

Environment

The 2022 IEA Climate Resilience Policy Indicator warns that over 85% of the organisation's member and associate countries are already exposed to a medium or high level of climate hazard risks (IEA, 2022). The report advocates reinforcing the climate resilience of energy systems, which it says is "the ability to anticipate, absorb, accommodate and recover from the effects of a potentially hazardous event related to climate change", in line with definition of resilience used in Chapter 2 of this publication. The IEA's recommendations could apply to any system exposed to climate-related shocks, a resilient energy system being one that: "can adapt to and withstand the long-term changes in climate patterns and continue to operate under the immediate shocks from extreme weather events, and restore the system's function after an interruption resulting from climate hazards".

Many of the changes observed in the climate are unprecedented in thousands, if not hundreds of thousands of years according to the IPCC (2021), and some of the changes, such as sea level rise, are irreversible over hundreds to thousands of years. The report cites evidence that strong and sustained reductions in CO2 and other greenhouse gas emissions would limit climate change, although it could take 20-30 years to see global temperatures stabilise. Lockdowns and other economic consequences of the Covid pandemic have not noticeably slowed the pace of climate change, and atmospheric CO_2 concentrations continue to grow, after a one-off dip in 2020. Only a small percentage of most Covid recovery packages are designed to reduce the impact on the climate and wider environment; a far greater amount is being spent on investments and activity that does not consider environmental or climate objectives or will even make things worse (OECD, 2021d). The IMF estimates that global fossil fuel subsidies for example were USD 5.9 trillion in 2020, or about 6.8% of GDP, and are expected to rise to 7.4% of GDP in 2025 (Parry et al., 2021).

Bad policy choices and prioritising are hampering strategies specifically meant to deal with climate-related problems. For example, projections by the UN Environment Programme and GRID-Arendal (2022) suggest a global increase of extreme fires of up to 14% by 2030, 30% by the end of 2050 and 50% by the end of the century. However, more than half the expenditures related to wildfires are for response, while planning typically receives just 0.2% of the total budget for wildfires. As in the IEA Policy Indicator, the UNEP study promotes a resilience-based approach, suggesting as a starting point that countries rebalance investments by up to 1% for planning, 32% for prevention, 13% for preparedness, 34% for response, and up to 20% for recovery.

Historical evidence of societies that proved to be resilient to climate change provides grounds for hope. Degroot et al. (2021) studied the period of cooling around the sixth century (the Late Antique Little Ice Age, LALIA) and the Little Ice Age (LIA) lasting from the thirteenth to nineteenth centuries. They combined findings from archaeology, history, geography, and palaeoclimatology with a definition of resilience based on that of the IPCC, focusing on a system's capacity to absorb energy and to redirect or to convert it without

losing the fundamental features and shape of the system as a whole; and adaptation, being able to adjust to moderate harm or exploit beneficial opportunities. They conclude that climate-resilient communities in the past had five overlapping pathways that could still be explored today: exploiting new opportunities; developing resilient energy systems; utilising trade and resources; political and institutional adaptations; and migration and transformation.

The OECD outlines four mechanisms and three enablers in support of climate resilience (OECD, 2021d).

First, an effective governance arrangement to provide the foundation on which a government can co-ordinate action on climate resilience across sectors and levels of government. This arrangement has to be adaptive to benefit from diverse perspectives, data and information on climate-related hazards, exposure and vulnerability, and approaches to manage the climate risks. Second, since climate risks are in many cases sector-specific, national climate resilience objectives must be mainstreamed into sectoral development policies. Third, integration of climate risks into financial management determines how, when, to whom and by whom finance will be allocated, provided or mobilised for climate resilience. Fourth, monitoring, evaluation and learning can support an iterative and adaptive approach to climate resilience informed by good practices and lessons learnt; and can also inform countries' own accountability mechanisms on progress made on climate resilience.

The first of three enablers is data and information on weather, water, and climate, and the underlying infrastructure that supports and distributes them, to guide decision making by state- and non-state actors. Second, greater awareness, as well as institutional and individual capacities, drive climate action, and capacity constraints can be important barriers to implementation. Third, technologies are also essential for action on climate resilience, but their characteristics should match the needs and available resources of users and their socio-economic and environmental contexts.

The advantages of a systems approach

With so many factors involved, it may seem at first sight that a systems approach is an impractical way to prepare for, react to and recover from a crisis. It seems reasonable to argue that by isolating a problem, policymakers can focus on tailoring their response to the specific issue in the most efficient manner. That is probably true in the rare cases where a problem really can be isolated. But as the wildfires example discussed in Chapter 5 show, often, the outcome of will not be as hoped for due to unintended consequences, unforeseen spill-overs, and unsatisfactory trade-offs.. At the same time, trying to adjust all the parameters of a problem simultaneously where the challenges are interconnected, multidimensional, and complex is impractical. There is another way, described in a joint report by NAEC and IIASA: "Systems thinking offers a solution to this dilemma. It allows us to identify the key drivers, interactions, and dynamics of the economic, social, and environmental nexus that policy seeks to shape, and select points of intervention in a selective, adaptive way" (Hynes et al., 2020).

Systems thinking also allows us to identify the most important system characteristics at play in a given situation. Some characteristics are given and are extremely hard or impossible to influence – radical uncertainty being the most obvious. But it is now becoming increasingly accepted that another system feature, resilience, can be strengthened and that by doing so, many of the costs of reacting to a crisis rather than preparing for it can be avoided. There is a shift in business thinking away from pushing for maximum efficiency. In an interview presenting the WEF report, James Corless, Head of Business Resilience Risk at Zurich, put it like this: "Just-in-time delivery has stripped the fat from supply chains but, in times of crisis, that fat can act as shock absorbers in the chain" (Zurich, 2022). This is the same argument Irina Sodin presented at the NAEC conference on Integrative Economics two years earlier – "Maybe just-in-time needs a dose of just-in-case" (Sodin, 2020).

The need for resilience

In the same interview, Corless also says that: “The pandemic is a reminder that you need to start thinking about engineering greater resilience into your existing operation”, or what Chapter 1 of this publication calls “resilience by design”. The Citi report (Citi, 2021) estimates that to reduce the probability, frequency, and severity of systemic risks, annual investments totalling nearly USD 3 trillion could be needed. This is a massive sum, but as the report goes on to say, “it pales into insignificance when compared to the tens of trillions of dollars in potential costs of inaction, and makes a strong argument that we can’t afford not to act”. The Global Preparedness Monitoring Board’s *A World In Disorder* report gives a stark illustration of this (GPMB, 2020). The GPMB calculate that preparing for a pandemic would have cost the world USD 5 per person, compared to the USD 16 trillion the IMF estimates had spent on pandemic responses by the end of 2021 (IMF, 2021).

The main lessons to be drawn from the work summarised in this publication is that decision makers should assume that any system will fail sooner or later and that it is not possible to guess when and how. One should also assume that the failure of the system in question will have consequences for the other systems it is connected to and this may create feedback loops. The winter power outages in Texas mentioned in the first chapter hit the Samsung microchip foundry in the state, quickly causing bottlenecks in the supply chain to auto manufacturers among others (Dobberstein, 2021). Burying the power lines was considered an unjustified expense. Spending money is no guarantee either though. It is impossible to buy down every risk, so the aim should be to reinforce the ability of a system to absorb the impact of a wide array of systemic threats, recover from them, and adapt to the new situation.

We do not know what, where or when the next major shock to the world system will be. We do know that its seeds have probably been planted already in the fertile soil composed of increasing interdependence and interconnectedness, failure to deal adequately with the climate emergency, and growing inequality and the resentment it generates. One positive lesson from our analysis of systemic challenges is that the good can be diffused and amplified by the same mechanisms that can provoke cascading failures. Systems thinking gives us a powerful tool to understand and shape our world, while resilience provides both a philosophy and pragmatic guide to ensure that systemic threats do not lead to systemic collapse.

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