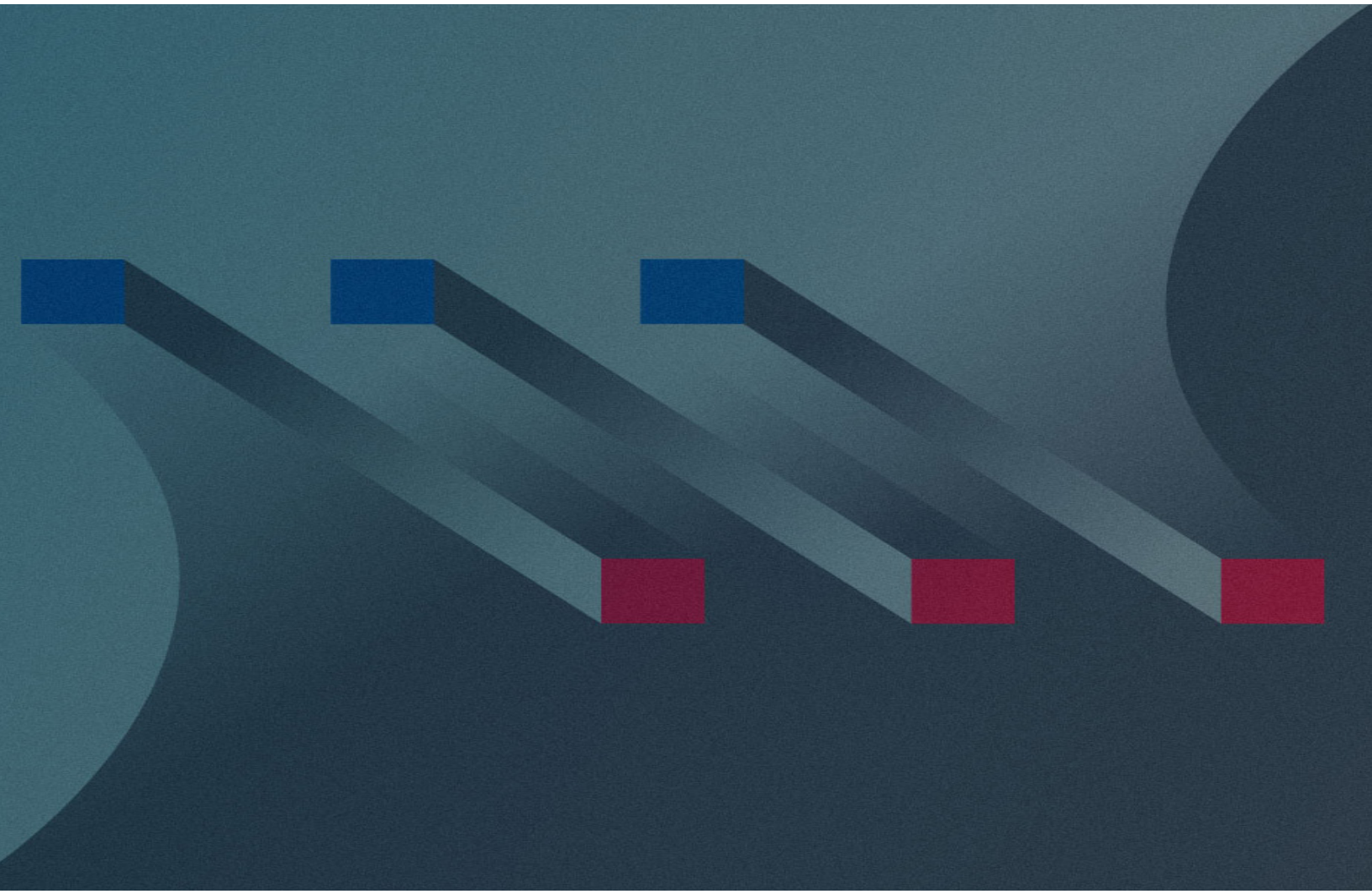
THE ORACLE PARTNERSHIP

Insurance futures

Global trends and issues reshaping the insurance landscape to 2035



Milliman

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FOREWORD

Reassessing the risks and opportunities of a hyper-connected world

Steve White, President & CEO, Milliman

JUNE 2020

COVID-19 has been a wake-up call on multiple fronts. One of the pandemic's central revelations has been that event-triggered risks can unfold more rapidly and with greater severity than even the most credentialed experts—whether scientists, technologists, economists, or others—could have predicted. Moreover, the interconnectedness of today's world, coupled with financial structures that have little margin for error, leave us increasingly vulnerable to these events.

Unfortunately, COVID-19 is not the only global risk we face and certainly not the worst. We should learn from this experience to better plan for our future. We have time and opportunity to do this. Business leaders, and the insurance industry in particular, can play a leading role, consistent with the Business Roundtable's revised purpose of a corporation to create long-term value for *all* stakeholders. But to achieve that goal, companies will need to better understand the increasingly complex and interconnected long-term risks they face.

To help address that challenge, we commissioned The Oracle Partnership to closely examine today's insurance risk landscape and project big-picture issues and trends most likely to impact our industry and the world through 2035. The result: a series of nine independent essays that the group published online between December 2019 and February 2020. This was the same period in which a novel coronavirus was first identified in China and rapidly evolved into a global pandemic. Soon thereafter, we commissioned the Partnership to develop one additional essay to examine the implications and long-term impacts of COVID-19, the toll of which will be difficult to calculate for years to come.

Given the gravity of these issues, we decided to republish the 10-essay collection in this digital format, so it can be openly and easily shared, which we encourage you to do. Our hope is that the insights contained in these essays will ignite a conversation about what the insurance industry, working in collaboration with government leaders and others, can do to help avert future crises—many of which could have larger and potentially devastating impacts.

One phrase I've heard repeatedly during the COVID-19 lockdown is, "the world will never be the same." And, while I agree, I prefer to think, "you're right; it's up to us to make it better." The trends reflected in the following essays are coming. We ignore them at our own peril. By working together to reinvent how companies manage strategic, long-term risk, we can build stronger businesses, create a more resilient society, and deliver greater value to all our stakeholders.

We need to step back before we can leap forward

One of the things I value most about The Oracle Partnership's essays is their objectivity. The group has looked at the insurance industry and our connection to large societal issues from the outside, and their view is refreshingly unbiased. While the tone of the essays is urgent, they are not alarmist. In fact, as you'll read on the following pages, many of the potential scenarios that the Partnership envisions result in highly positive outcomes—both for society and the insurance industry.

But it is highly unlikely that we'll achieve any of those positive outcomes if we maintain a business-as-usual mindset. In order to build greater resiliency—the ability to cope with what the Partnership calls "fragile, tightly coupled systems and growing risks of extreme events"—we need to apply more foresight and imagination to our business planning processes.

We need to be especially mindful of wild-card risks like COVID-19—those that we *know* are coming, but we just don't know *when*. It would be a mistake to simply wave off the pandemic as a so-called Black Swan, because the political, social, and economic conditions that fueled such widespread consequences still exist and, arguably, may have gotten worse. We will ultimately develop a vaccine for COVID-19. But there is no vaccine that will help us to overcome existential threats like climate change if we exceed the tipping point.

That is why it is so important for us to step back before we can leap forward. More specifically, the Partnership advises that insurers must begin "shifting from covering individuals and specific events, to insuring interlinked complex 'systems of systems.'" You'll see the theme of complex, multi-variable risks repeated throughout the essays, which focus on three century-shaping challenges:

- **Climate change**, including swiftly mounting pressure from consumers, regulators and investors, and the insurance industry's opportunity to position itself as a key player in transitioning to a more sustainable world.
- **Technology**, including the issues of cybercrime, privacy and surveillance, as well as the opportunities that technology (from AI to mass automation) provide insurers to reinvent our industry, and create entirely new products and services.
- **Global politics**, including the rise of geopolitical competition, nationalism, populism, trade wars and growing antagonism among nations, including the United States and China.

We can't turn our backs on these issues. We need to extinguish these potential threats now, or we will exhaust our resources fighting future wildfires—both real and figurative. While we can do many things on our own, real change will require a coordinated, global effort of governments, businesses, and individuals. The truth is, we're at a fork in the road. Today's decisions will help determine how positive or negative the outcomes will be.

The rise of nationalism will make this effort difficult, since strained relations between and among countries have resulted in less global cooperation at the very time we need more. Timing also poses a significant challenge, because the "wins" involved with these issues are longer-term in nature. In many cases, we may not recognize the value of the investments we make today for a decade or more. The result is limited incentive for our leaders to take the long view. Somehow, we must demand this of them.

At the same time, challenges such as climate change are time-constrained. So even though taking action today may not produce immediate results, not taking action may lead to irreversible damages. This perilous push-and-pull dynamic is likely to lead to a series of shocks and aftershocks that we may not be able to avoid, but that we can join together to overcome.

An unprecedented opportunity for insurance to lead

The first of The Oracle Partnership's "Insurance Futures" essays includes this prescient warning: "Contrary to conventional wisdom, in chaotic economic and political conditions, culture can change abruptly. This has potentially profound implications for insurance, both because cultural attitudes to the long-term will be felt short-term and because they will impact risk appetite."

Within a few short months, the social and economic tumult caused by the COVID-19 crisis has certainly proved that to be true. That's why we don't have time to wait for the next crisis to unfold—we need to act now. Regulators, particularly in the UK and other European countries, have already taken an active role in addressing some of the long-term risks discussed in this series. But those efforts alone will not be enough to solve the underlying problems.

The insurance industry has an unprecedented opportunity—and a social responsibility—to embrace a leadership role. Our work addresses critical issues facing the world, and insurance underpins the very confidence upon which our global economy is built.

Among the many tools at our disposal:

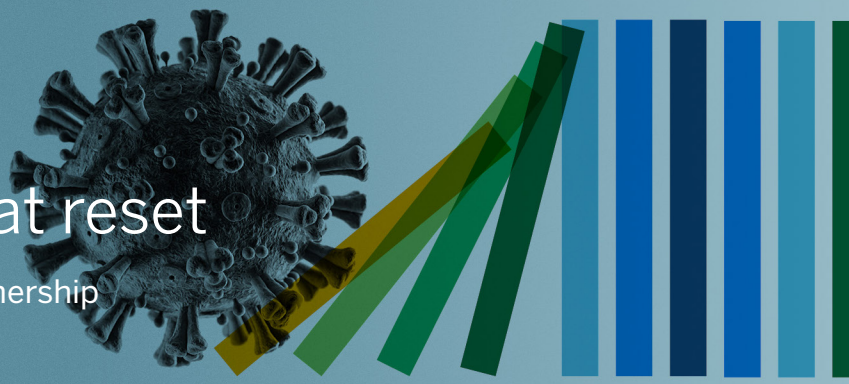
- Becoming more proactive and future-focused in pricing risks
- Being more restrictive in our underwriting
- Working with cities to build more sustainable systems
- Leading the development of tougher ESG standards
- Building more predictive models to anticipate long-term impacts
- Investing in new products and services that address the complex challenges of our interconnected world

We also need to become more vocal advocates for change, helping to tear down political barriers and inspire more cooperative action.

At Milliman, we are committed to positioning the insurance industry as a key player and helping our clients lead the change to build a more sustainable world. Since the mission of our company is "to help our clients protect the health and financial well-being of people everywhere," I can think of no cause that is more vital.

Steve White, President & CEO

June 3, 2020



INSURANCE FUTURES

COVID-19: The great reset

By Peter Kingsley of The Oracle Partnership

MAY 2020

Towards the end of 2019 and early 2020, we published Insurance Futures, a series of essays exploring the possible futures of the insurance landscape to 2035, commissioned by Milliman.

Beneath the surface, yet clear on our risk horizon, was the near certainty that a pandemic would emerge—a major wild card event well-known to governments and major corporates around the world. The uncertainty was timing.[1]

This essay looks back at the main themes of Insurance Futures, after what we call 'The Great Reset'. We explore geopolitics, climate change, financial stability and trade. We take another look at cities, sustainability and radical innovation.[2]

The original essays shared a common narrative about a world of fragile, tightly coupled systems and growing risks of extreme events. The pandemic, put simply, has accelerated many of the developments we explored. It has, for example, given new urgency to action on climate change. Cultural transformations that might have taken decades are happening in weeks. We are seeing radical economic development and invention, particularly amongst medical research teams around the world.

We begin by focusing on how individual countries responded to the pandemic. We illustrate some of the lessons to be learned, to draw out how the future may unfold. After the reset, recovery of complex societal systems will depend on the new 'initial conditions'. Countries that acted quickly and implemented well-designed public health measures will emerge with better long-term prospects. In the short-term, country risk will be a primary factor as the cycle of lockdown and recovery continues.

We then move on to explore the impacts of the crisis on some of the themes of the earlier essays. We illustrate the implications for the insurance industry. Finally, we examine the idea that amidst the volatility and uncertainty, insurers, the public sector and the wider community have an opportunity re-invent risk management. Novel approaches to systemic risk and exponential innovation will shape the future.

This is not a reset in the sense that we can expect stability or a return to 'normal'. The pandemic emerged at a time when many global systems—from finance and trade to multi-lateral governance and the earth's biosphere—were, as we illustrated in the original essays, vulnerable.

The crisis has created a 'hyper-turbulent' environment, characterised by two inter-related factors. Complexity, radical uncertainty and exponential rates of change coincide with the inability of many global, national and corporate leaders to adapt. 'Inter-systemic' failures that coincide in time create 'perfect storms' and present major challenges. Policy levers no longer work or have unintended consequences.

One lesson is that long-term thinking, good governance and stewardship are vital.

For the insurance industry, a vital socio-economic sector that both underwrites strategic risk and, as a primary asset owner, investment in the future, the pandemic amplifies both the risks and opportunities.

Shockwaves

In these conditions, we can expect wave after wave of shocks and policy errors, primarily because leadership teams are often flying blind.

The public health crisis may create casualties for years, even if treatments and vaccines emerge. The full political and social impacts of the virus remain uncertain, even before the humanitarian crises in the poorest communities emerge.

The economic impacts will last for a decade or perhaps a generation. GDP is in free-fall and the mountain of debt rising by the day. To put this in context, according to the Institute of International Finance, global debt rose to 322% of GDP in 2019 before the pandemic—40 per cent higher than the onset of the 2008 financial crisis.[3]

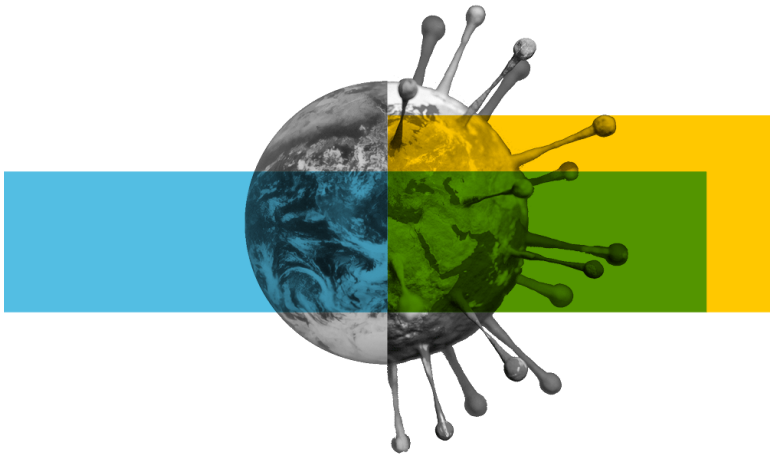
Massive job losses and falling demand in major economies have compounded the problems. How or if the debts are repaid will determine financial outcomes but more important, the investment landscape in vital public services, pensions, health care and infrastructure. There are competing theories. Some argue that debt deflation is the primary risk. Others fear that inflation may take off. The question is 'who will pay?' Above all, the pandemic will shape responses to the 'climate emergency'.

The dilemma for policymakers is not just if, how and when to ease lockdown, but whether to follow austerity measures that primarily raise taxes, embrace publicly funded investment in a 'green' renewal, or rely on central banks to manage public debt. Some argue that open trade is the best solution. The idea that controlled inflation may be the best way to reduce national debt has momentum. The overarching challenge is to develop novel approaches to both monetary and fiscal policy amid unparalleled uncertainty. In the extreme, governments and central banks may run out of options. Sovereign defaults are on the horizon.

One of the vital lessons to emerge from catastrophes such as 9/11, the Challenger disaster and the financial crisis of 2008 was that leadership groups frequently lack imagination and reject possible

extremes. Failure of imagination and 'too little, too late' go together. By the time the evidence is irrefutable, synchronised 'inter-systemic' failures often create runaway conditions. Decision-making in uncertainty is both imagination and science.

The crises that followed the initial outbreak of the virus were as much political and cultural as about public health. This should serve as a warning for world leaders on climate risk—a more profound crisis on the near horizon. The pandemic may have brought forward the tipping point feared by Mark Carney back in 2015: "Once climate change becomes a defining issue for financial stability, it may already be too late".



Fortunately, renewed multilateralism is not beyond the imagination and exponential innovation may yet transform the risk landscape. Seeing risk in systems terms, rather than as isolated events, has the potential to create a philosophy focused on early warning and precautionary principles.

The time to begin is now, above all for the insurance industry. History never repeats itself, but there are lessons. A crucial theme of the earlier essays is that cultural transformation, contrary to conventional wisdom, can change quickly, particularly in times of chaos, as we argued in our essay on Climate and Culture.[4] Novel ideas emerge. Statesmen start thinking early to re-imagine better worlds and strategies to shape them. The Atlantic Charter was developed by Roosevelt and Churchill in 1941, paving the way to the UN. In the UK, the Beverage Report, published in 1942, created the blueprint for the Welfare State and the National Health Service. In 1944, the Bretton Woods conference shaped the post-war financial infrastructure.

Public Health

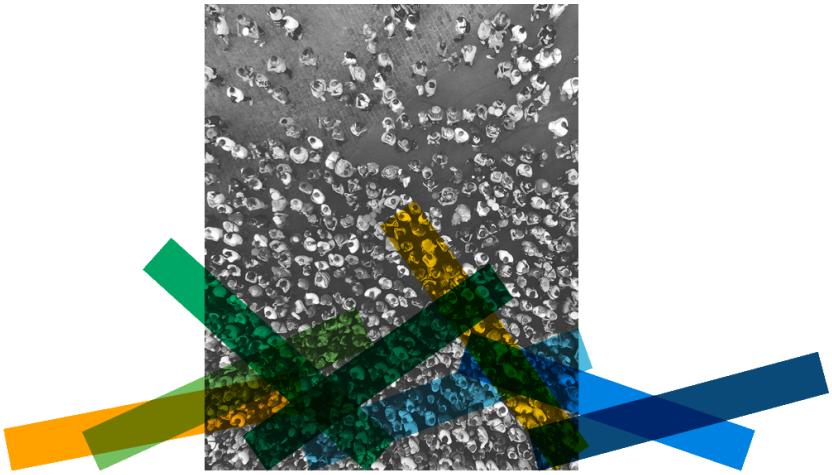
COVID-19 began as a public health crisis. Then a governance crisis. It soon became an economic crisis. It may yet become a humanitarian catastrophe. While it is a global challenge, requiring global solutions and collaboration, the outcomes are in the hands of national leaders short-term.

There will be a wide variety of pathways towards recovery, defined primarily by national responses, but also by how the wider international community develops both shared understanding and a sense of collective purpose.

In the next few months, we can expect countries that create the best 'system conditions' and strategies will be more resilient, recover quicker and experience fewer setbacks, until and unless treatments and vaccines emerge.

Some countries and regions will fare better than others. The relative success of countries like South Korea, Singapore, New Zealand, Taiwan and Germany is best explained by rapid implementation of multi-threaded, strategic responses. To illustrate, lockdown is essential because the movement of people is a critical factor in halting the spread of the disease, but without test, trace and isolate it will not work.[5]

In the best cases, both infection and death rates were limited and levelled within three months of the start of the first wave. In contrast, delays in Italy, Spain, Iran, the UK and the US demonstrated that speed was vital.[6] By mid-April, more than 20,000 had died in Italy, against little over 220 in South Korea. Strategies to exit the lockdown will be at best haltingly successful.



Looking ahead, individual country risk profiles and credit ratings will depend on the quality of 'exit' strategies, prospects for post-pandemic resilience and economic recovery.

There is, however, positive news. Open knowledge sharing between medical researchers around the world is playing a critical role in developing a response to the crisis. The Allen Institute for Artificial Intelligence (AI) created an 'Open Research Dataset' that brings together about 44,000 published papers on the virus. Deep Mind released an open-source version of their 'Alphafold' system, designed to predict protein structures. A project led by the Darpa Advanced Research Projects Agency (DARPA) promises to publish results of research into blood tests that identify virus carriers 24 hours after infection and before they show symptoms.

This is linked to the 'open data' principles promoted by Tim Berners-Lee. The argument is that publicly funded information, in particular, should be shared in machine-readable formats, to encourage knowledge transfer and accelerate innovation. High-quality data drives the current generation of AI.

The evidence suggests that where there are shared international interests, particularly in public health, sustainable development and financial security, open innovation will accelerate.

Financial Stability and Hedging

To recap, as we put it in our original essay on financial stability and hedging, the world's financial system was overstressed before the pandemic.[7] Fine-tuned to finding yield and profit at the cost of resilience and security, the system was long over-leveraged.

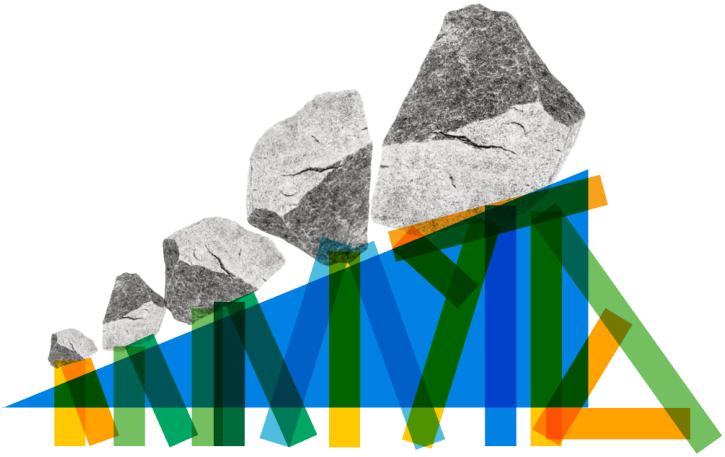
Fears of 'secular stagnation', Japanisation and recession were already in the air. Climate change was seen a 'force multiplier':

> The world's financial system is fragile and vulnerable. Long-ignored structural weaknesses range from public, private sector and corporate debt to the challenges facing pension funds and insurers in matching long-term liabilities to investments in a low-interest-rate environment.
>
> There are fears that the end of the US dollar era will create instability and that cryptocurrencies will undermine financial structures. Trade fears and growing political risks, some driven by inequality, compound the problems.

We argued that the combination of trade and currency wars, restrictions on technology and intellectual property, 'deglobalisation' and risks to security in the Middle East darkened the horizon.

The underlying problem was that some sectors, such as "aviation and the major carbon emitters, cannot re-invent quickly enough".

In other words, the seeds of the 'hyper-turbulent' world were there. Few had hedging strategies in place to respond to climate risk, nor the wider perfect storm created by the pandemic.



The overarching narrative is now about debt and credit defaults that may evolve into stories not about debt and liquidity, but solvency. Corporate weakness was evident before the crisis. According to Morgan Stanley's Ruchi Sharma, "Today, 16 per cent of American public companies are 'zombies', meaning they earn too little to cover the interest payments on their debt and stay alive only by issuing new debt."[8] The simple story is debt creates vulnerability to systemic shock.

The combination of corporate weakness, major job losses, weak consumer demand and lack of confidence in government heralds a fundamental shift in corporate prospects. Many will lose export markets or see supply chains cut. Government interventions place the public sector and state power at the centre of the capital, corporate bond and equity markets.

Tracking the emerging narrative over the last two months, the momentum has changed, from 'recession' to 'deep recession', to 'depression'. Initially, corporate credit defaults dominated the news. The emphasis then shifted to sovereign debt and the ability of national governments to reconcile growing demands for health and pension funding with income in a world hit by pervasive supply and demand shocks.

All this points to fundamental structural change. Both monetary and fiscal interventions will dominate short-term. We may then see the emergence of a world of wealth redistribution, greater regulation, higher savings rates and a new balance of priorities between capital, labour and societal resilience. Consumer confidence, the foundation of growth over decades, may not bounce back. Discretionary spending on everything from tourism to restaurants may be replaced by spending on the essentials of life, security, health and the environment. Demand for new forms of insurance may gain momentum.

The story will first revolve around competing versions of public health safety nets and financial, economic and social resilience. The absence of safety nets has long been the elephant in the room. Second, the debt overhangs have deepened the risks that funding to meet the growing challenge of climate change may be beyond both national governments and international leadership. Public sentiment will shift from focusing on security to how to deal with global warming, increasing pressure on banks, insurers and asset owners to demonstrate transparency.

Meanwhile, further wild card events lay in wait. Super volcano eruptions, a major earthquake along the US North West coast and superstorms may emerge at any time. Nuclear confrontations cannot be ruled out, particularly involving weak or failed states. Following SARS and COVID-19 and given the structural weaknesses caused by the destruction of natural habitats, a second and third novel coronavirus cannot be ruled out.

On a more positive note, at the other extreme, treatments or vaccines to combat COVID-19 may emerge earlier than consensus forecasts assume.

Geopolitics: alternative futures

The pandemic has also deepened the global political crisis. As Mat Burrows put it:

> The political risk landscape is being rapidly transformed. Among the factors driving this are a new era of geopolitical competition; increased migration flows; the rise of national populism; rapid and destabilising technology change; a new and apparently more easily manipulated media environment; climate change; and new and more disruptive forms of conflict. Many of these feed off each other, creating a more volatile and unpredictable environment than at any time since perhaps the 1940s.

Relations between the US and China have since deteriorated, with accusation and counter-accusation about the response to the virus dominating world headlines.[9] The Trump administration appears set on confrontation with China. The lack of mutual understanding points to a 'lose-lose' outcome. Both the US and China are vulnerable. In the extreme, US and China tensions may slide towards a cold war and even long-term confrontation.

There is a more positive possible outcome: the US and China may find common ground, particularly in global health, climate and financial security. Multi-lateral trade may re-emerge, in new forms, driven in part by mass-scale digital innovation and automation. The US and China may ultimately both seek to preserve the world's rules-based order.

Whatever the outcome, the shift in the balance of economic, cultural and political power from West to East has new momentum. To put this in context, the Asia-Pacific Economic Cooperation (APEC) countries accounted for about 60 percent of the world's estimated GDP in 2019. This excludes India, estimated at around 8 percent.

In 'The Great Reset', the fortunes of Western countries that failed to respond decisively to the pandemic contrast with those of East Asia and parts of Europe.[10] Good governance counts. The formula that has led to relative success in the first wave of the pandemic is a guide to how the rest of the world will emerge. This is vital because global health is only as strong as the weakest link.

Trade: local, regional and virtual

In the short-term, amidst the chaos, many of the themes we identified in our work on trade have new momentum. Closed borders, restrictions on the movement of people and supply chain failures seem to point to isolationism.

Localisation already had momentum. As Philippe Legrain put it:

> Vertical urban farms and locally produced synthetic alternatives to meat ('alt-meats') could trim agricultural trade. A shift to renewable energy could cut fossil-fuel trade. And if robots and artificial intelligence can take over many more human tasks, why rely so much on foreign factories in countries with cheaper labour? Thus trade in food, fuels and factory goods may fall, especially since these sectors are likely to continue shrinking as a share of the global economy, which is increasingly dominated by services and intangibles.

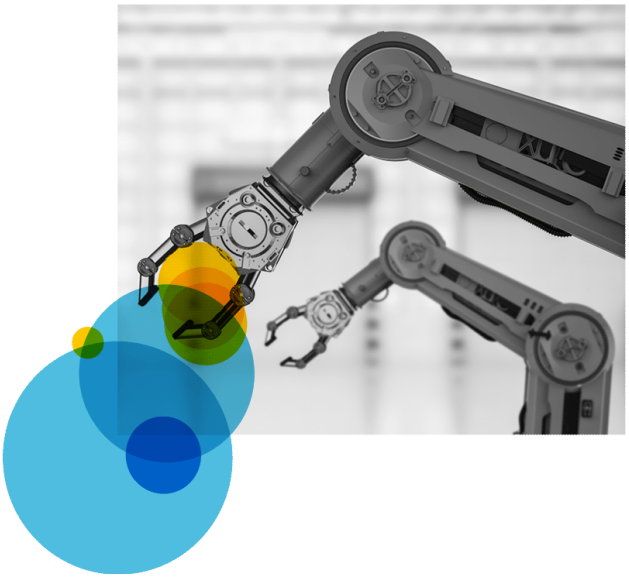
We argued that debate about globalisation was too often framed as a simple binary question: 'is globalisation set to go into reverse'?

More likely, in the immediate post-pandemic world, technology will drive both localisation *and* new forms of globalisation. Trade may open up in regional groupings. For all the talk about globalisation, the majority of physical trade takes place between near neighbours. On average, a 10 per cent increase in distance cuts bilateral trade by about the same amount.[11] Virtual trade and services follow similar patterns, shaped by cultural alignment.

Even so, the crisis may yet bring globalisation to an end. Borders may remain closed. The pandemic has exposed the vulnerability of a global economic system dependent on complex transnational supply chains tuned to efficiency rather than resilience. This in itself will transform the risk landscape, reducing complexity and shifting attention from international networks to country risk.

From another perspective, the current economic and trade assumptions about digital technologies are about to be tested. The future of virtual trade will remain uncertain until fundamental challenges about privacy, trust, propaganda and cyberwar are resolved. The US and China are likely to shift quickly towards self-sufficiency, particularly in key strategic and dual-use technologies. Social control, surveillance, 5G communications, AI, synthetic biology and quantum computing, are all subject to growing restrictions. The race to dominate the world of ideas is more intense than ever.

'Re-shoring' and localisation will gain momentum. Trade in ideas, designs and more broadly intellectual property—already dominant features of the global economy—will become the focal point of innovation. At a time when shipping goods across borders and moving people has been put on hold, remote 3D manufacturing, together with renewed waves of investment in robotics and automation, may dominate the trade landscape.



Amongst the winners during the crisis and long-term are health, strong national champions with sustainable domestic demand, media, virtual and remote service providers, and technology platforms. The digital economy will see growth, but also become a prime target for taxation reform, which many argue is long overdue. It may become the focal point for competing national rules and regulatory models. Risks associated with cybercrime will continue to be primary sources of insurance demand as criminals seek to exploit weaknesses.

Global Warming: the deeper crisis

The climate emergency has not gone away. Recent reports suggest that 2020 will be the hottest on record. The post-pandemic response to global warming by national leaders may go in any direction. Yet the green agenda has fresh momentum. Culture and public sentiment are important indicators:

> "Contrary to conventional wisdom, in chaotic economic and political conditions, culture can change abruptly. This has potentially profound implications for insurance, both because cultural attitudes to the long-term will be felt short-term and because they will impact risk appetite. This is more about emotion and sentiment than analysis and logic. We can expect culture shocks to reverberate through the financial system long before the physical impacts of climate change—such as irreversible damage to low-lying cities—emerge. The imagined future shapes short-term asset management.
>
> As the climate debate unfolds, all industries face reputational risk. Insurance has an opportunity to position itself for the endgame in the public mind and as a key player in the transition to a sustainable world."[12]

There are specific messages from the EU that the 'Green Deal' will shape the future investment and innovation agenda. The same sentiment characterises much of Asia. The IMF has joined in the chorus of voices calling for the pandemic recovery to build around action on climate change. The US appears to be in opposition to both multi-lateral cooperation and domestic sustainable development measures, in contrast to the increasingly resolute action by many major US cities.

As we said in our original essay on cities:

> Cities concentrate creativity, jobs and economic power. They also concentrate risk. At the same time, they are playing a leading role in driving the sustainability agenda, often in the face of weak national political commitments to large-scale, urgent change.

We also pointed to the scale of the challenges:

> Many of the challenges might be met over generations, not a decade or two. Some of these demands they impose are in conflict: find a path to zero emissions and zero waste; cut pollution; secure water and food supplies; generate jobs; re-invent mobility; and transform well-being and health.

There is growing evidence that even though many of the world's cities have experienced the worst of the pandemic, they are also redoubling commitments to a green recovery. Global warming, public health, security and pollution are deeply intertwined. Rising temperatures and urbanisation increase the risks of further pandemics in densely populated communities. Images of clear skies over Wuhan and clean water in Venice made headlines in the early stages of the pandemic. Clean air means better health.

To illustrate, the drastic 40% reduction in the average level of nitrogen dioxide pollution and a 10% cut in particulate matter during April 2020 has avoided 11,000 deaths in Europe, according to research by The Centre for Research on Energy and Clean Air. Power generation from coal has dropped 37% and oil consumption by about one third. More broadly, there have been 6,000 fewer cases of asthma in children.

The International Energy Agency forecasts energy demand will fall by 6% in 2020 "in absolute terms, the decline is unprecedented—the equivalent of losing the entire energy demand of India".[13]

> "At the same time, lockdown measures are driving a major shift towards low-carbon sources of electricity including wind, solar PV, hydropower and nuclear. After overtaking coal for the first time ever in 2019, low-carbon sources are set to extend their lead this year to reach 40% of global electricity generation – 6 percentage points ahead of coal. Electricity generation from wind and solar PV continues to increase in 2020, lifted by new projects that were completed in 2019 and early 2020."

We may yet see 'the great acceleration' following 'the great reset'.

Post-Industrial Landscape

There is further evidence that a green post-industrial world may emerge from the disaster. A group of narrative threads have new momentum. 'Stakeholder capitalism' and 'environmental, social and governance' (ESG) initiatives dominate the agenda. In the midst of the COVID-19 crisis 'asset owners' at the top of the investment hierarchy, including private offices, insurers and pension funds, have increased pressure on companies to meet the UN's Sustainable Development Goals (SDG) goals.

A series of studies have shown that 'good governance' is a crucial indicator of credit ratings and resilience in the crisis. Specialist governance funds have outperformed the main financial markets. So too have companies with strong ESG and SDG credentials.

Major asset management firms like Blackrock, have said they will 'punish' companies that fail to link executive pay to long-term outcomes and climate change, irrespective of the pandemic. As CEO Larry Fink put it recently: "we are on the edge of a fundamental shaping of finance", signalling that the firm will withhold investments from companies that fail to act.

In other words, the investment community is shaping a post-COVID-19 and post-fossil fuel business environment. Corporate leaders must re-invent businesses from first principles and above all, address strategic, long-term risk.

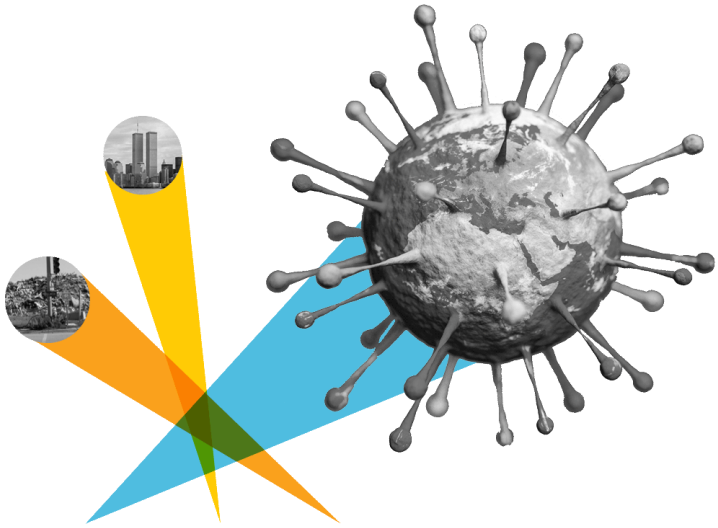
Regulatory change is converging towards the same agenda. The Bank of England has introduced frameworks for banking and insurance that call for scenarios and strategic plans that look decades ahead, to 2050.[14] [15] Similar rules will follow for listed companies around the world.[16]

Insurance is a pivotal sector. In some cases, the challenge is strategic and focuses on re-inventing business to develop new models. In late 2017, AXA announced withdrawal from both underwriting and portfolio investment in fossil-fuel related businesses. They cut Eur 100 million from premium income. At the time, this was a novel strategy designed to align the corporate risk group to the future cultural environment.

In early 2020, Allianz, Swiss Re, Munich Re and Zurich announced cuts to their fossil-fuel underwriting and investment exposures, aligning to SDGs to align to the emerging environment, as well as reduce credit and liability risk.

Re-Inventing Threat Management

The insurance industry has been hit hard. As the head of Lloyds of London put it recently, the pandemic is likely to be the most expensive event in insurance industry history "dwarfing other major disasters such as Hurricane Katrina in 2005 and the 9/11 terror attacks". Over time, losses of tens, perhaps hundreds of billions may emerge. The fact that Lloyds has put aside £ 15 million to fund research how better to handle pandemics and other major events in future illustrates that the industry was ill-prepared.



In Financial Stability: inventing the big hedge, we explored the readiness of insurers and the wider market to respond to different scenarios, particularly in relation to climate risk.[17] The 'big hedge', in simple terms, is defined by what insurers and their key clients can develop as strategic responses to possible future worlds. The principle is that resilience and sustainability are defined by strategies that 'work' in all scenarios, even the most extreme, yet are optimised to achieve the most positive outcome.

The starting point is to develop long-term scenarios, explore emerging 'weak signals' and monitor 'wild card' events.

To put this in context, our core scenarios explore three alternative futures to 2050.[18] 'Dark Ages' is a world at war, with nature and with itself—a chaotic world of public health, economic and climate failures that accelerate at exponential rated, beyond the adaptive capacity of national and international leaders. A world of runaway crises. 'Walled Gardens' is a world of enlightened and inclusive nationalism, self-sufficiency and a patchwork of winners and losers. Global collaboration is limited to vital shared interests, like climate change. 'Renaissance' describes a vision of mutual understanding and multi-lateral collaboration that creates a form of global governance, focused on shared risks and a common sense of purpose.

The strategic question for the insurance industry is what strategic options 'work' in each scenario? The answers are both general and specific. In general, insurers have a pivotal role in supporting resilience against physical climate risk and extreme events. From an investment perspective, there are strong arguments for investing in companies and communities that are 'future-ready' and meet the standards set out by the SDGs.

More specifically, the insurance industry has opportunities to meet the challenges of systemic risk and to drive strategic innovation. The pandemic has created a new sense of urgency.

Systemic Risk

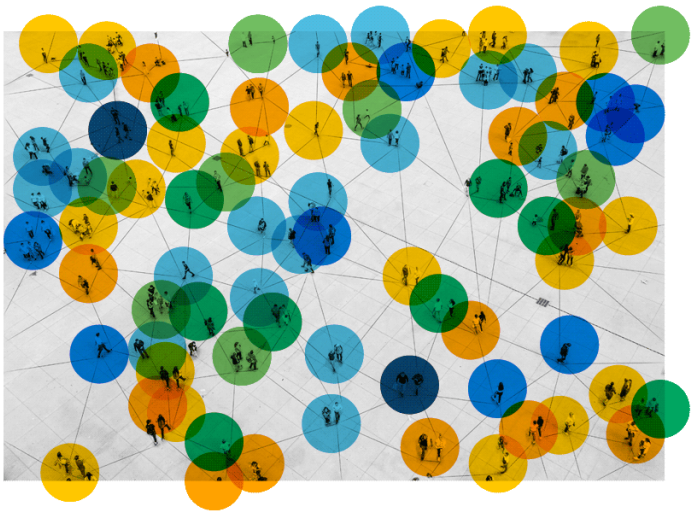
To recap, in chaotic environments, foundational cultural values can change rapidly. Faced with profound uncertainty, entire communities search for new imagined futures and stories of long-term hope amidst harsh short-term realities.

This is an important principle: we act in the present on imagined futures, which are cultural realities. As we put it in an earlier essay on Inventing the Big Hedge:

> *"The world's financial institutions have barely explored risks to the global system as investors position themselves in the short-term against the long-term climate change scenarios – well before the events themselves emerge."*[19]

In other words, shocks emerge when underlying narratives break down.

This is important, because in this crisis, as in all others, backwards-looking statistics and simulated models are not reliable guides to the post-pandemic world. Financial markets are non-linear because institutions and groups of people behave in unique ways. Algorithmic methods fail, as illustrated by the losses of several prominent computer-based hedge funds during the first months of the pandemic. In times of crisis, mapping the stories protagonists tell is a better guide than complex statistical models and simulations alone.



Resilience and adaptive capacity carry costs. Fine-tuning for efficiency creates fragility, as we have seen. Policymakers, the financial markets, insurers, primary asset owners and governments face choices about how to balance risk and profitability. The implication is that there will be growing demand from companies, governments and cities for insurance to cover a wider range of 'tail risk' events, as well as systemic failures. The primary lesson of the pandemic is that complex, systemic risks, possible major shocks and the weak signals that foreshadow them cannot be ignored.

Insurers have an opportunity to provide services that map and measure system fragility, since this in itself delivers early warning. Complexity must be understood in ways that reflect not just numbers and financial prospects, but the interdependencies and dynamics of relationships between protagonists and everything from public health, climate risk, propaganda, cyberwar, global governance and trade. In summary, the opportunity is to create insurance services that address underlying systemic risk and deliver early warning.

Exponential Innovation

There is, however, a more important theme that has growing momentum: exponential, systemic innovation. Put another way, invention at machine speed. The waves of innovation in the search for COVID-19 treatments and vaccines illustrate that machine-based knowledge management and AI are pervasive.

Speed has long been a defining characteristic in military and commercial worlds. The race for technological leadership drives political and economic investment. Bewildering rates of change are a defining characteristic of 'hyper-turbulent' environments. Yet there are blind spots between risk management practice that typically emphasises downside threats over ground-breaking invention.

Amongst the primary inter-related technological developments, three are particularly relevant:

- Internet of Things (IoT), by which we mean sensors of all kinds, from smartphone, wearable and embedded health monitoring devices used by individuals to image recognition devices in vehicles, workplaces, and public spaces that can monitor and distribute behavioural, health and environmental data;
- Real-time operations of large-scale IoT-based 5G networks capable of instant responses; and
- AI and real-time predictive models that exploit IoT, fusing 'all-source' content—personal, public, environmental and proprietary insurance data.

There is evidence that sensor-based early warning, prediction and machine control systems will become pervasive, particularly in cities. This has the potential to transform the risk landscape and the underlying structure of insurance. Sensor-based 'mass automation' infrastructure is already accelerating the growth of green transport systems, as we illustrated in our essay on Radical Innovation, particularly to cut traffic volumes, density, energy use and pollution.[20]

One of the lessons of the ongoing crisis is that sensor-based public health and personalised services are essential in crises. In the early research for Insurance Futures, public health and security were 'white space' opportunity areas: there was a gap between the public good and both public and private sector invention. So too was privacy and 'de-identification'. The signs were there.

The pandemic has accelerated innovation in public health and security, sensors, smartphone applications and real-time monitoring, as well as collaboration between the 'big tech' platforms and medical science. It is bringing 'open data' services front and centre, already illustrated by medical knowledge-sharing and the waves of Covid-19 mapping applications now in the public domain.

The white space gap is closing as national governments and technology companies like Apple and Google race to deliver services that trace suspected COVID-19 sufferers. There are other new entrants. Roche is focusing on personalised healthcare, bringing together digital technologies with core pharmaceuticals and diagnostics businesses. IBM is using the Watson AI platform to deliver monitoring services in partnership with municipal governments. These developments point to convergence, with governments, city leaders, technology firms and insurers vying to both reduce systemic risks, particularly in urban environments and provide insurance and risk management services.

Since individual well-being, health and risk are inextricably linked to social groups and the wider environment, dynamic risk modelling and risk mitigation may become more effective than premium-based insurance pricing, based on historical data.

It may also be more profitable for insurers and new entrants, who will have an in-depth understanding of the complex interactions that make up the realities of daily life for individuals and commercial organisations, in cities and industrial high-risk environments.

If we set this against the surge in 'big tech' interest in health insurance, the move by health insurers into the social and environmental determinants of health and new service models, we can expect partnerships to be forged and the landscape to change fast. There are early examples of 'computational biology' firms integrating personal sensors, medical-grade privacy and predictive algorithms to deliver personalised control of their own well-being. Some are collaborating with insurers to provide patients with well-being, health and insurance services.

This model has broader implications for casualty insurance, life, pensions and health insurance. The emerging narrative is that over time, pervasive sensors, real-time data, novel privacy models, and AI will form new insurance and risk platforms. This is both a source of opportunity and a strategic threat to the insurance industry.

There are, however, constraints on the development of these technologies, above all ethical, cultural and public attitudes to human rights, privacy and surveillance. In the West, there are tensions and trade-offs between personalised services and public security. Alphabet's Sidewalk Labs 'smart city' initiative in Toronto has been closed amidst a backlash. In contrast, in China, surveillance is largely culturally accepted, in the interests of public safety and security. This explains why China and Chinese insurers have developed a leading role in mass-scale data aggregation and surveillance technologies.

There is, however, evidence that in the West, the technology industry is keen to respond to fears surrounding what Shoshana Zuboff calls 'surveillance capitalism'.[21] If this holds true, we can expect, over time, solutions that deliver public security while guaranteeing privacy. This is not far-fetched. Privacy and virtual trust are innovation hotspots. The Web Foundation's 'Contract for the Web', led by Tim Berners-Lee, has been endorsed by major technology firms, including Microsoft, Google, Twitter and Facebook.

The overarching challenge for the insurance industry is to play an active role in this fast-moving emerging and controversial environment. The COVID-19 pandemic has changed public attitudes. There is an opportunity to re-invent risk management as intelligent infrastructure, particularly in cities, becomes pervasive. Good governance and trust, involving all stakeholders, is crucial. The stakes could not be higher, both for public security and for the insurance industry itself.

1 https://oraclepartnership.com/long-reads/covid-19-a-wild-card-event/

2 https://oraclepartnership.com/insurance-futures/

3 https://www.iif.com/Portals/0/Files/content/Research/Global%20Debt%20Monitor_April2020.pdf

4 https://oraclepartnership.com/long-reads/climate-and-culture-shocks-ahead/

5 Movement of people gives early warning about the spread of the virus: https://www.nature.com/articles/s41586-020-2284-y

6 Sample research: https://theconversation.com/6-countries-6-curves-how-nations-that-moved-fast-against-covid-19-avoided-disaster-137333

7 https://oraclepartnership.com/long-reads/financial-market-stability-inventing-the-big-hedge/

8 https://ruchirsharma.com/wp-content/uploads/2020/04/12_Sharma-FA-Comeback.pdf

9 https://www.scmp.com/economy/china-economy/article/3082968/coronavirus-china-us-new-cold-war-relations-hit-lowest-point

10 South Korea, Singapore, New Zealand and Australia have emerged relatively well. So too have Austria, Germany, Greece, Jordan, Luxembourg, Iceland, Slovakia and Croatia.

11 https://www.ft.com/content/eb666f8a-770b-11e9-be7d-6d846537acab

12 https://oraclepartnership.com/long-reads/climate-and-culture-shocks-ahead/

13 https://www.iea.org/news/global-energy-demand-to-plunge-this-year-as-a-result-of-the-biggest-shock-since-the-second-world-war

14 Prudential Regulatory Authority https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/supervisory-statement/2019/ss319

Note: the regulators have allowed insurers more time to meet the demands, in the light of COVID-19: https://www.bankofengland.co.uk/prudential-regulation/publication/2020/pra-statement-on-prioritisation-covid19

15 Financial Conduct Authority https://www.fca.org.uk/news/press-releases/fca-today-announces-future-work-climate-change-and-green-finance

16 Task Force on Climate-related Financial Disclosures: https://www.fsb-tcfd.org

17 https://oraclepartnership.com/long-reads/financial-market-stability-inventing-the-big-hedge/

18 https://oraclepartnership.com/the-rome-scenarios/

19 https://oraclepartnership.com/long-reads/climate-change-inventing-big-hedge/

20 https://oraclepartnership.com/long-reads/radical-innovation-and-sustainabililty/

21 The Age of Surveillance Capitalism

INSURANCE FUTURES

Hybrid realities

By Ian Kearns of The Oracle Partnership

FEBURARY 2020

It is projected that a trillion devices will be connected to the internet world-wide by 2035, creating a huge and growing Internet of Things (IoT).[1] Among them: smart city, utilities and home technologies, industrial monitoring systems, connected health devices and cars, wearables, and white goods.

This mass deployment of connected devices and sensors will usher in what some have called a Mirrorworld. 'Every place and thing in the real world—every street, lamppost, building and room will have its full-size digital twin.'[2]

In this future, almost everything and everybody will become a source of data. Reality will rarely be experienced without an overlay of additional information relevant to location or circumstance. Alongside this historic shift, we are also witnessing continued growth in the use of virtual reality (VR) headsets and applications, with some suggesting there will be almost one hundred million headset sales a year by 2023.[3] Virtual replicas of the physical world are being built in order to better model and understand the dynamics of environments like homes and cities.[4] Entire virtual worlds are becoming locations for commerce, artistic expression, relationship building, education, and political argument.[5]

The combination of these changes foreshadow the emergence of a new hybrid-reality, in which the physical world, digital representations and extensions of it, and entirely virtual worlds will co-exist, with people moving from one environment to another frequently in daily life. One consequence will be unprecedented flows of real-time data on everything from the state of physical systems and traffic flows to the location and status of individual people. The implications for insurance will be profound.

A New Risk Management Era

When combined with predictive analytics the growing sources and flows of data will facilitate new approaches to the management of both systems and risks.

This is already happening. In the U.K., for example, the water companies are rolling out a networked approach to the management of water resources.[6] The sewage system and water network are increasingly being embedded with sensors that allow remote monitoring and early detection and repair of leaks. Elements of the water management system have also been automated.

In Jinan in China, the ride-sharing company Didi Chuxing and the local authorities are working together to develop a completely new approach to the management of traffic congestion.[7] Didi's fleet of drivers generate a continuous flow of real time locational data as they move around the city, allowing a detailed picture of traffic patterns to be built up. The city authorities have deployed sensors on traffic signals, taking Didi's data on real time traffic flows and synchronising traffic, easing congestion.

The same hybrid reality infrastructure of deployed sensors, real-time data flows and predictive analytics that allows these advances is also being used to manage very specific risks.

In a sign of what is to come AIG and NC4, a California based risk and incident management firm, are collaborating to build risk mapping solutions that provide real-time, site-specific incident detection at locations around the world. This allows notification of incidents to travelers, employees and others who may be in or heading in the vicinity of the incident. Some of these alerts relate to accidents, public disturbances or terrorist attacks and some to issues like public health scares.

AIG is also linking data on patterns of individual driver behavior to location, place history, and distance travelled to generate real-time, usage-based risk profiles of individual drivers. Safer drivers, travelling shorter distances in safer places can be offered lower usage-based insurance premiums. In Ireland, the company has also gone one step further and lobbied the government for legislation to make telematics facilitated usage-based insurance mandatory for drivers under 25, on the grounds that it stimulates safer driving and prevents accidents.

Elsewhere, in a context in which a worker dies somewhere in the world every 15 seconds due to a work-related accident or disease and 374 million non-fatal workplace accidents cost companies in the US alone $220bn a year, firms like IBM have been piloting the use of wearable technology to help keep employees safe.[8]

In one project with North Star Bluescope Steel, sensors have been embedded in safety helmets and protective vests to act as a real time early warning system for employees.[9] These are needed because workers are often operating in high temperature environments containing toxic gas, open flames and heavy machinery. Data on heart rate, body temperature, and skin response is correlated with external sensor data on ambient temperature and humidity in the workplace. North Star management then receives alerts when staff appear to be in danger or discomfort and can personalise safety guidelines for individual employees.

Augmented Reality (AR) and VR systems are also being used to gain a better understanding of risk and to manage it out or reduce it before problems occur. AR for example is being used to improve commercial aircraft safety by 3D scanning of the aircraft exterior to build a digital twin that makes it easier to identify problems that may not be visible to the naked eye. Sensors embedded in aircraft engines monitor engine performance and pick up early signs of stress, part fatigue or breakdown.

Virtual Reality models are being used to simulate major incidents in complex environments so that staff and the emergency services can better understand interdependencies between variables and plan more effectively in advance. In the US, the Federal Emergency Management Agency (FEMA) uses such a tool to allow community leaders to witness flood damage in a neighbourhood, experience the difficulties involved in carrying out an evacuation, and see the impacts of possible mitigation decisions.[10]

As discussed further in the essay in this series on crime, the new hybrid reality technology architecture makes widespread monitoring of public spaces and buildings possible in ways that can help detect and prevent crimes against both individuals and property. Sensors and cameras deployed in the home are being used to monitor and sometimes video unauthorised entry and to issue alerts.

In Camden, New Jersey, gun-shot detection sensors have helped create a local sound map that led the police to realise a large number of shots were previously going undetected. Additional officers have been deployed to affected neighbourhoods as a preventive measure in response.[11]

New Vulnerabilities and Risks

Alongside these potential upsides, there are barriers to the full adoption of the emergent hybrid reality and its arrival will bring new threats, potential harms and risks.

Concerns over freedom, privacy and decisions by machines may destroy public trust in virtual monitoring systems. Claims of 'total surveillance' could become significant political flashpoints, placing constraints on the extent of their deployment, undermining their risk reduction potential. Already there are concerns that such surveillance technologies can facilitate the introduction of new mechanisms of social control, like social credit scoring systems that offer points and rewards for certain kinds of behavior while imposing costs and penalties for others. This system is being extensively trialed in China.[12]

The explosion in connected devices is also having an impact on sectors and manufacturers who never anticipated that they could become central to internet security concerns and have therefore done little to make their devices secure. Devices like baby monitors have already been hijacked to launch denial of service attacks on major websites. IoT deployments also often involve one layer of technology being placed on top of another and different generations of devices being connected together. These networks suffer legacy security weaknesses that are not always uncovered. Reliance on extended connectedness also means a growth in complex systems the intricacies and interdependencies of which are not always well understood.

As the scale of connected device deployment grows, the potential for human error to trigger unintended consequences grows with it too, as does the cyber-attack surface that could be exploited by state-sponsored or independent cyber-terrorists and criminals.

A recent survey of US security professionals working in the connected transport, manufacturing and health space found that IoT focused cyber-attacks were becoming widespread. Eighty per cent of respondents said they had experienced such an attack in the past twelve months and over half said their systems had suffered downtime. More than a third also reported data breaches as a result of attacks on IoT devices within their organisations. The potential legal and financial liabilities are mounting, suggesting a cost to businesses in the US alone of around $8.8 billion a year.[13]

For policy-makers, business leaders and insurers alike this is about far more than a new battleground in cyber-security. The potential risks and implications go much wider. As more and more systems become networked and automated, they will take over functions that are ever more central to the running of whole cities, societies and economies. This means that when an attack, disruption or unintended failure occurs the consequences will be cyber-physical and not only cyber in nature.

If and when autonomous cars and trucks rely on GPS technology for navigation and road transport signaling systems rely on other forms of connectivity, successful attacks will almost certainly cause physical chaos, accidents and deaths. When critical water infrastructure systems, partly monitored by networked sensors and managed by autonomous systems, are attacked and disrupted, the consequences could affect water supplies, heating and cooling systems and energy generation plants. They could also trigger a volatile human response, with riots, looting, and physical attacks by one group of people on another if disruption lasts for anything more than a very short period of time.[14]

In such incidents, there may also be spill-over effects from one networked system to another. Many IoT devices and sensors will be very widely deployed across multiple systems. Connections between water, energy, transport and industrial networks may mean an attack that targets a particular device will have effects on multiple networks across several geographies.

The increasing development and deployment of hybrid reality technologies may therefore reduce risks in some areas while creating new risks to companies, cities and society at large in others. The overall risk effect could be that there are fewer major incidents in total but when they do occur, they have higher or even massive impacts.

Implications for Insurance

There will be demand and opportunity to develop and adapt new insurance products and services in this environment. Processes such as claims will be speeded up and automated.

The connected device and sensor explosion also point to continued growth in the cyber insurance market. That said, there will be a need to innovate around cyber exclusion clauses, which may need to end as cyber becomes embedded in wider non-cyber specific policies.

Usage based systems will become more feasible, for example in motor insurance where use of telematics is a major development. There will also be opportunities to use policy content and pricing to change behavior in everything from health and life to motor insurance. Gamification will be easier in the hybrid reality world, with points being acquired for certain behavior patterns, like the amount of exercise taken, leading to rewards and/or reduced premiums for the insured.

Insurers should also be able to build IoT advisory services to help SME's cope with a confusing device and security landscape. They could also work with technology providers and cyber-security companies to offer approved device and product lists as a security improvement and risk prevention measure.

More strategically, insurers could partner with city governments and tech companies to build smart city platforms that drive down risks and costs across city relevant sectors, and 'export' that ability and know-how to others in return for fees. Smart city platforms could also generate revenues via API's made available to others who use access to data to generate new products and services.

While the opportunities are real however, insurers will also face major new challenges.

The complexity and interdependencies of the IoT will generate multiple layers of 'nested liability' that will be contested. Complex and expensive legal battles may follow when incidents occur.

It is also likely that major owners of data and the computing firepower to analyse it will emerge as players in the insurance landscape, since they will be control the data required to facilitate real-time risk assessment and management. Existing insurers that do not form partnerships with data owners, like city authorities and networked device providers will risk being shut out of the game.

There is currently also a gap in IoT risk modelling capabilities that the industry will need to address in order to be able to understand, underwrite and price risk. Doing this will require that different data-sets, owned by different stakeholders, both historic and real-time, be brought together to model the risks.

There will also be a need to blend risk assessments of physical assets with those of cyber-systems to gain a better understanding of the overall risk profile of cyber-physical systems.

Being able to imagine complex scenarios with wide-ranging consequences and to use counter-factual analysis and what if questions will be central to understanding the complexities and possible exposures. Getting at some of this will also mean developing close relationships with those being insured to get a sense of just how their systems are being configured, how they deploy sensors and other monitoring technologies, and the real risks and potential interdependencies that exist in relation to the IoT. VR simulation models might also offer useful tools to model and visualize the risks.

If it can achieve all this, the industry may be well-placed to answer perhaps the biggest strategic question facing it: does it want to work alongside regulators, governments and others to make the hybrid reality world a safe one for all, or is content to think in narrower terms about the risks only to the clients it insures or the assets it holds? The answer will have a major impact not only on the future of the industry but on society at large.

1 'One Trillion IoT devices will be produced by 2035' at: https://learn.arm.com/route-to-trillion-devices.html.

2 Kevin Kelly, 'Welcome to Mirrorworld', Wired, March 2019.

3 '2019: The Year Virtual Reality Gets Real' https://www.forbes.com/sites/solrogers/2019/06/21/2019-the-year-virtual-reality-gets-real/#4ed4d9bf6ba9.

4 See for example, a short video on Singapore Virtual City at: https://www.youtube.com/watch?v=Dix-8SNxlA0.

5 Read about virtual worlds Second Life and Sansar at: https://www.lindenlab.com/about.

6 https://www.waterbriefing.org/home/company-news/item/15953-thames-waterto-invest-%C2%A31-billion-to-build-a-digital-first-water-company.

7 How China's meshing ride-sharing data with smart traffic lights to ease traffic congestion, available at: https://venturebeat.com/2017/05/05/how-chinas-meshingride-sharing-data-with-smart-traffic-signals-to-ease-road-congestion/.

8 For more on the data on workplace deaths and non-fatal injuries see the International Labor Organisation at: http://www.ilo.org/global/topics/safety-andhealth-at-work/lang--en/index.htm.

9 North Star BlueScope Steel Taps IBM Watson and Wearable Devices to Monitor Activity of Workers in Extreme Environments, available at: https://www-03.ibm.com/press/us/en/pressrelease/49994.wss.

10 See https://www.fema.gov/immersed.

11 Ian Kearns, 'Crime and the Pros and Cons of the Internet of Things', The Police Foundation, 10th October, 2018, available at: http://www.police-foundation.org.uk/2018/10/crime-and-the-pros-and-cons-of-the-internet-of-things/.

12 It has been oversimplified and misrepresented in some western coverage but is happening, nonetheless. See 'How the West got China's Social Credit System Wrong', available at: https://www.ibtimes.com/internet-things-counting-cost-cyberattacks-2804695.

13 'Internet of Things: Counting the Cost of Cyber-Attacks', at https://www.ibtimes.com/internet-things-counting-cost-cyberattacks-2804695.

14 For a discussion of scenarios such as these, see 'Networked World: Risks and Opportunities in the Internet of Things', Lloyds and the Department of Science, Technology, Engineering and Public Policy at University College London, 2018.

INSURANCE FUTURES

Cultural attitudes to climate: Shocks ahead?

By Peter Kingsley and Ian Kearns of The Oracle Partnership

DECEMBER 2019

Pressure on the corporate and financial sectors to respond to climate change is mounting. Investors and regulators such as the U.K. Prudential Regulation Authority (PRA), are demanding financial institutions assess short and long-term climate risk. In a sign of the changing mood, Christine Lagarde, the new President of the European Central Bank (ECB), has made clear she wants to put climate change at the heart of monetary policy via the ECB's new strategic review.

Delegates to the COP 25 conference in Madrid meet against a background of growing public concern and activism. For all the attempts to create top-down action, in this essay we explain why the public mood and the narratives about climate change will be decisive.

Cultural attitudes to climate, biosphere and environmental challenges are fundamentally uncertain. Over the next decade and beyond, in some parts of the world, 'strong government' will drive urgent change, under public pressure. In others, the financial and psychological costs of deep cuts in emissions and, more broadly, changes in consumer behaviour will continue to slow progress.

There are a growing number of viral narratives and weak signals that indicate the potential for disruption in the short-term. These may deliver shocks, changing the nature of the risk landscape and attitudes to insurance value.

Contrary to conventional wisdom, in chaotic economic and political conditions culture can change abruptly. This has potentially profound implications for insurance, both because cultural attitudes to the long-term will be felt short-term and because they will impact risk appetite. This is more about emotion and sentiment than analysis and logic. We can expect culture shocks to reverberate through the financial system long before the physical impacts of climate change—such as irreversible damage to low-lying cities—emerge. The imagined future shapes short-term asset management.

As the climate debate unfolds, all industries face reputational risk. Insurance has an opportunity to position itself for the endgame in the public mind and as a key player in the transition to a sustainable world.

The power of narrative momentum

The change in public opinion about plastic waste illustrates how major shifts in industry, market conditions and regulation can emerge without apparent warning. Over the last two years momentum has not only built up behind the narrative that plastic waste is deeply damaging to the natural environment, but also behind the view that it is a cause of species extinction and a problem for human health. The fact that most plastic is derived from fossil fuels has made the link between plastics and climate change in the public mind.

Some of this narrative shift has been attributable to China's decision in 2017 to stop receiving, burning, or disposing of much of the rest of the world's waste. This made a problem that had previously been invisible to many people suddenly visible. Popular nature documentaries such as the BBC's Blue Planet, which brought millions of viewers around the world face to face with the damage to wildlife and natural habitats created viral conditions. The combination of these developments, together with the transmission mechanisms of social media, drove a new narrative into the global mainstream.

The result has been that single-use plastic bans have been introduced around the globe. More than 140 countries have introduced taxes or partial bans on plastic use. This includes some of the most populous countries in the world, such as China, India, and Bangladesh, and more than 34 countries in Africa.[1] Laws have been introduced to ban or fine the use of plastic bags in supermarkets. Plastic-free shops and restaurants are also emerging.[2] In May 2019, 180 member states of the United Nations agreed amendments to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, to better regulate the global trade in plastic waste, make it far more transparent and less likely that microplastics will end up in the world's oceans.[3]

Emerging narratives

There are other narratives emerging that may have the power to bring similar, short-term shocks. Some of them, like the Green New Deal, which is an over-arching term used to describe an urgent, radical overhaul of the current economic system in order to simultaneously deal with the climate crisis, create millions of well-paid jobs and tackle deep-rooted sources of economic injustice, have gone from almost nowhere to the mainstream in the last two years. The Green New Deal has been adopted by radical green and progressive politicians around the world, though it has yet to be implemented anywhere. If and when it is, few should be taken by surprise.

FLIGHT-SHAMING

Less sweeping, but still potentially shock-generating narratives are also emerging. Barely registering just a few months ago, 'flight shaming' has momentum, particularly in Europe. It illustrates how changing public attitudes can have a short-term impact on industry.

A public backlash against airlines may emerge at a time when airlines have no 'clean' alternatives. These remain some time away, despite progress with electric planes. The total 'climate impact' of air travel is, according to recent research, higher than the widely-used estimate of the two percent contribution to carbon emissions.

This may be one of the early examples of an industry sector vulnerable to short-term cultural change. The sector has not articulated a clear way forward. Some senior airline executives, including the CEO of SAS, see 'flight shaming' as an 'existential risk', having been quiet on the subject for years. The CEO of Lufthansa sees it as a threat to growth. The CEO of KLM has urged passengers to "make responsible decisions about flying".

In June 2019, the International Air Travel Association Director General Alexandre de Juniac said that "Unchallenged, this sentiment will grow and spread" and asked the public to "give aviation time to come up with green methods of propulsion". The CEO of Qantas raised fears that the industry could be brought to a halt.

Greta Thunberg's sail to New York, added to the viral quality, drawing positive coverage in mainstream and social media alike. The structural weakness is that in some scenarios, if climate activism grows, cutting airline travel and international tourism will be seen as an easy, symbolic lifestyle change. 'Cruise shaming' is a similar weak signal that is gaining momentum.

TIME RUNNING OUT

Another narrative with disruptive potential reads that there is little time left to address the climate challenge. The conclusions of recent Inter-Governmental Panel on Climate Change (IPCC) reports, and warnings from the Executive Secretary of the UN Convention on Biological Diversity, have established that time is running out.[4] The idea of 'tipping points' and 'too little, too late' have momentum amongst leading scientists and regulators.[5] These narratives have risen up the list of concerns seen as most pressing to voters. They have also driven a new wave of disruptive direct climate action as frustration at the slow speed at which conventional politics moves has spilled over into something more radical.[6]

A group calling themselves Valve Turners have interrupted the flow of oil from Canada to the United States through the Keystone Pipeline. In Germany, hundreds of climate protesters in the Ende Gelande movement have occupied coal mines, closing down operations for days at a time.

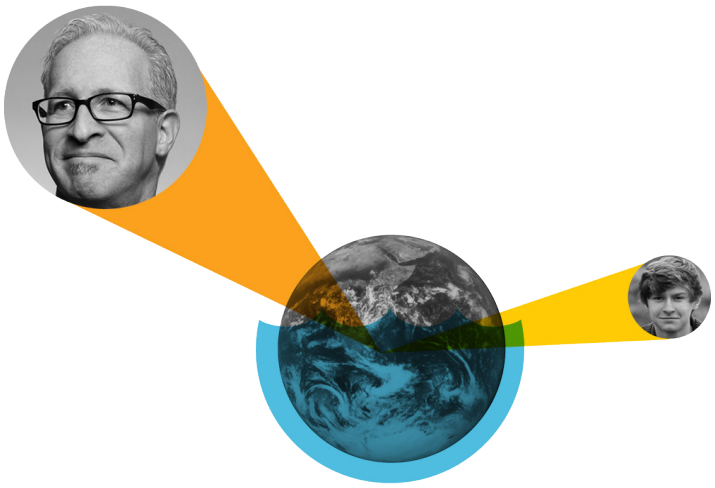
Mass action by Extinction Rebellion activists has disrupted daily life and business activity in London, Berlin, Paris and Rome and many other cities around the world.

This is not spontaneous, but well organised and planned. In Europe, training camps were run through the summer of 2019 for thousands of activists, focusing on how to conduct civil disobedience campaigns and resist arrest.[7] It is hard to predict exactly where direct action will be focused, but fossil fuel enterprises, non-renewable power-stations, banking, rail stations and airports are all likely targets.

INTERGENERATIONAL TENSION

In September 2019 the idea of an inter-generational fissure on climate change gained narrative momentum through a series of youth- and schoolchildren-led climate strikes. This became a global event, involving millions of people in protests against climate change and for more urgent measures to address it. Strikes took place not only in expected locations in climate-concerned Europe but across Africa, including in Nigeria, Ghana, Ivory Coast, Senegal and many other parts of the continent. Politicians in many countries felt compelled to support the strike. The elected Mayors of Paris, New York, Copenhagen and Los Angeles were exemplars, issuing a strong joint statement of support.

The notion of inter-generational tension on climate change is backed by survey evidence. In the US, for example, among the over-55's climate scepticism has been as high as 25 percent in some surveys, while among 18-24-year olds, it falls to six percent.



There are also signs that attitudes to climate change are linked more to age than to party political identity. Recent tests of opinion of Generation Z and Millennial Republicans in the US show that young Republicans are as concerned about climate change as their Democrat counterparts.[8]

It remains to be seen how the attitude of the young translates into political action but a global tidal wave of demand for radical action to address the climate emergency cannot be ruled out.

EXTREME EVENTS MAKE THE POLITICAL WEATHER

Another narrative pointing to disruptive change concerns the link between physical climate events and public attitudes. Evidence is mounting that extreme weather events power public climate concern. Surveys indicate, for example, that the people most exposed to extreme weather events are the ones most likely to acknowledge that climate change is real and that human behaviour is responsible.

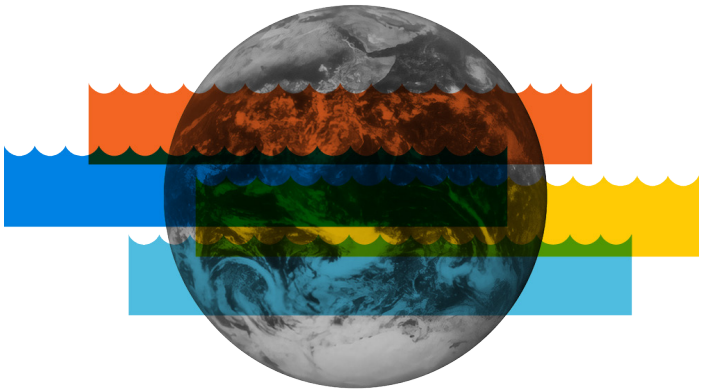
In practice, this translates to very high levels of concern about climate change across Asia and the Middle East, with 10 of the top 13 most concerned countries in a recent YouGov survey coming from Asia. When asked whether they thought climate change would have at least a moderate impact on

their own lives, people in 14 of the top 15 ranked countries came from Asia and the Middle East. The top-ranking country outside of Asia and the Middle East is Italy, which came in 15th overall. Italy is notable because it is on the front-line of secondary effects, like climate influenced flows of people from Africa to Europe, an issue which has had huge profile in Italian politics over the last two years and has been a big factor in growing support for the populist Lega party.

CLIMATE CHANGE DENIAL

Not all emerging narratives, however, point in the same direction.

Although levels of climate concern are high and getting higher around the world, climate denial still has influence, particularly in the United States. A YouGov survey of 32,000 people in September 2019 showed that 15 per cent of Americans either did not believe climate change was happening or did not believe it was happening as a result of human activity. That number is five times higher than in China and India and three times higher than the global average.[9]



CLIMATE POLARISATION

There is also growing evidence that climate change is the source of polarisation in legislative and party-political terms. Again, the US seems to be at the extreme. Data compiled by the non-partisan League of Conservation Voters shows that since President Trump's election, Democrats in Congress have voted for pro-environmental legislation 92 per cent of the time, compared to just 5 per cent for Republicans.

Even in Europe, opposition to measures designed to address climate change is influencing party politics. A new political party, No to More Toll Money, has emerged in Norway in response to environmentally motivated increases in road toll charges in major cities. In Finland, the nationalist True Finns have made campaigning against environmental measures an important part of their programme. In the most high-profile backlash against new environmental taxes, the Gilets Jaunes movement in France has led to violence and major disruption in Paris and other cities. In this case the Macron administration had to back down and withdraw the measures it had wanted to introduce.

A common theme in many of these protests is that measures to address climate change disproportionately hurt the poor and those outside of major metropolitan centres.

GREEN RADICALISM AS ECO-TERRORISM

Another counter-narrative that may gain momentum seeks to frame environmental radicalism as a form of eco-terrorism. In the autumn of 2018, for example, Ryan Zinke, the former US Interior Secretary blamed wildfires in the west of the US on "environmental terrorist groups that have not allowed public access, that refuse to allow the harvest of timber."[10]

At around the same time, 84 members of the US Congress wrote to the Justice Department to ask that oil pipeline activists be prosecuted as terrorists. A few months later, a group of activists heading for a UN climate conference in Katowice, Poland, were either arrested and deported, or refused entry to the country, on the grounds that they were a national security threat. There have been reports too, that the French counter-terrorism police have been involved in investigations of climate activists.

This apparent 'securitisation' of the issue makes sense, perhaps, if one is the owner of assets being disrupted by Green Radicals. Given the wider context, however, a hardened response to green protests by authorities around the world might suggest more confrontation is inevitable, and that some of it might turn violent.

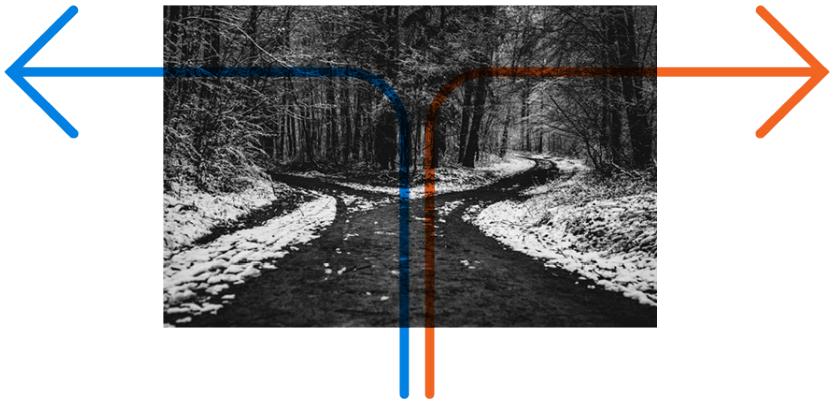
Two Scenarios

Against this background, two scenarios may emerge.

In one extreme, grass-roots activism and public pressure transforms politics. National and city leaders are forced to take radical action, shifting from 'prevarication to panic'. Climate change dominates the US political agenda. The Extinction Rebellion and mass-scale strikes around the world add to pressures. Young people place the environment at the top of their agenda. The Green New Deal unites disparate political factions around a shared purpose. City leaders, responding to shifting political attitudes, collaborate across boundaries. Many force substantive cuts in emissions, curbing fossil fuel vehicles in city centres.

In this scenario, leading asset managers, insurance companies and investment funds deliver on their better intentions, cutting funding and insurance support from many forms of emissions-linked corporate activity. Some central banks impose standards for transparent reporting of climate risk over the long-term in order to protect investors. Corporations are mandated to develop scenarios and test strategies against them. Similarly, cities raising long-term capital face demands to present cohesive resilience strategies, or face funding shortfalls.

In this scenario, public opinion, city leadership, corporate boards and the financial community align around radical and urgent action, creating structural shocks in underwriting, increasing market risk and unprecedented volatility in investment asset values.



At the other extreme, in another scenario, public attitudes, investment sentiment and politics change slowly. There is a mismatch between the need for urgent, system-wide action and levels of commitment. 'Transition risks' act as barriers to change amongst entrenched interests, outweighing changing sentiment. Short-term costs and concerns dominate. This is most marked in coastal regions, for example in the US, where the idea of 'retreat' to higher ground is culturally an admission of failure. The embedded narrative is that man controls nature, that technological solutions will contain climate risk while sea and flood defences will deliver protection and resilience.

In this scenario, the investment community continues to operate on the basis that risk can be priced in the short-term, rather than intervene strategically, acting as a catalyst to transform the system for the long-term. Limits are placed on high-risk city, infrastructure and corporate assets. The underlying system remains unchanged, even as some parts of the world become uninsurable.

Implications for insurance

In each scenario, the insurance industry, through decisions about underwriting and investment, faces strategic challenges. Governments conventionally deliver 'last resort' support for the vulnerable. Yet before extreme decisions are taken, insurers have opportunities to collaborate across institutional boundaries, in the public interest. Decisions about which cities and industries will have long-term backing are already political. The industry's strategic positioning will signal where to look for winners and losers.

As we explore in some of the other essays in this series, one of the major decisions the insurance industry must take is whether to take a leadership role as a social actor in its own right, attempting to use the underwriting and investment power at its disposal to drive long-term adaptation and resilience, or focus more narrowly on short-term security.

Beyond that, it is clear that it must come to terms with a set of risks that cannot be calculated by probability, the application of logic and backward-looking catastrophe models. The ability to detect changes in cultural and political narrative and to monitor for developing momentum in some narratives rather than others, will be key to navigating a volatile landscape. This implies the ability to develop and integrate a new set of methods alongside conventional risk assessment methods.

Without these, the industry faces more shocks and surprises. After all, in the extreme, we may see the emergence on the horizon of a perfect storm: runaway climate change; political panic measures; radical, systemic innovation; culture shocks; and environmental activism. Public cultural attitudes and values will be decisive in the transition to a sustainable world. The insurance industry has a vital role to play.

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5 Timothy Lenton et al, Nature, 27 November 2019 https://www.nature.com/articles/d41586-019-03595-0

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INSURANCE FUTURES

Policing and crime in a networked world

By Ian Kearns of The Oracle Partnership

JANUARY 2020

As more people go online, more systems are networked and the Internet of Things (IoT) expands, the context in which crime occurs and the police attempt to deal with it will change markedly. Some technological developments, coupled to the way criminals innovate around them, may tip the balance in favour of those interested in breaking the law. Others, if police forces, public policy-makers, consumers and citizens can learn to adapt and adopt them quickly, may point to improved crime prevention and increased law enforcement effectiveness. There are competing narratives.

Two things do seem relatively certain. The first is that, as the networked world expands, the opportunities for cyber-criminals, spies, terrorists and foreign governments to exploit it will expand with it. The second is that the outcome of the battle between networked crime and networked policing will have significant implications for crime rates and for those tasked with underwriting the risks associated with crime.

A digital 'crime harvest'?

One possible scenario that could evolve between now and 2035 involves a catastrophic loss of law enforcement effectiveness, leading to a huge digital crime harvest.

The paths to this scenario include continued growth in cyber-crime activity, a police failure to acquire the skills and specialist capabilities needed to fight crime in the digital age, a loss of public trust and confidence in the surveillance and analysis systems that might help the police fight crime more effectively, and technological breakthroughs that might undermine the ability to encrypt information and communications.

There are signs that each of these elements could fall into place.

It is predicted that cyber-crime will cost companies around the world $6 trillion by 2021, a rise from $3 trillion in 2015.[1] Cyber criminals are thought to be acquiring annual revenues in excess of $1.5 trillion, a large proportion of which is being re-invested in activities like cyber-criminal software development, drug production and human trafficking as part of a self-sustaining criminal 'platform economy'.[2]

A number of factors are driving this growth.

The explosion in the number of connected devices is increasing the available cyber-attack surface. Since many Internet of Things devices are not secure, they are being attacked at scale to acquire personal information and to launch denial of service attacks on larger corporate entities. Online marketplaces have developed, allowing criminals with only very basic technical knowledge to buy off-the-shelf software, like advanced phishing kits, that enable them to conduct cyber-crime quickly and easily. Money laundering and illicit criminal transactions are being increasingly conducted on crypto-currency platforms like Monero, Zcash and Ethereum. Cyber-criminals are also becoming increasingly adept at using artificial intelligence tools to conduct automated criminal operations at scale, to by-pass cyber-security arrangements or to generate content that appears legitimate but is actually being used to pass through cyber-security filters.[3]

There is also growing evidence of cyber-espionage being conducted by organised and state-backed groups. To name just a few examples, the Russian state is thought to sponsor many groups, each supported by a different part of the state intelligence apparatus, and each developing its own Advanced Persistent Threat (APT) malware.[4] There are reports of state-backed Chinese APT's being used to try to steal health sector intellectual property from the United States[5] and of North Korean malware being used to target ATM's to steal user card details in India.[6]

In acknowledgement of another growing dimension of the threat, the UN Secretary General, Antonio Guterres, has warned of the 'new frontier' of cyber-terrorism, involving the use of the dark web and social media outlets to spread propaganda and coordinate attacks.

In the context of this onslaught, law enforcement agencies around the world face huge challenges and are struggling to cope. Many lack sufficient numbers of officers and agents trained in fields such as digital forensics. As the number of devices and sources of data that may be relevant to criminal investigations explodes, police forces are also being overwhelmed by the sheer scale of the data analysis task. Many more crimes today are carried out across national and international jurisdictional boundaries too, as criminals use the global nature of the internet to extend their reach. This often leaves national law enforcement agencies powerless or at the mercy of a patchwork of international cooperation agreements and treaties in terms of their ability to investigate crime.

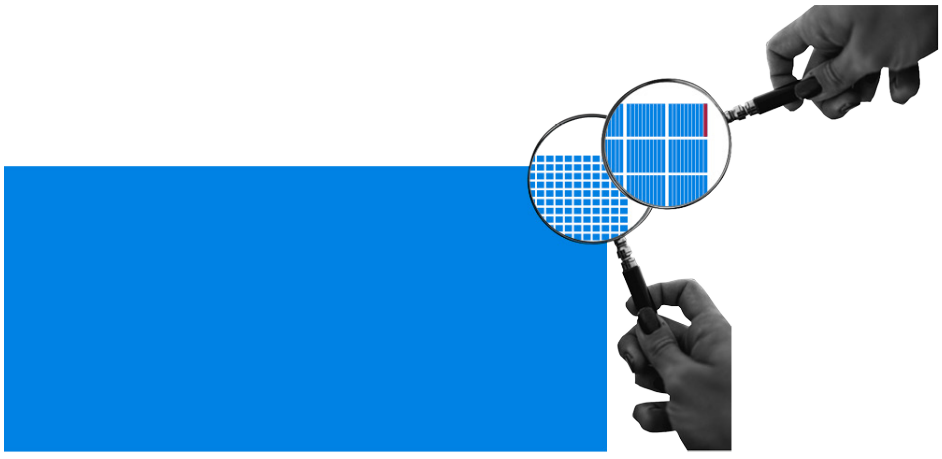
Attempts by policing organisations to seize the crime fighting or crime investigating potential of new technologies are also running into trouble. The global controversy surrounding police use of facial recognition technologies is but one example. Several US cities have banned the use of the technology over privacy and surveillance state concerns. Some point to China's use of surveillance technology and the backlash it has provoked in Hong Kong, as a sign of what is to come.

Elsewhere, police use of artificial intelligence tools to help sift through vast amounts of data, predict hotspots of crime and assess whether those arrested are likely to re-offend—and therefore need to be given custodial sentences—are highly controversial. This is partly because such systems have been demonstrated to exhibit bias. They can lead to some crimes being investigated and not others. They can lead to the over-policing of some communities and neighbourhoods and the under-policing of others. Machine learning algorithms used, once trained on a body of data, can operate like a black-boxes that cannot be reverse engineered to understand precisely why some predictions and judgements have been arrived at by the algorithm, and not others. For that reason, they cannot be 'cross-examined' in court by a suspect's legal team.

The significance of all this is that it is not a given that citizens around the world are going to trust their law enforcement agencies to use these new technologies responsibly. It is also possible that the attempts to use them, if not handled with great sensitivity, may destroy the public trust, legitimacy and confidence that some police services already enjoy.

In the background to all of this, a great technological battle is under way with regard to encryption. There are concerns that breakthroughs in quantum computing may overwhelm current encryption standards, rendering all electronic networks hackable and destroying confidence in virtual networks while undermining the foundation stone of the networked society in its entirety. What is secret and secure today—from commercially sensitive contract details, personal health data and intellectual property databases to systems that manage essential infrastructure—may become insecure and accessible tomorrow. This may drive a sudden retrenchment from virtual to physical worlds, with massively destabilising consequences.

In September 2019, reports began to circulate to that effect. A Google research paper was temporarily published and then removed, which claimed the company had achieved quantum 'supremacy' through the building of a quantum computer that took only three minutes and 20 seconds to perform a calculation that the most powerful existing computer would have taken around 10,000 years to perform.[7] The implication was that brute force attacks could in future 'break' encryption codes by trying every possible numerical permutation in a very short space of time.



The result of all of these developments and challenges, seen collectively, could be a major increase in crime, a catastrophic loss of public confidence in the police's ability to maintain law and order, and huge public concern over the security and safety of a wide range of digital systems and services, leading to a refusal to adopt and rely on them.

A digital policing breakthrough?

At the other extreme, it is possible to see the outlines of a far more upbeat scenario as we move toward 2035.

In this more positive scenario, new technologies deliver such huge advances in both crime prevention and detection that criminals are deterred and crime rates fall dramatically. Law enforcement leaders and politicians succeed in overcoming privacy concerns with regard to systems of surveillance. Public confidence in the use of facial recognition and other surveillance and monitoring tools like Automatic Number Plate Recognition (ANPR) systems grows as awareness of their benefits increases. As a result, the mass deployment of sensors and cameras in public places, transport systems, homes and places of work, rolls out and becomes largely trusted and socially acceptable.

The public also become more comfortable with law enforcement use of artificial intelligence tools to enable predictive policing. These tools combine historical data on crime patterns with real-time data sources to give the police a fine-grained understanding of where crime can be expected to occur and when. Deployments of officers then take place to prevent crime before it happens.

Alongside this, the machine 'reading' of vast amounts of digital data in the criminal investigation process becomes publicly accepted as the only way to prevent the police being overwhelmed. The Internet of Things effectively becomes the digital crime scene. When a crime does occur, investigators and their algorithms can access the mass of data from widely deployed sensor and surveillance systems to piece together what happened. Crime detection rates soar to such an extent that criminals are deterred, given the high chance they will be caught.

In this more positive scenario blockchain technologies are used across a wide front as crime prevention tools, almost eliminating the potential for crimes such as fraud and money laundering. The same systems, coupled with widespread use of smart contracts, are also being used to restore and maintain public confidence in systems of evidence disclosure and the wider criminal justice system.

New post-quantum cryptographic standards emerge, capable of withstanding brute force attacks powered even by quantum computers. Confidence in the secrecy and security of networked systems is preserved.

There are some signs that the building blocks for this scenario are falling into place. Some surveys suggest the public is willing to support large-scale deployment of surveillance technology, at least in some countries. A recent Pew Research Centre survey found, for example, that 56% of Americans do trust law enforcements agencies to use facial recognition technology responsibly, despite the controversy around the issue and the bans that have been introduced in some U.S. cities.[8]

Predictive policing trials are emerging in many jurisdictions and getting results. Cities like Chicago and Vancouver have seen reductions in crime where technology and different approaches to policing have been combined to good effect.[9]

Data from the IoT is being used to stop crime and build cases against suspected criminals once crime has occurred. In one example, sensors on fences and vehicles, coupled to alerts sent over wi-fi, form part of a Reserve Area Network (RAN) in a wildlife park battling against poaching in South Africa.[10] The sensors detect and track the entrance and location of guns entering the park so rangers can intervene before poaching takes place. In another example, data from IoT devices like Fitbits is being used to undermine alibis and bring criminal charges in murder cases.[11]

Blockchain technologies are also being used to prevent crime and combat fraud. A World Wildlife Fund trial in the Pacific tuna industry has fisherman attaching scannable codes to caught fish. The codes are uploaded to a blockchain ledger so buyers can be sure the source of the fish does not breach agreed treaties and rules with regard to preserving fish stocks.[12] The blockchain start-up Verisart is using the technology to prove the provenance of art works and track their movements through the world's art markets in an attempt to make art fraud far more difficult and to protect the interests of artists.[13]

There are claims too that the battle to protect encryption from quantum computing attack is far from lost. The US National Institute of Standards and Technology (NIST) opened a call for ideas on post-quantum cryptographic algorithms in 2016 and is moving toward selection of what it believes could be a new standard that would be capable of withstanding the age of quantum computing. In August 2019, IBM announced that it had successfully tested a quantum-ready approach to encryption that it now hopes to use in protecting cloud-based data.[14]

Implications for insurance

It is clear that in relation to policing and crime in a networked world, very different extremes are possible. At least two plausible scenarios with regard to the future are in play and a third, in which a game of cat and mouse between innovative criminals and innovative law enforcement organisations battle it out to a draw, is also possible.

Against this backdrop, the insurance industry will need to consider a number of issues and responses.

In all scenarios, the industry will need to invest in its understanding of trends in cyber-crime and in organised and state-backed cyber-espionage and disruption. The same applies to understanding of the cyber-security industry's ability to meet the changing cyber threat. Assessing the real potential of blockchain to prevent crime, and how public sentiment about privacy and the use of surveillance and AI systems can impact the crime landscape, will be important. Both will prove pivotal in the ability of law enforcement and wider society to rise to the networked crime challenge. The outcome of the battle over post-quantum encryption will also be of massive consequence to the risk landscape.

The insurance industry's ability to model the impact of various technology developments and deployments on risk will be crucial to putting a price on it.

Beyond that, however, the industry will face a choice. It can either use that modelling to simply vary the price or availability of cover, or it can attempt to lead in ensuring the right kinds of technologies are deployed in the right ways, in the right places, to achieve a desired reduction in crime risk and a better social outcome overall.

The former course of action may imply more available cover, at lower prices, in more extensively monitored societies and settings that are deemed more secure. It may also imply prohibitively priced or non-existent cover in locations and settings where privacy has won out over surveillance and where concerns over police use of AI have taken root. In this case, as the cyber threat grows, the insurance protection gap and the rate of crime may grow with it.

The latter course of action would see the industry acting to drive up the adoption of the best technology facilitated approaches to fighting crime and reducing risk. This could involve work with regulators, device manufacturers and clients to drive up awareness of cyber threats and to improve security best practices and standards. It could involve developing an understanding of and investing in privacy enhancing technologies to help smooth the path to more surveillance and monitoring systems, without undermining public confidence. It might involve building predictive risk reduction software that can more effectively win public trust, perhaps by better handling the challenge of algorithmic bias against particular communities, or by developing machine learning algorithms that can be reverse engineered and have their predictions and decisions challenged in court.

In this latter approach the industry would see itself as an actor helping to shape the overall outcome, inventing new products and services en route.

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7 Google claims to have reached quantum supremacy, available at: https://www.ft.com/content/b9bb4e54-dbc1-11e9-8f9b-77216ebe1f17
Others have subsequently played down the achievement, arguing traditional computers could complete the task in far less time, though not as quickly as via quantum.

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INSURANCE FUTURES

Trade futures

By Philippe Legrain of The Oracle Partnership

JANUARY 2020

Unprecedented uncertainty hangs over international trade. While markets and multinationals are—understandably—fixated on the immediate prospects for trade relations between the US and China, far bigger long-term questions cloud the future. This is often simplistically framed as a binary question: is globalisation set to go into reverse? Or more politically, are the US and China heading for a new Cold War? But in practice, the future pattern of international trade could take many different forms over the next decade or two.

The huge expansion of international trade in recent decades has been driven by three G factors: globalising technology, government policy and geopolitics. Digital technologies have made many more services tradable and together with falling transport costs facilitated the development of complex international supply chains for the production of physical goods. Governments have opened markets and liberalised regulations, both unilaterally and through bilateral, regional and multilateral trade deals. A stable, rules-based, liberal international order led by the United States and anchored around the World Trade Organisation (WTO) has also prevailed. All three of these factors are now in flux.

Localising technology, localising systems?

For a start, technology may in future be localising as well as globalising. Vertical urban farms and locally produced synthetic alternatives to meat ('alt-meats') could trim agricultural trade. A shift to renewable energy could cut fossil-fuel trade. And if robots and artificial intelligence can take over many more human tasks, why rely so much on foreign factories in countries with cheaper labour? Thus trade in food, fuels and factory goods may fall, especially since these sectors are likely to continue shrinking as a share of the global economy, which is increasingly dominated by services and intangibles.

At the same time, the emergence of remote 3D manufacturing may herald a world in which trade in ideas and design soars, both in terms of value and production.[1] The range and volume of trade in digitally provided services may also continue to rise. Now that surgeons can operate remotely using robotic arms, even the archetypal local service—a haircut—could eventually be provided from afar too.[2]

Multi-dimensional policy drivers

Government policy could accentuate or mitigate these technological shifts. Climate, digital, tax, immigration and, of course, trade policies could all have a localising impact, while the latter two could potentially have a globalising impact instead.

While it is plausible that measures to curb climate change in coming decades will be inadequate, it seems unlikely that governments will do nothing. Tougher climate measures could push up transport costs for trade in physical products and travel costs for international tourism. Changing public attitudes to travel and tourism may also, in the extreme, present existential risks to airlines. In addition, carbon border taxes—in the EU, for instance—might penalise imports from jurisdictions that fail to put a proper price on carbon emissions, such as, say, the US.

Governments everywhere are seeking to regulate the ever-growing and previously freewheeling digital economy. As they do, it becomes more likely that their disparate regulations will conflict and fragment the digital economy, affecting almost every business.

Businesses can already fall foul of countries' conflicting data-localisation requirements.[3] The EU's new General Data Protection Regulation (GDPR) also bans personal data flows—which in practice means almost all data flows—to jurisdictions deemed not to protect such data adequately. In part for domestic reasons but also because the US does not want the EU to set the global standard, the US seems likely to craft its own data-protection regulations. Meanwhile, the Chinese market is largely closed and other authoritarian regimes such as Russia are increasingly tempted to emulate elements of the Chinese model. Competition policy could also segment markets: if the European Commission decided that, say, Google ought to be broken up, it would most likely withdraw from operating in the EU instead.

Since almost all businesses are now reliant on data (as they are on electricity) governments' conflicting digital policies could impede all kinds of trade, with digital services hardest hit. Even local decisions can bite: witness many cities' curbs on Uber and Airbnb. However, the resulting Balkanisation of the digital economy could eventually spur governments to seek an international agreement to facilitate such trade and the EU to complete its single market in services.

Tax competition between different jurisdictions shapes the location of business activities, both real, such as where factories are built, and notional, notably where intellectual property (IP) rights and associated payments are attributed for tax purposes. In an era of high public debt and growing public disquiet in many countries about the tax-minimising profit-shifting of international companies, it seems plausible that governments will increasingly seek to increase their tax take, either unilaterally or in cooperation with their counterparts. This may redirect and decrease both real and notional levels of international trade, notably licenses and royalty payments to IP rights-holders nominally located in low-tax jurisdictions.

Immigration policies could also have a big impact. Trade in services often relies on people flows.[4] Sometimes producers, such as IT workers, management consultants, construction teams and foreign university campuses, move to provide services. In other cases consumers—such as tourists, patients and international students—do too. Digital technology, such as online university courses, for instance, may in future remove the need for many people to move, changing the means and location of internationally supplied services. Tighter immigration controls, on students or academics, may accentuate that; where alternative means of supply are not feasible or economical, they would reduce trade. Conversely, more flexible visa policies could open up new opportunities for international trade. For instance, Polish construction companies could bid for contracts to build American roads.

Last but not least, trade policy itself could also have a major impact. Increased import tariffs and quotas as well as greater use of trade-discriminatory standards, regulations and subsidies could impede all kinds of trade—as could security-motivated export restrictions and politically-motivated trade sanctions. Reduced barriers could facilitate it.

At a national level, the economic intermeshing fostered by global supply chains, the political power of business lobbies that benefit from them and the constraints of multilateral rules are all powerful obstacles to protectionism even in difficult times, as the post-crisis period shows. But they are not insuperable: nationalism and anti-establishment politics can overwhelm them. Even policy inaction can lead to an increase in trade barriers: as the mostly open manufacturing sector shrinks and more protected services sectors expand, the global economy becomes less open.

The scope for regional or multilateral action on trade depends largely on the broader geopolitical context, scenarios for which are presented below. But even in scenarios where the WTO collapses or the world splits into rival US and Chinese blocs, there will still be some scope for countries to pursue unilateral policy changes and bilateral trade agreements.

In short, many aspects of government policy could shape the pattern and volume of international trade. The policy choices are likely to differ country by country and indeed sector by sector depending on the political ideas, economic interests and intermediating institutions that hold sway. National policy choices will also be shaped by the broader, geopolitical context.

Geopolitical uncertainty

Perhaps the biggest uncertainty hanging over the future of international trade is geopolitical. The US is in relative decline. Nationalism is on the rise around the world. Moreover, the US has a protectionist, unilateralist president who believes that trade is zero sum, that America is losing and that he can extract better deals out of both allies and rivals by ignoring international rules and flexing his muscles, while the US is still dominant. As a result, the US-led liberal international order—the system of largely open markets, multilateral rules and institutions and security alliances, underpinned by American hegemony that has prevailed globally since the end of the Cold War—is crumbling.

Meanwhile, a new era of great-power rivalry is emerging between the US and a rising and increasingly assertive China, with trade and technology as key economic and security battlegrounds. Future scenarios range from the *collapse* of globalisation at one extreme to *cooperation* restored at the other, with strategic *competition* or *conflict* as intermediate possibilities.

Trade cooperation restored?

Start with the most benign scenario, cooperation restored. Trump's trade conflict with China might prove too costly for the US and largely ineffective in changing Chinese behaviour. Post-Trump America might therefore decide to cooperate with China to maintain the current rules-based system and prolong US influence as its power declines. China would continue to benefit from sustaining

the openness and predictability of the multilateral trading system for now and bide its time in anticipation that it would be stronger in future. At the same time, both would seek to develop alternatives in case relations broke down again.

A cooperative scenario could give a new lease of life to the WTO, both as a dispute arbiter and as a negotiating forum. The prize would include a more open global economy, more stability and predictability for business and a greater say for smaller and weaker countries. Sustaining the cooperative scenario would require activist counter-cyclical macroeconomic policies, generous welfare safety nets and active retraining and regeneration policies to maintain political support for openness. Even in a broadly liberal global environment, however, the combined impact of localising technology, technocratic climate policy and an increased taste for services could all limit many kinds of trade.

At the same time, both the US and China would likely wish to pursue their competing regional and bilateral trade initiatives. The US might rejoin the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). It might also pursue a free-trade agreement with the EU. Meanwhile, China would press forward with the Regional Comprehensive Economic Partnership (RCEP), a China-centred Asian free-trade agreement. More broadly, it would continue to develop trade, finance and infrastructure ties with a wide range of partners in Eurasia and beyond through the Belt and Road Initiative (BRI).

While such a cooperative scenario would be highly appealing to liberal internationalists and global businesses, there are good reasons to think post-Trump US-China relations may be less cooperative. While they may disagree with Trump's tactics, a broader consensus has formed among American elites that an authoritarian and mercantilist China needs to be confronted and contained. And unless China's development is derailed by its demographic ageing, a financial crisis or indeed a political one, the global power shift looks set to continue, increasing future US administrations' sense of vulnerability.

History highlights that when a declining hegemon is challenged by a rising power, the chances of conflict and chaos are high. War between the US and China is certainly not inevitable; *pace* Graham Allison, our nuclear age is very different to the world of ancient Athens and Sparta.[5] Even so, increased geopolitical conflict seems likely, as the essay on geopolitics in this collection suggests. Moreover, as Robert Kagan observes, as the liberal order underpinned by American hegemony retreats, the jungle grows back.[6] Even the least antagonistic geopolitical power shift, from the British Empire to the American Republic, led to the breakdown of the international system in the first half of the 20th century.

The collapse of globalisation?

An alternative scenario is that international order could collapse and with it the international trading system, as in the 1930s. Conscious of its relative decline, an increasingly protectionist and isolationist US might step back from providing global public goods to focus on domestic priorities. Meanwhile, China may not yet be willing or able to fill the vacuum.

Like the inter-war League of Nations, the WTO would fall into disuse. Without an independent means of settling trade disputes, and political pressure from greater powers to do so, trade wars would erupt; the recent escalation of the conflict between Japan and South Korea may be a foretaste of that. Economic pain and political nationalism would feed on each other. Policy and technology would renationalise production.

In between the two extreme scenarios of cooperation and collapse are two more nuanced ones that involve changes to the current model of globalisation but not its collapse: strategic competition between the US and China, and strategic conflict.

Strategic competition?

Strategic competition would involve increased tensions between great powers and more restrictions on their interactions, on technology transfer for instance. But some or even much of their economic and financial interdependence might be maintained. Global institutions such as the WTO would be weakened, but US- and China-centred regional and bilateral arrangements could overlap. Other regional blocs such as the European Union could continue to pursue independent trade policies.

Such a scenario is compatible with continued nationalism. While this is often associated with protectionism, as with Trump's America First stance, it can also sustain some degree of openness if access to international capital, imports and technology are deemed vital to strengthen a state's economic power, as is true to some extent of China.

Strategic conflict?

In contrast, strategic conflict would entail two rival blocs in trade, investment, technology, payments systems and security arrangements. This new Cold War might even become hot. Unlike the Cold War with the Soviet Union, this would be very disruptive economically, since it would rupture the existing ties between the US and China. But international economic integration within blocs would survive and might deepen. Businesses would need to reshape supply chains, financing, hiring and much else.

For smaller countries caught between the two giants, their rivalry could have upsides. Whereas in the era of American hegemony, there was no-one else to turn to, it might be possible to play off the superpowers against each other, as some countries did during the Cold War.

The danger though is that both countries and businesses might be forced to choose sides. The huge US pressure on foreign governments and businesses to stop doing business with the Chinese technology company Huawei to build their crucial 5G telecoms networks is a foretaste of this. So is the updated trade deal that the US has struck with Mexico and Canada, which precludes them striking deals with China.

Choosing sides would be particularly difficult for countries in Asia-Pacific that trade primarily with China, but which currently enjoy a security relationship with the US. Further considerations would include how the relative strengths of the US and China are likely to evolve within the region and globally, and what strings are attached to joining each camp.

Implications for the insurance industry

The uncertainty that clouds the future of international trade has important implications for the insurance industry. It will affect the demand for particular insurance products and their pricing. It will impact both the asset and the liability side of insurers' balance sheets. It will create new risks that may be neglected or poorly understood, as well as systemic uncertainty that, by definition, does not conform to a known probability distribution. Successfully navigating these choppy waters and potentially disruptive storms will require new sources of data and new models for thinking about the future.

Some potential changes are relatively easy to prepare for and adjust to. A decline in trade in physical goods, for instance, would reduce demand for trade credit insurance.

Others would require greater adjustments. Except in the scenario of cooperation restored, increased geopolitical uncertainty is likely to stimulate much greater demand for political risk insurance. Many businesses would face increased risks of supply-chain disruption, licensing issues, being left with stranded assets or indeed government expropriation. As the example of Canadian executives detained in China in retaliation for the arrest of Huawei's CFO in Canada shows, such risks extend to company executives too. While this offers huge and potentially lucrative opportunities for savvy insurers, the challenge will be how to price risks accurately.

In a world of increased geopolitical uncertainty, an increase in the size and frequency of insured losses is likely. To cope with this, insurers will need to be better capitalised, have better financial planning and where possible lay off more risks with reinsurers and markets.

Geopolitical uncertainty will also affect insurers' investment portfolios. Trade disruptions could spark financial crises. While US Treasuries have traditionally been a safe haven in a crisis, rupture with China would accelerate the development of alternatives to the US dollar. A breakdown in international cooperation would also undermine the collective action by the authorities of major countries in the G-20 that limited the global damage from the 2008-9 financial crisis.

The changing trade context will also affect the competitive landscape for the insurance industry. While digital technologies are likely to facilitate the development of new competitors to established Western insurers, protectionism, digital regulation and other regulatory barriers could segment markets. If globalisation collapses or strategic conflict between the US and China develops, the scope of international competition and the opportunities for international expansion will be reduced.

To successfully navigate such an increasingly uncertain world, the insurance industry will need to draw on new sources of data and new ways of thinking about the future. Data gleaned by AI can give an early warning of weak signals that hint at future business and political risks. More detailed and regularly updated scenario planning can better map risks and uncertainty. More strategic thinking can bolster business resilience and profitability.

Conclusion

To conclude, technology, policy and geopolitics will continue to frame the future of international trade, but very different scenarios are possible. In 'Walled Gardens', we explore a hyper-localised world in which trade is dominated by intellectual property and local manufacturing production. Cross-border licensing of ideas, patents and designs in everything from synthetic food to buildings would create a fundamental shift in which air and shipping volumes decline.

Since businesses cannot prepare for every eventuality, it is essential to build in resilience: the ability to cope with a wide range of circumstances. The guiding principle that pervades this series of essays is that a portfolio of imaginative options that pay off in even the most extreme possible future scenarios are vital. Long-term foresight and flexibility are also key. The sooner you know that changes may be coming, the better you can prepare and the faster you can adapt.

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INSURANCE FUTURES

Radical innovation and sustainability

By Peter Kingsley of The Oracle Partnership

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Innovation to address climate and biosphere sustainability is both a source of solutions to urgent problems and a source of systemic technological, socio-political and financial risk. It is also an opportunity for the insurance industry.

Over the next decade and more, novel forms of complex risk will emerge as industries, trade, financial markets and political systems—each fragile—begin to mitigate and adapt. We can expect shockwaves where global systems are not risk-adjusted for possible downsides, or chaotic extremes that may emerge as, say, oil companies lose investor support and write off stranded assets. Or for sudden changes in government policies and unintended consequences.

Less recognised is that they are not adjusted for radical innovation—a new system of far-reaching, fundamental structural change. One reason is that innovation is a hidden world. This essay reveals some of the secrets of that world. It explores emerging innovation, drawing on evidence from patent landscapes, and outlines both scenarios and options for the industry.

Towards extremes

The convergence of possibly runaway climate change, cultural wars, political instability and radical innovation will present major challenges and opportunities. Insurance has a potentially vital, even central role in addressing sustainability by driving risk management innovation and leading development of what we refer to as 'inventing the big hedge'.

Public and investor confidence rests on finding a set of innovative options that will work in any future scenario, even the worst case.

The scale and urgency of the global challenges are driving development towards extremes. There is a growing consensus that the world faces ecological disaster. This demands fundamental and urgent action to mitigate or adapt to the risks of 'too little, too late'.

In a complex, interdependent, uncertain world; systemic, integrated inventions in everything from politics to technology and core infrastructure will determine long-term outcomes.

The principle that underpins our work is that long-term resilience depends on matching the complexity of the future environment with the complexity of response in human systems. Simple or incremental solutions will not work. Nor will a slow transition that keeps current systems and ways of life in place.

Given the scale and urgency of the challenges, radical innovation is not simply desirable, but essential.

Radical innovation

In the past, radical innovation was defined by the image of the individual inventor, the eccentric outsider, the maverick. We see it differently. Individual genius and 'fundamental' or 'pioneering' inventions, in the language of patent experts, remain vital. Yet they are just part of the picture. Radical innovation is best framed by scenarios and imaginative long-term foresight—vision-led and systemic. With an ecological disaster in prospect, it must be focused on the public good.

Yet prospects of system-wide innovation remain remote. It is inherently complex, with many moving parts, ideas and inventions integrated from disparate fields—from science and technology, to law and regulation, to commercialisation and policy interventions at city, regional, national and international levels.

Developing and mapping possible future scenarios that describe the evolution of complex systems over time presents challenges. Scenarios are too often seen as a key component of risk management, rather than a primary framework to develop strategy and a source of inventive ideas for new products and markets, social policy or political ideology.

Imaginative, rigorous long-term thinking is rare. The Bank of England's Prudential Regulation Authority guidance on 'managing the financial risks from climate change' suggests that the lack of scenario and inventive expertise at high levels, particularly in the insurance and banking sectors, is itself a risk factor.

Secret worlds, white space

The potential impact of innovation is understated in financial market forecasting and insurance modelling. If we define radical innovation as systemic, then it is a vital driver of sustainability, a source of risk and the target of insurers searching for new products and services.

Analysts are typically silent on the broad potential influence of disruptive ideas, in part because they are not yet articulated, or even imagined. Invention and innovation are secret worlds. Why secret? Inventors in small firms and corporates alike protect big ideas with their lives.

The challenge is compounded by the fact that breakthrough inventions are latent in 'white space'. This is best defined as areas at the intersection of business ideas, technologies and markets where patent coverage is weak or non-existent, yet commercially, socially or ecologically valuable.

Inventing in white space is about creating new paradigms and by definition market leadership, high margins and returns, public good, and sustainable differentiation. The world's leading inventors are white space experts. In contrast, innovation 'hot spots' are overcrowded, with many overlapping and competing claims, patent 'clusters' and 'thickets' that ultimately mean low returns.[1]

All together now

The challenge for national leaders is to anticipate the shape of the future landscape and invent policy in advance. The question is how to adapt to the societal and environmental threats long before full impacts are known. Political leaders, faced with uncertainty and unpopular decisions in the short-term, default to prevarication.

This is a primary source of cultural tension. As fears grow in the public imagination, inventive policy will become the focal point, not simply inventive technology. In other words, a new innovation paradigm may emerge, focused on ecological security and social stability, setting the agenda over the next decade and beyond. Public action is critical, if short-termist politics is to change.

There are signs of convergence around a shared vision and sense of purpose. Investors may shift from short-term hedging, to long-term perspectives and provision of 'patient capital' for the sustainable economy. Regulators[2] are re-framing the system of rules, progressively enforcing a scenario-based framework on insurance, financial institutions and corporations, to demonstrate they have developed strategies to address the downside risks of climate change out to 2050.

We can expect novel hedging strategies to emerge that protect long-term investor, consumer and societal interests, as well as deliver security to insurers in both asset and liability terms.

Radical invention needs both ground-up action at scale and visionary leadership from the state—as well as investors and corporate leaders. The challenge is to re-invent the system of governance itself, in the wider interests of the public, bringing together public and private funding.

Progress towards the 'inventive state', which recognises the role of government in 'moon shot' projects will depend on the ability to take the long view and shape a vision that anticipates future needs. Some elements of this are illustrated by the EU's Green Deal, which sets out a 'mission oriented' growth agenda focused on carbon neutrality, green innovation across all industry sectors, and a 'just transition' that combats inequality and does not leave workers behind.

The innovation landscape: Evidence

This then raises the question of the role of insurers. It is easy to forget that insurers underwrite risk, pooling 'availability' and shaping credit rating and asset management culture. Investors cannot support funding infrastructure or home insurance in high flood-risk areas without insurance. In other words, insurance underpins financial stability, life and health policies, mortgage security and pensions.

The challenge is to match insurance industry innovation with the emerging, increasingly volatile and uncertain operating environment, which will both create threats and drive demand for new risk products and services. Insurers have a leadership role to play in inventing novel approaches to mapping emerging, complex risk and delivering solutions to minimise the protection gap.

The context in which insurance operates is itself changing fast. Innovation takes many forms. The list of initiatives and inventions ranges far and wide. Much of it focuses on specific challenges, rather than systemic transformation, such as localised energy efficiency in domestic and industrial settings and 'off grid' solar power. There are early signs of technological breakthroughs, such as carbon capture from air. Novel forms of geo-engineering have new momentum. At the same time, 'natural geo-engineering', in the form of mass reforestation and restoring wetlands to protect coastal regions is mainstream. Vertical farming promises to transform local food production.

In the short-term, many of the solutions will be less about technology than local leadership by cities, sometimes despite national level complacency.

There are also policy interventions that may achieve similar ends by different means, such as bans on fossil vehicles in cities emerging in Europe. We can expect tax changes in air travel, particularly aimed at frequent flyers.

Over the next decade, radical, systemic innovation will emerge. Take two illustrations: predictive networks and mass automation in cities, and modelling that explores possible impacts of sea-level rise and flooding.

Mass automation: Intellectual property evidence

Our research of intellectual property landscapes draws together patent analysis and non-patent literature. It shows that insurance has so far focused on incremental innovation, often using blockchain and artificial intelligence (AI) to streamline existing processes, looking for cost reduction, automation and efficiency rather than fundamental or pioneering invention. The same is true of early stage systemic innovation. The evidence suggests that so far, little of the potential has been realised.

There is evidence of more ambitious strategies. Take the intersection between insurance and cities. Patent filings surged by ten times between 2014 and 2018. There are indications of 'patent wars' between insurers and new entrants, such as IBM, and between the US and China.

Some of this has been spurred by opportunities for individual and behaviour-based pricing in automotive insurance: a sign of things to come across the risk industry and in all insurance classes. Drones feature prominently, for everything from monitoring industrial sites to agriculture and water risk assessment. Some key patents focus on incident management: remotely controlled drones can use cameras and sensors to scan household fires and automate claims management.

A central strand in the narrative is that mitigation, prevention, mass-automation and control via Internet of Things (IoT) and complexity modelling is central to the development of sustainable urban environments. Sensor-based 'big data' fits within the broader narrative. Insurance-focused patents illustrate that aggregation and fusion of data about people, things, places and real-time system dynamics will shape the future agenda.

Some of the world's leading insurers, including State Farm (the most prominent in terms of patent filings), Allstate and Swiss Re, together with industrial systems suppliers such as Johnson Controls, are vying for dominance. Individual and small-scale inventors are also significant. They are potential acquisition targets.

More important, Didi and China Re are filing patents at scale. China now matches the US on patent volume. Didi's filings illustrate that mass-automation, control, adaptive cover and pricing can reach city-scale. IBM, the world leader in AI-based IP, is patenting at system-scale, using blockchain and AI to deliver insurance on demand, in partnership with municipal authorities.

'Mass-automation' and real-time insurance is a hot-spot of systemic innovation that has the potential to substantially cut traffic volumes, traffic density and accidents, as well as lower pollution, emissions and overall systemic risk.

More important, there are significant white space opportunities. Data security and privacy are 'system conditions' that will determine progress. They are also white spaces. Similarly, there is little overlap in the patent landscape between pollution control, well-being and health, and active monitoring and control systems. This is despite the fact that this has the potential to address some of the primary challenges of climate change.

Taken together, the hot spots and white space have predictive qualities. The endgame conjures up images of 'total automation', as well as 'total surveillance'. The rate of development will be determined more by socio-cultural norms than by technology alone. Active surveillance may be the price that some countries choose to pay for a low-risk, environmentally sustainable future.

Even so, this paints a largely technology-centric picture. It reflects the culture and pre-occupations of important groups, not least investors, who have experienced decades of high returns from funding technology.

There are other, equally radical ways of delivering sustainability. Some depend on forward-looking models not of the man-made environment, but of the natural physical environment and how it will shape the transition to a post-fossil fuel world.

Sea-level rise: Retreat to higher ground

Assessments about whether coastal regions are vulnerable to frequent flooding, storm surges and rising sea levels, short and long-term, present challenges for individual mortgage holders, corporate leaders, communities and insurers alike. Simulations and predictive modelling will point to the winners and losers, and solutions—such as natural ecosystems, man-made defences or retreat to higher ground.

The recent Intergovernmental Panel on Climate Change report on 'The Ocean and Cryosphere in a Changing Climate' flood and coast risk puts this in perspective.[3] Even if carbon emissions are cut to the best case projections, by 2050, floods previously expected to occur every hundred years will be annual events. Many of the world's major cities, including Miami, Jakarta, Manilla, Bangkok and Los Angeles risk being overwhelmed.

The shocks, as we explore in our essay on *Inventing the Big Hedge*, will emerge long before. The trigger will be that mortgage holders, investors, credit agencies and insurers lose confidence in the narrative that coastal regions can be defended, creating a potentially sudden crash in asset values.

Detailed maps capturing long-term scenarios that predict vulnerability are the raw material of new complexity models—the input to simulation and predictive systems.

Complexity modelling

Complexity modelling, as these illustrations suggest, has many applications. As long-term perspectives and 'stewardship' gathers momentum with investors and insurance leaders, modelling of possible outcomes will have a vital role. Trust in science, modelling and simulations will be decisive.

This raises questions of where insurers and the risk industry may look for future value, beyond sustainable development and security.

The answer is complexity modelling itself.

To recap, the guiding principle is that the innovation agenda and human action should match the complexity, uncertainty and speed of the future operating environment. This means that active models that describe that environment, simulate future pathways, drive ecosystem design and automation are where the insurance and risk industry have a major role. Complexity modelling will both reduce risks and open up the potential of radical, systemic innovation.

Some of these systems are emerging. High quality, secure data is a pre-condition, necessary but not sufficient. In US property insurance, localised flood models rely on loss data and granular detail down to a few feet from newly available historical records going back 40 years.

This is just the start. In volatile weather and climate conditions, historical data is not a reliable guide to the future. The insurance industry is shifting from backward-looking historical analysis to real-time feeds, live risk assessment and predictive systems. Long-term scenarios of possible—distinct from probable—risks are now the focus of regulators, investors and credit agencies. With this, insuring systems for both the short- and long-term, rather than individual risk events, will be at a premium and define the future role of the industry.

Extreme scenarios, radical innovation

The scale and urgency of the challenges is driving development towards extremes. The tendency to look for individual inventions that transform, for example, carbon capture, is pervasive. Yet system-wide innovation, involving the integration of multiple ideas, will have more impact.

Novel forms of risk will emerge as industries restructure, driven by the convergence of the sustainability agenda and digital technology.

All fossil fuel and emissions related industries are already in turmoil. Water, energy, agriculture and transport sectors, as well as cities, are beginning to re-invent from first principles, in part under pressure from investors and credit agencies.

Two extremes may emerge. In one scenario, radical, high-risk and systemic innovation transforms the industrial, environmental, financial, economic and political landscape. Everything from e-vehicles, decentralised micro-solar and automated cities, to cutting pollution at source, to new alternatives to high-emission concrete, emerge. In some parts of the world, desalination, nano-filtration, efficiency and re-use deliver practical answers to water stress. Agriculture is localised. Mass-scale investment in green technology delivers high levels of energy efficiency and creates prospects of a post-oil and fossil fuel world. Reforestation, or 'natural geoengineering', together with carbon capture and novel photosynthesis, deliver at scale.

Whilst many transformations have the potential to mitigate or drive adaptation to long-term climate risk, short-term volatility dominates the risk landscape, as core systems and industrial sectors re-shape both underwriting and investment strategies.

In the other extreme, lack of leadership, investment caution and public resistance hold back development. In this scenario, fragmented innovation fails to deliver breakthroughs. Ideas do not cross-national boundaries, address strategically critical issues, or spread in the public interest. Fears of 'too little, too late' are realised. Lack of patient, long-term capital hinders progress.

The financial community hedge their bets by supporting the current industrial models and systems, slowing adaptation and increasing risk. Fears and uncertainty about stranded assets begin to crystallise, but the transition is slow and cautious. There is perpetual volatility as the mismatch between actual innovation and what is needed emerges.

In this scenario, radical innovations do not emerge, nor scale. The absence of leadership, at corporate, city and national levels means lukewarm support. The potential of vision-led innovation in the public interest, driven by partnerships between governments, financial institutions and inventors is only realised in the most politically cohesive countries and cities. Social and political innovation fails to deliver. At the same time, extreme weather produces volatility and instability, made worse by fears of runaway climate change.

Insurance: The options

In each scenario, insurers face the challenge of shifting from covering individuals and specific events, to insuring interlinked complex 'systems of systems'. With the earth's ecological systems entering a period of unprecedented volatility, complexity will increase, as will human responses, through 'green' innovation, policy interventions and digital systems. Many technologies will increase complexity risk.

The insurance industry has the opportunity to lead the development of long-term, sustainable resilience, playing a role, for example, in automating prediction and control systems. Complexity modelling is central. Sensor data and source integration is necessary, but again not sufficient.

Earlier, we argued that the strategic challenge for national leaders is to anticipate the shape of the future landscape and invest well in advance. In the past, exponential technological innovation has been seen to be a good thing in its own right. Now the question is how to adapt to the societal threats posed by that same innovation, long before the storms begin. As fears grow in the public imagination, inventive policy will become the focal point, not simply inventive technology. In other words, a new innovation paradigm will emerge, focused on security and social stability. This will set the agenda over the next decade and beyond.

Against this background, some insurers may withdraw, increasing the protection gap through higher pricing and restricted coverage. Others will specialise only in high margin, relatively simple risk classes. Competition to find profitable niche markets will increase.

On the other hand, specialists in complex risks will emerge. The industry has the opportunity to lead vision-led, radical, systemic innovation. Success will depend on dynamic, real time complexity modelling, novel forms of products and risk advisory services. Insurers can shape the innovation landscape and in turn the risk environment to meet the challenges of both physical and transition risks, limiting growth in the protection gap. This is in the interests of the public, cities and corporations and national governments. It is also in the insurers own interests, since it protects their own business models and positions them to act as both drivers and informal regulators of change.

1 https://oraclepartnership.com/long-reads/geo-politics-innovation/

2 Illustrated by the Bank of England's Prudential Regulation Authority

3 https://www.ipcc.ch/srocc/download-report/

The politics of climate change

By Tom Burke of The Oracle Partnership

DECEMBER 2019

2019 is the year the global conversation on the climate changed. The children's climate strikes, the arrival of Extinction Rebellion, the EU's Green Deal and the importance of climate change in choosing a Democratic presidential candidate illustrated the strength of public anxiety. The ceaseless procession of harrowing images on our screens from floods, fires, storms and droughts showed why. A stream of ever more alarming reports from climate scientists, culminating in the World Meteorological Organisation's projection that this would be the warmest decade ever, validated their concern.

No other challenge in human history has simultaneously threatened the prosperity and security of every single person on the planet. There are many millions of people whose lives are being disrupted by conflict, disease, poverty or extreme weather. There are many more millions living lives that are peaceful, healthy, comfortable and sheltered. Climate change will disrupt the life of all eight billion people on the planet if we fail to keep the rise in global temperature below 2°C. Or even lower, if estimates of the relationships between carbon emissions and temperatures prove understated.

Europeans had a foretaste of what this might mean in the 17th Century. As Geoffrey Parker's monumental study, Global Crisis, documents in depth, a changing climate is a stress multiplier.[1] The then cooling produced disruptive weather extremes that intensified the political, economic and religious tensions roiling a primarily agrarian European population. The consequent famine and disease reduced the population of Germany by 40%.

Today's warming will add similar amplification to the far greater stresses already churning the planet's still growing population. Delivering prosperity and security to a now predominantly urbanised population in a highly interconnected world depends on the integrity of a vast network of relationships and institutions. This network has coped well with the explosive growth in the global demand for goods and services over the past century. However, as the expanding realm of climate attribution science makes clear, it is already being disrupted by the limited climate change we have so far experienced.

The interaction between the climate and human affairs is neither sequential nor linear. It is our skill at adapting to our environment that makes us so successful as a species. It is a skill that copes best with incremental change. What climate scientists fear most about our current disruption of the earth system is the likelihood of non-linear change leading to accelerating, abrupt and irreversible shifts in the climate.

We also succeed as a species because we are able to anticipate as well as react to change. We do not always wait for something to happen before thinking about how to respond to it. Anticipation of how the climate might change is already casting an ominous shadow on a wide range of decisions today—from where to invest to whether to have children. As events continue to validate the projections of climate scientists that shadow will grow darker.

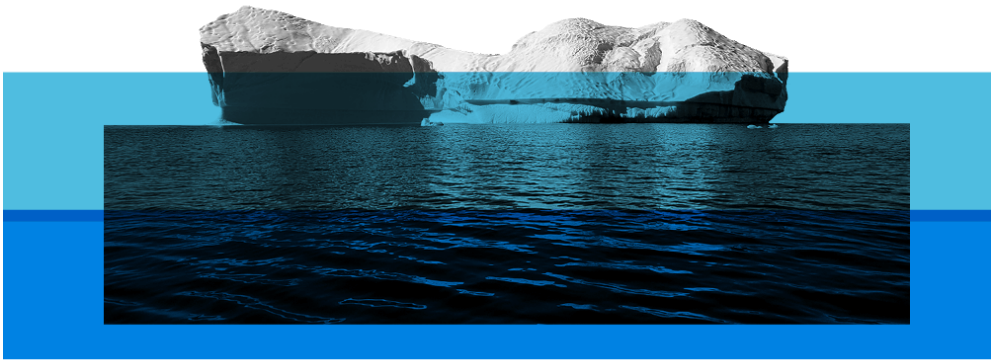
The politics of climate diplomacy

There is a further way in which climate change is unique. Although there are likely to be hard power consequences of climate policy failure, there are no hard-power pathways to climate policy success. Human beings have only a limited set of tools to induce others to do what they want them to: coercion, bribery or persuasion. We can force people to do something by the threat of violence or the law; we can bribe them by monetary or other rewards, or we can persuade them by argument or deception.

This tool kit scales from the family to the nation. Solutions to serious problems require some permutation of all three tools. It is hard to see how military force, or the threat of it, could be used to compel recalcitrant countries to decarbonise their economies in the next thirty years, or sooner. This puts a premium on strengthening the limited coercive power of the Paris Agreement while intensifying the use of bribery and persuasion.

There is considerable misunderstanding outside the ranks of government officials about how such agreements actually work. Much criticism focuses on the absence of strong mechanisms to enforce compliance leading to a fear of free riding. This misses two crucial points.

Nations signed up to the Paris Agreement because it was in their interest to do so. China and India did not sign the Agreement in order to curry favour with the US or the EU. They did so because climate change threatens to disrupt their own internal stability. To protect that stability, they need other nations to act so they must be, and be seen to be, willing to act themselves. Naturally, each nation negotiated commitments which minimised its own burden but remained sufficient to keep other nations in the Agreement.



The bargain thus struck is messy and far from optimal. It will not keep the climate manageable. That does not mean it is futile. Climate change is not an event. It is an evolving condition of the planet. In many ways it is like type two diabetes, a manageable problem, which, if untreated, becomes progressively unmanageable, and eventually catastrophic. Recognising this, the Paris Agreement established a specific process to allow the bargain to be strengthened if the state of the climate so required. There will be a global stocktake in 2023, and every five years thereafter, to determine what more needs to be done.

There is no question that much more needs to be done—urgently—for there to be a reasonable chance of meeting the goals of the Paris Agreement. It is important to remember that goal is to limit the rise in the global average temperature to below 2°C. The actual climate driven temperature change will vary from place to place. The Arctic has already experienced a rise of more than 3°C bringing with it graphic pictures of melting ice sheets and boreal forest fires. These temperature differences will be regional but their physical, economic and political consequences will often have global impacts.

There is understandable frustration within both the public and the climate policy community at the sluggish response by governments to the urgency of climate change. This has led some to doubt the value of the United Nations Framework Convention on Climate Change (UNFCCC) process. Such doubts are at best a distraction and at worst dangerous. Climate change is a time bound problem. If we do not succeed in decarbonising the global economy by the middle of the century, at the latest, climate policy will have failed. There is simply no time to build an alternative mechanism for international cooperation on climate change. In any case, the same political failures that might allow the UNFCCC process to collapse would still face some new mechanism.

Better, therefore, to focus on how to build political support for a more ambitious outcome to the 2023 stocktake. Negotiators at international treaty meetings work on the basis of the instructions they are given by their governments. The political space within which an eventual agreement will be struck is thus defined by the sum of those instructions. To achieve an ambitious outcome you need an ambitious set of instructions.

The most critical work towards a successful outcome in 2023 will take place in national capitals not international negotiating rooms. Attention on the politics of climate change typically focuses on the annual round of UNFCCC meetings. This inevitably leads to an over -concentration on short-term difficulties with the treaty text and distracts attention from the more strategic developments in the real economy that are fundamental to decarbonisation.

The Paris Agreement marked a number of crucial turning points. Prior to Paris, the dominant climate policy conversation was about how best to constrain economic development in order to reduce its carbon burden. Unsurprisingly, positioning yourself in the middle of a collision between the economy and the climate was not a compelling prospect to many politicians. Hence the prevarication that has been such a feature of climate policy in many countries.

The climate opportunity

There has been a marked shift in the climate conversation since Paris. Opportunity has now become a significant driver of global decarbonisation. The costs of the renewable and battery technologies essential for decarbonising power and transport have fallen both further and faster than was anticipated even then. They are continuing to fall. Globally, renewable energy capacity has quadrupled in ten years to take power sector carbon emissions 15% below where they would otherwise have been. It is now likely that renewables will become consistently cheaper than fossil fuels early in the twenty twenties, around the world.

This has changed the fundamental political equation shaping the response to climate change. The political risks of inaction on the climate are rising and those of acting are falling. In a policy conversation dominated by constraint, climate change looked to most politicians like a choice between today's winners (the fossil fuel industries and those dependent on their revenues) and tomorrow's possible losers (future victims of a changing climate) plus tomorrow's possible winners (renewable industries). Politically, this is a no brainer. You back today's winners with what you do, and you shield yourself from the future with warm words.

Since Paris this has begun to change. The low carbon opportunity narrative has taken hold and the growing number of extreme weather events has begun to register with the public. The emerging political equation pits today's fossil fuel incumbents against tomorrow's cheaper innovators and increasingly harrowing images of today's victims. This is much more difficult politically and is, paradoxically, currently intensifying the prevarication on climate policy as politicians struggle to accelerate the energy transition without alienating key voters.

The horns of their dilemma have been brought sharply into focus this year. Despite their increasing efforts to paint themselves as energy companies, the oil and gas industry invested nearly half a trillion dollars in new supply last year. This is not compatible with achieving the Paris goal. Meanwhile public anxiety about climate change has found increasingly forceful expression in many countries.

A new debate

Greta Thunberg's schools strikes, Extinction Rebellion's street protests and Alexandria Ocasio-Cortes' Green New Deal are not so much creating a wave of public anxiety as riding it. The wave has been created by the extraordinary series of extreme weather events in all parts of the world over the last two years which have led to $225 billion in insured losses. These have so focussed public attention on climate change that London's Evening Standard recently devoted its front page to declaring that 85% of Britons are now worried by climate change.

The political impact of these events has been reinforced by the entry of a new, powerful and wholly unexpected voice into the climate policy debate: central bankers. Since Bank of England Governor, Mark Carney, gave his first climate speech in 2015 an organised network of central bankers, the Network for Greening the Financial System has emerged. It now has 42 members representing countries with over half of global GDP. His speech led to the creation of the Task Force on Climate Related Disclosure. This has now developed a set of detailed protocols for how companies should disclose their exposure to a spectrum of climate risks so that the financial community can be adequately well informed to assess their impact on investments. Transparency is key. When central bankers speak investors and politicians listen.

Subsequently the Bank of England has begun to develop a regulatory framework for the financial services industry's management of climate risk through the Financial Conduct Authority and the Prudential Regulatory Authority. Long-term scenarios and strategic options that demonstrate how

individual listed companies will respond have a central role. There is much to be done. For many listed companies, this perspective is new and unfamiliar territory. This public sector response has been matched in the private sector by the creation of the investor-led Climate Action 100+ network designed to tackle both the emissions reduction challenges and low carbon technology opportunities of climate change. It now involves 289 investors from 29 countries with over $30 trillion in assets.[2]

The result of all these developments has been to elevate climate change to the top tier of mainstream politics. With both the public and financial institutions increasingly concerned about climate change, the pressure on governments to act urgently and effectively is growing. It is now clear that technology is not an insurmountable problem. Thirty years of deep analysis and innovation mean that we have, or have in sight, the technology we need to stop burning fossil fuels without depriving people of affordable energy services. Nor will we wreck our economies to do so. Some two thirds of the energy from burning fossil fuels is simply waste heat that does no useful work. Much of the $1.8 trillion the world invested in energy last year added no real economic value. As we make the energy transition out of fossil fuels by spending that capital on a carbon free energy system we will also be improving the overall productivity of the economy.

It would be wrong to think that there are no real technological and economic problems to be solved to avoid dangerous climate change. There are. However, the amount of systematic study of both over the past thirty years has been sufficient to justify a high level of confidence that they can be dealt with should we wish.

The remaining political problem

This is not true of the political problems of making the transition to a carbon-free energy system. Little sustained effort has been put into identifying, let alone solving, these problems.

If we are to have any realistic prospect of making an orderly and timely transition to a carbon free global energy system then we need to urgently deepen our understanding of its politics. The scale and pace of the technology changes that climate policy success requires will be accompanied by a similar scale and pace of change in the patterns of winners and losers in the energy world. Politics is how we choose who wins and who loses. Typically, those interests that will lose make a noisy and sustained effort to oppose the changes. Those that will win tend to quietly get on taking advantage of them. Prevarication is a typical response of governments faced with hard choices and it is often a wise way to ease the pain of change. This will not work for a time bound problem like climate change.

The change from fossil fuels to carbon free energy will create large numbers of jobs and opportunities for investors. They will not be jobs or opportunities for the same people with the same skills in the same places. Climate policy makers have a great deal to say about the shape of an energy policy that is Paris compatible. They have had far less to say about the labour, skills and regional development policy that must accompany it. Without such a policy the political obstacles to the energy transition will be formidable.

The EU countries derive some €400 billion a year in revenues from taxation on the fossil fuel industry. While we can see how to replace the energy from fossil fuels by new technologies it is much harder to see how to create the same opportunities for taxation and dividends. There is far less headroom for the extraction of rents. The reason why pension funds have such significant holdings in oil and gas companies is because they are such reliable providers of dividends. Climate policy makers have had nothing serious to say about how those revenue streams are to be replaced. Given an orderly transition, replacing dividends can be left to the market as investors adjust their expectations.

Replacing the public revenues will be more difficult. The relative inelasticity of demand for fossil fuels has made them a reliable tax base. They are familiar and broadly accepted by voters. Since the purpose of carbon taxes is to drive carbon out of the economy they cannot provide the same underpinning for tax policies because the more successful they are in changing behaviour, the less they produce in revenue. Nor is it sensible to tax renewables at precisely the point when one needs to see a massive investment in, and increase in their use. This means new taxes need to be imposed elsewhere in the economy and new taxes are always unpopular and will be resisted. Failing to replace the public revenues, however, will undermine support for ambitious climate policies. There are already some politicians in Europe arguing that dealing with climate change will lead to a prolonging of austerity.

For climate policy to succeed we must end the burning of fossil fuels by around the middle of the century, or earlier. We have to keep in mind that climate science, including the work of the Intergovernmental Panel on Climate Change (IPCC) has consistently underestimated the severity of systemic impacts and the rate of change. This will have significant geopolitical consequences which are yet to be fully understood. Some countries, Saudi Arabia and Russia among them, depend critically on revenues from oil and gas exports for their national budgets. There has been little serious examination of the options available to those countries to replace those revenues. Mozambique, one of the world's poorest countries, was devastated by two powerful and unusual hurricanes this year. Climate change makes the likelihood of further such catastrophes in Mozambique greater. It is also a country with large offshore gas resources on the verge of development. Climate policy makers have yet to propose any advice to the government of Mozambique as to how it should handle the dilemma this presents.

There is a growing risk that governments will be caught between a rock and a hard place. As the scale of the political obstacles to the necessary change for climate policy success becomes more apparent the temptation to continue prevaricating will grow. As climate events drive an ever more anxious and better informed public to demand urgent action the inducement to panic will also grow. Governments oscillating between prevarication and panic are probably least able to construct an orderly path to a carbon free global system.

Insurance: Some critical questions

Against this background, the insurance industry has a vital role to play. Insurers underpin everything from corporations, to cities and municipalities. More important, insurance is a pre-condition for investors. If rates increase and cover is withdrawn, confidence in the financial system will quickly be undermined. Some insurers, like Swiss Re, are supporting communities in developing long-term resilience, often integrating 'natural' solutions with conventional infrastructures. This is, in one sense, enlightened self-interest. It may limit the growing 'protection gap', as governments themselves fail to provide insurance of last resort.

At the same time, the cities and insurance systems are vulnerable to sudden corrections, some triggered by changing public attitudes and levels of confidence. Severe weather events may put insurer's capital under pressure, as both insured losses and investment returns are hit. In the longer term, the success or failure of climate policy will impact on asset valuations and therefore on capital adequacy requirements.

There will also be multiple opportunities. By understanding complex risk and modelling the potential for long-term systemic crises, the industry can provide new risk products, services and advice, partnering with specialists. The same applies to modelling individual businesses and sectors, as we explore in the role of 'Radical Innovation'. This may take the industry into new markets where they act as risk managers, advisors and primary actors, rather than providers of transactional services. It will also require an increasingly mature relationship with governments in order to maintain the flow of affordably priced capital into the economy as the dial shifts on the success or failure of climate policy.

1 Geoffrey Parker, Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century, Yale University Press, 2017.

2 http://www.climateaction100.org

INSURANCE FUTURES

Global politics: Alternative futures

By Mat Burrows of The Oracle Partnership

JANUARY 2020

The political risk landscape is being rapidly transformed. Among the factors driving this are a new era of geopolitical competition; increased migration flows; the rise of national populism; rapid and destabilising technology change; a new and apparently more easily manipulated media environment; climate change; and new and more disruptive forms of conflict. Many of these feed off each other, creating a more volatile and unpredictable environment than at any time since perhaps the 1940s.

The challenges to leadership teams at all levels are pervasive, complex, interdependent and permeated by uncertainty.

Ultimately, they may be met. The US and China might yet find an accommodation. Multilateral trade, finance and security regimes and institutions may enjoy a renaissance. New and effective instruments of arms control and disarmament may be found to deal with autonomous, bio-, cyber- and nano-weapons. Effective international action on climate change has the potential to create a shared sense of purpose, limiting migration pressures and associated geo-political stress.

Innovation on a mass scale, facilitated and aided by permissive forms of anticipatory regulation may help to solve many of humanity's greatest problems. New technology may create more jobs than it destroys, ushering in a period of rising living standards for the masses, and less economic insecurity. Improvements in health and productive lifespan may also ease burdens on the public purse. More effective measures to secure nuclear and biological materials that could be used by terrorists or 'weirdos with expertise', could be put in place.

It is far from certain, however, that this will be the outcome. At the other extreme the relationship between the US and China may slide from cold to hot war, triggering a collapse of wider multilateral financial, trade and security regimes in the process. Existing nuclear and conventional arms control regimes may be destroyed by proliferation and new weapons systems that are impossible to control, destabilising wider conflict prevention measures and making inter-state war once again more commonplace. Runaway climate change may generate new and massive waves of migration, adding to geopolitical pressures and increasing the risks of policy errors.

Within states, the fuel for a re-nationalisation of politics might be driven by a growing backlash against migration, the dominance of a new politics of national identity and by the popular desire to wrest control from what are increasingly seen as remote and unaccountable global and regional institutions. Islands of innovation may be hemmed in by over-cautious political and regulatory environments, meaning many structural problems remain unaddressed. Concerns over rising

inequality, as wealth is accrued by a few while technology drives job losses on a massive scale could create an ugly and volatile mood, one easily manipulated by fake news and disinformation campaigns on social media.

This essay sets out two possible extreme scenarios that may emerge between now and 2035 before going on to consider the implications for the insurance industry. Our experience is that by exploring extreme possible, distinct from probable scenarios is that they create a framework within which policy options, hedging and business strategies can be developed. They reduce the risk of surprises and create 'memories of the future' that make recognising emerging risks more likely.

Worst case scenario: The possible path to war

The growing US-China rivalry is at the core of this worst-case scenario which many current trends point to. Previous US presidents had always assumed that China could be integrated into a US-dominated international system. Starting with the Trump presidency, more and more Americans now believe—especially the foreign policy elite—that US and Chinese interests are fundamentally opposed on any number of grounds from governance to economics.[1]

The same has been occurring in China but from a different angle.[2] For most Chinese, the US remains the most powerful country, but is in decline. The Chinese believe they are owed respect by others, including Americans. After all, China saved the West after the 2008 financial crisis—and Beijing has just been doing in the South China Sea and elsewhere what the US has long done, namely dominating its neighbourhood. The Chinese bristle at the thought of the US holding China back, putting a ceiling beyond which it could not rise unless it constantly defers to Washington.

A key question for the Trump and successor US administrations is whether the United States should make China into an outright enemy. By 2035, both the US and China will have hedged for years, building up military capabilities in case the bilateral relationship turns sour. Both sides know there would be economic costs in such a case. Most US multinationals rely on global supply chains involving a strong Chinese role. Chinese leaders aim to make their economy more domestically driven, but so far it remains vulnerable to a trade war with the United States.[3]

Given these serious downsides, a bipolar world has not appeared likely until recently. But, with falling middle class living standards fuelling populist fears and Trump's electoral base believing that they were globalisation's sacrificial lambs, China has become a natural target. Increasingly, the foreign policy elite thinks as well that Washington needs to stand up to China if the US is to remain the world's most powerful country. Any US President would find it hard to balance the risks of conflict against China's increasing business, technological, and military challenges to US primacy. For Trump, particularly so, with his re-election chances hanging in the balance on another big turnout by his base. That said, Trump must worry about precipitating an economic recession as a result of a crisis—trade or otherwise—with China.

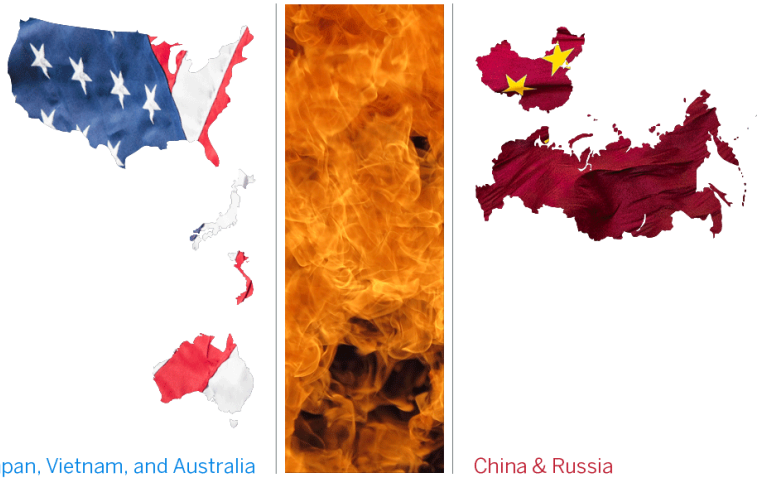
Equally on the Chinese side, could Xi or his successors take the risk of seeming to be weak even if economic growth begins to weaken? The Chinese economy is anyway becoming less dependent on US trade and investment, and China's leaders are more confident of the country's technological prowess. Party leaders know that the public would be as outraged as they are about US attempts to keep China down. The stage seems set for a possible conflict.

How a conflict could happen

Just as in the lead up to the First World War, many people today say they are against getting into a war—but that did not stop the conflagration from breaking out in 1914.[4] A bipolar world that is on the road to conflict may not be as unlikely as it appears at first glance. Japan, Australia, Vietnam, and India share US concerns about a dominant China and have been pushing Washington to maintain, if

not increase its military presence in Asia. They think that a stronger US presence will force China to respect them even as they seek to avoid a Sino-US conflict which could cripple their economies.

With more US assets patrolling near Chinese-claimed territorial waters, the risks of a naval clash are increasing. No doubt, if a clash happened, a truce would be called but could break down as the rhetoric—each condemning the actions of the other—escalates. Some Asians—Japan, Vietnam, and Australia—would take the US side, others would straddle the fence. In this scenario, the US could create a collective Pacific Treaty Organization with the three as signatories with Washington. Other Asians—South Korea, the Philippines, Malaysia, India, and Indonesia—may seek observer status hoping that they can benefit from the US security umbrella even though officially non-members.



US & Japan, Vietnam, and Australia

China & Russia

Threatened by this development, China and Moscow could publicly sign a Reinsurance Treaty that provides that each party would support the other if it were attacked by the US or NATO.[5] This would stun Western observers who believe that the Russians are wary of their dependence on Beijing. Nevertheless, the Russian economy has profited from massive Chinese investments into the energy and infrastructure sectors in recent years. Moscow could use the opportunity to expand aggressively its sphere of influence, provoking several proxy conflicts in Ukraine, Georgia, and Kosovo.

NATO could be expected to react forcefully, providing local governments with weapons and military equipment and by deploying further forces into Kosovo to stabilize the region. Pro-Russian protests in Latvia could break out and turn violent, leading NATO to immediately deploy troops into the Baltic nation, to which Russia could be expected to react by mobilizing its western military district. Although this standoff may not ultimately lead to war, it would raise the stakes for both sides.

Europe has had the experience of a Cold War and does not want a repeat performance. Following French proposals, the EU could create a common defence fund and swiftly deployable common defence forces. The EU sanctions regime against Moscow would likely be widened. Brussels would start competing with Russia for influence in the Balkans, Ukraine, and parts of the Middle East, using its superior economic power to coerce leaders and people. Russia would respond with cyberattacks, misinformation, and surrogate forces.

The global confrontation and economic pressures could draw India closer to the West. Although New Delhi may try to remain neutral, its dependence on energy imports from the Gulf and access to Western markets—combined with the increasing threat of an assertive China in the Indo-Pacific—would foster closer cooperation with the United States. For its part, Pakistan would ramp up its cooperation with China and Russia, further distancing Islamabad from Washington.

Iran, supported by Russia and China, would be more likely to develop nuclear weapons in this scenario, increasing its support for Hezbollah. The Saudis, mainly supported by Israel, could follow suit. The Shia-Sunni wars in Syria, Iraq, Jordan, Yemen, and Lebanon would be reignited and turn into proxy wars between NATO and Russia. Terrorism would become a weapon used by both sides.

The end of globalisation

With this East-West conflict breaking out, globalisation would fray enormously with everyone paying the price in serious losses in economic growth. From time to time, US and global business leaders might appeal for lowering tensions and going back to free trade, but neither group would want to seem unpatriotic, so they would not press their case too hard. With liberal and conservative media united in blaming Russia and China, minimal political dissent would occur in the West. Governments everywhere—not just Beijing and Moscow—would use data and surveillance to identify, track, and isolate troublemakers in any event. With modern technology, George Orwell's 1984 vision proves easy for governments to implement. The war atmosphere provides the justification.

More widely, Chinese firms would be restricted from investing in Western technology firms.[6] All sides would slap export controls on sensitive technology. Chinese students would no longer attend Western universities for their STEM education. The US would also discourage students from countries friendly to Russia and China. East-West travel may fall to a low ebb as Chinese tourists find it difficult to get permission to travel to the West. Those who do travel would find a mixed reception in the West and vice versa.

Although Russia, China, and the United States are building up WMD arsenals, including tactical nuclear weapons and new and devastating agents, cyber will be the likely weapon of choice for all sides. Increasingly, other countries—not just Russia and China—would close off their national borders to all kinds of information, to better protect themselves from outside attacks. There would be separate internets, despite their once common ancestor. They would no longer connect. Periodically, Russia and China and US/NATO on the other side would test each other's defences. No national leader would have any idea what the red lines were for the other. None of the major players might take down a power grid or any major infrastructure in another's homeland, but they would be preparing by taking opposing sides in various proxy wars and sending each other warnings of what they could do in the event of a real war.

Fear would be the dominant emotion in this scenario. Everyone would just be waiting for the moment when a hot war erupts. As in August 1914, no one would believe that such a war could be stopped.

Best case scenario: Resurgent cooperation

Worrying as this scenario is, an opposite, brighter future- of *resurgent cooperation* is possible—though even if it happens, it is likely only after a period of growing disruption. The US may decide that containment of China is too costly and many people in the US may come to fear that such a strategy would only result in a war. Chinese President Xi's gambit of forcing innovation while suppressing freedoms might finally hit a brick wall. In the US, the dream of recreating a unipolar world could finally be dropped by the US foreign policy elite. Chinese leaders could be forced to accept the fact that the so-called 'Chinese model' of a heavy state-led development can only get a country so far. The result on both sides may be to reach for an accommodation.

Middle classes opting for prosperity

Washington's instinct has been to stifle Chinese innovation during the Trump Administration. Restrictions on Chinese access to US markets and know-how has increasingly been hardened. Even in a more benign future scenario US markets are likely to become inaccessible to Chinese goods and investment while China can be expected to reciprocate, forcing US companies to

depart. The Europeans will be divided. West European firms feel the same way as US companies about alleged Chinese intellectual property (IP) theft and replication and have pressured their governments to tighten up access for Chinese investments. In Eastern Europe, it is a different story. Still seeking to bring living standards up to Western levels, most East European countries welcome Chinese investments, particularly as those from elsewhere are declining.

Eventually the world may suffer a deep recession because of the standstill in trade. Trumpian populism in the US could become discredited partly as a result and populism elsewhere will take a similar hit. US debt will soar as tax revenues are hit. Policy makers will talk about cutting back entitlements, which will anger the middle class, especially seniors who are dependent on it for their welfare. Most European countries will face even stiffer fiscal challenges. The instinct to turn back to cooperation could grow. A new peace movement could take off, calling for an end of the arms race.

China's burgeoning middle class will be in the same situation as their Western counterparts. Aging and growing more risk-averse and tired of the social restrictions, Chinese citizens could begin making their displeasure known. Fearing that the Communist Party could be dethroned, the elites could ease out President Xi and resurrect the memory of former Chinese leader Deng Xiaoping, who had counselled caution in confronting the West.

With new leaders on all sides, the opportunity might arise for East-West relations to be reset. This would occur slowly, however. At times it will look like both sides are falling back into confrontation. While recommitting itself to multilateralism, the US would start by strengthening ties with its traditional allies in Europe and Asia. A new president could return to Obama's idea of negotiating an updated Trans-Pacific Partnership (TPP) and a Transatlantic Trade and Investment Partnership (TTIP) to bolster US leadership and turn a page on Trump's "America-First" stance.

Meanwhile, China would use its ties with the developing world to press for a new global trade round. It knows it might have to give on IP but it wants more access to Western markets, including relaxation of Committee on Foreign Investment in the United States (CFIUS) and other restrictions.[7] Developing countries want better treatment of their young citizens educated and working in the US and Europe. Similarly, they want the advanced economies to incentivize their return to their home countries in order to ease the brain drain.

Western governments understand that inequality is a sore point with the middle and working classes, who feel they are losing too much ground to the rich, worry that their children's futures are endangered by it and could act to do something about it.[8] Raising taxes on the wealthy would be hard absent an international agreement ensuring that the rich cannot simply relocate, thereby escaping taxation. Pressured by the US, Europe, and Japan, the G20 could therefore create a comprehensive agreement to combat international tax evasion.

Growth returning

A renewed commitment to global trade could then ensure a return of higher global growth rates. The continuous exchange among the global innovation hubs could prevent the balkanization of online and communication standards and create significant breakthroughs in fields such as AI, genetics, and robotics, which in turn could spur productivity growth in the developed world. Western governments could use an increased tax on tech companies to compensate workers hurt by automation and increased use of robotics in manufacturing.

In China, a new social contract could emerge, one that enhances welfare programs and creates more opportunities for the middle class. Although Xi might be history, his anticorruption campaign could gather new momentum as Chinese leaders seek to bolster inclusive growth.

The US under new leadership would re-join the international community in fighting climate change, though the efforts to lower emissions may still not make the hoped-for difference. Coal would remain king in the developing world, where economic growth is prized over environmental preservation. The US and the rest of the West would seek to increase assistance to the developing world so China is not its only patron. Much more assistance aimed at boosting renewable energy sources would be needed to incentivize clean growth in the developing world.

From nationalism to global cooperation

With climate change accelerating and becoming an obstacle to growth, the international agenda could begin to see significant shifts. Some countries could initially flirt with geoengineering to solve their climate challenges, but those efforts often lead to unintended negative consequences, both for themselves and their neighbours. Over time, just as countries had to band together to fight inequality, rapid climate change and its associated economic toll on all major powers could lead them to emphasize cooperation over competition on this issue too. All this new cooperation would form the basis for more extensive cooperation on peace-building. The leading military powers (US, Russia, and China) could agree on a global defence spending freeze and successfully negotiate new international conventions on the ban/limitation of the militarisation of space, biological and cyber weapons.

Conflict would not completely go away: the Middle East, Africa, and Central Asia would continue to experience civil wars, terrorism and insurgencies. The major powers would, however, seek to dampen those conflicts instead of turning them into proxy wars and would cooperate on fighting terrorism.

Implications for the insurance industry

As the two dramatically different scenarios just outlined demonstrate, geopolitics is a growing uncertainty and risk. Gone are the assumptions of a decade ago about the permanence of globalisation or a Western-led rules-based order. We live in an unstable world where geopolitics and globalisation are being transformed.

In this “extremist” world where the alternatives are almost diametrically opposed to one another, we are likely to see growing demand for political risk insurance. The potential for contagion from one issue domain or geography of political risk to others will also make risk assessments challenging. The frequency and scale of losses is likely to increase in what will be a less stable environment. In addition to insisting on key preventive and protective measures as a condition of cover, the industry therefore faces the challenge of keeping capitalisation requirements under constant review when few basic assumptions can be made. Financial planning is especially hard when the possible scenarios are so divergent.

This context does not necessitate hauling up the drawbridge—as there will be opportunities even in adversity—but being proactive in investing in a deeper understanding of the risks. A systematic effort is needed to understand the risk environment, develop scenarios on how they could affect key industries, and then determine the measures required to mitigate those risks, both to aid a sensible approach to underwriting and for effective management of the insurance industry's own investment portfolios. This may involve partnerships and investments in open source intelligence and foresight platforms that can deliver next generation risk insights.

Too often, decision-makers wait until the crisis is upon them before acting, by which time it is too late. It takes judgment and courage to make decisions amidst uncertainty, when the storm clouds are not yet visible. Yet waiting often lessens the effectiveness of any actions aimed at averting the threat.

A first step in assessing risk for many multinational firms comes from understanding how global value chains could be impacted by such geopolitical forces as trade disputes, conflict, climate change and shifting tax or regulatory regimes. Anticipating what the implications would be for business operations from specific changes in the environment must come before figuring out ways to lessen them, including alternative options for how businesses are currently positioned.

Insurers working with large multinational clients can help by developing supply chain risk assessments, including use of innovative modelling techniques that use artificial intelligence to generate a wider array of scenarios and desirable mix of policies favouring positive outcomes.[9] These new methodologies not only identify risk exposures but opportunities that could arise in the changing geopolitical context. Insurers can also be helpful in elevating the risks discussion to a higher level in firms by organizing regular briefings for the C-suite on geopolitical trends and events and their likely effects on businesses. This could open a two-way communication between senior management and insurers, resulting in an increased focus on geopolitics in the overall strategy and planning by firms.

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6 Curbs on Chinese investments in US tech is already happening. https://www.chinalawblog.com/2019/01/new-cfius-rules-shut-down-chinese-investment-in-u-s-technology.html.

7 https://home.treasury.gov/policy-issues/international/the-committee-on-foreign-investment-in-the-united-states-cfius.

8 https://www.pewresearch.org/fact-tank/2018/09/06/the-american-middle-class-is-stable-in-size-but-losing-ground-financially-to-upper-income-families/.

9 See the author's *Global Risks 2035 Update: Decline or New Renaissance*, pp 76-77 on the Atlantic Council, Washington DC website at www.atlanticcouncil.org.

INSURANCE FUTURES

Cities: Underwriting risk and innovation

By Peter Kingsley of The Oracle Partnership

FEBRUARY 2020

Cities: on the edge

Cities concentrate creativity, jobs and economic power. They also concentrate risk. At the same time they are playing a leading role in driving the sustainability agenda, often in the face of weak national political commitments to large-scale, urgent change. Most recently, the C40 coalition, a collaboration of city mayors, announced support for the Global Green New Deal and targets to cut emissions in half by 2030.

Cities are on the front line in the race to reduce climate change and biosphere risks, and avoid the 'too little, too late' scenario. The decisions city leaders take over the next decade will shape the future of the planet. Time is short.

The insurance industry has a vital role to play in underwriting and financing responses to both the physical and systemic transition risks, working in partnership with city leaders. It also has an opportunity to drive systemic innovation, in the public interest.

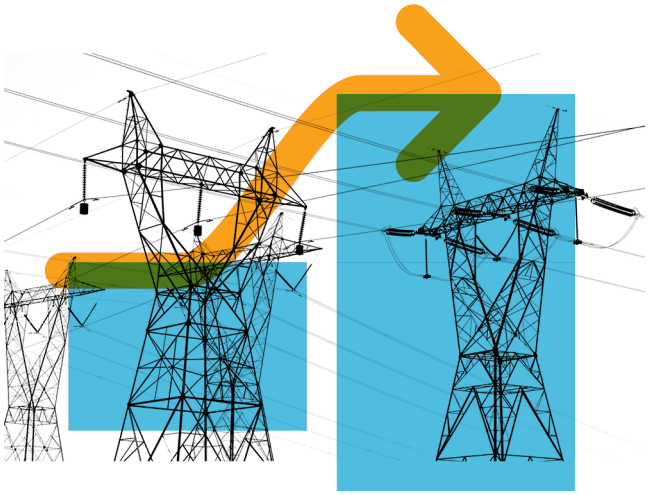
The challenges are formidable. They range from extreme urban temperatures, intense rainfall, storm surges, frequent flooding, higher sea levels and pollution to wildfires, droughts, food shortages, mass migration and population growth. Urban areas consume 78 per cent of global energy and produce 60 per cent of carbon emissions.[1] According to the World Health Organisation, 93 per cent of the world's children breathe toxic air every day.

Some of the world's leading cities will become uninhabitable, sooner or later, as sea level rises overwhelm defences. The stark choice looming on the horizon is invest in long-term resilience that is credible to investors and insurers, or retreat to higher ground.

Many of the challenges might be met over generations, not a decade or two. Some of these demands they impose are in conflict: find a path to zero emissions and zero waste; cut pollution; secure water and food supplies; generate jobs; re-invent mobility; and transform well-being and health.

Above all, the urgent priority is to cut fossil fuel consumption. The fundamentals of energy in particular are a major barrier to sustainability. Energy consumption is expected to rise by almost 50% to 2040 and world population by two billion. Multiple projections suggest that without structural change, supplies will continue to be dominated by oil, gas and coal, despite rapid growth in renewables and the revolution in electric vehicles. We may see runaway climate change and growing social unrest in the world's major cities if energy fundamentals are not transformed.

Cities face similar challenges to financial institutions and corporations. One of the principles that underpins this series of essays is that in a world characterised by complex interdependencies, radical uncertainty and speed, the challenge is to invent hedging strategies that will work, even in the most extreme scenarios, short and long-term. This defines resilience.



The challenges are not just about 'physical', natural world and infrastructure risk, but risks associated with cultural change. Transparency, led by public activism and investment specialists will transform the risk landscape, leaving some systemically important cities, sectors and companies facing existential failure if they cannot adapt quickly. If cities are to attract investors and insurance support, as well as talent, they need sustainable narratives to match the sustainable world narrative.

This essay explores a single, pivotal theme: that narratives about the resilience and inventive capability of individual cities to climate change risk over the long-term will shape the endgames. In other words, the 'imagined future', derived from innovative ideas, sophisticated data aggregation, and scenario and complexity modelling will set the agenda and determine the winners and losers.

Radical transparency

The starting point is that radical transparency will expose cities around the world to detailed scrutiny. Models will show vulnerability in a variety of scenarios to everything from floods and sea level rise, to storm surges, both short and long-term. One recent example shows vehicle emissions in US cities over the last three decades at a granular level.[2] These new forms of analysis will ultimately force city leaders to develop coherent strategies that demonstrate resilience, or face losing investor and insurance support.

To put this in another context, there is evidence that credit ratings agencies, institutional investors and insurers—who stand at the top of the asset management system—are already pricing climate risk into municipal and corporate bonds.

In the past, climate risk was seen as a long-term challenge that could be addressed over time. No longer. Wildfires in California and the disasters in Australia illustrate that extreme weather is clear and present. Fears of both physical risk and future, simulated financial market risk, have momentum. Regulators are demanding that financial institutions assess climate risk, as the Prudential Risk Authority puts it 'over decades', to 2050. The interplay between short and long-

term investment perspectives and insurance modelling is a new frontier for financial services, corporations and, above all, for cities that face the challenge of transforming core infrastructures at scale and against shortening timescales.

Radical transparency will pervade the risk landscape as more complete information and sophisticated predictive modelling and real-time decision support tools emerge. This means short-term action to develop scenarios and strategies for the long-term will have immediate, systemic impacts (see Financial Stability: inventing the big hedge in this series of essays).

In parallel, investigative journalism is exposing contradictions between green 'rhetoric and reality'. Public activism, focused on language like 'climate emergency' has viral qualities, much of it felt directly in cities where, to some, it presents security risks.

Equally important, institutional asset managers, credit ratings agencies, academic researchers and risk specialists are developing data sources, climate scenarios and complexity models that will reveal how individual cities, core infrastructures and industry sectors are vulnerable. Catastrophe models, until recently focused typically on short-term risk, are beginning to rise to the challenge of evaluating complex risk over time.

Hyper-localisation

This fundamental change in perspective, from short to long-term and from generalised views of global climate risks to detailed impact maps transforms not just risk, but geography.

Whilst carbon emissions and sea level rise are global, the real impacts and challenges are uniquely local. Each city and coastal region has particular systemic vulnerabilities and faces future scenarios specific to local geography, demographics, economic models and infrastructure. There is no one-size-fits-all. Some cities are sinking for natural structural reasons. Some have developed rapidly on outdated assumptions, making them vulnerable to subsidence. Many are also vulnerable to torrential rain and flash floods that are likely to become more common as global temperatures rise. The threat, in other words, is from the sea and the sky. Houston is an example: planners ignored warnings that development left some areas acutely vulnerable to heavy rain and flooding.

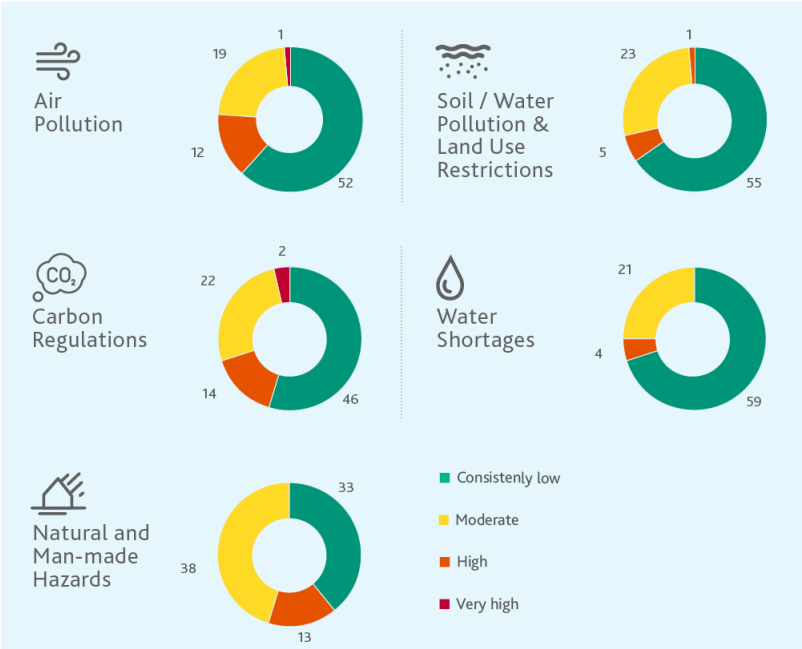
The long-term security of coastal regions depends not simply on climate, oceans and geography, but on multiple local factors, from the politics of foreign aid and investor confidence, to the quality of resilience-oriented designs and 'managed retreat'.

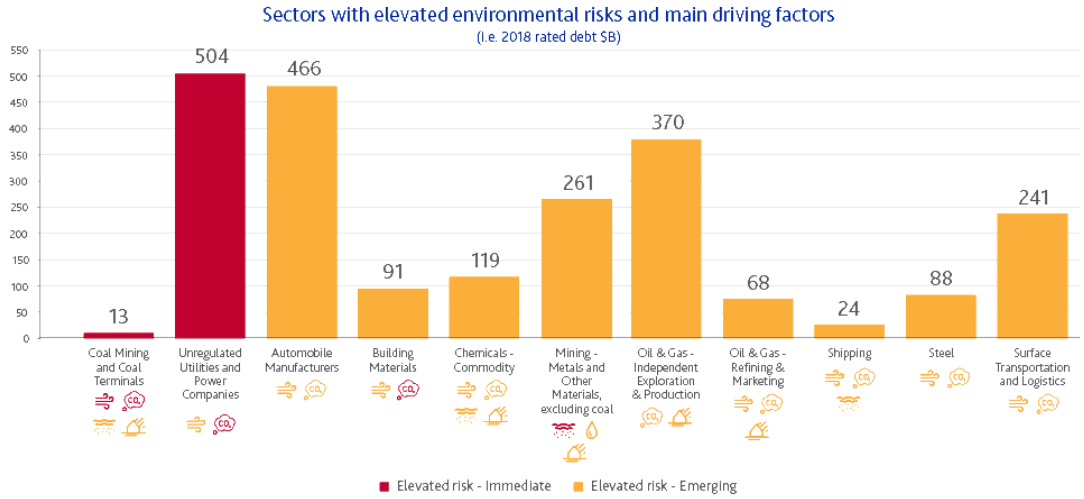
Take some examples. In 2017, the drought in Cape Town and lack of resilient water infrastructure led to a downgrade by Moody's. Wildfires in the Trinity Public Utilities District in California led to similar downgrades in 2019. Moody's have developed a 'heat map'[3] that shows the credit exposure to environmental risk across sectors representing US$74.6 trillion in debt. In the short-term, the unregulated utilities and power companies are exposed to 'elevated risk'. The risks to automobile manufacturers, oil and gas independents and transport companies are growing.

Blackrock's report from April 2019, focused primarily on physical climate risk, showed that securities backed by commercial real estate mortgages could be confronted with losses of up to 3.8 per cent due to storm and flood related cash flow shortages.[4] Climate change has already reduced local GDP, with Miami top of the list. The report was amongst the first to link high-level climate risk to location analysis of assets such as plants, property and equipment.

In other words, adaptation and resilience options are also uniquely local. The outcomes hinge on mapping long-term interdependencies to predict physical world changes and explore how core economic and social systems transition to a sustainable world. The redesign, renewal and re-engineering of resilient core city infrastructures has, as Goldman Sachs puts it 'the potential

to drive one of the largest infrastructure build-outs in history' in which both innovative financing and innovative insurance play a role.[5] City-wide engagement of all stakeholders in all aspects of the urban redesign is a source of both risk and opportunity.





Adapt or retreat

This perspective cannot be reduced to debates about insurance risk, asset management judgment, infrastructure re-design, or city futures, as if they exist in isolation. It is about a 'system-of-systems' view, over time. Nothing is static: some cities will become uninhabitable. Others will adapt. Others will be naturally resilient, even in the most extreme possible futures.

In any case, investment and insurance sentiment and judgment will be more recursive than ever as key indicators of resilience are refined and as cities respond.

Cities and key infrastructure companies will face higher insurance and funding costs if they fail to act, or produce convincing strategies.

From a financial perspective, for example, climate-resilient city utilities are already trading at a premium. Cyrus Taraporevala, President of State Street Global Advisors predicted recently that investors will reward companies that focus on the long-term through a 'patience premium'. The same will apply to individual regions and cities.

From an insurance perspective, some cities face heightened risks before they are forced to retreat to higher ground. The Indonesian government's decision to relocate Jakarta is a sign of things to come.

For the rest, heightened risks may simply mean higher premiums, or lack of insurance availability, which will amplify the protection gap, increasing pressure on government institutions, the public, or both. The picture is not simple. For example, some parts of cities will be more resilient than others, or more vulnerable to specific risks like flooding. Perspectives are changing, as more advanced catastrophe models, geospatial techniques and property-specific information—down to a few metres—automates underwriting and refines the relationship between price and risk.

The problem is that many models, at least for the time being, rely on historical data. They lack scenario-based, forward-looking context. Given the uncertainties associated with climate science and systemic failures to core infrastructures like power and water networks, city leaders face a decision that in practice is rooted in how they see time. Long-term, to 2100, sea levels are projected to rise by up to three feet. Sea level rise is 'locked in' and irreversible. In more extreme scenarios, with global temperatures rising to four degrees Celsius above pre-industrial levels, rises of 27 feet and more are possible.

Model risk comes in many forms. Models are estimates, capturing some dimensions of, say, climate and simplifying real-world complexity. Others are proved inaccurate, or incomplete and are refined over time. One example illustrates fundamental uncertainties: the so-called 'sensitivity' of global warming to carbon emissions. According to established models going back decades, warming was expected to increase between two degrees and four and a half degrees over pre-industrial levels with a doubling of carbon dioxide in the atmosphere. New models suggest five degrees centigrade[6] may be more accurate.

This level of uncertainty alone explains why policy based on achieving certainty and consensus before action is taken is fundamentally flawed. More important, it explains why scenarios that explore extreme possible, distinct from probable or consensus, outcomes, are so important. The gold standard for city leaders is to develop strategies that work in even the most extreme futures—one of the recurring themes of these essays.

Regardless of the primary uncertainties and model risk, city adaptation strategies will come under ever-increasing scrutiny. The dangerous myth is that long-term resilience is a technological and financial challenge that can be met by building sea defences and adopting flood-resistant architecture.

Exploring extremes, if a sustainable environment is to be delivered and the natural world regenerated, the underlying narrative reads: ban or heavily tax oil, gas and coal consumption; ban fossil fuel transport; impose heavy restrictions or costs on commercial aircraft until they are sustainable; close non-renewable primary power plants. This may seem unimaginable, yet there is growing evidence that this is the pathway ahead.

The questions are about how and when. Take mobility. On the near horizon, as we illustrated in *Radical Innovation*, the convergence of hydrogen fuel cells and electric vehicles, city-scale sensor networks, traffic and vehicle automation, 'mobility as a service', and restrictions or bans on fossil fuels are all emerging. Cities like Copenhagen, Amsterdam and Helsinki illustrate what is possible. In Brazil, Curitiba has transformed bus transport. In China, autonomous electric vehicles look set to dominate urban centres within a decade.

Scenarios

To recap, cities face major challenges from rising temperatures, extreme rainfall, storm surges, flooding, higher sea levels, pollution, wildfires and population growth. If they respond with aggressive restructuring agendas to deliver long-term sustainability, there may be high short-term political costs. Policy and regulatory complexity, uncertainty and growing volatility add to risks.

In the most likely scenario, many cities face both extreme weather and long-term climate risks and at the same time major economic, political, social and cultural disruption, driven in part by the imperative for exponential innovation.

Maintaining social security and stability in the face of climate change is one of the defining challenges of the 21st century. Mass migration will expose cities to a new class of security and political pressures.

At one extreme, many of the world's cities fail to deliver coherent resilience strategies against short and long-term risks. Sea defences will fail to protect the most exposed coastal regions and become a decisive factor in raising long-term infrastructure capital. In this scenario, public loss of confidence in city leadership, weak investment funding and insurance restrictions on major developments create political crises. Funding and insurance for renewal of water, energy, agricultural and transport systems become prohibitive. Residential housing prices collapse in vulnerable areas that fail to develop coherent strategies.

In this scenario the insurance protection gap widens, as local and national governments and insurers scale back. This sends shockwaves through political and financial systems. It creates a chaotic risk and investment environment, squeezing the insurance and re-insurance markets. The impacts are, however, specific to individual locations.

In an alternative scenario, city leadership teams, many collaborating across regional and national boundaries, pioneer a sustainability revolution. They take radical action, irrespective of national and international political agreement. Long-term assessments of risk for particular locations shape the investment and insurance industry agenda. Vulnerability is assessed according to a set of new criteria, from long-term projections about sea levels and temperatures to resilient

infrastructure. Flexible, adaptive, ecosystem-oriented strategies emerge that provide assurance against even the most extreme scenarios. A new realism about long-term risks and the importance of flexible strategic options emerges. Digital technologies transform understanding of strategic and operational risk.

For some cities, radical transformation is seen as an opportunity to address long-standing social and cultural inequalities. Cities are re-invented and redesigned, not just to meet the challenges of climate risks, but wider and deeper questions of security and automation. Transport is revolutionised within a decade, cutting both emissions and pollution, easing pressure on urban space and opening up sustainable regeneration of central areas. Food production is localised. Energy efficiency and renewables focus on decentralised self-sufficiency as green investment delivers jobs.

Insurance: Underwriting long-term security

In all scenarios, at least in some parts of the world, retreat to higher ground, or to cooler, climate-resilient regions will emerge as the preferred option, driving mass migration, even in the most developed, wealthy countries.

In the more extreme climate scenarios, even amidst radical innovation, corporations will relocate at scale, contributing to the emergence of havens, as an entirely new political and economic geography emerges. Climate resilient cities and regions will attract both investors and talent.

For the insurance industry, sanctuaries on the new, post-retreat front line of climate change will become focal points of activity. Underwriting of relocation risk will become a growing market. As we have described in separate essays, the convergence of green technologies with sensor networks; the Internet of Things; and artificial intelligence will transform the risk environment. Augmented and hybrid reality; drones, robotics; and mass automation will add to the momentum.

Early warning, prediction and machine control systems will become pervasive. Complexity risk alone may slow progress. In any case, demand for risk products and advisory services will rise.

More specifically, both government insurance systems and the industry play a vital role. In cities, how risk is shared between the public, government and private insurers will remain highly contested. There is, however, a shared agenda, which begins with cutting energy demand, primarily through well-known efficiency measures.

City-scale projects that demonstrate long-term resilience through vision-led innovation that integrates multiple services, such as water, waste management, energy and transport, will be rewarded. Insurers are key stakeholders, with multiple options, including:

- Increasing premiums or withdrawing insurance cover for fossil-fuel intensive sectors, such as oil, gas, coal and transport;
- Reducing premiums and tax burdens for cities, municipal areas and corporations that make long-term commitments to sustainable development and reduce systemic risk. For example, banning development on projected flood plains, or encouraging reforestation, or building ‘natural’ defences such as wetlands and marshes;
- Delivering novel predictive models, 3D virtual reality tools (such as ‘Virtual Singapore’), to design support and real-time monitoring by city planners so they can assess and price infrastructure design, renewal and development risk; and
- Develop ‘mass automation’ and insurance systems that accelerate the growth of green transport systems, as illustrated in our essay on Radical Innovation, particularly to cut traffic volumes, density, energy use and pollution.

The overarching challenge for the industry is to play an active role in accelerating redevelopment, with multiple national and local government institutions, investors, infrastructure designers and the public.

1 Source: UN Habitat.

2 https://www.nytimes.com/interactive/2019/10/10/climate/driving-emissions-map.html?smid=nytcore-ios-share.

3 https://www.moodys.com/sites/products/ProductAttachments/Infographics/Environmental-Risks-Global-Heatmap-Overview.pdf.

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INSURANCE FUTURES

Financial market stability: Inventing the big hedge

By Peter Kingsley of The Oracle Partnership

JAUNARY 2020

Risk and opportunity

Regulators, banks, insurers, corporations and institutional asset managers share a problem: how to 'transition' to a sustainable world, whilst maintaining financial stability.

The two are in conflict. Timing is central. Climate, in many parts of the world, is changing fast. Culture, contrary to conventional wisdom, can change in weeks and months, as futures are re-imagined and new narratives emerge. Politics, even faced with long-term strategic and possibly existential risk, is characterised by prevarication and delay.

We can expect shocks to the financial system long before the full impacts of climate change are felt and sea levels rise, as investors make large-scale changes to their asset portfolios. The fundamental structures of asset management and insurance will be transformed. Some risks will be uninsurable. Radical transparency will force sectors, individual corporations and financial institutions to re-invent themselves, or face failure.

There are three broad long-term financial scenarios. The first is 'too little, too late', in which action to avoid the extremes of runaway earth systems and adaptation ultimately fails, irrespective of attempts to reduce emissions. There is no financial and economic transition to a sustainable world.

In the second, 'stable transition', the 'orderly' pathway that regulators, insurers and the investment community hope will be found, emerges. If we define resilience as a set of strategies that will work in all scenarios, even the most extreme, then this amounts to 'inventing the big hedge'. A set of adaptive options are created, delivering short and long-term action on climate change and zero-emissions, shaping a sustainable world and maintaining financial and economic stability.

The third, 'crisis now', operates on a shorter timeframe. This is a scenario in which the world economic and financial system is driven to crisis by sudden cultural changes that leave systemically important sectors and companies facing short-term existential risk and stranded assets. This essay explores the fragility of the financial system and some industry sectors; how hardening public attitudes, investor and regulatory pressure, together with political intervention creates unparalleled transparency and, with that, radical uncertainty.

It outlines the possible financial impacts of 'earth system' collapse and draws out scenarios from the complex underlying forces, mental models and cultures that will shape prospects for financial stability and security over time. It goes on to illustrate how the insurance industry has a decisive, central role in supporting vulnerable industries, corporations, institutions and cities, whilst both underwriting and investing in innovative sectors with sustainable long-term growth prospects.

Unhedged and fragile

The world's financial system is fragile and vulnerable. Long-ignored structural weaknesses range from public, private sector and corporate debt to the challenges facing pension funds and insurers in matching long-term liabilities to investments in a low interest rate environment.

There are fears that the end of the US dollar era will create instability and that cryptocurrencies will undermine financial structures. Trade fears and growing political risks, some driven by inequality, compound the problems. The combination of trade and currency wars, restrictions on technology and intellectual property, 'deglobalisation' and risks to security in the Middle East that raise oil prices may create 'supply shocks' and recession.

Some economists fear 'Japanisation', or 'secular stagnation'—the combination of deflation, weak growth and failing monetary stimulus packages. Europe may be heading in the same direction. Larry Summers, the former US Treasury secretary, said recently that "The United States is only one recession away from joining them."

For some time, some private and institutional investors have looked to direct investment, unconventional assets, corporate bonds and private equity for returns, reflecting a lack of confidence in conventional assets and public markets. Non-regulated 'shadow banking' has continued to grow and as many investors have turned to illiquid assets, in search of yield, concerns about market structures and stability grow.

Resistance and denial

Against this background, climate change is a force multiplier. It is a clear and present danger, yet there is widespread resistance to rapid structural change. A study of 3000 listed companies by Arabesque S-Ray in 2019 showed that 18% have disclosed plans aligned to respond to the 1.5 Celsius targets by 2050. One explanation is that companies are reluctant to reveal the full scale of emissions for fear of losing short-term investor and insurance support.

A report by the World Resources Institute suggests that only half of the world's 50 largest banks have made commitments to sustainable finance. In 2019, only seven of the major banks invested more in sustainable finance than fossil fuels.

The hedge, deliberate or not, is that they can continue to drive profits from existing business models until they are forced to change. For some corporate leaders, the current hedging strategy is to maintain business as usual, in order to satisfy shareholders and investors that rely on dividends for as long as possible. This is not, as we will see, an answer: the shocks may emerge at any time.

On the other hand, three-quarters of investors are using the climate rules set out by the Task Force on Climate-related Financial Disclosures (TCFD) before buying company shares. In a recent speech in Japan, Mark Carney, the governor of the Bank of England, said that if listed companies do not set out their climate-related risks, then regulators will impose standards.[1]

The underlying problem is that some sectors, such as aviation and the major carbon emitters, cannot re-invent quickly enough. Take aviation: 'green' aircraft, using next generation batteries, will not emerge for a decade or more. This explains why the response of airline leaders to the viral idea of 'flight shaming' included language like 'existential threat'. For growing numbers, flying is discretionary spending and so demand may fall abruptly. Carbon offsets are not an answer. Meanwhile, there are early signs of substitution: international rail has found new momentum.

Fossil fuel corporations and oil-dependent nation-states, both major sources of dividend income, face similar challenges: they cannot become 'green energy' specialists overnight. Total is investing in biofuels, Shell in electric power. Neither will transform the picture in the short timescales demanded by a growing number of public and investor activists. Meantime, massive carbon taxes and bans on fossil fuel vehicles in cities have momentum on political agendas.

Culture shocks

There is, above all, growing realisation that the financial system is vulnerable to long-term climate-related shocks. What is less recognised is the underlying narrative that multiple major cultural and structural adjustments are underway.

Shocks will emerge well in advance of events themselves, such as major floods and storms leaving some of the world's major cities, like Miami, uninhabitable by 2050. This is because markets and strategic asset management decisions are shaped by imagined futures—the cultural realities that determine whether investors should buy or sell, sooner or later.

According to conventional wisdom, culture changes slowly. The reality is that, in volatile, chaotic times, culture change can be abrupt. Faced with large-scale, radical uncertainty and the lack of a shared sense of purpose or vision at international level, a new narrative is emerging around urgent action. The recent shift in public attitudes to microplastics, the surge in global protests on climate change illustrated by the schools strikes and the momentum of the 'flight shaming' story illustrate.

Public, investor and regulatory pressures are aligning with a shared sense of purpose. Pressure will only increase, as images of extreme weather events dominate daily news headlines and social media. When lived experience makes language like 'climate crisis', 'climate emergency' and 'existential risk' real, sudden shifts in attitudes will undermine the narrative that climate is a problem solved by making commitments to be met in the distant future, say by 2050. Evidence of short-term action to meet long-term risks will be decisive.

Regulators: Prime movers

Against this background, the cumulative impact of fragility and resistance will put the financial sector, corporations and insurers under unprecedented scrutiny. Transparency will emerge as the dominant driver of disruptive, urgent change.

In the short-term, much of the pressure will come from regulators. Banking, insurance and corporations will be judged according to new criteria.

Take as an example the framework set out in the recent discussion paper for banking and insurance by the Bank of England's Prudential Regulation Authority (PRA) in the UK.[2] As recently as March 2019, the narrative was that the 'catastrophic impacts of climate change will be felt beyond the traditional horizons of most banks, investors and financial policymakers, imposing costs on future generations that the current one has no direct incentives to fix. Once climate change becomes a clear and present danger to financial stability it could already be too late to stabilise the atmosphere at two degrees.'[3]

In just a few months, the story has changed. The stakes are 'existential' and the realisation that there is little time left has galvanised action. The PRA has set out a framework on climate risk that requires banks and insurers to adopt a 'strategic approach' to evaluating long-term financial risks linked to climate change. The strategies must use long-term 'scenario analysis to inform strategy setting', governance and an approach to disclosure to investors.

Limiting the scenarios to climate may itself encourage reductionist thinking and fail to capture the full scale of potential inter-systemic failures. The challenge is to recognise the uncertainties surrounding the transformation of the global economy, rather than simply evaluating 'physical and transition' risks of climate change.

This is best seen as a holistic 'future-readiness assessment'. The PRA defines long-term as 2050. This is new to the vast majority of banks, insurers and corporate boards, who often operate on one to three-year time horizons. Few leaders in the financial and corporate worlds are practised in thinking long-term.

One of the consequences that the PRA notes is that many regulated institutions lack the experience, methods, specialist skills or imaginative talent to meet new demands for what amounts to a new way of thinking. This will slow implementation and itself increase financial market volatility.

Nowhere to hide

Transparency will be decisive in other ways. Understanding imagined futures and the narratives that describe them is as important in the short-term as mapping the complexities of long-term coastal resilience or asset class prospects and structures. Any futures readiness assessment must include socio-cultural forces, which are in play today, not 2050. The 'climate catastrophe', in cultural terms, is here and now.

Financial services firms and corporations will be judged by the rate at which they can align strategic re-invention with demands for action. They need a sustainable business narrative to match the sustainable world narrative. As Janet Yellen put it as long ago as 2003 when talking about Federal Reserve strategies "communication is policy". For banks, insurers and corporates, the narrative is not simply an expression of strategy, it is strategy.

The surge in granular information about the regions, cities and corporations most at risk from short and long-term physical changes, such as flooding and sea level rise will put the financial system in the spotlight. Intelligence techniques are improving. To illustrate, governance statements made by corporate leaders can be interrogated to reveal underlying strategic intent, revealing gaps between rhetoric and reality. Hedge funds are already developing shorting strategies. The upshot is that the intelligence and complexity modelling tools needed to make targeted judgments about everything from underwriting, to asset management, to supplier networks are emerging.

There is some way to go. The challenge is constantly changing context and uncertainty. Even so, rigorous, imaginative, company-specific long-term scenarios are rare and few corporates align strategies to scenarios. The gold standard for resilience is to match strategic options to scenarios and monitor them over time.

To recap, the portfolio options, from investor and insurance perspectives, should deliver answers to even the worst-case scenarios. The corporate playbook should be adaptive, as one scenario emerges over another.

Scenarios: Emerging extremes

TOO LITTLE, TOO LATE

In one possible scenario, irrespective of large-scale, urgent action to slow climate change, for many vulnerable parts of the world it is 'too little, too late'. The fears of a growing number of scientists are realised, as earlier estimates of the relationships between carbon emissions and rising temperatures prove understated. Carbon emissions already stored in the atmosphere, cumulative ocean-warming and melting ice sheets begin to drive 'runaway' conditions and biosphere collapse over the next two decades and beyond.

Climate change exposes structural weaknesses in politics, society and financial systems, leading to existential crises before the full impacts are felt. The narrative reads: worsening climate and weather systems; food, water and temperature crises; social unrest, mass migration, revolution and wars; radical innovation; political panic, policy errors and unintended consequences; accelerating financial chaos. Some regions and sectors are hit harder than others, reverting to subsistence conditions and isolation. Feedback loops emerge.

Despite central bank and regulatory intervention, support from corporate leaders and long-view asset managers, the finance sector fails to anticipate the scale or severity of the structural disruption. The lack of coherent management of systemic risks to the climate and the biosphere undermines confidence.

The insurance 'protection gap' increases due to the mismatch between demand and available capital. This leaves corporations, cities, the public and national governments exposed. Stranded assets and long-term liabilities dominate the agenda. In the extreme, sudden shifts in dominant investor and public narratives trigger panic and financial collapse. Shockwaves follow, with cascading impacts flowing through sectors, regions and nations.

STABLE TRANSITION

In a second scenario, temperature rises are moderated slowly over time. The theoretical models that suggested the Paris Agreement of two degrees over pre-industrial levels could be achieved are proved broadly right. The worst impacts are avoided. Vulnerabilities are met with 'systemic innovation' in everything from global governance to coastal ecosystems. The 'transition' to a sustainable economy follows a 'predictable', if rocky and hazardous path.

There are financial and corporate winners and losers, since some companies cannot re-invent themselves strategically, or quick enough to keep pace with growing public, investor and political pressure, to the new economy.

This pressure on corporate leaders, the finance and insurance sector plays a vital role in preventing extreme outcomes. The financial system, seen as a whole, is hedged, in anticipation of emerging endgames and the so-called 'transition risks'. The finance sector, insurance and credit agencies are prime movers in shaping a sustainable economy. Trillions of investment dollars are directed towards corporates that match short-term action to environmental promises.

CRISIS NOW

A third scenario emerges on a shorter time frame. The financial system is thrown into short-term crisis by sudden cultural changes that leave entire sectors facing existential risk, long before the full impacts of climate change, or on corporate profits, take hold. The underlying narrative that having created climate change, the mechanisms can work in reverse and the rate of change brought under control proves unsustainable.

The convergence of public, institutional and political pressures delivers systemic failures in corporate value and assets. This is before, for example, vulnerable cities experience direct impacts from changing climactic conditions. In this scenario, the shocks are driven by social, cultural and political action. Total transparency plays a vital part.

The realisation that coastal cities in India, or the Eastern seaboard of the US, cannot be saved from extreme storms and flooding, is enough for investors and credit agencies to withdraw support. This amounts to a sudden, cultural shift, a new realism already clear in the structure of narratives about long-term resilience. Since real estate and investment markets depend on confidence, the story that critical assets can be defended, or migrated, is not sustained for long.

In this scenario, the integrated, fragile financial system, characterised by complex interdependencies, creates instability and crisis, as large numbers of investors take action to avoid the long-term, risks associated with stranded assets and poorly performing portfolios.

INSURERS: INVENTING THE BIG HEDGE

These scenarios raise the question of how insurers can contribute to the invention of the big hedge, both in their own interests and broader social terms. What options will work, in all scenarios?

The first option, well documented but not widely implemented, is to support and underwrite large-scale government borrowing and, with that, corporate national and regional investment in sustainable development and infrastructure. More specifically, in a world where some regions face long-term existential risk, by directly investing in resilience measures, such as 'natural' defences, insurers can shape sentiment.

Geography is beginning to play a direct role in borrowing costs and long-term investments, since the impacts of climate change, whilst global, are specific to individual locations. We can expect property and casualty insurance to become hyper-local as climate models improve.

The second option, illustrated by AXA, is to withdraw insurance cover and investment from fossil fuels and polluting industries. This amounts to bringing forward the structural adjustment to the future operating environment, absorbing short-term business impacts in the public interest and building reputational assets. As CEO of AXA Thomas Buberl said in 2017, announcing divestment in tar sands companies, oil pipelines and coal "an increase of 4C is not sustainable and therefore uninsurable". AXA announced cuts in both underwriting and investment.

The third: to invest in complexity modelling, drawing together partnerships that target sustainable developments in vulnerable regions and easing the transition of sectors that have a long-term role, but short-term problems.

Insurers can take a leading role in delivering what Mark Carney calls 'high quality disclosure' insisting that their underwriting clients meet rigorous long-term risk management standards. This might include providing advice and services in everything from anticipating policy and regulatory interventions, to supporting tax incentives for sustainable policies. In broad terms, insurers are well-positioned to lead the development of environmental, social and governance (ESG) standards.

More generally, the industry has a public policy role. It can re-invent itself in the public mind by stressing its role in providing security, underwriting emerging, systemic risks and supporting financial stability, as well as driving systemic innovation, in say transport, in the public interest.

More important, insurers can underwrite ambitious infrastructure renewal projects, to accelerate change and minimise climate and biosphere risk. In a new sustainable economy, developing insurance products and services is an opportunity to not simply support systemic innovation, but to lead and drive it, giving inventors and investors confidence to take risks.

Backing rapid changes in transport networks and electric vehicles is one clear strategy, where both public and commercial interests can be aligned. This support can range more widely, from encouraging developing intellectual property regimes to support sustainable infrastructure in the world's major cities to direct innovation, in, for instance, extensive use of drones to improve risk assessment, management and claims.

Insurance and risk services are by definition a key part of any institutional hedging strategy. They define the boundaries of the risk envelope and shape risk appetite, particularly for investors and governments. It is easy to forget that insurers underpin risk assessments for investors, banks and corporate supply chains.

The industry has the opportunity to protect its own business models and support clients. Bespoke risk management and advisory services will complement the drive for greater automation and self-service. Catastrophe bonds and novel reinsurance instruments may form part of a reinvention of the industry, placing it at the centre of new partnerships with wider stakeholder groups to meet rising demand.

1 https://www.bankofengland.co.uk/-/media/boe/files/speech/2019/tcfd-strengthening-the-foundations-of-sustainable-finance-speech-by-mark-carney.pdf?la=en&hash=D28F6D67BC4B97DDCCDE91AF8111283A39950563.

2 https://www.bankofengland.co.uk/paper/2019/biennial-exploratory-scenario-climate-change-discussion-paper.

3 Mark Carney, Bank of England, https://www.bankofengland.co.uk/-/media/boe/files/speech/2019/a-new-horizon-speech-by-mark-carney.

More information on Insurance Futures and The Oracle Partnership can be found at:

oraclepartnership.com/insurance-futures

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