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Insight Report

The Global Risks Report 2018
13th Edition

MARSH & McLENNAN COMPANIES

Strategic Partner of the Report

MARSH GUY CARPENTER MERCER OLIVER WYMAN

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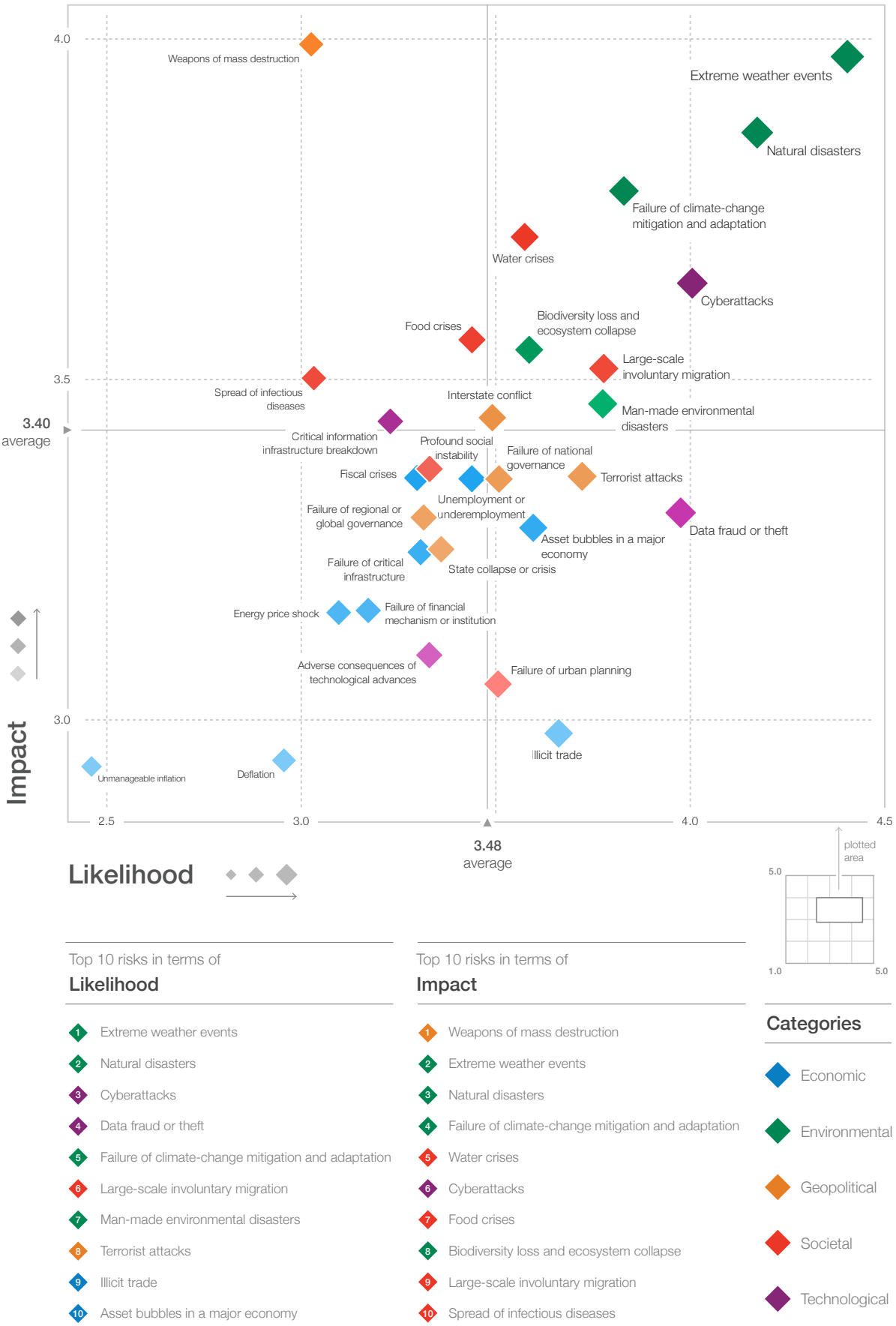
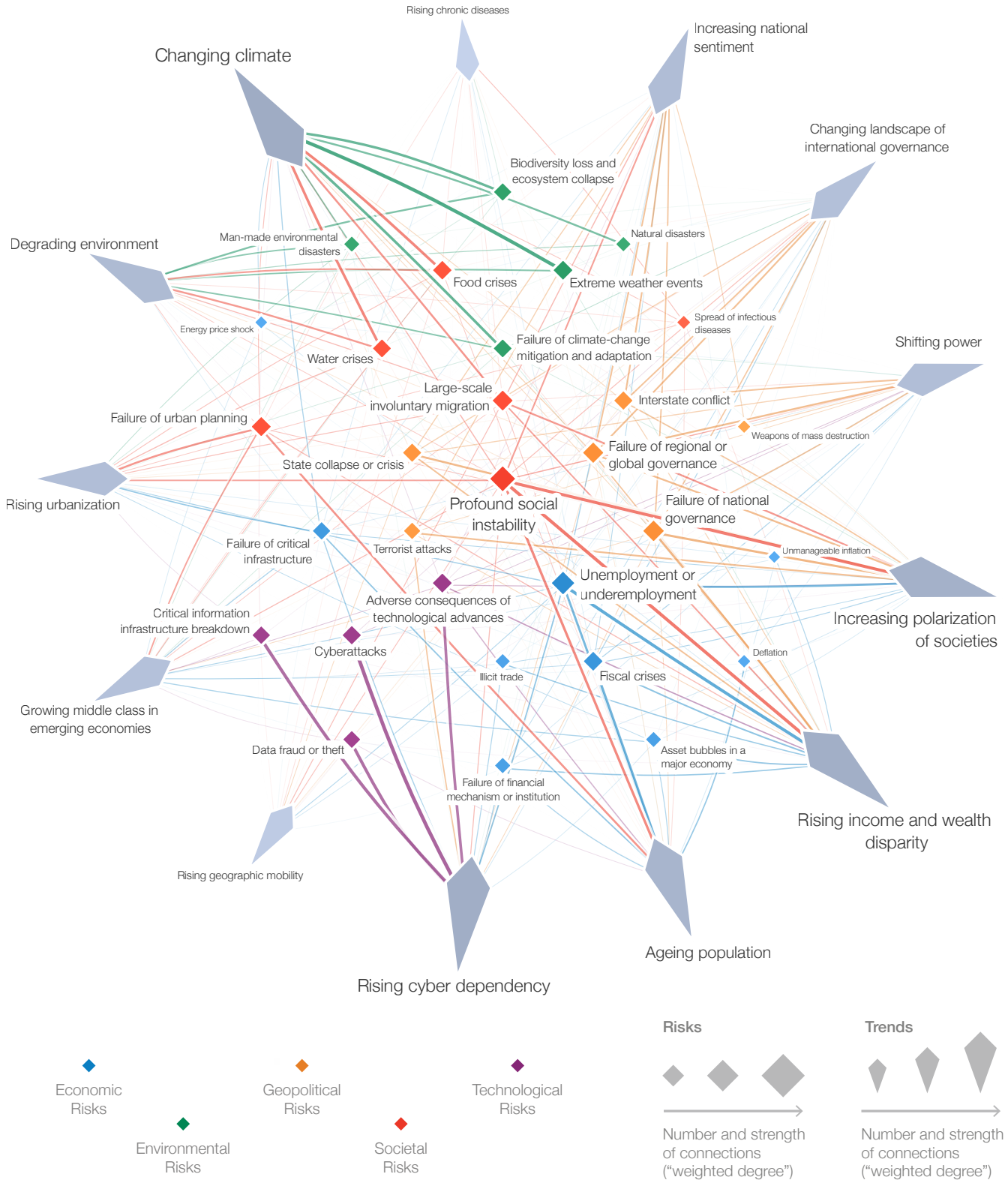
Figure I: The Global Risks Landscape 2018



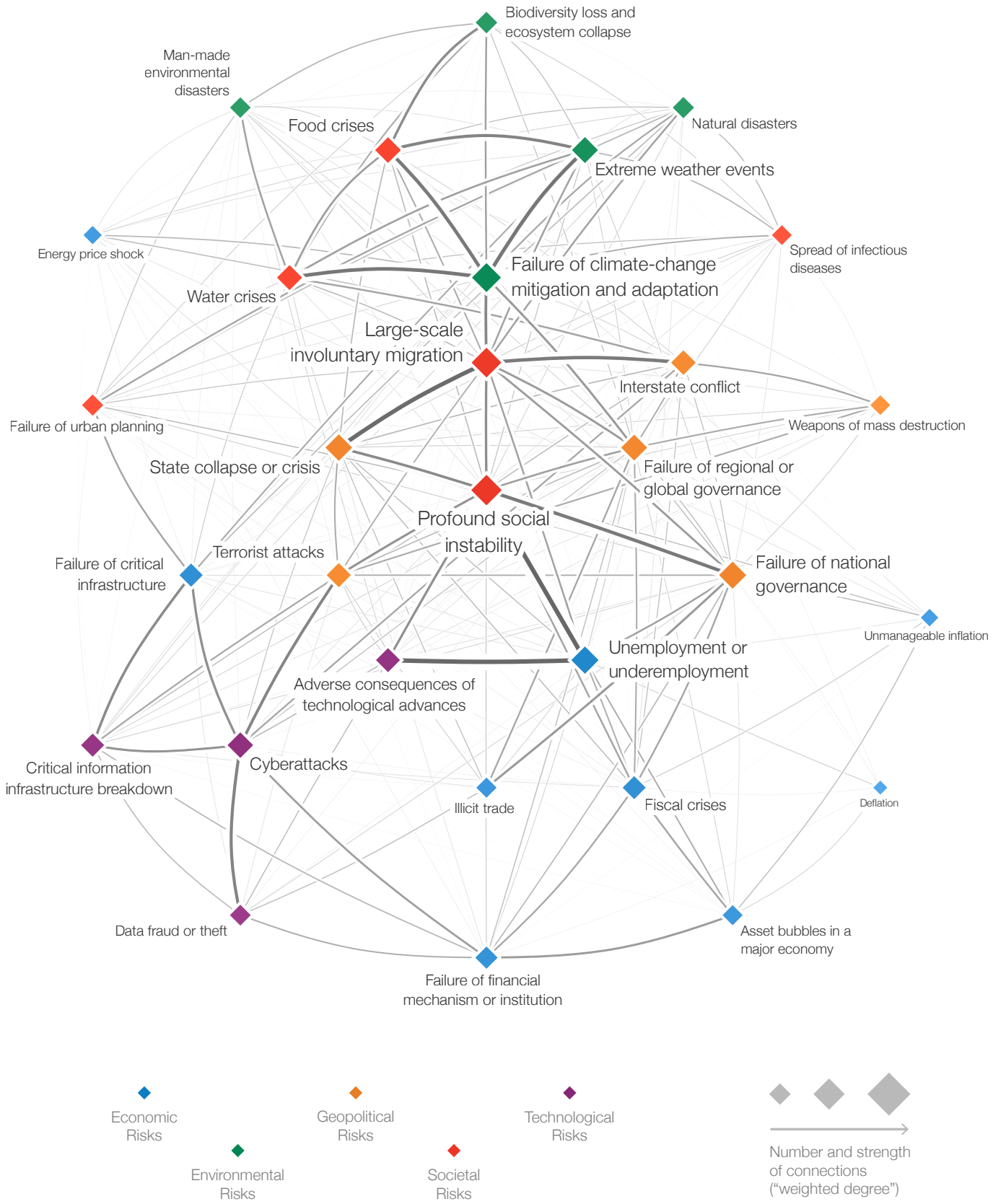
Source: World Economic Forum Global Risks Perception Survey 2017–2018.
Note: Survey respondents were asked to assess the likelihood of the individual global risk on a scale of 1 to 5, 1 representing a risk that is very unlikely to happen and 5 a risk that is very likely to occur. They also assess the impact on each global risk on a scale of 1 to 5 (1: minimal impact, 2: minor impact, 3: moderate impact, 4: severe impact and 5: catastrophic impact). See Appendix B for more details. To ensure legibility, the names of the global risks are abbreviated; see Appendix A for the full name and description.

Figure II: The Risks-Trends Interconnections Map 2018



Source: World Economic Forum Global Risks Perception Survey 2017–2018.
Note: Survey respondents were asked to select the three trends that are the most important in shaping global development in the next 10 years. For each of the three trends identified, respondents were asked to select the risks that are most strongly driven by those trends. See Appendix B for more details. To ensure legibility, the names of the global risks are abbreviated; see Appendix A for the full name and description.

Figure III: The Global Risks Interconnections Map 2018



Source: World Economic Forum Global Risks Perception Survey 2017–2018.
Note: Survey respondents were asked to identify between three and six pairs of global risks they believe to be most interconnected. See Appendix B for more details. To ensure legibility, the names of the global risks are abbreviated; see Appendix A for the full name and description.

Figure IV: The Evolving Risks Landscapes, 2008–2018

Top 5 Global Risks in Terms of Likelihood

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1st	Asset price collapse	Asset price collapse	Asset price collapse	Storms and cyclones	Severe income disparity	Severe income disparity	Income disparity	Interstate conflict with regional consequences	Large-scale involuntary migration	Extreme weather events	Extreme weather events
2nd	Middle East instability	Slowing Chinese economy (<6%)	Slowing Chinese economy (<6%)	Flooding	Chronic fiscal imbalances	Chronic fiscal imbalances	Extreme weather events	Extreme weather events	Extreme weather events	Large-scale involuntary migration	Natural disasters
3rd	Failed and failing states	Chronic disease	Chronic disease	Corruption	Rising greenhouse gas emissions	Rising greenhouse gas emissions	Unemployment and underemployment	Failure of national governance	Failure of climate-change mitigation and adaptation	Major natural disasters	Cyberattacks
4th	Oil and gas price spike	Global governance gaps	Fiscal crises	Biodiversity loss	Cyber attacks	Water supply crises	Climate change	State collapse or crisis	Interstate conflict with regional consequences	Large-scale terrorist attacks	Data fraud or theft
5th	Chronic disease, developed world	Retrenchment from globalization (emerging)	Global governance gaps	Climate change	Water supply crises	Mismanagement of population ageing	Cyber attacks	High structural unemployment or underemployment	Major natural catastrophes	Massive incident of data fraud/theft	Failure of climate-change mitigation and adaptation

Top 5 Global Risks in Terms of Impact

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1st	Asset price collapse	Asset price collapse	Asset price collapse	Fiscal crises	Major systemic financial failure	Major systemic financial failure	Fiscal crises	Water crises	Failure of climate-change mitigation and adaptation	Weapons of mass destruction	Weapons of mass destruction
2nd	Retrenchment from globalization (developed)	Retrenchment from globalization (developed)	Retrenchment from globalization (developed)	Climate change	Water supply crises	Water supply crises	Climate change	Rapid and massive spread of infectious diseases	Weapons of mass destruction	Extreme weather events	Extreme weather events
3rd	Slowing Chinese economy (<6%)	Oil and gas price spike	Oil price spikes	Geopolitical conflict	Food shortage crises	Chronic fiscal imbalances	Water crises	Weapons of mass destruction	Water crises	Water crises	Natural disasters
4th	Oil and gas price spike	Chronic disease	Chronic disease	Asset price collapse	Chronic fiscal imbalances	Diffusion of weapons of mass destruction	Unemployment and underemployment	Interstate conflict with regional consequences	Large-scale involuntary migration	Major natural disasters	Failure of climate-change mitigation and adaptation
5th	Pandemics	Fiscal crises	Fiscal crises	Extreme energy price volatility	Extreme volatility in energy and agriculture prices	Failure of climate-change mitigation and adaptation	Critical information infrastructure breakdown	Failure of climate-change mitigation and adaptation	Severe energy price shock	Failure of climate-change mitigation and adaptation	Water crises

Economic · Environmental · Geopolitical · Societal · Technological

Source: World Economic Forum 2008–2018, Global Risks Reports.
Note: Global risks may not be strictly comparable across years, as definitions and the set of global risks have evolved with new issues emerging on the 10-year horizon. For example, cyberattacks, income disparity and unemployment entered the set of global risks in 2012. Some global risks were reclassified: water crises and rising income disparity were re-categorized first as societal risks and then as a trend in the 2015 and 2016 Global Risks Reports, respectively.

The Global Risks Report 2018
13th Edition

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Preface

Klaus Schwab
Founder and Executive Chairman
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President
World Economic Forum

The World Economic Forum presents the latest *Global Risks Report* at a transformational time for the world. Encouraging signs suggest that we have put the worst financial crisis of the post–World War II period behind us. Globally, people are enjoying the highest standards of living in human history. And yet acceleration and interconnectedness in every field of human activity are pushing the absorptive capacities of institutions, communities and individuals to their limits. This is putting future human development at risk. In addition to dealing with a multitude of discrete local problems, at a global level humanity faces a growing number of systemic challenges, including fractures and failures affecting the environmental, economic, technological and institutional systems on which our future rests.

This generation enjoys unprecedented technological, scientific and financial resources, which we should use to chart a course towards a more sustainable, equitable and inclusive future. And yet this is perhaps the first generation to take the world to the brink of a systems breakdown. There are many signs of progress and many reasons for hope—but we still lack the momentum and the necessary depth of collaboration to deliver change on the scale required. By providing a global platform for public-private collaboration, the World Economic Forum seeks to advance this goal by working with governments, businesses and civil society organizations to find new ways of tackling the systemic risks that affect us all.

We have to work together—that is the key to preventing crises and making the world more resilient for current and future generations. Humanity cannot successfully deal with the multiplicity of challenges we face either sequentially or in isolation. Just as global risks are increasingly complex, systemic and cascading, so our responses must be increasingly interconnected across the numerous global systems that make up our world. Multistakeholder dialogue remains the keystone of the strategies that will enable us to build a better world.

Our hope is that this edition of the *Global Risks Report* and the debates it fosters at the World Economic Forum's Annual Meeting 2018 will focus minds on the need for systems thinking and new ways of collaborating globally and involving all stakeholders. This year's report grapples with some of the most pressing challenges that we face, including biodiversity loss, cybersecurity threats, rising geopolitical tensions, and the risk of another financial crisis erupting. A new "Future Shocks" section highlights the importance of being prepared not just for familiar slow-burn risks, but for dramatic disruptions that can cause rapid and irreversible deterioration in the systems we rely on.

The *Global Risks Report* occupies a unique position in the World Economic Forum, at the heart of our deepening partnerships with the world's governments and international organizations. It operates across the network of thematic, industry and regional teams that shape our systems-based approach to the challenges facing the world. This allows it to leverage the full extent of the Forum's internal expertise as well its global expert networks in order to analyse the evolution of global risks. As in previous years, this year's report also draws on our annual Global Risks Perceptions Survey, which is completed by around 1,000 members of our multistakeholder communities.

As one of our flagship reports, the *Global Risks Report* is a collaborative effort and we would like to thank all those across the Forum and its communities who have contributed to this year's edition. We are particularly grateful for the energy and commitment of the report's Advisory Board. We would also like to thank our long-standing strategic partners, Marsh & McLennan Companies and Zurich Insurance Group, as well as our academic advisers at the National University of Singapore, Oxford Martin School at the University of Oxford and the Wharton Risk Management and Decision Processes Center at the University of Pennsylvania.

Executive Summary

Last year's *Global Risks Report* was published at a time of heightened global uncertainty and strengthening popular discontent with the existing political and economic order. The report called for "fundamental reforms to market capitalism" and a rebuilding of solidarity within and between countries. One year on, a global economic recovery is under way, offering new opportunities for progress that should not be squandered: the urgency of facing up to systemic challenges has, if anything, intensified amid proliferating indications of uncertainty, instability and fragility.

Humanity has become remarkably adept at understanding how to mitigate conventional risks that can be relatively easily isolated and managed with standard risk-management approaches. But we are much less competent when it comes to dealing with complex risks in the interconnected systems that underpin our world, such as organizations, economies, societies and the environment. There are signs of strain in many of these systems: our accelerating pace of change is testing the absorptive capacities of institutions, communities and individuals. When risk cascades through a complex system, the danger is not of incremental damage but of "runaway collapse" or an abrupt transition to a new, suboptimal status quo.

In our annual Global Risks Perception Survey, **environmental** risks have grown in prominence in recent years. This trend has continued this year, with all five risks in the environmental category being ranked higher than average for both likelihood and impact over a 10-year horizon. This follows a year characterized by high-impact hurricanes, extreme temperatures and the first rise in CO_2 emissions for four years. We have been pushing our planet to the brink and the damage is becoming increasingly clear. Biodiversity is being lost at mass-extinction rates, agricultural systems are under strain and pollution of the air and sea has become an increasingly pressing threat to human health. A trend towards nation-state unilateralism may make it more difficult to sustain the long-term, multilateral responses that are required to counter global warming and the degradation of the global environment.

Cybersecurity risks are also growing, both in their prevalence and in their disruptive potential. Attacks against businesses have almost doubled in five years, and incidents that would once have been considered extraordinary are becoming more and more commonplace. The financial impact of cybersecurity breaches is rising, and some of the largest costs in 2017 related to ransomware attacks, which accounted for 64% of all malicious emails. Notable examples included the WannaCry attack—which affected 300,000 computers across 150 countries—and NotPetya, which caused quarterly losses of US$300 million for a number of affected businesses. Another growing trend is the use of cyberattacks to target critical infrastructure and strategic industrial sectors, raising fears that, in a worst-case scenario, attackers could trigger a breakdown in the systems that keep societies functioning.

Headline **economic** indicators suggest the world is finally getting back on track after the global crisis that erupted 10 years ago, but this upbeat picture masks continuing underlying concerns. The global economy faces a mix of long-standing vulnerabilities and newer threats that have emerged or evolved in the years since the crisis. The familiar risks include potentially unsustainable asset prices, with the world now eight years into a bull run; elevated indebtedness, particularly in China; and continuing strains in the global financial system. Among the newer challenges are limited policy firepower in the event of a new crisis; disruptions caused by intensifying patterns of automation and digitalization; and a build-up of mercantilist and protectionist pressures against a backdrop of rising nationalist and populist politics.

The world has moved into a new and unsettling **geopolitical** phase. Multilateral rules-based approaches have been fraying. Re-establishing the state as the primary locus of power and legitimacy has become an increasingly attractive strategy for many countries, but one that leaves many smaller states squeezed as the geopolitical sands shift. There is currently no sign that norms and institutions exist towards which the world's major powers might converge. This creates new risks and uncertainties: rising military tensions, economic and commercial disruptions, and destabilizing feedback loops between changing global conditions and countries' domestic political conditions. International relations now play out in increasingly diverse ways. Beyond conventional military build-ups, these include new cyber sources of hard and soft power, reconfigured trade and investment links, proxy conflicts, changing alliance dynamics, and potential flashpoints related to the global commons. Assessing and mitigating risks across all these theatres of potential conflict will require careful horizon scanning and crisis anticipation by both state and non-state actors.

This year's *Global Risks Report* introduces three new series: Future Shocks, Hindsight and Risk Reassessment. Our aim is to broaden the report's analytical reach: each of these elements provides a new lens through which to view the increasingly complex world of global risks.

Future Shocks is a warning against complacency and a reminder that risks can crystallize with disorientating speed. In a world of complex and interconnected systems, feedback loops, threshold effects and cascading disruptions can lead to sudden and dramatic breakdowns. We present 10 such potential breakdowns—from democratic collapses to spiralling cyber conflicts—not as predictions, but as food for thought: what are the shocks that could fundamentally upend your world?

In **Hindsight** we look back at risks we have analysed in previous editions of the *Global Risks Report*, tracing the evolution of the risks themselves and the global responses to them. Revisiting our past reports in this way allows us to gauge risk-mitigation efforts and highlight lingering risks that might warrant increased attention. This year we focus on antimicrobial resistance, youth unemployment, and "digital wildfires", which is how we referred in 2013 to phenomena that bear a close resemblance to what is now known as "fake news".

In **Risk Reassessment**, selected risk experts share their insights about the implications for decision-makers in businesses, governments and civil society of developments in our understanding of risk. In this year's report, Roland Kupers writes about fostering resilience in complex systems, while Michele Wucker calls for organizations to pay more attention to cognitive bias in their risk management processes.

REUTERS/ Rentsendorj Bazarsukh

Global Risks 2018: Fractures, Fears and Failures

Last year's *Global Risks Report* was published at a time of heightened global uncertainty and rising popular discontent with the existing political and economic order. The report called for "fundamental reforms to market capitalism" and a rebuilding of solidarity within and between countries. One year on, the urgency of facing up to these challenges has, if anything, intensified. Economic growth is picking up, but 2017 was a year of widespread uncertainty, instability and fragility—and the latest results of our annual Global Risks Perception Survey (GRPS) suggest respondents are pessimistic about the year ahead: in a new question gauging expectations for 2018, only 7% of responses point to a reduction of risk, compared with 59% pointing to an increase.[1] In the sections that follow, we highlight four concerns: (1) persistent inequality and unfairness, (2) domestic and international political tensions, (3) environmental dangers and (4) cyber vulnerabilities. We conclude by reflecting on the increased dangers of systemic breakdown.

Inequality and unfairness

One of the most striking findings of this year's GRPS is the reduced prominence of economic risks (see Figure I, The Global Risks Landscape 2018). This continues the trend of recent years: as the financial crisis has receded, economic risks have faded sharply in prominence in GRPS responses, replaced increasingly by environmental risks. The latest results come at a time of improvement in the global economy, albeit a relatively modest one—the International Monetary Fund (IMF) expects global GDP growth of 3.6% for 2017, up from 3.2% in 2016.[2] Recovery is underway in all of the major economies, leading to a sharp improvement in sentiment.

But it is important to ask whether this swing to optimism suggests the possibility of complacency and a developing blind spot around economic risks? There are certainly reasons to be cautious: one does not have to look far for signs of economic and financial strain. In the chapter Economic Storm Clouds (see page 18) we suggest that greater attention should be paid to the risks of another crisis erupting. Even without another crisis, economic risks can be hugely disruptive, and last year brought fresh evidence of chronic economic problems, particularly related to earnings and inequality. In its latest *Global Wage Report*, the International Labour Organization highlighted that worldwide earnings growth has been decelerating since 2012. It called, among other things, for the increased use of collective bargaining to reverse this trend.[3] While global inequality is down, within-country inequality is an increasingly corrosive problem in many places. According to the IMF, over the past three decades 53% of countries have seen an increase in income inequality, with this trend particularly pronounced in advanced economies.[4] Furthermore, today's economic strains are likely to sow the seeds for longer-term problems. High levels of personal debt, coupled with inadequate savings and pension provisions, are one reason to expect that frustrations may deepen in the years ahead.

59%

of survey responses point to increased risks in 2018

The importance of inequality is reflected again in the GRPS this year, with "rising income and wealth disparity" ranking third as a driver of global risks over the next 10 years. Automation is another potential driver of growing inequality, and this year's GRPS reflects increasing concerns about its impacts on the labour market. When respondents were asked to highlight the most closely interconnected risks, the most frequently cited pairing was "adverse consequences of technological advances" and "high structural unemployment or underemployment". Automation has already been a disruptive labour-market force,[5] and its effects are likely to be long-lasting as new technologies diffuse throughout the global economy.[6] For the foreseeable future, automation and digitalization can be expected to push down on levels of employment and wages, and contribute to increases in income and wealth at the top of the distribution.

These are not just economic risks. Norms relating to work are an important part of the implicit contract that holds societies together. If many people's hopes and expectations

relating to employment are fraying, we should not be surprised if this has wider political and societal effects. The idea that "the system is rigged" has gained electoral traction in recent years, and research suggests that concerns about inequality rest on more fundamental worries about societal fairness.[7] One fault line around fairness that came to particular prominence in 2017 is gender. The global gender parity gap across health, education, politics and the workplace widened for the first time since we began tracking it in 2006,[8] while a succession of high-profile cases are highlighting continuing endemic levels of sexual harassment, both in the workplace and in society generally.[9]

Risks of conflict

Debates about the populist surge of recent years tend to pit economic causes against cultural ones, but there is a strong case for arguing that the two are closely related—that economic pain has been sufficiently concentrated among groups and geographic regions for those groups and regions to begin to assert themselves politically.[10] Clashes related to identity and community continue to drive political dislocations in many countries and are increasingly fuelling cross-border tensions.

In the latest GRPS, societal polarization slipped slightly in respondents' rankings of the main underlying drivers of global risks—replaced in the top three by rising cyber dependency—but it remains a politically destabilizing force. This is perhaps still most evident in the United Kingdom and the United States, the two Western countries that recorded dramatic anti-establishment democratic results in 2016. The United Kingdom's political system is struggling to cope with the strains unleashed by the decision to leave the European Union, while in the United States deepening polarization has, among other things, weakened democratic debate and increased the confidence of far right movements.[11]

In Europe, fears about the rise of the far right were allayed by the victory of Emmanuel Macron in the French presidential election in May 2017—but perhaps at the risk of fostering complacency about the region's political stability. As highlighted by elections in Germany and Austria in late 2017, far right parties continue to grow in strength and influence in many European countries. More generally, issues of culture and identity are causing political tension within and between a growing number of EU countries, including Poland, Hungary and, in different ways, Spain. Polarization between groups with different cultural heritages or values looks set to remain a source of political risk in Western countries in 2018 and beyond.

Identity politics could fuel geopolitical as well as domestic risks. As discussed in the chapter Geopolitical Power Shifts (see page 36), charismatic strongman politics is on the rise across the world. In addition to the "America First" platform of President Trump, variations on this theme can be seen in numerous countries from China to Japan, Russia, Turkey, Saudi Arabia, the Philippines and elsewhere. The trend towards increasingly personalized power takes place amid rising geopolitical volatility. The escalation of geopolitical risks was one of the most pronounced trends of 2017, particularly in Asia, where the North Korea crisis has arguably brought the world closer than it has been for decades to the possible use of nuclear weapons. There are numerous other potential flashpoints around the world, not least in the Middle East, where an increasing number of destabilizing forces might lead to the eruption of new military conflicts in addition to those in Syria and Yemen.

Perhaps surprisingly given the febrile backdrop, there was relatively little movement of perception among the core geopolitical risks in the latest GRPS. However, when asked about risk trajectories in 2018 the level of concern is clear: 93% of respondents expect a worsening of "political or economic confrontations/frictions between major powers" this year. Perhaps more worryingly, nearly 80% of respondents reckoned that risks associated with "state-on-state military conflict or incursion" and "regional conflicts drawing in major power(s)" would be higher in 2018 than in 2017 (see Figure 1.1).

Geopolitical risks are exacerbated by the continuing decline in commitment to rules-based multilateralism. In 2017, President Trump delivered on some of his unilateralist campaign pledges, withdrawing the United States from both the Paris Agreement on climate change and the Trans-Pacific Partnership (TPP) trade deal. Although the United States has not withdrawn from the deal designed to halt Iran's nuclear weapons programme, the Joint Comprehensive Plan of Action (JCPA), in October 2017 President Trump signalled his

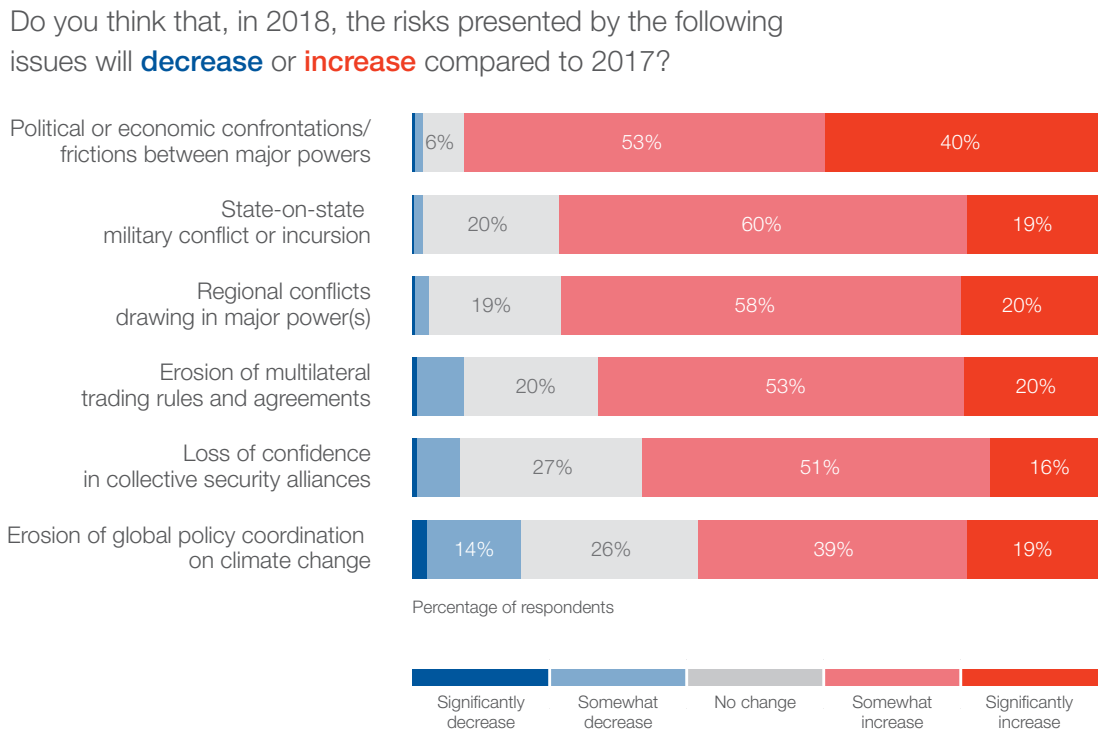
dissatisfaction by refusing to certify that Iran is in compliance with it. It is to important note that all of these agreements remain in place and that other states and non-state actors have sought to compensate for the waning multilateralism of the United States. Nevertheless, the erosion of institutions of multilateral dialogue and decision-making damages the prospects of reaching new global agreements at a time when the need for cooperation looks more urgent than ever.

One institutional risk that is likely to intensify in 2018 relates to the World Trade Organization (WTO) and its ability to resolve trade disputes. This is particularly important at a time when protectionist sentiment and policies are on the rise. However, the United States has been blocking appointments to the WTO's seven-member appellate body; since December 2017 only four seats have been filled and in theory the body could cease functioning in 2019. A weakening of the global trading system's institutional architecture creates risks beyond a renewed slowdown in trade and growth:[12] the possibility of trade tensions spilling over into increased geopolitical strains should not be dismissed. In this year's GRPS, 73% of respondents said they expect the risks associated with the erosion of multilateral trade rules and agreements to increase next year (see Figure 1.1).

Our planet on the brink

Environmental risks have grown in prominence over the 13-year history of the *Global Risks Report*, and this trend continued in the latest GRPS. All five risks in this category occupy the top-right quadrant of The Global Risks Landscape 2018 (see Figure I), indicating higher-than-average perceptions of both likelihood and impact. Among the most pressing environmental challenges facing us are extreme weather events and temperatures; accelerating biodiversity loss; pollution of air, soil and water; failures of climate-change mitigation and adaptation; and transition risks as we move to a low-carbon

Figure 1.1: Geopolitical Worries

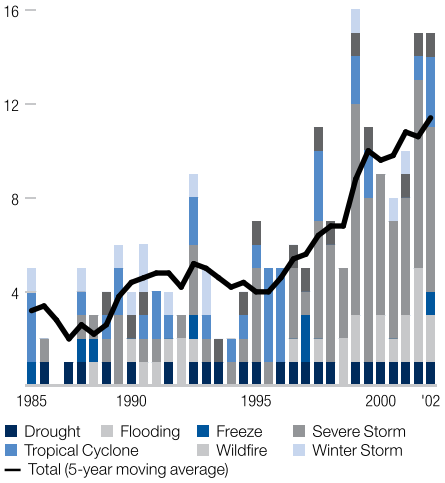


Source: World Economic Forum Global Risks Perception Survey 2017–2018.

future. However, the truly systemic challenge here rests in the depth of the interconnectedness that exists both among these environmental risks and between them and risks in other categories—such as water crises and involuntary migration. And as the impact of Hurricane Maria on Puerto Rico has starkly illustrated, environmental risks can also lead to serious disruption of critical infrastructure.

Extreme weather events in 2017 included unusually frequent Atlantic hurricanes, with three high-impact storms—Harvey, Irma and Maria—making landfall in rapid succession. According to the Accumulated Cyclone Energy (ACE) index, which is used to measure the intensity and duration of Atlantic storms, September 2017 was the most intense month on record. It was also the most expensive hurricane season ever.[13] These extreme incidents continue a trend towards increasingly costly weather events over recent decades (see the US data in Figure 1.2), although rising costs reflect factors such as the location and concentration of assets as well as changing weather patterns. Extreme rainfall can be particularly damaging—of the 10 natural disasters that caused the most deaths in the first half of 2017, eight involved floods or landslides.[14] Storms and other weather-related hazards are also a leading cause of displacement, with the latest data showing that 76% of the 31.1 million people displaced during 2016 were forced from their homes as a result of weather-related events.[15]

Figure 1.2: Billion-Dollar Disasters
Number of US weather-related disasters



Source: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2017). https://www.ncdc.noaa.gov/billions/

Note: Data are inflation-adjusted and valid as of October 2017.

Last year also saw numerous instances of extreme temperatures. When the data are finalized, 2017 is expected to be among the three hottest years on record—the hottest was 2016—and the hottest non–El Niño year ever. In the first nine months of the year, temperatures were 1.1°C above pre-industrial levels and further increases are inevitable—the most ambitious target included in the Paris Agreement envisages increases only to 1.5°C. Average changes are giving rise to localized extremes: during 2017, record high temperatures were experienced from parts of southern Europe to eastern and southern Africa, South America, and parts of Russia and China. California had its hottest summer ever and by the end of November, wildfire burn across the United States was at least 46% above the 10-year average, and was continuing into December. Chile had its most extensive wildfires ever—eight times the long-run average—while in Portugal more than 100 wildfire-related deaths were recorded.[16]

Rising temperatures and more frequent heatwaves will disrupt agricultural systems that are already strained. The prevalence of monoculture production heightens vulnerability to catastrophic breakdowns in the food system—more than 75% of the world's food comes from just 12 plants and five animal species, according to the Food and Agriculture Organization of the United Nations, and it is estimated that there is now a one-in-twenty chance per decade that heat, drought, and flood events will cause a simultaneous failure of maize production in the world's two main growers, China and the United States.[17] This would cause widespread famine and hardship. Fears of "ecological Armageddon" are being raised by a collapse in populations of insects that are critical to food systems: researchers in Germany found falls in such populations of more than 75% over 27 years.[18]

More broadly, biodiversity loss is now occurring at mass-extinction rates.[19] The populations of vertebrate species declined by an estimated 58% between 1970 and 2012.[20] Globally, the primary driver of biodiversity loss is the human destruction of habitats including forests—which are home to approximately 80% of the world's land-based animals, plants, and insects[21]—for farming, mining, infrastructure development and oil and gas production. A record 29.7 million hectares of tree cover was lost in 2016—an area about the size of New Zealand. This loss was about 50 percent higher than 2015.[22] As

much as 80% of the deforestation in Amazon countries is accounted for by cattle ranching, suggesting that pressures on environmental and agricultural systems will intensify as the global population increases, pushing up demand for meat.

Pollution moved further to the fore as a problem in 2017: indoor and outdoor air pollution are together responsible for more than one tenth of all deaths globally each year, according to the World Health Organization (WHO). More than 90% of the world's population live in areas with levels of air pollution that exceed WHO guidelines.[23] Deaths are overwhelmingly concentrated in low- and middle-income countries, where health problems caused by pollution exacerbate strains on already stretched health systems and public finances. In November 2017, a public health emergency was declared in Delhi when air pollution reached more than 11 times the WHO guideline levels.[24] Urban air pollution is likely to worsen, as migration and demographic trends drive the creation of more megacities.

Soil and water pollution cause about half again as many deaths, according to findings published in October 2017 by the Lancet Commission on Pollution and Health.[25] The Commission estimates the overall annual cost of pollution to the global economy at US$4.6 trillion, equivalent to around 6.2% of output. Many of the associated risks to health are still not well understood. Research suggests, for example, that the huge volume of plastic waste in the world's water—approximately 8 million more tons every year[26]—is finding its way into humans. People eating seafood could be ingesting up to 11,000 pieces of micro-plastic every year.[27] Micro-plastic fibres are found in 83% of the world's tap water.[28] One concern is that these micro-fibres could bind with compounds containing toxic pesticides or metals, providing these toxins with a route into the body.[29]

90%

of the world's population lives with polluted air

The growing urgency of acting to halt climate change was demonstrated in 2017 with the news that emissions of CO_2 had risen for the first time in four years, bringing atmospheric concentrations of CO_2 to 403 parts per million, compared with a pre-industrial baseline of 280 parts per million. The increase in emissions last year was partly a result of developments in China, where the heatwaves mentioned above led to a 6.3% increase in energy consumption, and extreme drought in the north of the country led to a switch from hydro to coal-fired power generation. There are reasons to expect further upward pressure on CO_2 concentrations in the future. Having absorbed 93% of the increase in global temperatures between 1971 and 2010,[30] the world's oceans continue to get warmer and studies suggest that their capacity to absorb CO_2 may be declining.[31] Research also suggests that tropical forests are now releasing rather than absorbing carbon dioxide.[32]

The risk that political factors might disrupt efforts to mitigate climate change was highlighted last year when President Trump announced plans to withdraw the United States from the Paris Agreement. However, several other major economies—notably China—reaffirmed their support of the Paris Agreement during 2017. In addition, many US businesses, cities and states have pledged to help deliver on the country's emissions reduction targets. This kind of network of subnational and public-private collaboration may become an increasingly important means of countering climate change and other environmental risks, particularly at a time when nation-state unilateralism appears to be ascendant.

In addition to meeting the immediate environmental challenges that we face, we also need to focus more acutely on the potential economic and societal risks that may arise as transition to a low-carbon and environmentally secure world accelerates. Moves towards financial disclosures to quantify the transition risks that businesses face have been accelerating, as has the idea of fossil-fuel divestment.[33] For example, in November 2017 the managers of Norway's sovereign wealth fund recommended divesting from oil and gas shares, and in December the World Bank announced a moratorium after 2019 on financing upstream oil- and gas-related investments.[34]

The potential spillover effects of climate-related transition will be more far-reaching than its effect on financial disclosure norms. For example, dramatic changes in the way energy is produced are likely to trigger large-scale labour-market

disruptions.[35] Structural economic changes in affected countries and regions could also stoke societal and geopolitical risks. There is no scope for complacency about the sufficiency of global efforts to deal with climate change and the continued degradation of the global environmental commons. Equally, however, it is time to prepare for the structural challenges and changes that lie ahead as those efforts gather pace.

Cyber-defences are being tested

Moving from the environmental commons to the virtual commons, cyber-risks intensified in 2017. Although in previous years respondents to the GRPS have tended to be optimistic about technological risks, this year concerns jumped, and cyberattacks and massive data fraud both appear in the list of the top five global risks by perceived likelihood.

Attacks are increasing, both in prevalence and disruptive potential. Cyber breaches recorded by businesses have almost doubled in five years, from 68 per business in 2012 to 130 per business in 2017.[36] Having been choked off by law enforcement successes in 2010–2012, "dark net" markets for malware goods and services have seen a resurgence:[37] in 2016 alone, 357 million new malware variants were released and "banking trojans" designed to steal account login details could be purchased for as little as US$500.[38] In addition, cybercriminals have an exponentially increasing number of potential targets, because the use of cloud services continues

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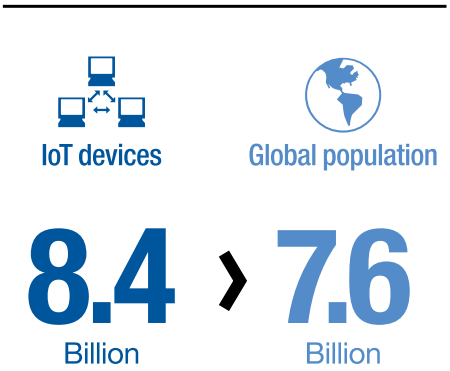

to accelerate and the Internet of Things is expected to expand from an estimated 8.4 billion devices in 2017 to a projected 20.4 billion in 2020.[39] What would once have been considered large-scale cyberattacks are now becoming normal. For example, in 2016, companies revealed breaches of more than 4 billion data records, more than the combined total for the previous two years.[40] Distributed denial of service (DDoS) attacks using 100 gigabits per second (Gbps) were once exceptional but have now become commonplace, jumping in frequency by 140% in 2016 alone.[41] And attackers have become more persistent—in 2017 the average DDoS target was likely to be hit 32 times over a three-month period.[42]

The financial costs of cyberattacks are rising. A 2017 study of 254 companies across seven countries put the annual cost of responding to cyberattacks at £11.7 million per company, a year-on-year increase of 27.4%.[43] The cost of cybercrime to businesses over the next five years is expected to be US$8 trillion.[44] Some of the largest costs in 2017 related to ransomware, a rapidly growing form of malware that locks targets out of their data and demands a ransom in return for restoring access. Ransomware attacks accounted for 64% of all malicious emails sent between July and September last year,[45] affecting double the number of businesses compared with 2016.[46] Notable examples included the WannaCry attack, which affected 300,000 computers across 150 countries, and Petya and NotPetya, which caused huge corporate losses: for example, Merck, FedEx and Maersk each reported third-quarter losses of around US$300 million as a result of NotPetya.[47]

Beyond its financial cost, the WannaCry attack disrupted critical and strategic infrastructure across the world, including government ministries, railways, banks, telecommunications providers, energy companies, car manufacturers and hospitals. It illustrated a growing trend of using cyberattacks to target critical infrastructure and strategic industrial sectors, raising fears that, in a worst-case scenario, attackers could trigger a breakdown in the systems that keep societies functioning. Many of these attacks are thought to be state sponsored. WannaCry's ultimate impact was relatively low, largely because a "kill switch" was discovered, but it highlighted the vulnerability of a wide range of infrastructure organizations and installations to disruption or damage. Since the 2015 attack on Ukraine's power grid—which temporarily shut down 30 substations, interrupting power supply to 230,000 people[48]—evidence has been mounting of further attempts to target critical infrastructure. In 2016, for example, an attack on the SWIFT messaging network led to the theft of US$81 million from the central bank of Bangladesh. The European Aviation Safety Agency has stated that aviation systems are subject to an average of 1,000 attacks each month.[49] Last year saw reports of attempts to use spear-phishing attacks (stealing data or installing malware using individually targeted email scams) against companies operating nuclear power plants in the United States.[50]

Most attacks on critical and strategic systems have not succeeded—but the combination of isolated successes with a growing list of attempted attacks suggests that risks are increasing. And the world's increasing interconnectedness and pace heightens our vulnerability to attacks that cause not only isolated and temporary disruptions, but radical and irreversible systemic shocks.

Our growing vulnerability to systemic risks

Humanity has become remarkably adept at understanding how to mitigate countless conventional risks that can be relatively easily isolated and managed with standard risk-management approaches. But we are much less competent when it comes to dealing with complex risks in systems characterized by feedback loops, tipping points and opaque cause-and-effect relationships that can make intervention problematic.[51]

Societies, ecosystems, economies and the global financial system are all examples of such complex systems, and they have various intersections. Think of how the world's infrastructure—from power generation to transport networks—is increasingly digitally networked. Think of the tensions between our creaking global institutional framework and the pace of change in the 21st century. Think even of the ethical value systems that shape behaviour within and between countries, and the unpredictability that can result when there is a re-evaluation of what is acceptable and unacceptable.

When a risk cascades through a complex system, the danger is not of incremental damage but of "runaway collapse"—or, alternatively, a transition to a new, suboptimal status quo that becomes difficult to escape. For example, even though a runaway collapse of the global financial system was averted a decade ago, the global financial crisis triggered numerous economic, societal, political and geopolitical disruptions. Many are still only poorly understood, but they shape a "new normal" that in turn will create its own disruptions, spillovers and feedback loops in the months and years ahead.

As the pace of change accelerates, signs of strain are evident in many of the systems on which we rely. We cannot discount the possibility that one or more of these systems will collapse. Just as a piece of elastic can lose its capacity to snap back to its original shape, repeated stress can lead systems—organizations, economies, societies, the environment—to lose their capacity to rebound. If we exhaust our capacities to absorb disruption and allow our systems to become brittle enough to break, it is difficult to overstate the damage that might result.

Notes

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REUTERS/Nguyen Huy Kham

Economic Storm Clouds

Headline economic indicators suggest the world is finally getting back on track after the global crisis that erupted 10 years ago. A broad-based pickup in GDP growth rates is under way, stock markets have never been higher and the world's major central banks are cautiously preparing to unwind the exceptional policies of the post-crisis period.

However, this relatively upbeat picture masks numerous concerns. This has been the weakest post-recession recovery on record. Productivity growth remains puzzlingly weak. Investment growth has been subdued, and in developing economies it has slowed sharply since 2010.[1] And in many countries the social and political fabric has been badly frayed by many years of stagnating real incomes.

The reassuring headline indicators mean that economic and financial risks are becoming a blind spot: business leaders and policy-makers are less prepared than they might be for serious economic or financial turmoil. The risks can be divided into two categories: (1) familiar vulnerabilities that have grown, mutated or relocated over time; and (2) newer fragilities that have emerged in recent years.

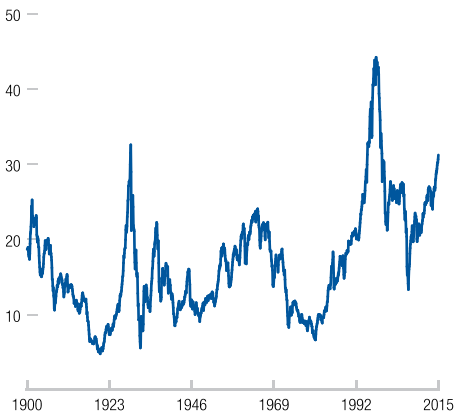
Long-standing vulnerabilities

Unsustainable asset prices?

The world is eight years into a bull run, with global stock markets hitting all-time high after all-time high. This has raised fears that this is another episode of "irrational exuberance", that the lessons of the crisis have gone unlearned,[2] and that a deep correction may follow. In 2017, the Dow Jones increased by 25%, the S&P500 by 19%, the Hang Seng in Hong Kong SAR by 35%, the Nikkei in Japan by 19%, the DAX in Germany by 11% and the CAC40 in France by 8%. According to one commonly used measure of cyclically adjusted prices (see Figure 2.1), US stocks have only twice in history been higher than they are at the moment: just prior to the crashes of 1929 and 2000.

Bond valuations are even more dramatic. In mid-2017, around 9 trillion US dollars' worth of bonds were trading with a negative yield, meaning that investors were, in effect, paying bond issuers for the privilege of holding their risky financial instruments. This anomaly reflects the impact of the huge asset-purchase programmes launched by central banks in the wake of the crisis, which seem to have divorced asset prices from assessments of their underlying riskiness. In Europe, for example, during 2017, yields on high-risk corporate bonds converged with yields on US government debt, the global financial system's risk-free benchmark.[3]

Figure 2.1: Equities on the Up
Cyclically adjusted price/earnings ratio (CAPE)



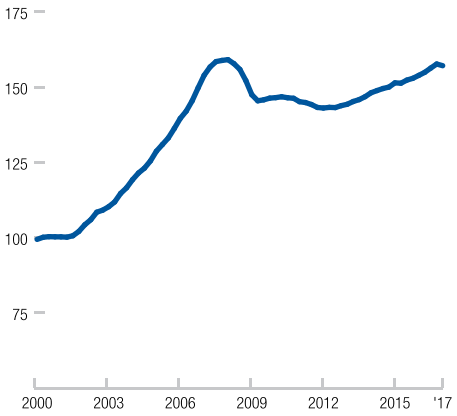
Source: Robert Shiller.
http://www.econ.yale.edu/~shiller/data.htm

If there were to be a sharp market correction, the impact on the real economy would arguably be greatest in countries most heavily exposed to sectors and markets in which bubbles have formed—for example, a country economically reliant on exports of a commodity that plunges in value. The impact of confidence and wealth effects means that real-economy impacts would also be felt strongly in countries—notably the United States and the United Kingdom—in which the ownership of financial assets is most widespread.

It is not just stocks and bonds that have seen their prices rise. The International Monetary Fund (IMF)'s index of global house prices is close to its pre-crisis peak again (see Figure 2.2), and signs of stretched valuations are evident in numerous cities including Hong Kong, London, Stockholm, and Toronto. Inflation in all these traditional asset classes has been dwarfed by more speculative assets such as the cryptocurrency Bitcoin, which increased in value by around 1200% in 2017.

A further source of potential market risk at present is that innovations in financial assets and asset management have yet to be tested in crisis conditions. One example is the rapidly expanding class of exchange-traded funds (ETFs), which have grown in value by 500% since 2008 and now account for US$4 trillion of assets and around 25% of all US stock market trading.[4] Some analysts suggest that ETFs would cushion the blow of a major market correction, while others reckon they would exacerbate it.

Figure 2.2: Building High
IMF Global House Price Index



Source: International Monetary Fund (IMF).
http://www.imf.org/external/research/housing

Indebtedness

High levels of indebtedness—particularly among households and in the financial sector—were a key driver of the financial crisis and one reason the recovery of the real economy has been so slow. Recessions accompanied by credit contractions or housing slumps tend to be much deeper and take longer to recover from, because they leave a legacy of expansive boom-era debts that act as a drag on consumption and investment.[5]

Prior to the 2008 crisis, the world was awash with cheap loans. Remarkably, there has been no aggregate deleveraging since. In fact, the total global debt-to-GDP ratio is significantly higher now than it was before the crisis. In its latest *Global Financial Stability Report*, the IMF highlighted the potential risks posed by the build-up of non-financial sector debt in the G20 (i.e. the debt held by households, governments and non-financial companies). In 2016, this debt totalled US$135 trillion, up from US$80 trillion in 2007.[6]

Indebtedness has risen differently in advanced and emerging economies. Advanced economies built up huge debts before the crisis erupted, but their overall level of debt has remained relatively constant in the subsequent decade: as a proportion of GDP, modest deleveraging by households and financial institutions has been offset by increases in government debt resulting from stimulus spending. Meanwhile, signs of strain are evident in parts of the corporate debt market. According to S&P Global, 162 corporate defaults worldwide occurred in 2016, the most since 2009 and up from 113 in 2015.[7] The debt-to-equity ratio of the median S&P 1500 company (excluding financials) has almost doubled since 2010 and is now well above its pre-crisis level.

In emerging markets, by contrast, aggregate debt levels were relatively low and stable prior to the crisis but have increased sharply since. This is especially true in China, where debt issuance has surged to help deliver the high levels of growth the country's plans require. The rapid expansion of debt in the Chinese economy is now one of the world's clearest flashpoints for potential economic turmoil: according to some analysts, China's current credit trajectory is "dangerous with increasing risks of a disruptive adjustment."[8]

China's banking sector has ballooned to hold assets valued at US$33 trillion, or 3.1 times the country's annual output. Arguably, these figures understate the full extent of the country's potential fragilities, because they do not capture the rapid growth of the more lightly regulated shadow banking sector.[9]

The regulatory separation of the financial sector in China from that of the rest of the world reduces the risk of systemically significant financial spillovers, but as early as 2015 the governors of the European Central Bank were cautioning that "financial developments in China could have a larger than expected adverse impact."[10] Given how deeply embedded China now is in the world economy, if the country's authorities were to step in decisively to secure the stability of the financial system, the resulting slowdown in domestic growth could represent a damaging blow to global demand.

China can deploy vast resources to protect its economy, but most emerging economies are much more directly exposed to any worsening of global conditions. If the major central banks' interest rates were to move significantly higher, lower-income emerging market economies would take a direct hit from the combination of higher rates and worse exchange rates, increasing the cost of borrowing US dollars or other hard foreign currency. Already there are signs that debt-servicing costs for many of these countries are rising gradually from the record lows of a few years ago. These problems are most pronounced in countries with high levels of foreign-currency debt, particularly oil-exporting countries where sustained low oil prices have hit companies' revenues and governments' fiscal positions. In October 2017, for example, the governor of the Central Bank of Kenya cautioned that government debt in a number of African countries has reached levels at which an external shock "could push us over".[11] Countries facing significant strain include Angola, Gabon, Ghana, Mozambique and Zambia.

Total non-financial sector debt across the G20

$80 trillion in 2007

$135 trillion in 2016

The global financial system

The third long-standing risk is the health of the financial system, even though much has been done to restore the banking system to stability after its near-collapse in 2008. Regulators have overseen an increase in the core capital ratios of 30 globally systemic banks, from 10.3% at the end of 2011 to 12.6% at the end of 2016.[12] Widespread changes in the structure of the sector include collapses, mergers, and a politically sensitive supranational "banking union" in the Eurozone.[13] Restrictions—such as the Volcker Rule, which since 2015 has prohibited banks in the United States from making market bets with their own capital—have been put on the risks that banks are allowed to take.[14] And there has been a winding down of the sector's reliance on wholesale inter-bank lending, a potentially volatile source of funding that evaporated in 2008 as banks began to lose trust in each other's creditworthiness.

There are reasons to be cautious, despite this progress. Measures of banks' capitalization continue to rest on risk-weighting methodologies that mask a lot of uncertainty about underlying risks. Calls are becoming louder for radical reform of the fundamental principles of banking,[15] but there appears to be no political will to introduce major reforms. In fact, deregulation may now be more likely: for example, pressure is already mounting for a loosening of the Volcker Rule. The issue of banks being "too big to fail" has not gone away, however: the assets held by the largest 30 banks have grown from less than US$30 trillion in 2006 to almost US$43 trillion, and concentration is continuing to increase.[16] Meanwhile strains have spread to emerging markets: banks that were relatively unscathed at the height of the crisis have since had to contend with the resulting deterioration of global financial conditions and the sharp downward turn of many commodity prices.[17]

REUTERS/Sheng Li

New and emerging challenges

The familiar vulnerabilities outlined above are now compounded by a range of newer fragilities that have emerged or strengthened materially since the crisis.

Limited firepower

How much room for manoeuvre policy-makers retain is open to question. Put simply, is there enough fiscal and monetary policy firepower left to deal with another crisis? In theory, the major Western economies that were at the centre of the global crisis could respond with another wave of major policy interventions reflecting the synergies that are currently at play between monetary and fiscal policies, with central bank asset purchases helping to alleviate governments' fiscal pressures by keeping down debt-servicing costs.[18] However, this scenario places a lot of faith in the effectiveness of unconventional monetary policies such as asset purchases, particularly when deployed as the primary line of defence rather than alongside a sharp interest-rate stimulus. Facing a recession—let alone a crisis—with very limited scope to cut interest rates would be unprecedented.

The Fed has responded to past US recessions by cutting its benchmark policy rate by an average of 5.5 percentage points. That benchmark rate currently stands at just 1.25%, and market expectations are that it will plateau at around 3%. In other words, even if the Fed were to cut rates to zero in response to a new recession, there would still be at least a 2.5 percentage point shortfall relative to the usual scale of response.[19] Assuming they wanted to deliver a similar level of stimulus, the European Central Bank, the Bank of Japan and the Bank of England would all face even greater shortfalls given that their interest rates are currently even lower than the Fed's.

Central banks were crucial to restoring economic confidence among households, businesses and markets after the crisis. Repeating that feat could be a struggle without interest rates at their disposal. And without a floor placed under confidence, the risk of the next downturn being much deeper and longer than might otherwise be the case would increase.

Technological disruption

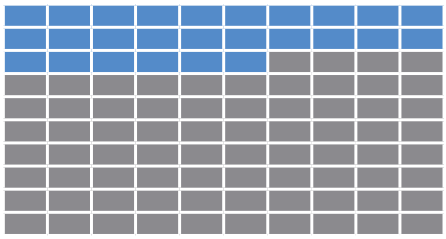
A second emergent source of economic risk is the rapid technological change that has taken place even in the decade since the global crisis. The history of previous waves of innovation suggests that the nascent Fourth Industrial Revolution will ultimately deliver broad-based economic benefits. However, technological pessimists query whether current innovation has little of the transformative power analogous to that of previous discoveries and inventions, such as electricity, household appliances and the combustion engine.[20] Even optimists caution that major disruption may be inevitable as societies adapt: the original Industrial Revolution delivered huge increases in human welfare, but it also caused prolonged social and economic turmoil and set the scene for new revolutionary modes of politics.[21] Worries about the economic impact of new technologies were prominent in this year's Global Risks Perception Survey (GRPS)—the most frequently cited risk interconnection was the pairing between unemployment and adverse impacts of technological advance.

Although technological advances have provided many benefits in emerging economies, the associated risks are arguably most pronounced in these countries too. The World Bank, among others, has cautioned that current patterns of innovation threaten the viability of long-established paths to development.[22] Historically economies have developed by moving workers from agricultural jobs into export-oriented manufacturing jobs that require similarly low skill levels but deliver much higher productivity. This "escalator to higher income levels" breaks down when the manufacturing sector becomes sufficiently automated to require workers who are more highly skilled.[23] In these circumstances, developing-country productivity can stagnate or decline if workers move back from manufacturing into agriculture, or from agriculture into low-end service sectors where productivity can be even lower.[24] Latin America is the clearest example of a region where "premature deindustrialization" has held back countries' productivity growth.[25] The associated risks are not purely economic—recent research suggests that weak industrialization can hamper the development of liberal democratic institutions by affecting the political divisions that become dominant in a country.[26]

Politics and protectionism

Last year's *Global Risks Report* discussed the spillover of economic risks into various recent episodes of political disruption across the world.[27] The directionality can run both ways, as discussed in the chapter on Geopolitical Power Shifts: populist and identity politics can amplify risks of economic and financial disorder by upending previously stable economic principles and practices, particularly those relating to trade.

Liberalizing versus protectionist trade interventions in 2016



The two countries that experienced the most disruptive political results in 2016—the United Kingdom and the United States—have both entered a period of uncertainty and volatility in their external economic relations. The United Kingdom is in the process of leaving the European Union, while the United States has withdrawn from the Trans-Pacific Partnership (TPP) and is seeking a renegotiation of the North American Free Trade Agreement (NAFTA).

Mercantilist and protectionist pressures have been building in many countries for years: according to Global Trade Alert, protectionist interventions have increased markedly since 2012. A new high was recorded 2016, when 571 of the 771 trade interventions tracked by Global Trade Alert were characterized as discriminatory and just 200 as liberalizing. Early data for 2017 point to a continuation of this trend, particularly in the United States, where the first six months of the year saw a 26% jump in trade actions against G20 partners.[28] The risk of economic damage is not restricted to trade protectionism—mercantilism and unilateralism could trigger a wider deterioration of global interconnectedness, including reduced investment flows, increased obstacles to cross-border business and constraints on labour mobility.

The backdrop of pronounced geopolitical uncertainty and increasingly transactional approaches to interstate relations increases the risk that economic disputes will flare up. We can distinguish between (1) disputes stemming from tensions between countries' economic agendas and policies, and (2) geopolitical tensions—up to and including military conflict—that cause disruption to economies and markets. The results of the GRPS are pessimistic in this regard: the overwhelming majority of respondents expect the risks of interstate military conflict or incursion to increase in 2018. New technologies add a layer of economic vulnerability to geopolitical disruptions, with emerging risks of asymmetric economic warfare including potential cyberattacks designed to disrupt critical financial infrastructure.

It is striking how sanguine financial markets have remained while political and geopolitical risk has jumped in recent years. Given current market dynamics, it may not be rational for any single market participant to price in rising political and geopolitical tensions. The risk is that we will hit a tipping point at which point everyone prices in these tensions, with a rush to the exits that hits asset prices, strains the resilience of the global financial system and tests whether policy-makers retain the firepower to prevent deep and long-lasting impacts on the real economy.

Notes

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FUTURE SHOCKS

As the world becomes more complex and interconnected, easily managed incremental change is giving way to the instability of feedback loops, threshold effects and cascading disruptions. Sudden and dramatic breakdowns—future shocks—become more likely. In the pages that follow, we present 10 such potential future shocks. Some are more speculative than others; some extrapolate from risks that have already begun to crystallize. These are not predictions. They are food for thought and action—what are the possible future shocks that could fundamentally disrupt or destabilize your world, and what can you do to prevent them?

Illustrations: **Patrik Svensson**

Grim Reaping

Simultaneous breadbasket failures threaten sufficiency of global food supply

In a world of growing environmental strains our increasingly complex food system is becoming more vulnerable to sudden supply shocks. The interaction of disruptors such as extreme weather, political instability or crop diseases could result in a simultaneous blow to output in key food-producing regions, triggering global shortages and price spikes. The risk of a systemic breakdown could be further elevated by wider fragilities, including reduced crop diversity, competition for water from other sectors and geopolitical tensions.

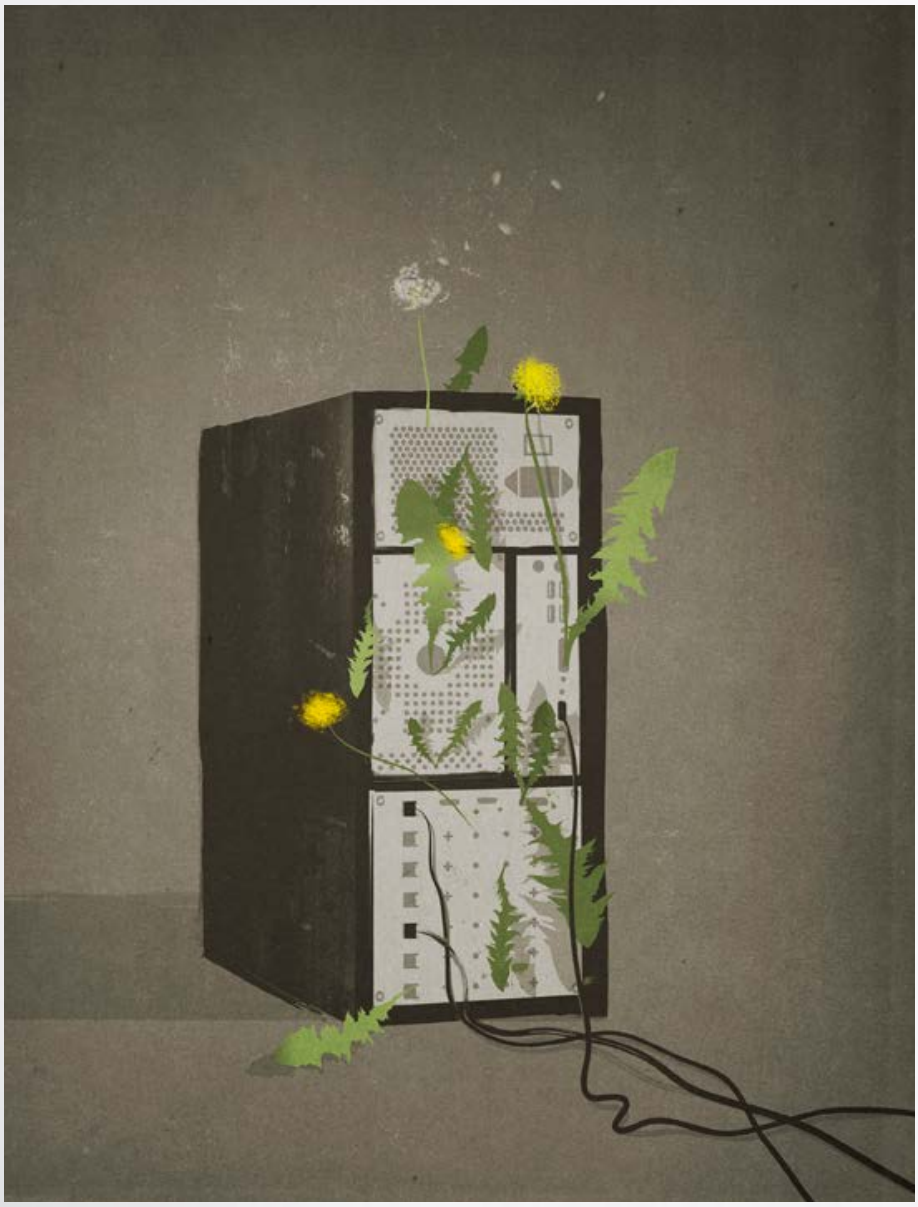
Widespread fear—let alone death on a large scale—could lead to devastating spillover effects. Social fractures would intensify in affected and at-risk countries. Political and economic crises would be likely. So too would a surge in smuggling, both of food and people. Against such a volatile backdrop, cross-border tensions could worsen sharply, hampering existing humanitarian response networks, frustrating efforts to develop regional and global mitigation strategies and increasing the possibility of interstate conflict.

Even on optimistic climate-change trajectories food-supply risks will remain elevated. Steps are needed to improve sustainability and resilience throughout the food system. Among the changes that could help are increasing crop diversity, establishing stress tests of "choke points" and other national and regional vulnerabilities, reducing waste along supply chains, reaffirming humanitarian principles and commitments and establishing early warning indicators.

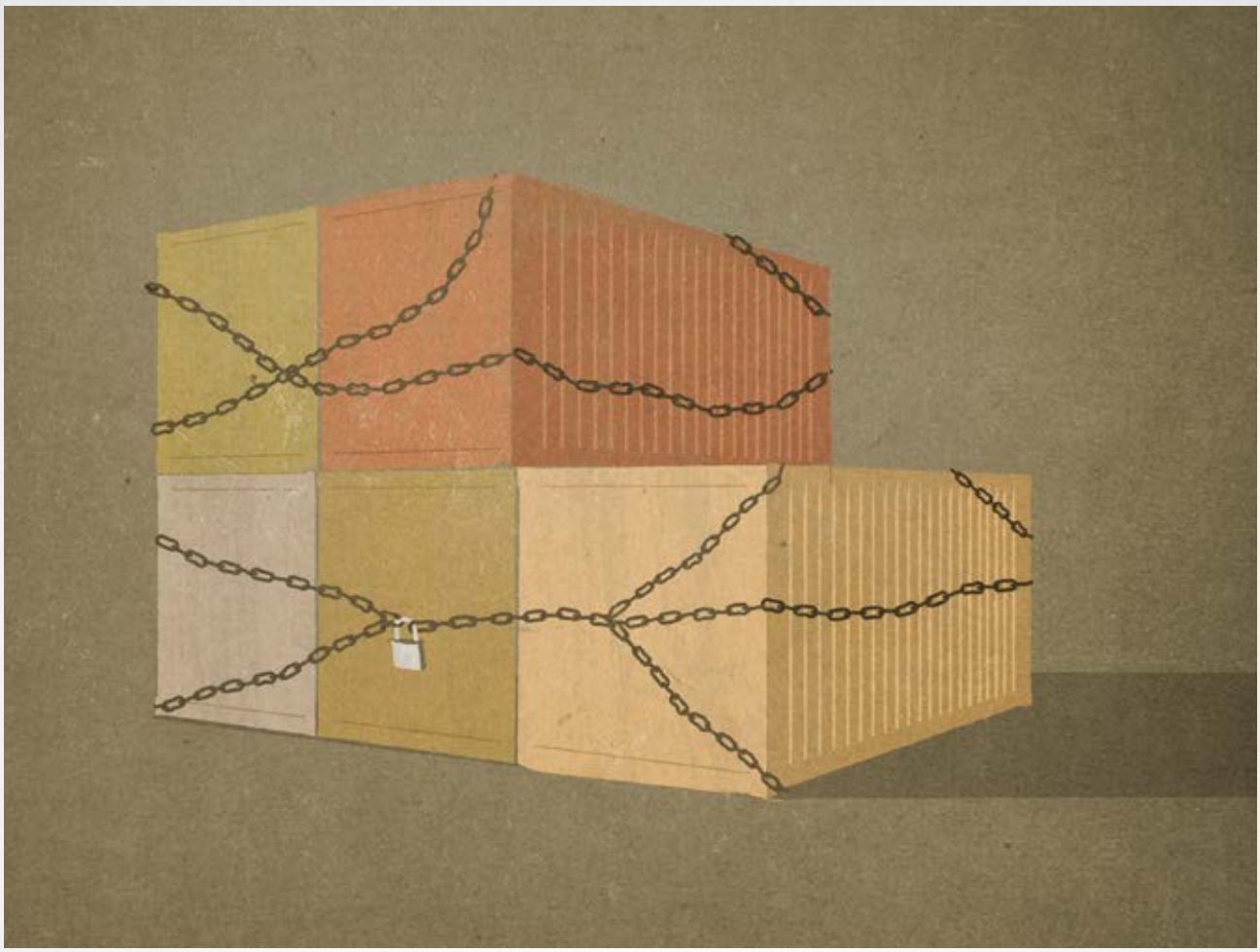
A Tangled Web

Artificial intelligence "weeds" proliferate, choking off the performance of the internet

What if the adverse impact of artificial intelligence (AI) involves not a super-intelligence that takes control from humans but "AI weeds"—low-level algorithms that slowly choke off the internet? Algorithms are already proliferating. As they increase in sophistication—as we become more reliant on code that writes code, for example—explosive growth becomes more likely. A divergence could open between the code we have created and our capacity to track and control it.
The tragedy of the commons means we often let chronic problems with dispersed responsibilities fester. Think of plastic in the ocean. A trend towards reduced internet efficiency would undermine service delivery in countless businesses. It could hobble the Internet of Things. It would frustrate users. If the problem became significant enough, it could prompt some governments to wall off parts of the internet. If malicious actors found ways to proliferate or weaponize the AI weeds, they could do extensive damage.



As the global demands placed on the internet increase in scale and sophistication, digital hygiene is likely to become a more pressing concern for end-users. The development of overarching norms, regulations and governance structures for AI will be crucial: without a robust and enforceable regulatory framework, there is a risk that humans will in effect be crowded out from the internet by the proliferation of AI.



The Death of Trade

Bilateral trade wars cascade and multilateral dispute resolution institutions are too weak to respond

Political commitment to globalization has weakened in the wake of the global financial crisis and even minor disputes could trigger an unravelling. Against a backdrop of deepening protectionist sentiment, trade disputes could spread rapidly by triggering adverse impacts and retaliatory moves along global value chains. The same pressures fomenting trade disputes would also undermine the already-weakened institutions designed to resolve them, potentially leading to multilateral rules being openly breached.

A breakdown of the global trade system would roil supply chains and reduce overall economic activity. Adverse impacts such as lower output and employment would be unevenly distributed within and between countries, creating new inequalities and frustrations. If this in turn fuelled more aggressive mercantilism, the risk would increase of proliferating trade-related disputes triggering deeper geopolitical tensions and policies of gunboat diplomacy on trade.

Whatever the settled position on global trade is to be, more deliberation and consensus-building would bolster its legitimacy. A period of de-globalization may be seen by many as a welcome corrective, but rejecting current frameworks in favour of binary nationalistic approaches would cause significant disruption. Securing durable and worldwide support for globalization would be made easier by an increased domestic policy focus on cushioning the impact on individuals and regions affected by transitions in economic activity.

Democracy Buckles

A new wave of populism threatens the social order in one or more mature liberal democracies

Democracy is already showing signs of strain in the face of economic, cultural and technological disruption. Much deeper damage is possible: social and political orders can break down. If an evenly divided country sees polarized positions harden into a winner-takes-all contest, the risk increases of political debate giving way to forms of secession or physical confrontation.

In these circumstances, a tipping point could be reached. A spiral of violence could begin, particularly if public authorities lost control and then intervened on one side with disproportionate force. In some countries—with widespread ready access to weapons or a history of political violence—armed civil conflict could erupt. In others, the state might impose its will by force, risking long-reverberating consequences: a state of emergency, the curtailment of civil liberties, even the cancellation of elections to protect public order.

The more that can be done to boost the resilience and responsiveness of democratic institutions, the less likely they will be to buckle under pressure. This might require processes of political and constitutional experimentation. It could even mean incorporating ideas from post-conflict politics into everyday democracy. We also need to better understand the democratic fissures currently being caused by the economy, by social media and by changing patterns of national identity.

Precision Extinction

AI-piloted drone ships wipe out a large proportion of global fish stocks

A third of all fish consumed in the world are already caught illegally. AI and drone technologies are increasingly commonplace. Add to these facts the automation of illegal fishing, and the impact on fish stocks could be devastating—particularly in international waters where oversight is weaker. Countless other areas exist where the same logic might unfold: huge short-term incentives might lead to the use of emerging technologies in ways that trigger irreversible long-term damage.

A rapid collapse of fish stocks could engender cascading failures across marine ecosystems. Communities reliant on fishing for their incomes might struggle to survive, leading to fiscal pressures and/or displacement. A sufficiently large surge in the supply of illegal fish might distort global food markets, leading to disruption in the agriculture and food-production sectors. If illegal drone fishing crossed national maritime boundaries and was perceived to be state-sanctioned, retaliatory measures might lead to diplomatic or military tensions.

Targeted schemes such as genetic markers to track fish throughout the supply chain might limit demand for illegally caught fish. So might better vessel observation. But key to progress in this and similar areas of hybrid technological disruption will be new global governance norms and institutions, particularly those designed to protect the global commons and prevent the destructive deployment of emerging technologies.

Into the Abyss

A cascading series of economic/financial crises overwhelm political and policy responses

Against a backdrop of domestic and international political strife—and with economic policy-makers already operating in uncharted territory—the eruption of another global financial crisis could overwhelm political and policy responses. A systemic collapse of the sort that was averted in 2007–2008 could push countries, regions or even the whole world over the edge and into a period of chaos.

If financial systems go down, contemporary economies and societies cannot function. Money would stop circulating. Wages would not be paid. Supply chains would break down. Scarcity would begin to become pervasive, and this would threaten to upend the political and social order. Policy-makers would pull every available lever to restore stability. But what if the prospect of another financial-sector bailout further enflamed societies rather than calming them? Or what if the financial system's collapse stemmed from a hostile cyberattack, raising fears that more attacks and disruption lie ahead?

More can be done to enhance the resilience of the financial system. Stress-testing methodologies could be strengthened by assigning greater weight to tail events and unexpected consequences. Greater consideration could be given to the growing number of voices calling for radical change of the way the banking system works. But societies might also want to prepare more actively for worst-case scenarios.

Inequality Ingested

Bioengineering and cognition-enhancing drugs widen the gulf between haves and have-nots

Drugs for human enhancement are in their early stages, but scientific advances may well be exponential. In a world of entrenched inequality, many people might choose to disregard potential health risks in order to maintain or elevate their status. Ingestion would be impossible to monitor, and even if bans are put in place black market channels would inevitably emerge.

If the price tag is significant and the benefits are strong, the result would be ever-deeper and more entrenched inequality. This could trigger social instability and conflict between the haves and have-nots. Divergent regulatory responses could lead to productivity disparities across countries and the emergence of "enhancement tourism" flows. If unforeseen consequences—such as serious brain deterioration—emerged in the future it could create a massive public health crisis.

Stronger measures to combat existing inequality might reduce consumption incentives, but that seems doubtful. Early and appropriate regulation of enhancement technologies may be more successful than an outright ban. For example, new workplace equality legislation might require employers to confirm that all staff are compliant with enhancement rules. If these technologies were ever proven to be an unalloyed good—analogous to vaccinations—then the regulatory objective might shift to ensuring universal access.

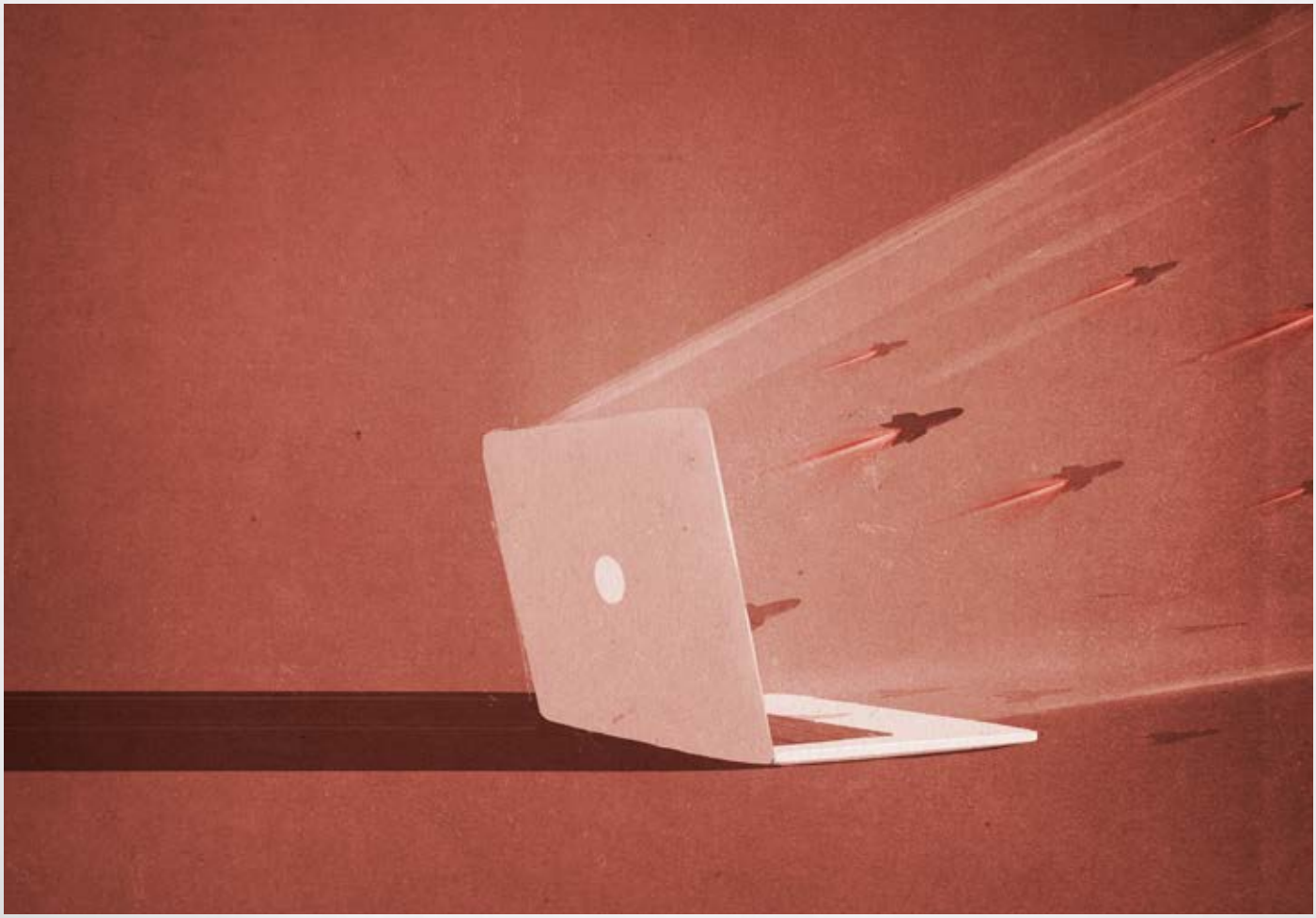
War without Rules

State-on-state cyberattacks escalate unpredictably owing to a lack of agreed protocols

Offensive cyber capabilities are developing more rapidly than our ability to deal with hostile incidents. This creates a fog of uncertainty in which potential miscalculations could trigger a spiral of retaliatory responses. Imagine that a country's critical infrastructure systems are compromised by a cyberattack, leading to disruption of essential services and loss of life—the pressure to retaliate would build rapidly, potentially setting off an escalatory chain reaction.

Questions of speed and attribution heighten the risk of unpredictable consequences. If an attack is developing more quickly than the targeted state's efforts to identify the attacker, retaliation might be misdirected, drawing new actors into a widening conflict. This would add to the potential for further confusion and escalation, including the resort to conventional military force or the unintended widening of conflict if an active cyberweapon inadvertently spreads through cross-border networks into non-target countries.

In conventional warfare, agreed norms and protocols provide predictability and slow the emergence of crises. If governments accelerated current efforts to establish similar ground rules for cyberwarfare, it would help to prevent conflict erupting by mistake. Familiar concepts such as transparency, proportionality and non-proliferation could be re-codified for cyber purposes. And perhaps classes of cyberweapons could be collectively prohibited, in the same way biological and chemical weapons have been.



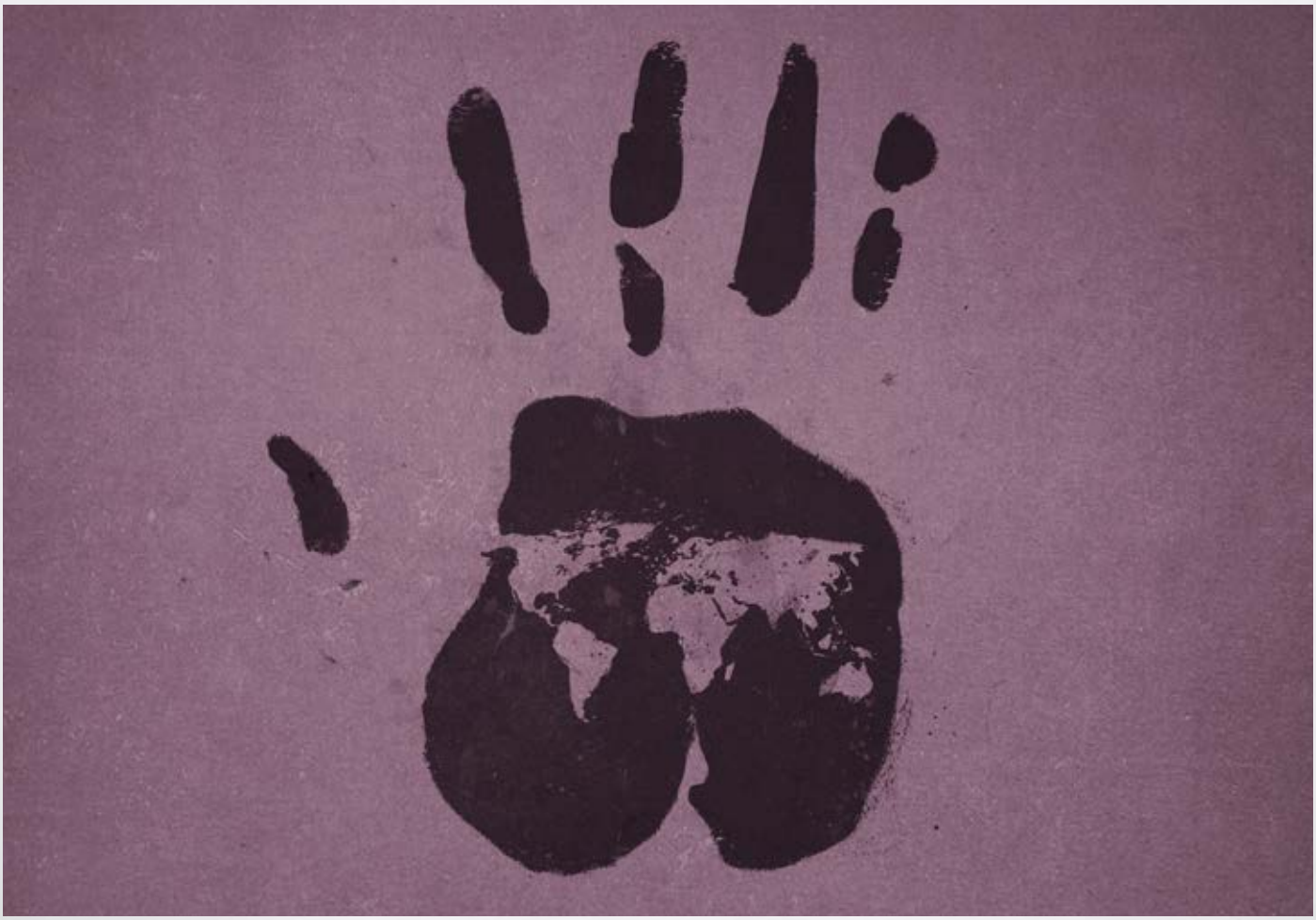
Identity Geopolitics

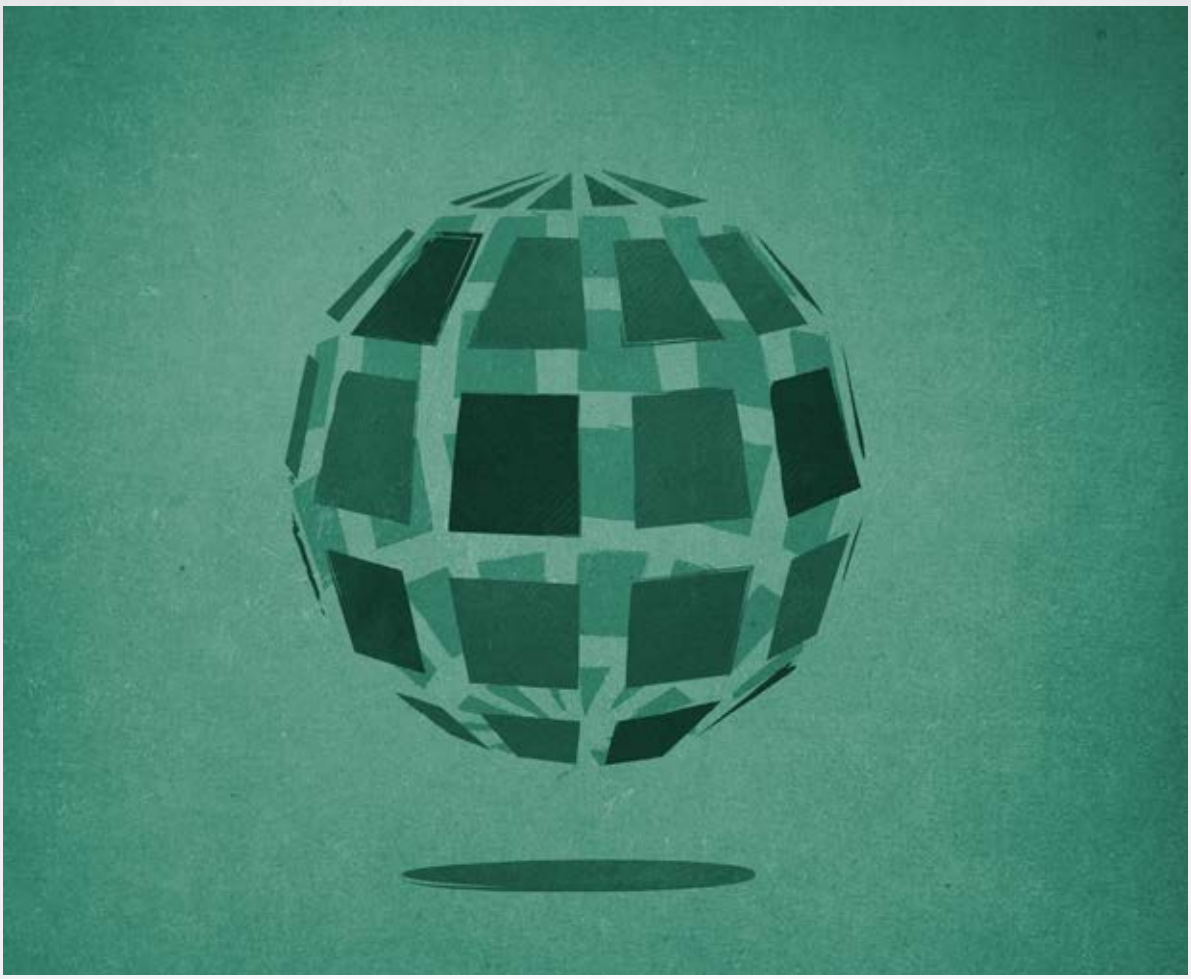
Self-determination around contested borders sparks regional conflict

At a time of global geopolitical uncertainty, the twin forces of national identity and self-determination are growing in disruptive capacity. Already this is leading to violence and constitutional instability, at times spurred on by foreign powers. Examples include states expelling ethnic or religious minorities, national minorities attempting to secede and nation-states extricating themselves from international constraints on their sovereignty.

A deepening of disputes over cultural and political borders would trigger widening clashes, potentially causing regional domino effects as states and sub-state actors mobilize in defence of or opposition to the status quo. This instability would create new trigger-points for interstate conflict, particularly in regions where disputes over self-determination are long-standing and are likely either to be resolved violently rather than consensually or to draw in regional hegemons and/or global powers.

Stronger promotion and protection of equal cultural and political rights within states would help defuse tensions about national identity. So would the fostering of stronger economic and other links between states sharing contested borders. Drawing on successful examples of constitutional innovation—such as multilevel and cross-community forms of governance—might help guide the administration of internally divided polities.





Walled Off

Regulatory, cybersecurity and protectionist concerns lead to the fragmentation of the internet

A proliferation of damaging cross-border cyberattacks might be the most likely trigger for a government-led breakup of the internet into national or regional "walled gardens", but there are many other potential drivers that could lead governments in this direction: economic protectionism, regulatory divergence, censorship and repression, the fraying of national political discourse and the loss of government power relative to global online companies.

Fragmentation of the internet could involve, among other things, interruption of technical internet functions or barriers to the flow of content and transactions. Some might welcome a move towards a less hyper-globalized online world, but many would not: resistance would be likely, as would the rapid growth of illegal workarounds. The pace of technological development would slow and its trajectory would change. Human rights abuses would likely increase as advances in international monitoring were rolled back.

Advances in cybersecurity governance and technology ought to mitigate the risk of worsening cyber disruption and theft that would trigger the imposition of firewalls. Ongoing dialogue between governments and technology companies would help to ensure that internet-based technologies develop in a politically sustainable context of shared values and agreed responsibilities.

REUTERS/Mike Segar

Geopolitical Power Shifts

The world has moved into a new and unsettling geopolitical phase. It is not just multipolar, but multiconceptual. There is no longer any assumption—as there had been in the post–Cold War phase, framed by so-called New World Order and Washington Consensus thinking—that norms and institutions exist towards which the world's major powers might converge. This creates new risks and uncertainties: rising military tensions, economic and commercial disruptions, and destabilizing feedback loops between changing international relations and countries' domestic political conditions.

International relations now play out in increasingly diverse ways: beyond conventional military build-ups, these include new cyber sources of hard and soft power, reconfigured trade and investment linkages, proxy conflicts, changing alliance dynamics and potential flashpoints related to the global commons. Assessing and mitigating risks across all these theatres of potential conflict will require careful horizon scanning and crisis anticipation by state and non-state actors alike. Actors with a global presence are likely to have to become increasingly adept at calibrating their responses across divergent political and legal systems.

Four related developments stand out as potential sources of disruption over the short and medium term. The intensification of strong-state politics is affecting both large and small states, while global norms are eroding and tensions growing between major powers. These two trends fuel two others: increasingly aggressive geo-economic agendas and the mounting pressures faced by small states.

State-centred politics

At a time of geopolitical flux, re-establishing the state as the primary locus of power and legitimacy offers governments—and citizens—an increasingly attractive strategic anchor. In particular, nationalist agendas and the external projection of a strong state can be an effective strategy for governments seeking to redress perceived international humiliations, past or present. In China, for example, President Xi Jinping calls for "the great rejuvenation of the Chinese nation" to put the country's "century of humiliation" firmly behind it. In the United States, President Trump seeks to "make America great again" after decades of being "taken advantage of."

Widely differing variations on the state-centred theme can be seen around the world: among these are Emmanuel Macron's effort to restore France's standing with his "Jupiterian" presidency; the United Kingdom's desire to "take back control" by leaving the European Union; stronger nationalism in Japan under Shinzo Abe; Vladimir Putin's focus on rebuilding Russia's international status from the rubble of the Soviet Union; the erosion of pluralism in Turkey as Recep Tayyip Erdogan bridles at his domestic and international opponents.

The intensification of nationalist and strong-state narratives creates risks both domestically and internationally. The profile of these risks will vary in each case, depending, among other things, on the way in which power is obtained and asserted, and on the ends towards which it is used. One domestic danger is that the interests of non-state actors will suffer. If the protection and projection of state power becomes more central to policy, then the rights or protections enjoyed by individuals, businesses and civil society groups become more contingent on leaders' perceptions of the state interest and—sometimes seen as the same thing—consolidation of their own personal power.[1] There are numerous instances to point to, along a spectrum of widely varying severity. An extreme example is the flight of Rohingya people from Myanmar. Other recent examples include the purge in Turkey following the attempted coup in 2016 and clashes over the separation of powers in Poland.[2]

Internationally, two main risks arise. First, the danger of miscommunication and miscalculation between states is heightened by the absence of a clear rules-based international order or a settled balance of power. Concern about possible conflict involving North Korea is a prominent example: the volatile clash between the strong-state instincts of Donald Trump and Kim Jong Un during 2017 has created uncertainty about the strength of the norms created by decades of work to prevent nuclear conflict.

A second international risk relates to states interfering in the domestic affairs of other states. There are a growing number of incidences of states projecting their power in ways that directly encourage or exacerbate problems inside other countries' borders. This kind of interference may foment instability within the "target" state, including violent reprisals or the eruption of civil conflict. By undermining the non-intervention principle set out in the UN Charter, it also ratchets up the risk of retaliation and a slide into interstate conflict. Interference in the affairs of non-Western states has been one reason for the erosion of the US-led rules-based order; however, the wheel has turned and non-Western countries now appear to be increasingly active in this area.[3]

Major-power tensions

The intensification of strong-state politics has the greatest disruptive potential among the world's major powers: relations between them are changing, mostly for the worse. As each of these states becomes increasingly assertive of its own interests, consensus is fraying on the rules that govern their interactions and the directions in which the world might converge. As a result, there is evidence of a general breakdown in trust and an erosion of respect for global norms designed to govern peaceful international interactions.

The United States has become less willing to act as enforcer of global norms at the head of a dominant coalition. This reflects, among other things, divisions within the United States over whether the benefits that flow from this global enforcer role are sufficient to justify its costs. As a result, rising and resurgent powers calculate that actions that may breach international law (UN Charter), the law of the sea (UNCLOS) or international humanitarian law (Geneva Conventions) can achieve objectives without incurring unacceptable costs in terms of opposition or punishment. The emergence of cyberspace as an unregulated battlefield has also created new ways to advance state interests, allowing interference in domestic political or economic affairs that might be considered acts of aggression if pursued by other means.

Strong trade and investment connections between the United States and China mean that, whatever their differences, a significant level of economic interdependence remains central to their relationship. However, as China exercises increasing power in the Western Pacific, confidence in the capacity of the United States to determine outcomes in the region is being gradually undermined. As has been seen in the North Korea crisis, the danger that long-term strategic rivalry could spill over and harm economic relations is becoming more real.

China's determination to press territorial and maritime claims, and its extension of the Belt and Road Initiative (BRI), have triggered responses among neighbouring powers. Japan and India, for example, are exploring more structured forms of strategic cooperation in both economic and military affairs. This initiative could become more significant if additional partners—such as Australia, the United States, or even European states—were to take part. However, most of these countries are currently cautious and would be wary of allowing such a hedging policy to cause tensions with China.

Meanwhile, Russia has used its policy in Syria to reposition itself as a leading foreign policy actor, with the ability to shape military outcomes and geopolitical balances. Russia's relations with China have improved, but those with Western powers have deteriorated: Russia's policies towards Ukraine have been seen as an unacceptable breach of the post–World War II order and have galvanized a Western coalition around a policy of individual and sectoral sanctions. Among other things, this has led to renewed debate in the European Union about the need for increased military capacity so that the bloc's defensive stance is less dependent on US policy.[4]

REUTERS/Lee Jae Won

Smaller-state disruptions

Shifting relations between global and regional powers is creating increased uncertainty for smaller states—an under-appreciated source of geopolitical risk. Smaller states tend to benefit from the predictability that comes with rules-based order and they are among the most affected when rules erode and major powers jostle for position. These countries are particularly vulnerable to the weakening of security alliances they may previously have relied upon, as well as to subtle or overt pressures to adapt policy or strategy to conform to the interests of a major power or regional hegemon.

The dilemma faced by smaller states, as they assess how best to recalibrate relations with larger states, was illustrated in Singapore last year. Mindful of China's growing power and recent developments in Qatar, some warned against overestimating Singapore's room for manoeuvre: "small states must always act like small states."[5] Others responded that Singapore should "stand up for the autonomy to define and pursue our own national interests rather than have them defined for us, even if this displeases major powers."[6] This is not an isolated example; an increasing number of smaller states face similar challenges. Last year, Bhutan found itself at the centre of a stand-off between India and China;[7] Lebanon is exposed to changing dynamics between regional powers in the Middle East; the annexation of Crimea has left Ukraine perched between two mistrustful power blocs; and a number of smaller EU states are concerned about whether the eventual departure of the United Kingdom will affect decision-making to their detriment.

Compounding their exposure to changes in the geopolitical environment, smaller states are more vulnerable to potential second-order effects such as refugee and migration flows resulting from conflicts or recessions in neighbouring countries. For example, Syrians who fled between 2011 and 2015 are estimated to have increased Jordan's population by 25%. And smaller states' finances are vulnerable to even the possibility of geopolitical risks, because nervousness can lead to lower inward investment and to governments feeling compelled to divert revenues into precautionary increases in security-related spending.

Smaller states are not always passive objects of geopolitical disruption: they can also be its source or conduit in various ways. A weak or collapsing state can become a locus of instability that radiates disorder or pulls in larger neighbouring states: Libya and South Sudan, for example, have caused instability in neighbouring countries, notably via flows of refugees and weapons. Elsewhere, for some years the near-collapse of the Greek economy was an ongoing source of existential risk for the Eurozone. Smaller states can also amplify geopolitical risk by actively asserting themselves on their neighbours: this can be seen in extreme form in the North Korea crisis, where tensions are particularly acute both because the government fears annihilation and because of the unique dynamics of its position relative to China and the United States.

Geo-economic risks

Increasing geopolitical fluidity and intensifying strong-state policies increase the risks associated with economic interactions between states. States have always used tools of economic policy and diplomacy to pursue their geopolitical goals. While globalization was ascendant, many believed that economic connectedness—Western companies and consumers benefiting from low-cost manufacturing, which simultaneously pushed forward emerging-economy development—would contribute to a gradual convergence of states' outlooks and goals, reducing the likelihood of geopolitical tensions. However, confidence in the mutuality of benefits has weakened. This is particularly true among Western countries, where the strongest geo-economic trend of recent years has been the erosion of support for globalization and growing support for protectionist policies. It is notable that two of the states that have traditionally been among the firmest advocates of global economic integration, the United Kingdom and the United States, have seen the most dramatic uncertainties emerge around their trade-related policies.

In other parts of the world, plans to extend and deepen networks of economic corridors are spurring huge investments in infrastructure. By far the most ambitious is China's Belt and Road Initiative (BRI): launched in 2013, it spans more than 60 countries and involves investment plans totalling a reported US$900 billion.[8] However, there are numerous other such corridors, most of which connect Asia and Europe. They include the China Pakistan Economic Corridor (CPEC); the Bangladesh-China-India-Myanmar Economic Corridor (BCIM-EC); the International North-South Transport Corridor (INSTC), which links India, Iran and Russia; and the Asia-Africa Growth Corridor (AAGC),[9] a joint initiative by India and Japan.

Proponents of these infrastructure plans argue that they will foster peaceful relations by creating new links and patterns of cooperation. However, the ambitiousness of some of these plans has raised concerns that they might exacerbate rather than prevent tension. The geostrategic interdependence they create—both through the physical presence of assets and people on the ground and through patterns of increased indebtedness, which is a potential source of vulnerability for lower-income countries in particular—are more durable and difficult to unwind than mere trade agreements. This raises questions about potential implications if relationships between corridor partners were to sour in the future.

Some have argued that criss-crossing the Eurasian landmass with a latticework of economic corridors could undermine the stability of the region's state system: "connectivity does not necessarily presage a more peaceful world … Eurasia is cohering into both a single trade and conflict system."[10] One potential trigger for disruption related to economic corridors might be pushback from a country that feels its sovereignty is being undermined. In early 2017 there were signs of this in Sri Lanka, where violent protests erupted at a ceremony to mark the start of construction of a Chinese special economic zone.[11] Another potential trigger might come from economic corridors crossing contested territory—CPEC, for example, runs through Gilgit-Baltistan, a part of Kashmir that is administered by Pakistan but claimed by India.

There remain strong incentives on all sides to avoid triggering trade wars, just as there are for all forms of conflict—but the risk of domestic political factors spilling over into disruption of the global trade system has risen sharply in recent years. Trade-related tensions could also create distractions and divisions that hamper the unity of regional or global responses to other geopolitical risks that might crystallize in the evolving confluence of strong-state politics, major power tensions and small-state disruptions in an increasingly disordered world.

Notes

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[11] Krejsa, H. and A. Cho. 2017. "Is Beijing Adopting an Ethnonationalist Foreign Policy?" *Foreign Affairs*. 23 October 2017. https://www.foreignaffairs.com/articles/asia/2017-10-23/beijing-adopting-ethnonationalist-foreign-policy

Hindsight

Each year the *Global Risks Report* highlights numerous potential sources of danger and disruption. In this new Hindsight section, we dip back into previous editions of the report to consider three of the risks to which we have previously drawn attention: antimicrobial resistance, youth unemployment and the phenomenon of online misinformation that we termed “digital wildfires” when we discussed it five years ago. The aim here is to trace the progress that has been made in the intervening years. How have these risks and the global responses to them evolved?

Antimicrobial Resistance

In the 2013 *Global Risks Report*, a chapter entitled "The Dangers of Hubris on Human Health" warned about the growing risks associated with complacency towards antimicrobial resistance (AMR). It highlighted two underlying drivers: the overuse and misuse of antibiotics, in both human health systems and livestock management; and the fact that no new classes of antibiotics had been invented since the 1980s. The chapter noted newly emerging resistance to the strongest class of antibiotics, carbapenems. It cited estimates of 100,000 AMR-related deaths in US hospitals and 80,000 in China. The potential economic impact was put at 0.4% to 1.6% of GDP.

The risks posed by AMR have continued to intensify in the five years since the 2013 report. Numerous welcome initiatives have been launched, but concrete successes in addressing the two drivers identified above remain elusive. We still face two trends that spell potential disaster: new classes of drugs are not being invented and resistance to existing drugs continues to spread inexorably. The stakes are incredibly high—if resistance overtakes all our available antibiotics, it would spell the "the end of modern medicine".[1]

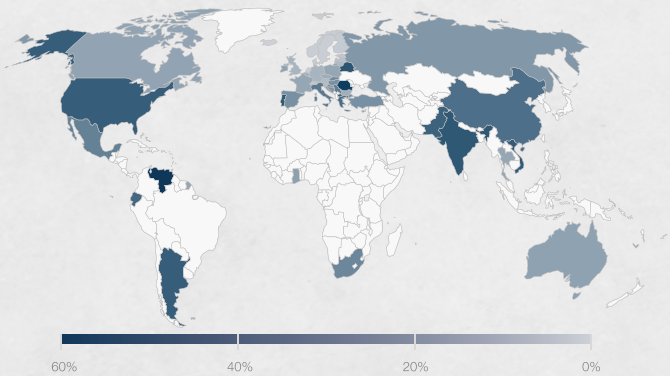
The costs are rising…

The latest economic impact assessments should be cause for alarm about the dangers of AMR to human health and the global economy. A study published by the World Bank in March 2017 estimated that AMR would exert a drag on global GDP of between 1.1 and 3.8 percentage points between now and 2050.[2] According to estimates from a report supported by the UK government and the Wellcome Trust, AMR could cost US$100 trillion between now and 2050, with the annual death toll reaching 10 million over that period.[3]

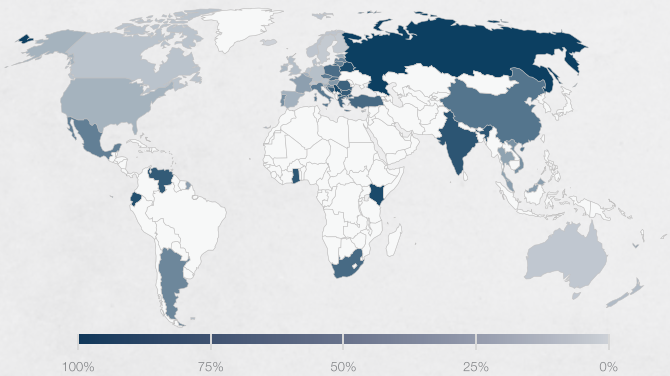
As in 2013, the patchiness of data continues to make a precise assessment of the AMR problem difficult. For example, a 2016 Reuters investigation in the United States determined that the accuracy of Centers for Disease Control and Prevention (CDC) estimates of AMR effects—2 million infections and 23,000 deaths per year—is undermined by problems such as AMR-related deaths being mis-recorded on death certificates.[4] One of the most exhaustive official studies of AMR—a two-year review commissioned by the UK government—concluded in 2016 that, globally, 700,000 deaths each year can be attributed to AMR.[5] The Center for Disease Dynamics, Economics & Policy (CDDEP) has been tracking antimicrobial resistance globally—the maps in Figure 4.1 illustrate their latest data, which show impacts broadly unchanged when compared with the European data for MRSA and *Klebsiella pneumoniae* we cited in 2013.[6] In October 2017, a new four-year global project that aims to track the evolution of AMR in 195 countries since 1990 was announced.[7]

Figure 4.1: Selected AMR Rates

Resistance of *Staphylococcus aureus* to Oxadcillin (MRSA), % Resistant (invasive isolates)



Resistance of *Klebsiella pneumoniae* to Cephalosporins (3rd gen), % Resistant (invasive isolates)



Source: Figure courtesy Center for Disease Dynamics, Economics and Policy. Used with permission via Creative Commons license. https://resistancemap.cddep.org/AntibioticResistance.php

Note: Countries in white indicate no data available.

…and resistance is spreading

Resistance to the strongest antibiotics continues to spread, even as their use increases to cope with still higher levels of resistance to weaker antibiotics. In 2014, the World Health Organization (WHO) reported that "*K. pneumoniae* resistant also to carbapenems has been identified in most of the countries that provided data, with proportions of resistance up to 54% reported."[8] In 2017, research demonstrated that bacteria resistant to colistin, the "antibiotic of last resort", had spread around the world within 18 months of the resistance first emerging.[9]

Global plans are taking shape…

There are some encouraging signs of action to counter AMR, although most of them are still at the planning stage. In 2015 WHO's five-point Global Action Plan on Antimicrobial Resistance was ratified, and it is being supplemented with accelerating completion of national action plans—important because the causes and consequences of AMR can differ widely across countries. As of April 2017, 67 countries had completed national action plans, according to WHO, with another 62 in the process of doing so.[10]

One key objective of these plans is to reduce excessive use of antibiotics, both in human health systems and in livestock and agriculture. The latter, in particular, is a growing problem.[11] In the United States, 62% of the antibiotics used in agriculture are medically important for humans.[12] And agricultural usage is rising sharply: the global use of antimicrobials in meat production is expected to grow by 67% between 2010 and 2030.[13]

Efforts to reduce the excessive use of antimicrobials need to also ensure access to affordable life-saving medications in the world's poorest countries, as underscored in a declaration by the G20 leaders in 2017, as well as by UNICEF.[14] UNICEF's Chief of Health has recommended using an integrated community case management (ICCM) approach, which can help to achieve an appropriate balance between ensuring access and preventing misuse of antibiotics.[15]

…but the drugs pipeline is a cause for alarm

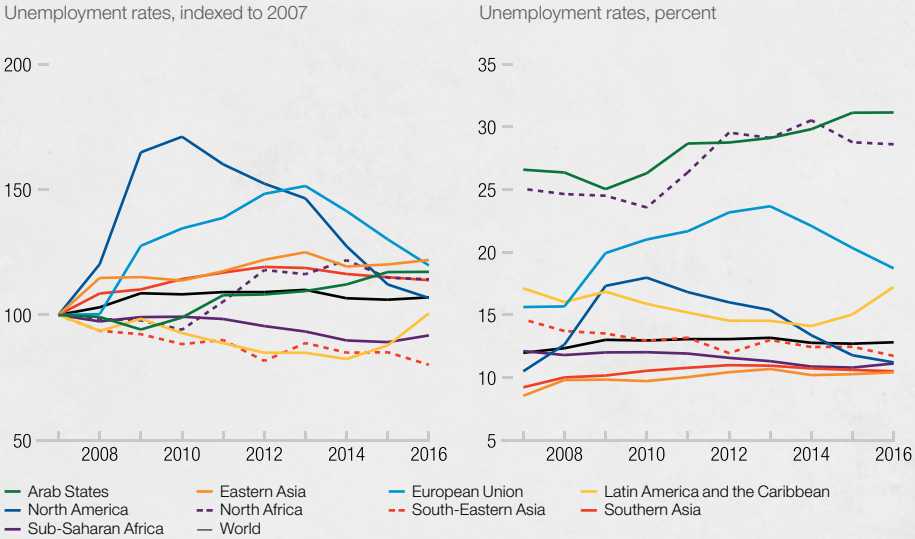
There is still a stark lack of new drugs in the development pipeline.[16] According to a 2016 study by The Pew Charitable Trusts, every currently available antibiotic is derived from a class discovered by 1984.[17] Efforts are, however, intensifying to steer research in the right direction, such as the first-ever priority list of antibiotic-resistant bacteria published by WHO in 2016.[18] New incentives are helping to catalyse new work. For example, CARB-X is an international non-profit partnership launched in July 2016 to accelerate research that focuses on the AMR bacteria prioritized as the most urgent by WHO and the CDC.[19] It has already funded 18 projects from six countries.[20] In the United Kingdom, the innovation foundation Nesta has offered a £10 million prize for the invention of a fast, accurate and affordable test for bacterial infections to help health professionals worldwide administer the appropriate antibiotics.[21] As of October 2017, 250 entries had been submitted. Scientific advances are allowing researchers to study a greater number of potential new sources of antibiotics; one company undertaking this kind of research is NovoBiotic Pharmaceutical, which studies soil microbes that until recently could not be cultivated in a laboratory.[22] More radical alternatives to traditional antibiotics are also being studied, including the potential use of CRISPR to trick harmful bacteria into destroying their own DNA.[23]

Youth Unemployment

The 2014 *Global Risks Report* highlighted the risk that the global financial crisis would create a "lost generation". We pointed to youth unemployment as a corrosive legacy, with the capacity to hinder young people's integration into traditional patterns of economic life, such as earning, saving and building careers. Among the specific issues raised were long-term unemployment; low-quality, part-time and temporary employment; weak links between education and work; the impact of demographic change and migration; and increasing pressures on social protection systems.

Globally, youth unemployment has been broadly static since the publication of the report in 2014, and it remains moderately higher than before the global financial crisis. Joblessness remains alarmingly high in some countries and regions. Even where job creation has picked up since the crisis, concerns are rising about the growing prevalence of low-quality employment and the rise of the "gig economy".[24] Youth unemployment is set to remain an important global challenge—particularly as demographic shifts in developing countries gather pace—and will continue to amplify numerous domestic and global risks, including social exclusion, mass migration and generational clashes over fiscal and labour-market policies.

Figure 4.2: Regional Youth Unemployment



Source: International Labour Organization (ILO) Modelled Estimates. http://www.ilo.org/ilostat

Note: Data valid as of 9 October 2017.

Global average masks big underlying differences…

Regional trends differ markedly, particularly in North America and the European Union, where the crisis hit hardest, leading to rapid increases in average youth unemployment followed by sharp reversals (see Figure 4.2). Two other regional outliers are North Africa and Latin America, which have seen youth unemployment jump for reasons unrelated to the crisis. The trigger in North Africa was the onset of the Arab Spring in 2010, while joblessness in Latin America has been increasing since 2014 against a backdrop of mounting political and economic turmoil.

Despite the rapid improvements recorded in Europe since 2013, the region remains particularly exposed to problems of youth unemployment: on average, young people in Europe remain much more likely to be unemployed than their counterparts either in North America or in most emerging regions (see Figure 4.2). In some European countries, which had high levels of youth unemployment before the crisis, the situation remains particularly dire—notably in Greece, Spain and Italy. These countries have seen sharp increases in poverty and other adverse societal impacts.

Youth unemployment remains stubbornly high across the Middle East and North Africa (MENA), at around 30%. The ongoing nature of the region's long-standing challenges on this issue are emphasized by the latest results of an annual World Economic Forum survey of more than 30,000 young people globally: in 2017, respondents from MENA cited the "lack of economic opportunity and employment" as the most serious issue facing their country.[25]

…and positive headline trends can mask structural challenges

Youth unemployment rates are, on average, significantly lower in developing than advanced economies. However, the structural factors we highlighted in 2014—notably bulging youth populations and the prevalence of low-quality and informal-sector work—continue to challenge developing regions. Across Africa, for example, youth unemployment decreased slightly over the past decade, but levels of working poverty among the young remain high: 70% of young people live on less than US$3.10 per day.[26] Since Africa is the youngest region in the world,[27] this is likely to have lasting consequences for the continent and beyond: the extent to which a sufficient number of good jobs can be created for rapidly growing youth populations will be a key driver of future migration flows.[28] Accelerating technological advances will complicate this challenge in many countries, requiring major improvements to education systems.[29]

China faces a different challenge: although youth unemployment in the country has remained stable, a 10-fold increase in the number of university graduates between 1997 and 2017 has created problems of underemployment. Many graduates are in low-skilled work, with 25% earning less than the average migrant worker.[30]

Youth employment schemes have their limits…

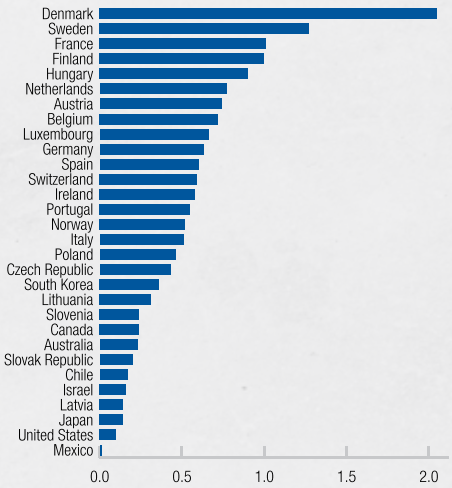
In 2016, the UN launched the Global Initiative for Decent Jobs for Youth to coordinate policies on youth employment and young people's labour rights.[31] A similar umbrella scheme exists at the EU level—the €6 billion Youth Guarantee programme, under which member states pledge to ensure that within four months of becoming unemployed young people are offered new employment, education or a workplace apprenticeship.[32] However, in countries where youth unemployment appears most intractable, structural drivers—such as relatively high rates of early school-leaving—mean that such short-term interventions will struggle to have much effect. Deeper structural reforms are needed.[33]

…unless accompanied by education and workplace reforms

The private sector is playing an increasingly prominent role in tackling youth unemployment by equipping youth with marketable skills, particularly in developing economies. Google and IBM, for example, have launched digital-skills programmes for young people in Africa.[34] There is a growing recognition of the importance of apprenticeships and vocational training. In Switzerland, the Global Apprenticeship Network (GAN) is a platform of 14 global businesses—including Adecco, IBM, Microsoft and Nestle—that help companies around the world to set up apprenticeship programmes. The government of Germany, a clear leader in this area, is currently working with 18 other countries on apprenticeship schemes.[35]

Figure 4.3: Public Spending on Active Labor Market Policies (ALMPs)

Percent of GDP



Source: Organisation for Economic Co-operation and Development (OECD). https://stats.oecd.org/Index.aspx?DataSetCode=LMPEXP

The increased use of "flexicurity" policies is another potential way of helping young people who are currently unemployed or consigned to low-quality work. Flexicurity combines (1) increased flexibility for employers to hire and fire workers with (2) generous state unemployment payments and (3) increased investment in active labour market policies (ALMPs)—measures that currently differ widely between countries (see Figure 4.3).[36] By encouraging increased movement between jobs in the labour market, flexicurity policies help to create employment openings for young people.

Digital Wildfires

Three years before the Brexit referendum and US presidential elections that brought the terms "fake news" and "post-truth" into broad circulation, a chapter in the 2013 *Global Risks Report* entitled "Digital Wildfires in a Hyperconnected World" warned of the increasing danger of misinformation being spread by social media. Among the key issues raised were the intentional use of social media to spread misinformation (for example, through the use of fake accounts to smear or impersonate political opponents), the difficulty of correcting misinformation when it spreads within trusted networks, global governance challenges and the danger that some governments might use well-intentioned constraints on misinformation to limit freedom of speech.

The prevalence and impact of digital wildfires have surged in the five years since we first discussed them. Even as the potential social, political and geopolitical risks are intensifying, however, the ways in which widely shared misinformation can influence human behaviour are still far from fully understood. While social media becomes increasingly deeply ingrained in daily life, mitigating adverse impacts will require sustained efforts by both policy-makers and technology leaders, and there will need to be a careful balance struck between regulation and preventing infringements of individual liberties.

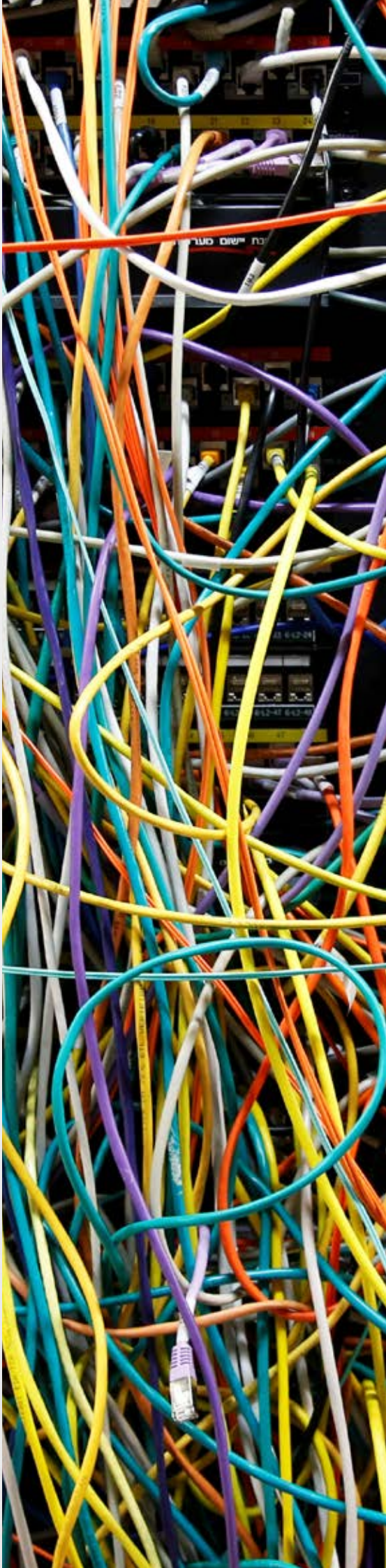
The prevalence of online misinformation has surged…

Digital misinformation is not a new phenomenon—Freedom House has been tracking the use of paid pro-government commentators to mimic grassroots supporters since 2009. Nor is it confined to the United States: Freedom House's *Freedom on the Net* report found 30% more countries using fake online grassroots activity in 2017 than 2016.[37]

However, it was during the 2016 US presidential election that "fake news" acquired global prominence, and much of the wave of research now underway has focused on this example. According to one study, in the three months immediately prior to the election, the top 20 false news stories outperformed—in terms of shares, reactions and comments—the top 20 stories from major news sources.[38] Engagement with fake news stories increased by 53% compared with the previous three-month period.[39] Another study noted that social media platforms directed 40% of the web traffic that went to fake news websites, compared with only 10% for the top mainstream news websites.[40]

…but its impact is difficult to gauge

Studies have found that people have a hard time distinguishing between accurate and fake headlines. One survey in late 2016 presented respondents with a random selection of six headlines—three accurate and three false—and asked them to rate the accuracy of the headlines they could recall having seen before.[41] It found that 75% of the time respondents judged the false



REUTERS/Baz Ratner

headlines to be "somewhat accurate" or "very accurate"—only slightly lower than 83% for the accurate news headlines.[42] However, another study conducted in 2017 suggests a greater level of user scepticism about news consumed via social media—it found that while 55% of respondents said they consumed news from Facebook, only 18% said they trusted news from Facebook most or all of the time.[43]

Efforts are underway to bolster safeguards

Numerous efforts are now underway to limit the prevalence and potential disruptiveness of online misinformation by helping the public to critically evaluate news sources. Since early 2016, Facebook has launched a number of efforts to address false news, clickbait, and sensationalism, including a partnership with fact-checking organizations and a network of researchers called the News Integrity Initiative.[44] An early study by Yale researchers suggests that these types of warnings reduce the likelihood of stories being shared, but has only a limited effect on users' perceptions of accuracy when stories are shown repeatedly.[45] And in 2017 the OECD announced plans to add critical thinking about information sources to its Global Competency tests.[46] Programmes to teach students to evaluate online sources critically are a growing trend around the world.[47]

Amid increasing pressure from governments and users, technology companies have also been taking steps to reduce the financial incentives for the creators of fake news and to enhance the transparency of material on their platforms. For example, Google announced in November 2016 that it would restrict its AdSense ads on sites that "misrepresent, misstate, or conceal information about the publisher, the publisher's content, or the primary purpose of the web property."[48] Facebook has taken action against ads on its platform that are "illegal, misleading or deceptive, which includes fake news";[49] however, these restrictions notably do not prevent users from writing or sharing inaccurate content.[50]

In September 2017, it was announced that a Russia-based organization spent US$100,000 on advertisements promoting divisive political issues during the US presidential campaign; Facebook said it would provide the ads to congressional investigators,[51] and has launched tools to make all ads it runs publicly accessible in the future. In October, Twitter announced it would ban RT (formerly Russia Today) and Sputnik, two major media organizations, from advertising on the platform following an internal investigation and the identification by the US intelligence community of these companies as vehicles of Russian government interference in the 2016 presidential election.[52] Twitter also announced that it is launching an "Advertising Transparency Center" and new policies that will (1) provide details about all ads carried on its platform, (2) place clear visual markers on political advertisements, (3) disclose how political ads are targeted and (4) strengthen policies regarding political advertising.[53]

Notes

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Risk Reassessment

One of the aims of the *Global Risks Report* is to encourage individuals and organizations to think critically and creatively about how they can respond to a rapidly evolving risks landscape. With that in mind, in the Risk Reassessment section we invite selected risk experts to share their insights about developments in our understanding of risk. In this year's report, Roland Kupers writes about resilience in complex systems, while Michele Wucker calls for organizations to pay more attention to cognitive bias in their risk management processes.

Resilience in complex organizations

By Roland Kupers

In a deeply interconnected world, stresses and shocks propagate across systems in ways that evade forecasting. Climate change is linked to the Syrian civil war, which is connected to heightened concern over immigration, which precipitated Brexit. Lehman Brothers was an investable company, until suddenly it wasn't and it catalysed a global financial crisis. None of these links are causal in a strict sense, nor could they reasonably be assigned a probability, but they nevertheless clearly form a web of cascading events. Organizations increasingly recognize how rapidly and often unexpectedly such events unfold. Since the 2008 financial crisis, the terms "black swans" and "fat tails" have become a familiar part of the risk conversation. Yet we don't always fully spell out the consequences.

Standard risk management tools assume that the risks follow a normalized distribution, mainly because this provides easy-to-understand narratives. But fat tail risks are not normal distributions. The only way to maintain the traditional tools is to neglect and wish away the fat tails. Simply denying the existence of black swans is hardly a way to deal with them. This approach may be approximately right most times, but in principle it is wrong. The consequences of being so wrong can impact an enterprise, perhaps catastrophically. Fortunately there is an alternative, which consists of applying a resilience lens where complexity prevails and traditional risk management is insufficient.

Resilience is, in fact, a property of complex systems. And complexity is the science of interconnected systems that has been driving a slow-motion revolution in science over the past 35 years or so. In 2013 the World Economic Forum published a comprehensive overview in *Perspectives on a Hyperconnected World*, describing the impact of complexity for policy and business. The conclusion is not that policy-makers and managers must become complexity experts. But a level of complexity literacy is crucial to navigate the modern age.

Nine resilience lenses

At the World Economic Forum's annual meeting in 2012, prominent companies began to take note of resilience. Peter Voser, at the time Shell's CEO, asked nine of his colleagues from across sectors what the impact of considering resilience would be on their business, on their clients and on their risk management. This led to the creation of the Resilience Action Initiative (RAI), which in turn resulted in a set of resilience tools and approaches informed by complexity theory but grounded in practice. One critical application is enterprise resilience: the capacity of a company or other organization to adapt and prosper in the face of high-impact, low-probability risks.

Working on the RAI project, we broke resilience into a set of lenses that could be applied across an organization's operations. We used the resilience lenses to examine the systemic risks and evaluate mitigation strategies. These lenses were then tested and tuned for applicability with the risk managers of the RAI companies. The new resilience tools are intended to be used in addition to traditional risk management tools, not instead of them. Organizations will continue to face normalized risks, which require the traditional tools. It is systemic risks that require the new tools.

The RAI work led to nine resilience lenses, grouped into the following three categories to provide the agenda for a fat-tail risk conversation:

- "Structural resilience" considers the systemic dynamics within the organization itself.
- "Integrative resilience" underlines complex interconnections with the external context.
- "Transformative resilience" responds to the fact that mitigating some risks requires transformation.

Structural resilience

This category encompasses redundancy, modularity and requisite diversity. The focus of structural resilience is on bouncing back faster from a disturbance. **Redundancy** is possibly the most familiar resilience strategy, but like the spare tyre on a car, it is the most expensive approach, because it requires non-performing assets. System **modularity** builds resilience only if the modules are loosely coupled: separate them too much and you no longer have a system, couple them too tightly and you lose the adaptive capacity. As in nature, diversity is a key resilience strategy. For organizations, however, this requires addressing the hard question of which diversity is fit for purpose for this problem at this time. That is what is meant by "**requisite diversity**".

Integrative resilience

This second category also consists of three lenses: multi-scale interactions, thresholds and social cohesion. These elements mainly focus on the context of the organization and its interconnections. The idea of systems operating at **multiple scales** is perhaps the most abstract, but also one of the most essential. It is perhaps most obvious in the geographic structure of individuals, families, neighbourhoods, cities, provinces and countries. The health of the connections at and between each scale is a potent contributor to the resilience of a system. **Thresholds** are familiar, but also neglected. The past of every organization shows discontinuities, but its future plans are always smooth. The fact that threshold effects generally cannot be forecast does not mean they should be ignored. Finally, **social cohesion**—such as the social capital an organization has to fall back on in times of crisis— is a strong source of resilience.

Transformative resilience

This category emphasizes that resilience is not simply about being able to return to the starting point after a shock. In some cases the organization needs to proactively change or it will end up being changed by external circumstances. The first lens is **distributed or polycentric governance**. Centralizing authority may seem efficient, but it often comes at the expense of resilience. Elinor Ostrom, winner of the Nobel Memorial Prize for Economics, has described how the use of multiple and overlapping levels of governance builds essential adaptive capacity in an organization. The second transformative lens is **foresight**, which is not the same as forecasting. Systemic effects generally cannot be extrapolated from past data, but require different techniques to engage with the uncertainty of multiple futures. Shell's scenario practice is an example of a foresight system that has been applied over the past 50 years for the purpose of structuring conversations about futures. The final lens is **experimentation and innovation**. This is obviously important for coming up with new ideas, but the purpose here is subtly different. Building capacity for change in an organization requires the capacity to explore the edges of the system. This implies having people with the time and resources to go outside the usual organizational boundaries, into possibly uncomfortable territory. Learning faster than competitors confers long-term advantage—having a purposeful system for such enquiry builds resilience.

It is not the case that measures to deal with systemic risk simply add up to the sum of these nine lenses. The interconnected nature of the underlying system precludes this. However, considering these nine aspects will provide a comprehensive—and, crucially, a practical— method for mitigating those risks. It is essential, however, for this to be a separate and distinct process from the standard processes used for dealing with normalized risks.

Roland Kupers is an adviser on Complexity, Resilience and Energy Transition and a fellow at Oxford University.

Cognitive bias and risk management

By Michele Wucker

Risk management starts with identifying and estimating the probability and impact of a given threat. We can then decide whether a risk falls within our tolerance limits and how to react to reduce the risk or at least our exposure to it. Time and again, however, individuals and organizations stumble during this process—for example, failing to respond to obvious but neglected high-impact "grey rhino" risks while scrambling to identify "black swan" events that, by definition, are not predictable.

New technologies and advances in data science have improved our ability to identify trends, assess risks and generate early warnings. But if business and policy decision-makers are to take full advantage of these new tools, we need a firmer handle on the reasons why people are more likely to react to some risks and ignore others. This behavioural element is crucial to managing risks effectively—to both recognizing the risks that confront us and then translating that knowledge into effective action.

Adjusting for bias in our risk assessments

Our brains play tricks that make some risks appear to be more or less likely than they are in reality. Being aware of the blinders that make it harder to recognize obvious risks allows leaders to counteract them, helping to prevent crises or at least mitigate the damage caused.

In deliberative situations such as a meeting of a corporate board or a legislative body, anchoring and confirmation biases can distort perceptions by assigning more weight to information and views presented early on. Leaders can offset these distortions by changing their processes to ensure that there are diverse voices around the table and by encouraging structured debate and constructive dissent. In other words, they can make it easier to consider a range of points of view that ultimately strengthens the choices they make.

One of the most pervasive cognitive blinders is the availability bias, which leads decision-makers to rely on examples and evidence that come immediately to mind. This draws people's attention to emotionally salient events ahead of objectively more likely and impactful events.

Hyperbolic discounting leads some decision-makers to prioritize short-term goals that end up hurting long-term value. Examples include putting off crucial investments or kicking the can down the road on tough but necessary budget decisions in companies or governments. Structures such as short-term quarterly earnings cycles or relatively short political terms create perverse incentives that magnify the hyperbolic discounting bias.

When members of a decision-making group are too homogeneous it can hamper their ability to recognize and react appropriately to risk. Among other things, too little diversity can heighten confirmation bias and make it more difficult for individuals to speak out about risks for fear of disrupting consensus. Cultural factors can also play a role. One approach for any organization that needs more robust inputs is for leaders to solicit opinions ahead of meetings, or to anonymize key inputs required during meetings—for example, by asking people to put their ideas on slips of paper and then considering them all in a group.

From box-ticking to reflective action

Organizations often act decisively to counter risk only once a major breach, such as a safety catastrophe or hacking event, forces them to. Part of this is because humans discount the likelihood of worst-case scenarios happening, which can blind us to obvious dangers.

Too often boards and C-suites approach risk analysis as a standalone activity to be ticked off a list, but then fall short on mitigating the risks that their analysis has identified. Think of an employee derailing cybersecurity plans by inadvertently clicking on a phishing email because not enough was done to spread risk awareness from the C-suite to the wider organization. To prevent this kind of breach, risk management needs to come out of its silo and become as much an organic part of operations as budgeting and project management. Organizations must do better in educating teams on risk awareness. But they also need to make sure their cultures encourage employees to feel that they can speak out and be taken seriously enough for problems to be dealt with.

Global risks require action across multiple organizations, which means that often one of the risk-management challenges at this level is the absence of the same kind of levers and hierarchies that facilitate decision-making and implementation within single organizations. Steeper obstacles to collective action heighten the challenge of getting varied stakeholders and networks to coordinate in responding to global risks.

There are encouraging developments on this front. All kinds of actors are already thinking in new ways about who can do what to solve global problems. After the US federal government pulled out of the Paris Agreement on climate change, for example, more than 2,300 businesses, cities, states and other non-federal actors pledged to honour a commitment to cut emissions. Organizations such as the World Economic Forum bring together global public- and private-sector actors to share ideas and catalyse action. The creation in some countries of new types of corporations, which include social and environmental impact in their bottom-line calculations, is re-shaping the role of businesses in confronting global risks head-on.

From signals to action

Organizations across the private and public sectors need to take a fresh look at how and why individuals and groups assess and act on risks in the way they do. We cannot ignore the cognitive and behavioural factors in risk management if we are to avoid both black swans and grey rhinos. Individuals and organizations must work to overcome biases, make better decisions, create warning-signal systems and act cohesively when red flags are raised.

Increasingly rich data resources give us better tools to anticipate problems and to track our progress in dealing with them. But decision-makers need to work hard to help to ensure that all of this information leads to effective action. That means developing better listening strategies, like those of CEOs who actively canvass the views of millennials as important intelligence on market trends and the future policy environment that businesses will face. It also means developing ways of encouraging and rewarding decision-makers who take difficult, long-term decisions. Finally, it means better tracking of outcomes and metrics to hold businesses and governments accountable for their promises.

Michele Wucker is the author of The Gray Rhino: How to Recognize and Act on the Obvious Dangers We Ignore *and a 2009 Young Global Leader of the World Economic Forum.*

Appendices

Appendix A: Descriptions of Global Risks and Trends 2018

Global Risks
A "global risk" is defined as an uncertain event or condition that, if it occurs, can cause significant negative impact for several countries or industries within the next 10 years.

To ensure legibility, the names of the global risks have been abbreviated in the figures throughout the report. The portion of the full name used in the abbreviation is in bold.

	Global Risk	Description
Economic	**Asset bubbles** in a major economy	Unsustainably overpriced assets such as commodities, housing, shares, etc. in a major economy or region
	Deflation in a major economy	Prolonged near-zero inflation or deflation in a major economy or region
	Failure of a major **financial mechanism or institution**	Collapse of a financial institution and/or malfunctioning of a financial system that impacts the global economy
	Failure/shortfall **of critical infrastructure**	Failure to adequately invest in, upgrade and/or secure infrastructure networks (e.g. energy, transportation and communications), leading to pressure or a breakdown with system-wide implications
	Fiscal crises in key economies	Excessive debt burdens that generate sovereign debt crises and/or liquidity crises
	High structural unemployment or underemployment	A sustained high level of unemployment or underutilization of the productive capacity of the employed population
	Illicit trade (e.g. illicit financial flows, tax evasion, human trafficking, organized crime, etc.)	Large-scale activities outside the legal framework such as illicit financial flows, tax evasion, human trafficking, counterfeiting and/or organized crime that undermine social interactions, regional or international collaboration, and global growth
	Severe **energy price shock** (increase or decrease)	Significant energy price increases or decreases that place further economic pressures on highly energy-dependent industries and consumers
	Unmanageable inflation	Unmanageable increases in the general price levels of goods and services in key economies
Environmental	**Extreme weather events** (e.g. floods, storms, etc.)	Major property, infrastructure and/or environmental damage as well as loss of human life caused by extreme weather events
	Failure of climate-change mitigation and adaptation	The failure of governments and businesses to enforce or enact effective measures to mitigate climate change, protect populations and help businesses impacted by climate change to adapt
	Major **biodiversity loss and ecosystem collapse** (terrestrial or marine)	Irreversible consequences for the environment, resulting in severely depleted resources for humankind as well as industries
	Major **natural disasters** (e.g. earthquake, tsunami, volcanic eruption, geomagnetic storms)	Major property, infrastructure and/or environmental damage as well as loss of human life caused by geophysical disasters such as earthquakes, volcanic activity, landslides, tsunamis, or geomagnetic storms
	Man-made environmental damage and **disasters** (e.g. oil spills, radioactive contamination, etc.)	Failure to prevent major man-made damage and disasters, including environmental crime, causing harm to human lives and health, infrastructure, property, economic activity and the environment

Geopolitical	**Failure of national governance** (e.g. failure of rule of law, corruption, political deadlock, etc.)	Inability to govern a nation of geopolitical importance as a result of weak rule of law, corruption or political deadlock
	Failure of regional or global governance	Inability of regional or global institutions to resolve issues of economic, geopolitical or environmental importance
	Interstate conflict with regional consequences	A bilateral or multilateral dispute between states that escalates into economic (e.g. trade/currency wars, resource nationalization), military, cyber, societal or other conflict
	Large-scale **terrorist attacks**	Individuals or non-state groups with political or religious goals that successfully inflict large-scale human or material damage
	State collapse or crisis (e.g. civil conflict, military coup, failed states, etc.)	State collapse of geopolitical importance due to internal violence, regional or global instability, military coup, civil conflict, failed states, etc.
	Weapons of mass destruction	The deployment of nuclear, chemical, biological and radiological technologies and materials, creating international crises and potential for significant destruction

Societal	**Failure of urban planning**	Poorly planned cities, urban sprawl and associated infrastructure that create social, environmental and health challenges
	Food crises	Inadequate, unaffordable, or unreliable access to appropriate quantities and quality of food and nutrition on a major scale
	Large-scale involuntary migration	Large-scale involuntary migration induced by conflict, disasters, environmental or economic reasons
	Profound social instability	Major social movements or protests (e.g. street riots, social unrest, etc.) that disrupt political or social stability, negatively impacting populations and economic activity
	Rapid and massive **spread of infectious diseases**	Bacteria, viruses, parasites or fungi that cause uncontrolled spread of infectious diseases (for instance as a result of resistance to antibiotics, antivirals and other treatments) leading to widespread fatalities and economic disruption
	Water crises	A significant decline in the available quality and quantity of fresh water, resulting in harmful effects on human health and/or economic activity

Technological	**Adverse consequences of technological advances**	Intended or unintended adverse consequences of technological advances such as artificial intelligence, geo-engineering and synthetic biology causing human, environmental and economic damage
	Breakdown of critical information infrastructure and networks (**Critical information infrastructure breakdown**)	Cyber dependency that increases vulnerability to outage of critical information infrastructure (e.g. internet, satellites, etc.) and networks, causing widespread disruption
	Large-scale **cyberattacks**	Large-scale cyberattacks or malware causing large economic damages, geopolitical tensions or widespread loss of trust in the internet
	Massive incident of **data fraud/ theft**	Wrongful exploitation of private or official data that takes place on an unprecedented scale

Trends

A "trend" is defined as a long-term pattern that is currently evolving and that could contribute to amplifying global risks and/or altering the relationship between them.

Trend	Description
Ageing population	Ageing populations in developed and developing countries driven by declining fertility and decrease of middle- and old-age mortality
Changing landscape of international governance	Changing landscape of global or regional institutions (e.g. UN, IMF, NATO, etc.), agreements or networks
Changing climate	Change of climate, which is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, in addition to natural climate variability
Degrading environment	Deterioration in the quality of air, soil and water from ambient concentrations of pollutants and other activities and processes
Growing middle class in emerging economies	Growing share of population reaching middle-class income levels in emerging economies
Increasing national sentiment	Increasing national sentiment among populations and political leaders affecting countries' national and international political and economic positions
Increasing polarization of societies	Inability to reach agreement on key issues within countries because of diverging or extreme values, political or religious views
Rising chronic diseases	Increasing rates of non-communicable diseases, also known as "chronic diseases", leading to rising costs of long-term treatment and threatening recent societal gains in life expectancy and quality
Rising cyber dependency	Rise of cyber dependency due to increasing digital interconnection of people, things and organizations
Rising geographic mobility	Increasing mobility of people and things due to quicker and better-performing means of transport and lowered regulatory barriers
Rising income and wealth disparity	Increasing socioeconomic gap between rich and poor in major countries or regions
Shifting power	Shifting power from state to non-state actors and individuals, from global to regional levels, and from developed to emerging market and developing economies
Rising urbanization	Rising number of people living in urban areas resulting in physical growth of cities

Appendix B: Global Risks Perception Survey and Methodology

The Global Risks Perception Survey (GRPS), discussed in the chapter "Fractures, Fears and Failures", is the World Economic Forum's source of original data harnessing the expertise of the Forum's extensive network of business, government, civil society and thought leaders. The survey was conducted from 28 August to 1 November 2017 among the World Economic Forum's multistakeholder communities, members of the Institute of Risk Management and the professional networks of our Advisory Board Members. The results of the GRPS are used to draw the Global Risks Landscape, Interconnections Map, and Trends Map presented, and to provide additional evidence used in the *Global Risks Report*.

Both the GRPS and the report adopt the following definitions of global risk and trend:

- **Global risk**: A "global risk" is an uncertain event or condition that, if it occurs, can cause significant negative impact for several countries or industries within the next 10 years.
- **Trend**: A "trend" is defined as a long-term pattern that is currently evolving and that could contribute to amplifying global risks and/or altering the relationship between them.

Changes from Previous Editions

Building on the adjustments made to the Global Risks Landscape for the 2017 edition of the report, this year we also have adjusted the likelihood scale to a 1–5 scale and used a more meaningful scale to assess likelihood, with a particular probability attached to each:

- Selecting "very unlikely" means that you believe the event has a probability of occurring within the next 10 years of less than 20%.
- Selecting "unlikely" means that you believe the event has a probability of occurring within the next 10 years of between 21% and 40%.
- Selecting "somewhat likely" means that you believe the event has a probability of occurring within the next 10 years of between 41% and 60%.
- Selecting "likely" means that you believe the event has a probability of occurring within the next 10 years of between 61% and 80%.
- Selecting "very likely" means that you believe the event has a probability of occurring within the next 10 years of more than 81%.

In addition, the 2017–2018 edition of the GRPS contained a new section about the expected evolution in 2018 of additional global risks that are more specific and current than the broader risks covered in the core module. The survey asked the following: "Do you think that in 2018 the risks presented by the following issues will increase or decrease compared to 2017?"

- Political or economic confrontations/frictions between major powers
- State-on-state military conflict or incursion
- Regional conflicts drawing in major power(s)
- Loss of confidence in collective security alliances
- Erosion of multilateral trading rules and agreements
- Erosion of global policy coordination on climate change

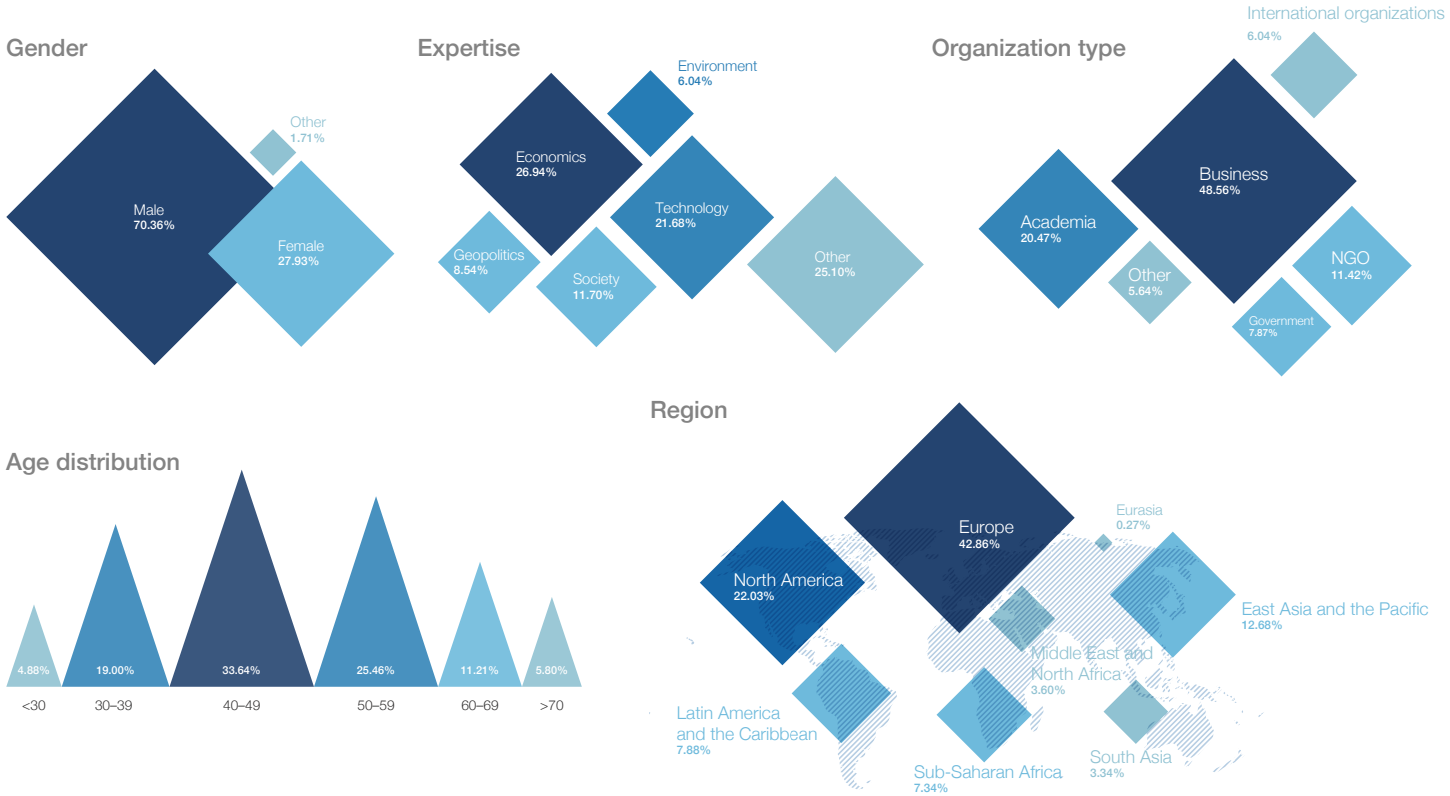
Respondents could then choose "significantly increase", "somewhat increase", "no change", "somewhat decrease" or "significantly decrease".

Methodology

Instead of applying an overall threshold for the completion rate, we set specific validity criteria for each question.

- Section 1 "The World in 2018": Question 1.01: Only respondents who assessed at least three of the six risks listed in this question were considered (999 respondents met the criterion).
- Section 2 "Assessment of Global Risks": The answers from the 871 respondents who assessed the impact and likelihood of at least one risk (the answer "no opinion" is considered a valid answer) were used to compute the results.
- Section 3 "Global Risk Interconnections": The answers from the 719 respondents who selected at least one valid pair of risks were used in the computation.

Figure B.1: Survey Sample Composition



Source: World Economic Forum Global Risks Perception Survey 2017–2018
Note: Reported shares are based on the number of participants who responded to biographical questions (Age: 758 responses, Gender: 759 responses, Expertise: 761 responses, Organization type: 762 response, Region: 749 responses)

– Section 4 "Assessments of Trends": The answers from the 684 respondents who selected at least one combination of an important trend and at least one associated risk were used in the computation.

Figure B1 presents some key descriptive statistics and information about the profiles of the respondents.

The World in 2018

For each considered risk, the share for each answer ("significantly increase", "somewhat increase", "no change", "somewhat decrease" or "significantly decrease") was obtained by dividing the number of respondents having selected that answer by the total number of answers.

The Global Risks Landscape 2018 (Figure I)

Respondents were asked to assess the likelihood and global impact of each of the 30 risks. For each risk, they were asked about the likelihood of the risk occurring globally within the next 10 years and about its negative impact for several countries or industries within the next 10 years. For the first question, the possible answers ranged from "very unlikely" to "very likely". These five choices were turned into a 1–5 scale (1 = very unlikely, 5 = very likely). For the question on impact, respondents could select one of five choices: "minimal", "minor", "moderate", "severe", or "catastrophic". These five alternatives were turned into a 1–5 scale (1 = minimal, 5 = catastrophic).

Respondents could choose "no opinion" if they felt unable to provide an informed answer, and they could also leave the question completely blank. For each risk, partial responses—those assessing only the likelihood of occurrence or only its impact—were dropped.[1] A simple average for both likelihood and impact for each of the 30 global risks was calculated on this basis.

Formally, for any given risk *i*, its likelihood and impact—denoted respectively likelihood_i and impact_i—are:

$$\text{likelihood}_i = \frac{1}{N_i}\sum_{n=1}^{N_i^1} \text{likelihood}_{i,n}$$

$$\text{impact}_i = \frac{1}{N_i}\sum_{n=1}^{N_i^2} \text{impact}_{i,n}$$

where N_i is the number of respondents for risk *i*, and $\text{likelihood}_{i,n}$ and $\text{impact}_{i,n}$ are, respectively, the likelihood and impact assigned by respondent *n* to risk *i*. The likelihood is measured on a scale of 1–5 and the impact on a scale of 1–5. N_i is the number of respondents for risk i who assessed both the likelihood and impact of that specific risk (the answers of respondents who left one of the two questions blank were not taken into account).

The Global Risks Interconnections Map 2018 (Figure III) and the Risks-Trends Interconnections Map 2018 (Figure II)

To draw the Global Risks Interconnections Map 2018 (Figure III), survey respondents were asked the following question: "Global risks are not isolated and it is important to assess their interconnections. In your view, which are the most strongly connected global risks? Please select three to six pairs of global risks."

Similarly, for the Risks-Trends Interconnections Map 2018 (Figure II), respondents had to identify up to three trends that they consider important in shaping the global agenda in the next 10 years and the three risks that are driven by each of those trends. The two questions read: "Which are the three most important trends that will shape global development in the next 10 years?" and "For each of the three trends identified in the previous question, select up to three global risks that are most strongly driven by these trends." The information thereby obtained was used to construct the Risks-Trend Interconnections Map 2018.

In both cases, a tally was made of the number of times each pair was cited. This value was then divided by the count of the most frequently cited pair. As a final step, the square root of this ratio was taken to dampen the long-tail effect (i.e. a few very strong links, and many weak ones) and to make the differences more apparent across the weakest connections. Out of the 435 possible pairs of risks, 56 or 20% were not cited. Similarly, out of the possible 377 trend-risk combinations, 35 or 9% were not cited. Formally, the intensity of the interconnection between risks *i* and *j* (or between trend *i* and risk *j*), denoted $\text{interconnection}_{ij}$, corresponds to:

$$\text{interconnection}_{ij} = \sqrt{\frac{\sum_{n=1}^{N} \text{pair}_{ij,n}}{\text{pair}_{max}}}$$

with

$$\text{pair}_{max} = \max_{ij}\left(\sum_{n=1}^{N} \text{pair}_{ij,n}\right)$$

where *N* is the number of respondents.

Variable $\text{pair}_{ij,n}$ is 1 when respondent n selected the pair of risks *i* and *j* as part of his/her selection. Otherwise, it is 0. The value of the interconnection determines the thickness of each connecting line in the graph, with the most frequently cited pair having the thickest line.

In the Global Risks Landscape and the Risks-Trends Interconnections Map, the size of each risk is scaled according to the degree of weight of that node in the system. Moreover, in the Risks-Trends Interconnections Map, the size of the trend represents the perception of its importance in shaping global development (answer to the first part of the question on trend, as explained above); the biggest trend is the one considered to be the most important in shaping global development.

The placement of the nodes in the Risks-Trends Interconnections Map was computed using ForceAtlas2, a force-directed network layout algorithm implemented in Gephi software, which minimizes edge lengths and edge crossings by running a physical particle simulation.[2]

[1] If a respondent answered "no opinion" for likelihood or impact, his or her assessment of the other dimension (impact or likelihood, respectively), was retained.
[2] Jacomy, M., T. Venturini, S. Heymann, and M. Bastian. 2014. "ForceAtlas2: A Continuous Graph Layout Algorithm for Handy Network Visualization Designed for the Gephi Software". *PLoS ONE* 9 (6): e98679. doi:10.1371/journal.pone.0098679

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