

# The Global Risks Report 2022

17th Edition

INSIGHT REPORT



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# The Global Risks Report 2022 17th Edition

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# Preface

Saadia Zahidi, Managing Director

A divergent economic recovery from the crisis created by the pandemic risks deepening global divisions at a time when societies and the international community urgently need to collaborate to check COVID-19, heal its scars and address compounding global risks.

In some societies, rapid progress on vaccination, leaps forward on digitalization and a return to pre-pandemic growth rates herald better prospects for 2022 and beyond. Others could be weighed down for years by struggles to apply even initial vaccine doses, combat digital divides and find new sources of economic growth. Widening disparities within and between countries will not only make it more difficult to control COVID-19 and its variants, but will also risk stalling, if not reversing, joint action against shared threats that the world cannot afford to overlook.

Last year's edition of the *Global Risks Report* warned of potential knock-on economic risks that are now clear and present dangers. Supply chain disruptions, inflation, debt, labour market gaps, protectionism and educational disparities are moving the world economy into choppy waters that both rapidly and slowly recovering countries alike will need to navigate to restore social cohesion, boost employment and thrive. These difficulties are impeding the visibility of emerging challenges, which include climate transition disorder, increased cyber vulnerabilities, greater barriers to international mobility, and crowding and competition in space.

Restoring trust and fostering cooperation within and between countries will be crucial to addressing these challenges and preventing the world from drifting further apart.

The 17<sup>th</sup> edition of the *Global Risks Report* identifies tensions that will result from diverging trajectories

and approaches within and between countries and then examines the risks that could arise from such tensions. This year's report also highlights the implications of these risks for individuals, governments and businesses.

The Global Risks Perception Survey (GRPS), which has underpinned the report since 2006, was refreshed this year to gather new and broader insights from nearly 1,000 global experts and leaders who responded. The 2021-2022 GRPS includes the following sections:

- **COVID-19 Hindsight** invites respondents to opine on the reverberations of the crisis, allowing comparability with the results from the previous year.
- **Future Outlook** captures respondent sentiment, informing our analysis of how individual contexts may influence global risk perceptions and affect mitigation.
- **Horizon** captures respondents' perceived trajectory and sense of urgency of global risks, informing our analysis of choices and trade-offs that decision-makers may face.
- **Severity** ranks potential damage while **Effects** asks respondents to consider cascading impacts in conjunction with the severity of the risk itself.
- **International Mitigation** asks respondents to assess international efforts in 15 global governance areas to identify achievements and areas of opportunity for global action and cooperation.
- **Open questions on risks, trends and warning signs** source expert knowledge.

This year the *Global Risks Report* also draws on the views of over 12,000 country-level leaders who identified critical short-term risks to their 124 countries, gathered through the World Economic Forum's Executive Opinion Survey. The areas highlighted in these responses are likely to inform national decision-making and provide a perspective on how short-term risk national priorities may compare with global risks and perspectives.

We are ever grateful to our partners in the report's development: Marsh McLennan, SK Group and Zurich Insurance Group. We also thank our academic partners: the National University of Singapore, the Oxford Martin School at the University of Oxford and the Wharton Risk Management and Decision Processes Center at the University of Pennsylvania.

This report continues to leverage the collective intelligence of an expanding community of the world's foremost risk experts, convened by the World Economic Forum's Global Risks Practice: the Global Risks Report Advisory Board, the Chief Risk Officers Community and the Global Future Council on Frontier Risks, as well as a series of consultations with regional and thematic experts from the public and private sectors.

The report also draws from and supports the World Economic Forum's platforms dedicated to catalysing a new economy and society, accelerating climate action for people and planet, leveraging Fourth Industrial Revolution technologies, stewarding industry transformations and enhancing global and regional cooperation. These platforms and their stakeholders use the insights from this report to shape their agendas for tackling the world's greatest challenges and embedding greater resilience and cooperation.

# Executive Summary

As 2022 begins, COVID-19 and its economic and societal consequences continue to pose a critical threat to the world. Vaccine inequality and a resultant uneven economic recovery risk compounding social fractures and geopolitical tensions. In the poorest 52 countries—home to 20% of the world’s people—only 6% of the population had been vaccinated at the time of writing. By 2024, developing economies (excluding China) will have fallen 5.5% below their pre-pandemic expected GDP growth, while advanced economies will have surpassed it by 0.9%—widening the global income gap.

The resulting global divergence will create tensions—within and across borders—that risk worsening the pandemic’s cascading impacts and complicating the coordination needed to tackle common challenges including strengthening climate action, enhancing digital safety, restoring livelihoods and societal cohesion and managing competition in space.

The *Global Risks Report 2022* presents the results of the latest Global Risks Perception Survey (GRPS), followed by an analysis of key risks emanating from current economic, societal, environmental and technological tensions. The report concludes with reflections on enhancing resilience, drawing from the lessons of the last two years of the COVID-19 pandemic. The key findings of the survey and the analysis are summarized below.

## Global risks perceptions highlight societal and environmental concerns

Asked to take a view of the past two years, respondents to the GRPS perceive societal risks—in the form of “social cohesion erosion”, “livelihood crises” and “mental health deterioration”—as those that have worsened the most since the pandemic began. Only 16% of respondents feel positive and optimistic about

the outlook for the world, and just 11% believe the global recovery will accelerate. Most respondents instead expect the next three years to be characterized by either consistent volatility and multiple surprises or fractured trajectories that will separate relative winners and losers.

For the next five years, respondents again signal societal and environmental risks as the most concerning. However, over a 10-year horizon, the health of the planet dominates concerns: environmental risks are perceived to be the five most critical long-term threats to the world as well as the most potentially damaging to people and planet, with “climate action failure”, “extreme weather”, and “biodiversity loss” ranking as the top three most severe risks. Respondents also signalled “debt crises” and “geoeconomic confrontations” as among the most severe risks over the next 10 years.

Technological risks—such as “digital inequality” and “cybersecurity failure”—are other critical short- and medium-term threats to the world according to GRPS respondents, but these fall back in the rankings towards the long term and none appear among the most potentially severe, signalling a possible blind spot in risk perceptions.

The 2021-2022 GRPS included a question on international risk mitigation efforts. “Artificial intelligence”, “space exploitation”, “cross-border cyberattacks and misinformation” and “migration and refugees” are the areas where most respondents believe the current state of risk mitigation efforts fall short of the challenge—that is, efforts are “not started” or in “early development”. Meanwhile, for “trade facilitation”, “international crime” and “weapons of mass destruction”, large majorities perceived risk mitigation efforts to be “established” or “effective”.



REUTERS/HEO RAN

## A divergent economic recovery threatens collaboration on global challenges

Economic challenges flowing from the pandemic persist. The outlook remains weak: at the time of writing, the global economy was expected to be 2.3% smaller by 2024 than it would have been without the pandemic. Rising commodity prices, inflation and debt are emerging risks. Moreover, with another spike in COVID-19 cases towards the end of 2021, the pandemic continues to stifle countries' ability to facilitate a sustained recovery.

The economic fallout from the pandemic is compounding with labour market imbalances, protectionism, and widening digital, education and skills gaps that risk splitting the world into divergent trajectories. In some countries, rapid vaccine rollout, successful digital transformations and new growth opportunities could mean a return to pre-pandemic trends in the short term and the possibility of a more resilient outlook over a longer horizon. Yet many other countries will be held back by low rates of vaccination, continued acute stress on health systems, digital divides and stagnant job markets. These divergences will complicate the international collaboration needed to address the worsening impacts of climate change, manage migration flows and combat dangerous cyber-risks.

Short-term domestic pressures will make it harder for governments to focus on long-term priorities and will limit the political capital allocated to global concerns. "Social cohesion erosion" is a top short-term threat in 31 countries—including Argentina, France, Germany, Mexico and South Africa from the G20. Disparities that were already challenging societies are now expected to widen—51 million more people are projected to live in extreme poverty compared to the pre-pandemic trend—at the risk of increasing polarization and resentment within societies. At the same time, domestic pressures risk stronger national interest postures and worsening fractures in the global economy that will come at the expense of foreign aid and cooperation.

## A disorderly climate transition will exacerbate inequalities

Respondents to the GRPS rank "climate action failure" as the number one long-term threat to the world and the risk with potentially the most severe impacts over the next decade. Climate change is already manifesting rapidly in the form of droughts, fires, floods, resource scarcity and species loss, among other impacts. In 2020, multiple cities around the world experienced extreme temperatures not seen for years—such as a record high of 42.7°C in Madrid and a 72-year low of -19°C in Dallas, and regions like the Arctic Circle have averaged summer temperatures 10°C higher



than in prior years. Governments, businesses and societies are facing increasing pressure to thwart the worst consequences. Yet a disorderly climate transition characterized by divergent trajectories worldwide and across sectors will further drive apart countries and bifurcate societies, creating barriers to cooperation.

Given the complexities of technological, economic and societal change at this scale, and the insufficient nature of current commitments, it is likely that any transition that achieves the net zero goal by 2050 will be disorderly. While COVID-19 lockdowns saw a global dip in greenhouse gas (GHG) emissions, upward trajectories soon resumed: the GHG emission rate rose faster in 2020 than the average over the last decade. Countries continuing down the path of reliance on carbon-intensive sectors risk losing competitive advantage through a higher cost of carbon, reduced resilience, failure to keep up with technological innovation and limited leverage in trade agreements. Yet shifting away from carbon-intense industries, which currently employ millions of workers, will trigger economic volatility, deepen unemployment and increase societal and geopolitical tensions. Adopting hasty environmental policies will also have unintended consequences for nature—there are still many unknown risks from deploying untested biotechnical and geoengineering technologies—while lack of public support for land use transitions or new pricing schemes will create political complications that further slow action. A transition that fails to account for societal implications will exacerbate inequalities within and between countries, heightening geopolitical frictions.

## **Growing digital dependency will intensify cyberthreats**

Growing dependency on digital systems—intensified by COVID-19—has altered societies. Over the last 18 months, industries have undergone rapid digitalization, workers have shifted to remote working where possible, and platforms and devices facilitating this change have proliferated. At the same time, cybersecurity threats are growing—in 2020, malware and ransomware attacks increased by 358% and 435% respectively—and are outpacing societies' ability to effectively prevent or respond to them. Lower barriers to entry for cyberthreat actors, more aggressive attack methods, a dearth of cybersecurity professionals and patchwork governance mechanisms are all aggravating the risk.

Attacks on large and strategic systems will carry cascading physical consequences across societies, while prevention will inevitably entail higher costs. Intangible risks—such as disinformation, fraud and lack of digital safety—will also impact public trust in

digital systems. Greater cyberthreats will also hamper cooperation between states if governments continue to follow unilateral paths to control risks. As attacks become more severe and broadly impactful, already-sharp tensions between governments impacted by cybercrime and governments complicit in their commission will rise as cybersecurity becomes another wedge for divergence—rather than cooperation—among nation-states.

## **Barriers to mobility risk compounding global insecurity**

Growing insecurity resulting from economic hardship, intensifying impacts of climate change and political instability are already forcing millions to leave their homes in search of a better future abroad. “Involuntary migration” is a top long-term concern for GRPS respondents, while 60% of them see “migration and refugees” as an area where international mitigation efforts have “not started” or are in “early development”. In 2020, there were over 34 million people displaced abroad globally from conflict alone—a historical high. However, in many countries, the lingering effects of the pandemic, increased economic protectionism and new labour market dynamics are resulting in higher barriers to entry for migrants who might seek opportunity or refuge.

These higher barriers to migration, and their spill-over effect on remittances—a critical lifeline for some developing countries—risk precluding a potential pathway to restoring livelihoods, maintaining political stability and closing income and labour gaps. At the time of writing, the United States faced over 11 million unfilled jobs in general and the European Union had a deficit of 400,000 drivers just in the trucking industry. In the most extreme cases, humanitarian crises will worsen since vulnerable groups have no choice but to embark on more dangerous journeys. Migration pressures will also exacerbate international tensions as it is increasingly used as a geopolitical instrument. Destination-country governments will have to manage diplomatic relationships and immigrant skepticism among their populations.

## **Opportunities in space could be constrained by frictions**

While humans have been exploring space for decades, recent years have witnessed increased activity, not only creating new opportunities but also signalling an emerging realm of risk, particularly with growing militarization and weaponization in the arena. New

commercial satellite market entrants are disrupting incumbents' traditional influence over the global space commons in delivering satellite services, notably internet-related communications. A greater number and range of actors operating in space could generate frictions if space exploration and exploitation are not responsibly managed. With limited and outdated global governance in place to regulate space alongside diverging national-level policies, risks are intensifying.

One consequence of accelerated space activity is a higher risk of collisions that could lead to a proliferation of space debris and impact the orbits that host infrastructure for key systems on Earth, damage valuable space equipment or spark international tensions. Limited governance tools increase the likelihood of space activity escalating geopolitical tensions, and recent weapons tests in space underscore such risks. Increased space activity could also lead to unknown environmental impacts or raise costs for public goods such as weather monitoring or climate change surveillance.

## Year two of the pandemic yields insights on resilience

In 2021, countries deployed new mechanisms to respond to a public health crisis with shifting characteristics, leading to both successes and

failures. Two interlinked factors were critical for effective management of the pandemic: first, the readiness of governments to adjust and modify response strategies according to changing circumstances; and second, their ability to maintain societal trust through principled decisions and effective communication.

Reflecting on the distinct resilience goals of governments, businesses and communities will help ensure that agendas are aligned in achieving a whole-of-society approach to tackling critical risks of any nature. For governments, balancing costs, regulating for resilience and adjusting data-sharing arrangements to ensure sharper crisis management are key to galvanizing stronger interaction between public and private sectors. Businesses—recognizing that better national-level preparedness is critical for planning, investing and executing their strategies—can leverage opportunities in areas such as supply chains, codes of conduct within their industry and inclusion of a resilience dimension into workforce benefit offerings. Communities can help local governments to join up with national efforts, improve communication and support grassroots resilience efforts. At an organizational level, strategies such as grounding resilience analyses in key delivery requirements, appreciating systemic vulnerabilities and embracing a diversity of approaches can help leaders build better resilience as well.



CHAPTER 1

# Global Risks 2022: Worlds Apart

6%

vaccination rate in poorest 52 countries

---

97%

public debt-to-GDP in 2020

---

51 million

increase in extreme poverty projections

---

197

countries aligned on the Glasgow Climate Pact

---

84%

of experts are worried or concerned about  
the world

---

## A divergent recovery

At the start of 2022, the COVID-19 crisis is still ongoing and its economic ructions continue to be felt. Disparities in progress on vaccination are creating a divergent economic recovery that risks compounding pre-existing social cleavages and geopolitical tensions. These tensions and the economic overhang of the pandemic will make it difficult to ensure a coordinated and sufficiently rapid approach to global challenges—most notably climate change.

Vaccination and accelerated digitalization have enabled some countries to recover rapidly from the economic crisis created by the COVID-19 pandemic, but many others are still struggling to avoid the worst consequences. At the time of writing, half of the world’s population was still unvaccinated,<sup>1</sup> 40% remained offline,<sup>2</sup> and only 35% of the world’s students lived in countries where schools are fully open.<sup>3</sup> Some 37% of respondents to this

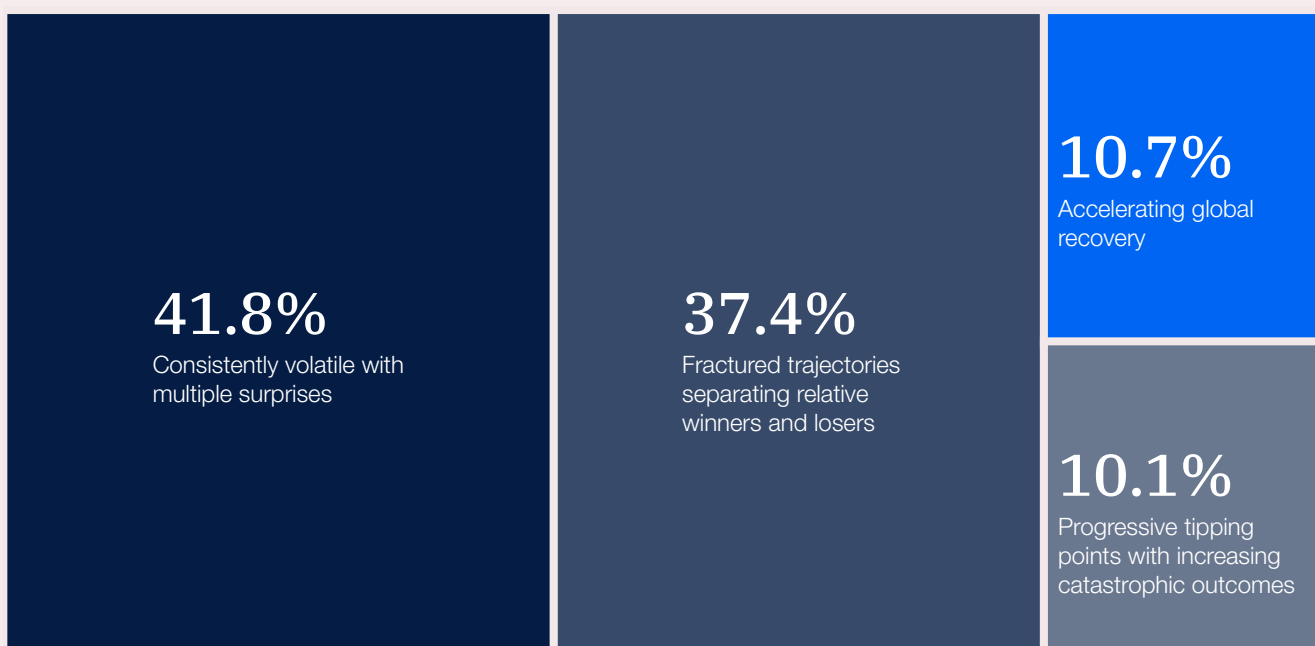
year’s Global Risks Perceptions Survey (GRPS) believe the world will follow a fractured trajectory in the medium term, increasingly separating relative “winners” from “losers” of the COVID-19 crisis (see Figure 1.1). By the time the GRPS was conducted (see the Technical Notes in Appendix C), only 11% believed the global recovery would accelerate over the next three years.

Economic, geopolitical, public health and societal fractures—which increase after pandemics<sup>4</sup>—risk leading to divergent and delayed approaches to critical challenges facing people and planet: accelerating the green transition in response to climate change (see Chapter 2), coordinating against heightened digital vulnerabilities (see Chapter 3), managing mobility and migration (see Chapter 4) and safeguarding the next global commons: space (see Chapter 5).

FIGURE 1.1

### “What is your outlook for the world over the next three years?”

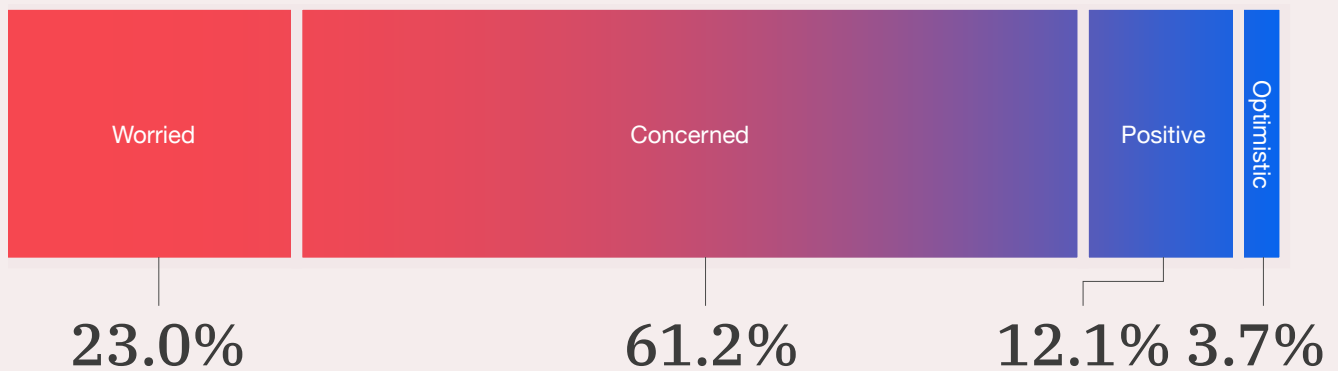
■ Negative scenarios ■ Positive scenario



Source: World Economic Forum Global Risks Perception Survey 2021-2022

FIGURE 1.2

## “How do you feel about the outlook for the world?”



Source: World Economic Forum Global Risks Perception Survey 2021-2022

Effective domestic and international action on these challenges depends on restoring trust within societies, galvanizing national and global leaders and finding new opportunities for collaboration (see Chapter 6). Fully 84%

of GRPS respondents were either concerned or worried about the outlook for the world (see Figure 1.2); lack of optimism could create a vicious cycle of disillusionment and social unrest.

## A turbulent global context

### The pandemic persists

The world continues to grapple with the effects of COVID-19 on public health. At the start of 2022, 5.4 million deaths from COVID-19 had been reported globally, out of 282 million confirmed cases.<sup>5</sup> Moreover, a significant proportion of those infected by COVID-19 have long-lasting symptoms—some 10% show persistent ill health 12 weeks after having the disease.<sup>6</sup> COVID-19 vaccination has progressed steadily but unevenly around the world. At the time of writing, 50 countries had vaccinated more than 70% of their population,<sup>7</sup> with some now starting to receive booster shots, while the vaccination rate in the poorest 52 countries—home to 20% of the world’s population—was still only 6%.<sup>8</sup> Potentially more infectious variants of the virus—notably the new Omicron variant—along with waning immunity among the vaccinated and a continued high proportion of people who are unvaccinated meant that the number of new cases increased again

towards the end of 2021.<sup>9</sup> Unsurprisingly, “infectious diseases” are still considered a critical short-term threat to the world in the GRPS.

The COVID-19 crisis has also had extensive collateral health impacts, partly because other diseases were deprioritized. The pandemic led to an additional 53 million cases of major depression globally.<sup>10</sup> “Mental health deterioration” was one of the top five risks that GRPS respondents saw as having deteriorated the most during COVID-19. The incidence of non-communicable diseases—which cause 41 million deaths every year, mostly in low- and middle-income countries—has also worsened worldwide due to treatment delays caused by COVID-19.<sup>11</sup> Antimicrobial resistance caused nearly 2 million deaths in 2020 and this number may increase—particularly for malaria and tuberculosis—because of the inappropriate use of antibiotics to treat COVID-19.<sup>12</sup> The pandemic and its collateral health impacts

will continue to put pressure on health systems across the globe, widen health inequalities between and within countries, create social frictions and weigh down long-term economic growth potential.

## Risks to economic recovery

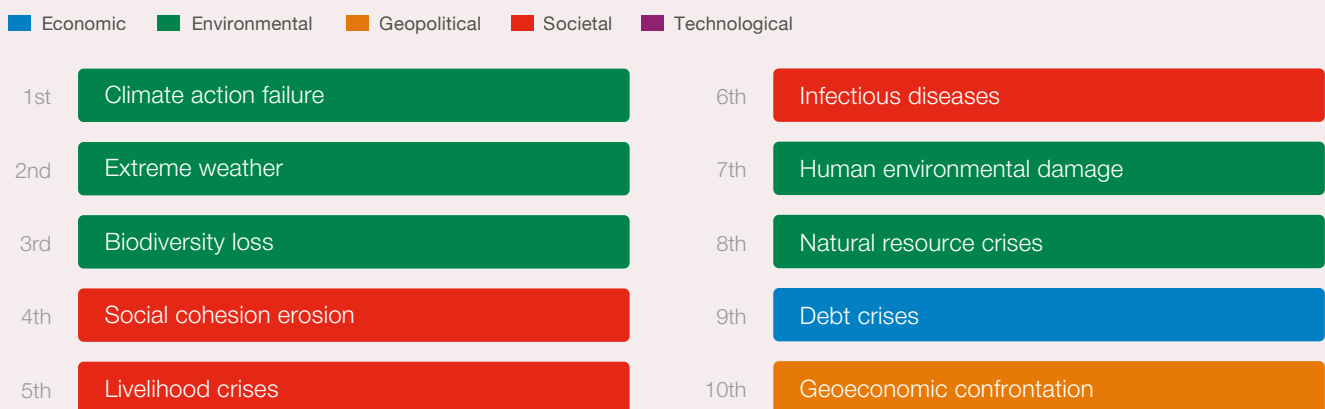
The global economic recovery from the recession caused by responses to the COVID-19 pandemic continues but is slowing. After a contraction of 3.1% in 2020, global economic growth is expected to reach 5.9% in 2021 and slow to 4.9% in 2022.<sup>13</sup> By 2024, the global economy is projected to be 2.3% smaller than it would have been without the pandemic.<sup>14</sup> Risks to economic growth are considerable, including risks from a potential resurgence of COVID-19 as new variants emerge. The previous edition of the GRPS identified “commodity shocks”, “price instability” and “debt crises” as critical medium-term concerns. These are already emerging to some extent. At the time of writing, commodity prices had increased nearly 30% since end of 2020;<sup>15</sup> they could remain volatile because of growing tensions between Europe and Russia, China’s energy shortage,<sup>16</sup> continued supply chain disruptions and transition challenges from disinvestment in fossil fuel reserves. Inflation has accelerated in many countries as a

result of pandemic-related disruptions to supply chains combined with resurgent consumer demand and higher commodity prices. This will dampen consumer sentiment—which has been fundamental for recovery—and will increase risks from central bank interest rate rises.<sup>17</sup> In advanced and developing economies alike, higher prices and more expensive debt would impact lower-income households especially hard, while small and medium-sized enterprises (SMEs) that are still trying to avoid bankruptcy would suffer from weakening consumption.

Moreover, sovereign debt has spiked because of the pandemic. Government debt globally increased by 13 percentage points, to 97% of GDP, in 2020.<sup>18</sup> Already-strained public finances in developing countries are at heightened risk from debt deleveraging<sup>19</sup> and an appreciation of the US dollar—the US Dollar Index had risen 7% since the start of 2021.<sup>20</sup> GRPS respondents identified “debt crises” as a critical short- and medium-term threat to the world, and one of the most potentially severe risks over the next decade (see Figure 1.3). Debt overhangs will make it more difficult for countries to deal with the economic impacts of COVID-19 and finance a socially just, net zero transition.

FIGURE 1.3

## “Identify the most severe risks on a global scale over the next 10 years”



Source: World Economic Forum Global Risks Perception Survey 2021-2022



GETTY/LIU JIN

## Economic divergence

COVID-19 prompted a global recession, but stark differences in vaccination rates between countries now risk leading to even greater economic divergence than they experienced before the pandemic. A greater prevalence of COVID-19 in low-vaccination countries than in high-vaccination ones will weigh on worker availability and productivity, disrupt supply chains and weaken consumption. Moreover, a lower post-pandemic risk appetite in the vaccinated world—comprised mostly of advanced economies—could weaken their investment in the non-vaccinated world. The economic disruption from the pandemic has also created stronger incentives in the vaccinated world to prioritize resilience over cost minimization. Governments and industries may now drive regional convergence at the expense of global integration as they seek to minimize supply chain disruptions.

Polarized connectivity, education and income trajectories risk further fragmenting the global economy, and divergence is likely to be aggravated by slowing and disparate growth. Advanced economies are

expected to surpass their pre-pandemic growth path by 0.9% by 2024, but developing economies (excluding China) will be 5.5% below it—with Latin America and Sub-Saharan Africa trailing even further behind.<sup>21</sup> Economic decoupling risks further hindering already-limited means to restore growth in developing economies. Such decoupling will make it harder for emerging economies to leverage young workforces, large consumer markets and competitive costs. They also risk having less access to financing and technology to face global challenges, including climate change.

Although employment is approaching pre-pandemic levels in many advanced economies, globally the jobs recovery from the COVID-19 crisis is lagging the economic recovery—global employment remains lower than it was before the pandemic and the Great Resignation in advanced economies has caused labour market

**Income disparities risk increasing polarization and resentment within societies**

participation to fall. Youth, women and lower-skilled workers have been especially affected. It will take the global economy at least until 2023 to create the jobs lost to COVID-19, but many of these jobs are expected to be of low productivity and poor quality, according to the International Labour Organization.<sup>22</sup> “Livelihood crises” is the second most immediate threat to the world in the GRPS, and the top one at the country level in the Executive Opinion Survey (EOS). It is the most immediate national threat in 97 countries, including 16 of the G20 economies.

A bifurcated economic recovery is likely to prompt an upsurge in economic migration. At the same time, worsening extreme weather and a rise in political instability, state fragility and civil conflict are likely to further swell refugee numbers. GRPS respondents rate “involuntary migration” as a critical threat to the world over the next decade. Yet, it is a top-10 concern in only 13 countries surveyed by the EOS—among them Armenia, El Salvador, Guatemala, Honduras, Nicaragua, Ukraine and Venezuela, which have recently experienced challenges related to migration and refugees. These results suggest that migration is perceived as a short-term challenge localized in certain countries, but a global risk in the longer term. However, the clash between heightened migration pressures in origin countries and increasing barriers to migration in destination countries

risks creating tensions internationally and, in the worst cases, humanitarian crises.

## Erosion of social cohesion

“Social cohesion erosion” is the risk that has worsened the most globally since the start of the COVID-19 crisis, according to the GRPS. It is perceived as a critical threat to the world across all time spans—short, medium and long term—and is seen as among the most potentially damaging for the next 10 years. In 31 out of the 124 countries surveyed in the EOS—including Argentina, France, Germany, Mexico and South Africa among the G20—“social cohesion erosion” was seen as a top-10 short-term threat to their countries. Inequality—economic, political, technological and intergenerational—was already challenging societies even before income disparities increased through the pandemic.<sup>23</sup> These disparities are now expected to widen further: research by the World Bank estimates that the richest 20% of the world’s population will have recovered half their losses in 2021, while the poorest 20% will have lost 5% more of their income.<sup>24</sup> By 2030, 51 million more people are projected to live in extreme poverty compared to the pre-pandemic trend.<sup>25</sup> Income disparities exacerbated by an uneven economic recovery risk increasing polarization and resentment within societies.





Differing views over vaccinations and COVID-related restrictions are also adding to social pressures, with a number of countries, including in Europe, seeing riots by those opposed to government's COVID responses. Racial justice also remains a pressing issue in many countries, notably the United States.

A recent poll in the United States, for example, found “division in the country” to be voters’ top concern: they expected it to worsen in 2022.<sup>26</sup> In Europe, another recent poll revealed significant generational differences, with 65% of respondents over 60 saying that they were “not impacted at all” by the pandemic, compared with just 43% of respondents under 30.<sup>27</sup> The attack on the US Capitol in January 2021 was one manifestation of the instability that political polarization risks creating.

Notwithstanding the agreements made at COP26 signal international commitment to climate action (see Box 1.1), short-term domestic pressures will make it harder for governments to focus on long-term national priorities and will limit the attention and political capital that some governments worldwide will be able or willing to allocate to global concerns. Such pressures could also lead to stronger national interest postures, which would worsen fractures in the global economy, potentially coming at the expense of foreign aid and cooperation needed to resolve conflicts, protect refugees and address humanitarian emergencies. The UK government, for instance, already dropped its target of spending 0.7% of gross national income on foreign aid until at least 2024.<sup>28</sup> Fragile economies could spiral into deeper crises.

## Geopolitical tensions

Widening geopolitical fractures risk being another force for global divergence. Competition between the United States and China is increasing. China’s growing military prowess is changing the balance of power in the Western Pacific.<sup>29</sup> The United States is strengthening alliances focused on the Pacific in response, most recently with the Australia-UK-US security pact

# Countries may drive regional convergence at the expense of global integration

(AUKUS). Other states, such as Russia and Turkey, are also showing greater capability and willingness to project power abroad. Meanwhile, key global and regional powers are testing boundaries of international law and cooperation by conducting military exercises around tense areas, such as the Russia-Ukraine border and the Taiwan Strait. Competition is intensifying in newer dimensions and geographies, as evident in the militarization and weaponization of space (see Chapter 5) and in developments in cyberspace, where already-sharp tensions between governments impacted by cybercrime and governments complicit in their commission will continue to rise (see Chapter 3).

Competition is also increasing in the exercise of “soft power”. For example, China’s vaccine diplomacy, external financing strategy and economic rebound—its economy is expected to have grown by 8% annually in 2021<sup>30</sup>—have allowed it to continue to expand its influence throughout the developing world. Brazil, Indonesia, Mexico and Turkey are among the top buyers of Chinese COVID-19 vaccines,<sup>31</sup> and net debt payments to China rose by 62% in 2020.<sup>32</sup> Developing countries may increasingly look to China for financial, technological and scientific support to thrive in the post-pandemic economy.

Geopolitical tensions are spilling over into the economic sphere. For example, India and Japan put protectionist policies in place during the pandemic.<sup>33</sup> Western companies in sensitive sectors such as technology are encountering increasing difficulties in doing business in China and Russia, and Western countries are themselves restricting investment from geopolitical competitors in strategic sectors. GRPS respondents identified “gloeconomic confrontations” as a critical medium- and long-term threat

to the world, and the most potentially severe geopolitical risk for the next decade (see Figure 1.3). Geopolitical and geoeconomic tensions will make it more difficult to tackle common global challenges, notably climate change.

## Risk of climate action failure

The 2021 United Nations Climate Change Conference (COP26) succeeded in getting 197 countries to align on the Glasgow Climate Pact and other landmark pledges (see Box 1.1), but even these new commitments are expected to miss the 1.5°C goal established in the 2016 Paris Climate Agreement and increase the risks from a disorderly climate transition (see Chapter 2).<sup>34</sup>

The economic overhang of the COVID-19 crisis and weakened social cohesion—in advanced and developing economies alike—may further limit the financial and political capital available for stronger climate action. The European Union, the United Kingdom and the United States, for example, were reluctant to commit to a formal climate finance target to respond to worsening climate change impacts in developing country Parties.<sup>35</sup> China and India lobbied to change the Pact’s wording from “phase out” to “phase down” of “unabated coal power and inefficient fossil fuel subsidies”.<sup>36</sup>

The economic crisis created by the COVID-19 pandemic risks delaying efforts to tackle climate change by encouraging countries to prioritize short-term measures to restore economic growth, regardless of their impact on the climate, over pursuing green transitions. Brazil, for example, joined the other 140 countries responsible for 91% of the Earth’s forests in endorsing the Glasgow Leaders’ Declaration on Forests and Land Use,<sup>37</sup> even as deforestation in the Amazon accelerated to a 15-year high in 2021 following the pandemic-induced recession of 2020.<sup>38</sup> Geopolitical tensions and nation-first postures will also complicate climate action. COP26 revealed heightened tensions on climate damage compensation, with affected countries facing pushback from large emitters, including the United States.<sup>39</sup>

Climate change continues to be perceived as the gravest threat to humanity. GRPS respondents rate “climate action failure” as the risk with potential to inflict the most damage at a global scale over the next decade (see Figure 1.3). However, EOS results hint at divergent senses of urgency between regions and countries. “Climate action failure” ranks 2<sup>nd</sup> as a short-term risk in the United States but 23<sup>rd</sup> in China—the two countries that are the world’s largest CO<sub>2</sub> emitters. In addition to its 2<sup>nd</sup> place rank in the United States, it ranks among the top 10 short-term risks in 11 other G20 economies.




## Outcomes of COP26 and COP15

The 2021 United Nations Climate Change Conference (COP26, held in Glasgow, the United Kingdom), which passed the Glasgow Climate Pact,<sup>1</sup> concluded with important steps towards the 1.5°C scenario: it requested governments from 153 countries to update and strengthen their nationally determined contributions (NDCs), bolstered climate adaptation finance efforts, and continued the mobilization of billions of US dollars for climate funding and trillions to be reallocated by private institutions and central banks towards global net zero. COP26 was the first with financial sector attendance, represented by the Global Financial Alliance for Net Zero (GFANZ), whose members manage over US\$130 trillion in assets and already actively fund sustainable investments.<sup>2</sup>


For the first time, the Pact made explicit mention of the importance of transitioning away from coal—but did not commit to “phase out” inefficient fossil fuel subsidies. However, as the United Nations Environment Programme (UNEP)’s Emissions Gap Report 2021 shows, reaching the 1.5°C target remains unlikely.<sup>3</sup>

Another key outcome was an agreement on the fundamental norms related to Article 6 of the Paris Agreement (on carbon markets), making it now fully operational.<sup>4</sup> Businesses and governments also agreed on more aggressive investment in clean technologies,<sup>5</sup> including a faster transition to electric vehicles and landmark pledges on methane emissions and deforestation.<sup>6</sup>


### Key pledges achieved at COP26:

-  India pledged to reach net zero emissions by 2070 and announced a target of 50% renewable energy by 2030. All the largest emitters have now agreed to start phasing out fossil fuels.


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-  46 countries pledged to transition from coal to clean power by 2040.

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-  104 countries pledged to a 30% cut in methane emissions by 2030. Methane accounts for 30% of historical global warming.

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-  141 countries that account for 91% of the world’s forests pledged to end deforestation by 2030.

The 2021 Conference of the Parties for the Convention on Biological Diversity (COP15, held in Kunming, China) resulted in “strong declarations for safeguarding life on Earth”,<sup>7</sup> along with joint measures for conservation actions and addressing unsustainable production and consumption;<sup>8</sup> it also paved the way to negotiate a post-2020 global biodiversity framework for part two of COP15 in May 2022.<sup>9</sup>

### Footnotes

- 1 UNFCCC. Decision -/CP.26, Advance unedited version. [https://unfccc.int/sites/default/files/resource/cop26\\_auv\\_2f\\_cover\\_decision.pdf](https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf)
- 2 UNEP. 2021. “Emissions Gap Report 2021. Addendum to the Emissions Gap Report 2021.” Report. UNEP. 2021. <https://wedocs.unep.org/bitstream/handle/20.500.11822/37350/AddEGR21.pdf>
- 3 UN Climate Change Conference UK2021. 2021a. COP26 The Glasgow Climate Pact. November 2021. <https://ukcop26.org/wp-content/uploads/2021/11/COP26-Presidency-Outcomes-The-Climate-Pact.pdf>
- 4 UNFCCC. 2021. “COP26 Reaches Consensus on Key Actions to Address Climate Change”. UN Climate Press Release. 13 November 2021. <https://unfccc.int/news/cop26-reaches-consensus-on-key-actions-to-address-climate-change>
- 5 GFANZ. 2021. Glasgow Financial Alliance for Net Zero. <https://www.gfanzero.com/>
- 6 European Commission. 2021. Launch by United States, the European Union, and Partners of the Global Methane Pledge to Keep 1.5C Within Reach. European Commission. Statement. 2 November 2021. [https://ec.europa.eu/commission/presscorner/detail/en/statement\\_21\\_5766](https://ec.europa.eu/commission/presscorner/detail/en/statement_21_5766) ; UN Climate Change Conference UK2021. 2021. “Glasgow Leaders’ Declaration on Forest and Land Use”. 2 November 2021. <https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/>
- 7 WWF. 2021. WWF reaction to the adoption of the Kunming Declaration at COP15. World Wildlife Fund. 13 October 2021. [https://wwf.panda.org/wwf\\_news/?3962441/WWF-reaction-to-the-adoption-of-the-Kunming-Declaration-at-COP15](https://wwf.panda.org/wwf_news/?3962441/WWF-reaction-to-the-adoption-of-the-Kunming-Declaration-at-COP15)
- 8 IUCN. 2021. IUCN closing statement – part one of the UN Biodiversity Conference. 18 October 2021. <https://www.iucn.org/news/secretariat/202110/iucn-closing-statement-part-one-un-biodiversity-conference>
- 9 Convention on Biological Diversity. 2021. “Part one of UN Biodiversity Conference closes, sets stage for adoption of post-2020 global biodiversity framework at resumption in 2022”. Press Release. 15 October 2021. <https://www.cbd.int/doc/press/2021/pr-2021-10-15-cop15-en.pdf>

## Secure digitalization

COVID-19 spurred a leap in digitalization, but to varying extents across countries. While moving towards hyperconnectivity has made some countries more competitive, others could remain stuck in a pre-pandemic analogue economy. In the latter economies, the need for rapid digitalization to avoid a widening digital divide remains pressing.<sup>40</sup> In the EOS, “digital inequality” is a top short-term risk in Latin America and Sub-Saharan Africa—the two regions expected to grow the least in 2022—as well as in low-income countries more widely. Governments, businesses and individuals in developing economies will be seeking to digitalize rapidly but may have limited technical and financial resources to enhance cyber

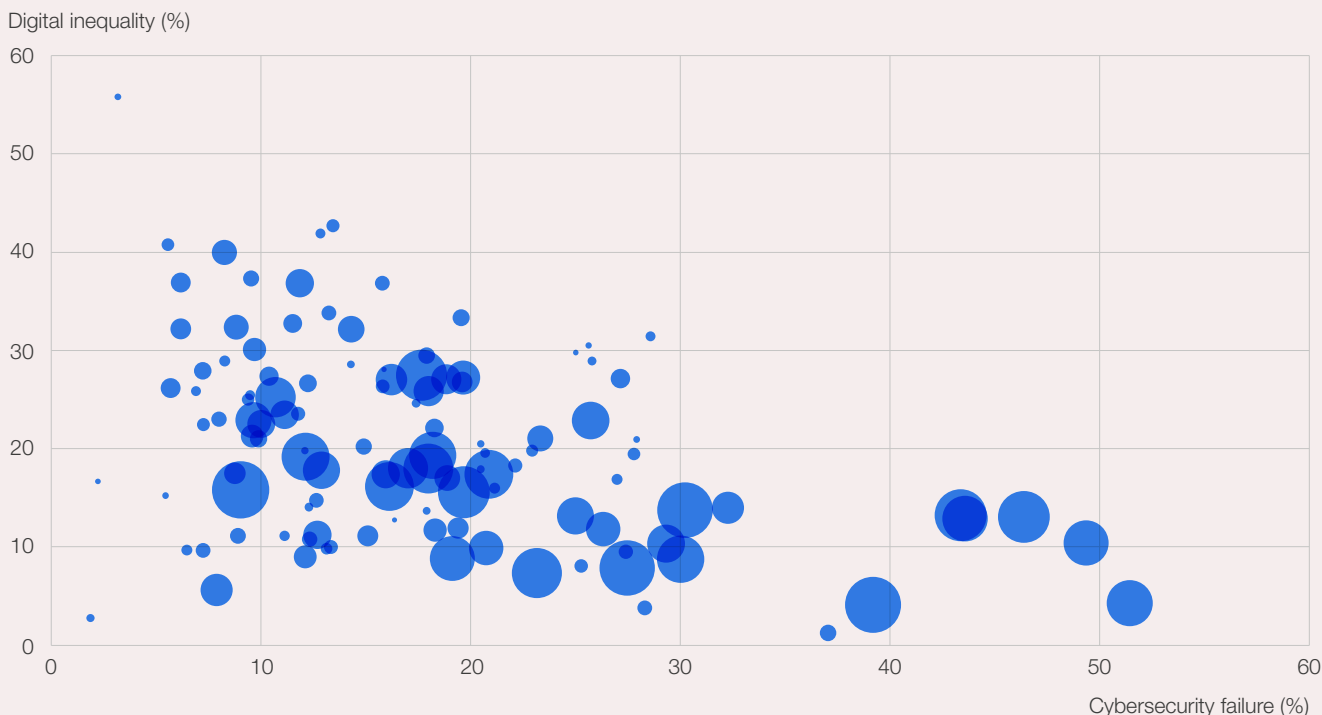
defences against critical infrastructure breaches or cyber regulations to safeguard data and privacy.

More parts of the world risk becoming a base from which cybercriminals can attack globally, which could deepen digital divides if such countries then face restrictions on their access to digital technologies. Rapid digitalization in advanced economies during COVID-19 has also led to new cyber vulnerabilities. “Cybersecurity failure” was identified by GRPS respondents as a critical short-term threat to the world and scores especially high with EOS respondents in high-income countries (see Figure 1.4). There is a risk that concerns over cybersecurity could further hamper attempts to promote rapid and inclusive digitalization globally.

FIGURE 1.4

## Score of “Digital Inequality” and “Cybersecurity Failure” in EOS 2021 versus GDP per Capita in 2020

● GDP per capita US\$ (2020) from smallest to largest



**Sources:** World Economic Forum Executive Opinion Survey 2021; World Bank Open Data, “GDP per capita (current US\$)”, <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>, accessed 7 December 2021.

**Note:** Excludes Luxembourg, Switzerland and Ireland, which have the highest GDPs per capita in the EOS sample (all above US\$80,000) and are distant from the rest of the sample (fourth highest is the United States, with US\$63,544).

## Space as a new frontier of divergence

Space is another area where global divergences risk complicating the collaboration needed to manage the development of a common good. Competition in space is rising and is a growing preoccupation for the world's leading militaries—evidenced by recent anti-satellite (ASAT) and hypersonic weapons tests.<sup>41</sup> Disparate economic and technological trajectories risk precluding many countries from accessing the

opportunities that space entails for tackling climate change and expanding connectivity, and from ensuring that their interests are accounted for in global decision-making around space governance and commercialization. Meanwhile, increased private sector participation in space and a higher risk of congestion are creating new challenges for space governance. However, there is still time for countries to come together to ensure common benefits and sustainable management of what should be a universal resource.

## Emerging tensions in global cooperation

The global divergence that risks resulting from ruptures within the world economy, stronger competition for geopolitical advantage and domestic pressures to prioritize national objectives will create complex challenges for global cooperation over the next years. Four such areas are analysed in the following deep dive chapters:

- Mounting conviction for a fast but disorderly climate transition, slowed by social, political and economic complexities, risks creating a kaleidoscope of net zero trajectories, each with different speeds and complications (see Chapter 2).
- Rapid digitalization risks exposing economies to new and more intense cyber vulnerabilities, as new technologies and an ever-expanding attack surface enable a more dangerous and diverse range of cybercrimes (see Chapter 3).
- Increased pressure for migration from origin countries as they become more insecure risks conflicting with higher barriers in destination countries (see Chapter 4).
- A new space race marked by accelerated commercial and military activity risks exacerbating tensions and oversaturation of this frontier common,

highlighting the need for strengthening international governance of space (see Chapter 5).

The COVID-19 pandemic exposed the shortcomings of global cooperation, but the way forward is not clear. There is a need for stronger global governance and more effective international risk mitigation efforts, since the global, interconnected challenges highlighted in this report cannot be solved by national governments alone. Yet coming together with common purpose to achieve lasting results will be challenging: effective global governance depends on international cooperation,<sup>42</sup> and it will be difficult to secure traction, harness the necessary capabilities and achieve resolution on critical issues in an international relations context characterized by economic divergence, skepticism around globalization, a narrower focus on national interests and intensified geopolitical competition. Existing institutions of global governance are under pressure—as shown, for example, by the challenges that an under-resourced World Health Organization (WHO) continues to face in responding effectively to the COVID-19 pandemic.<sup>43</sup>

Appreciating this challenge, the final chapter of the report reflects on how governments can hedge against the prevailing limitations of multilateralism by pursuing a whole-of-society approach to bolstering national resilience (see Chapter 6).

## Reflecting on the future

Crises prompt unexpected paths. Different blind spots, triggers and shocks can have a wide range of outcomes, all with varying likelihoods and impacts. As readers consider the results of the GRPS survey, review the emerging global context and read the deep dives, this report invites them to consider the behaviours and actions of specific stakeholders and to consider the consequences for a range of risk outcomes, from probable to improbable and manageable to severe.

Among the most notable areas of socio-economic concern are the divergent recovery, economic hardship and growing inequality, along with their interaction with ideological polarization and the sense of disenfranchisement of large sections of the global population. Governments' struggles to contain the pandemic

and a lack of global collaboration on COVID-19 offer a sobering view of prospects for managing future global risks such as extreme weather and for pursuing bolder climate action. When it comes to business and industry, even enterprises with the financial room to manoeuvre sometimes struggle to deliver on environmental, social and governance (ESG) commitments while also strengthening the resilience of their supply chains, adapting to social and technological change and remaining vigilant to threats such as cyberattacks.

Two years on from the start of this unprecedented crisis, the actions and behaviours of all stakeholders will determine how quickly the world recovers and embeds the resilience needed to prepare for the next major shock.



# Global Risks Perception Survey 2021-2022 Results

## Scars of COVID-19

“Social cohesion erosion”, “livelihood crises” and “mental health deterioration” are three of the five risks that have deteriorated the most globally through the crisis, according to the GRPS. These three risks—and the pandemic itself (“infectious diseases”)—are also seen as being among the most imminent threats to the world. This societal scarring compounds the challenges of effective national policy-making and reduces the attention and focus needed on international cooperation for global challenges.

## Looming debt crises

“Debt crises” were identified as an imminent threat to the world for the next two years, but GRPS respondents believe they will reach their most critical point in three to five years. Government stimulus was vital to protect incomes, preserve jobs and keep businesses afloat, but debt burdens are now high and public budgets will continue to be stretched after the pandemic, even as they are needed for financing just and green transitions.

## The planet cannot wait

“Extreme weather” and “climate action failure” are among the top five short-term risks to the world, but the five most menacing long-term threats are all environmental. “Climate action failure”, “extreme weather” and “biodiversity loss” also rank as the three most potentially severe risks for the next decade. While GRPS respondents’ concern about environmental degradation predates the pandemic, increasing concern with climate action failure reveals respondents’ lack of faith in the world’s ability to contain climate change, not least because of the societal fractures and economic risks that have deepened.

## Connectivity blind spots

“Digital inequality” is seen as an imminent threat to the world as 3 billion people remain offline. However, it is also the case that many countries and industries were able to quickly access and seamlessly adapt to new forms of human interaction and remote work. This digital leap came with increased vulnerability. GRPS respondents believe “cybersecurity failure” will continue to test the world’s digital systems over the next two years and, to a lesser extent, in three to five years. No technological risk appears among the most potentially severe for the next decade. This suggests lower relevance to respondents—or a blind spot in perceptions given the potential damage of cyber-risks—compared to economic, societal and environmental concerns.

## Growing rivalries

GRPS respondents believe “gloeconomic confrontations” will emerge as a critical threat to the world in the medium to long term and as one of the most potentially severe risks over the next decade. While pressing domestic challenges require immediate attention, the pandemic and its economic consequences have proven once again that global risks do not respect political frontiers. Humanity faces the shared and compounding threats of economic fragmentation and planetary degradation, which will require a coordinated global response.

To see the full results of the GRPS 2021-2022 see: <https://www.weforum.org/reports/global-risks-report-2022/data-on-global-risks-perceptions#report-nav>

FIGURE 1

# COVID-19 Hindsight

Risks that worsened the most since the start of the COVID-19 crisis

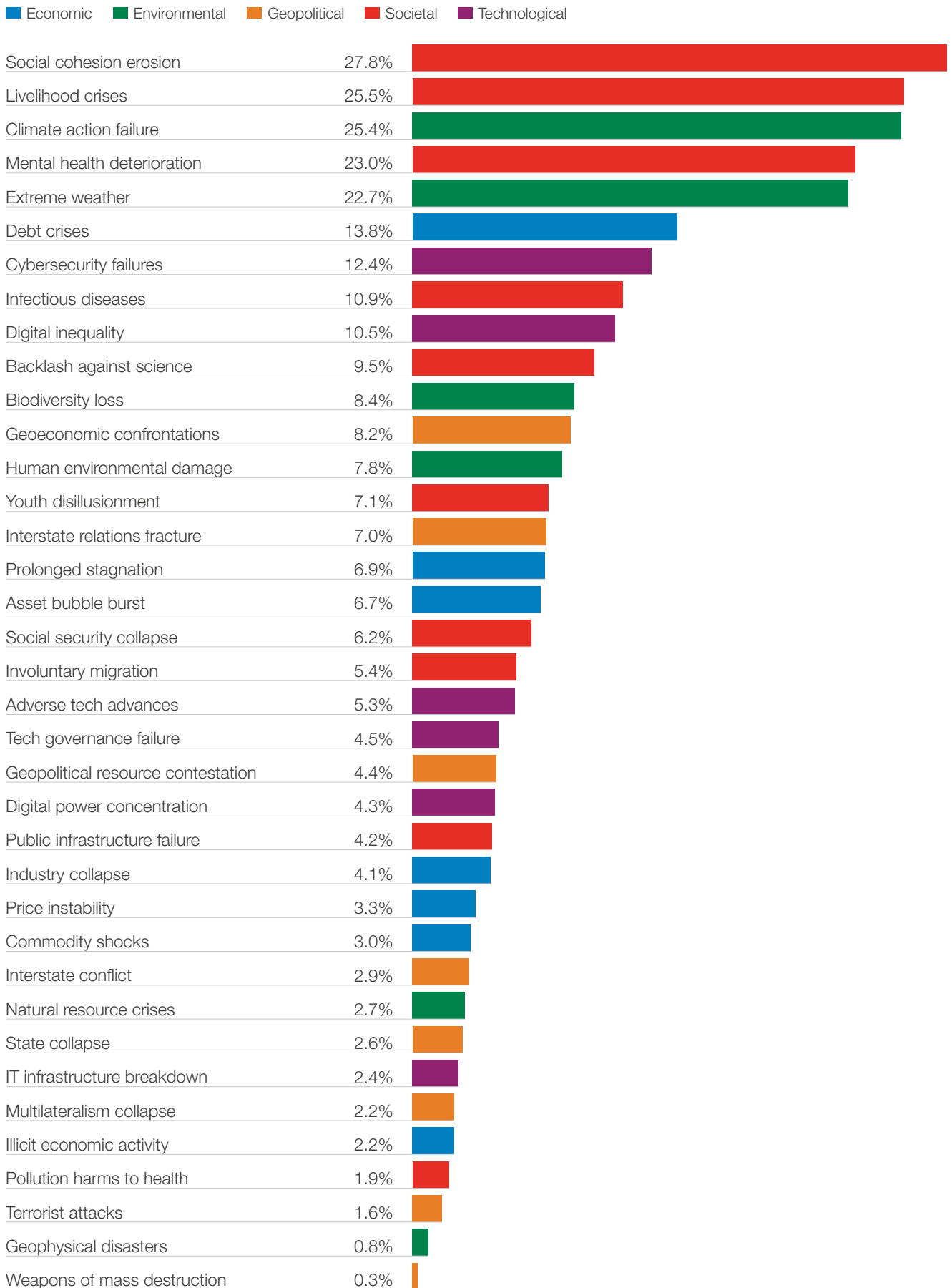




FIGURE II

# Global Risks Horizon

When will risks become a critical threat to the world?

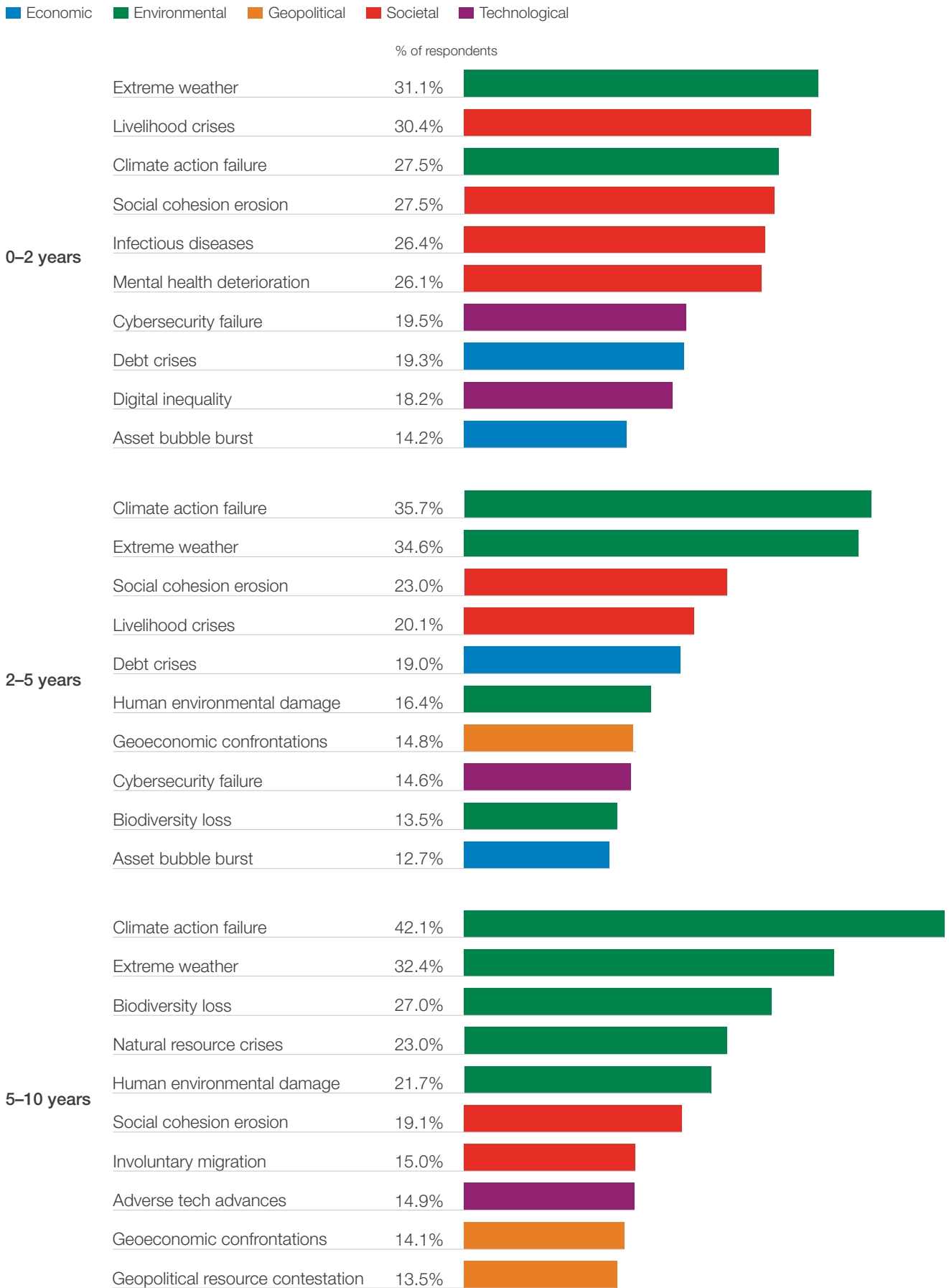
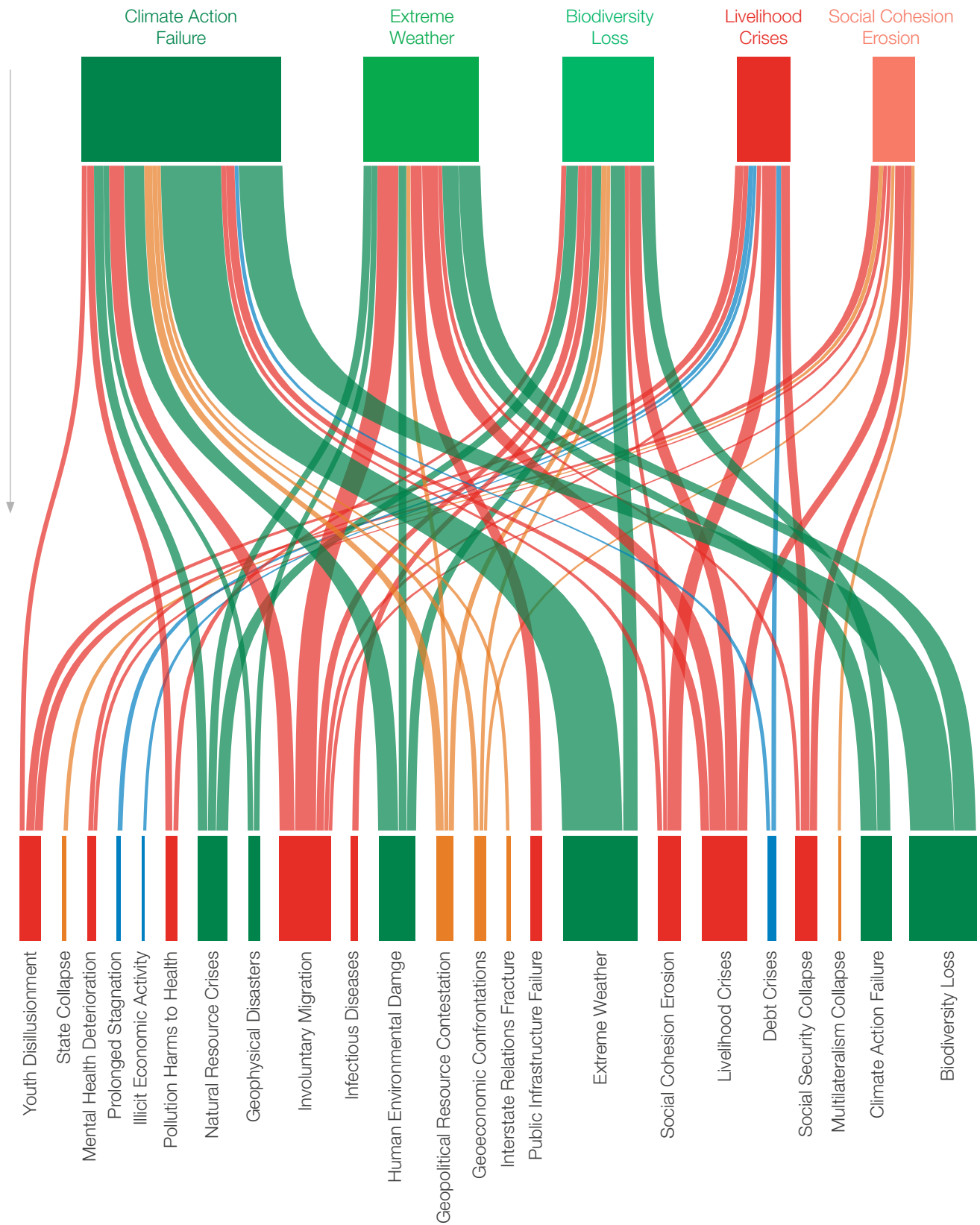


FIGURE III

# Global Risks Effects

Most potentially damaging risks (top row) and risks they will aggravate (bottom row)\*

■ Economic ■ Environmental ■ Geopolitical ■ Societal ■ Technological

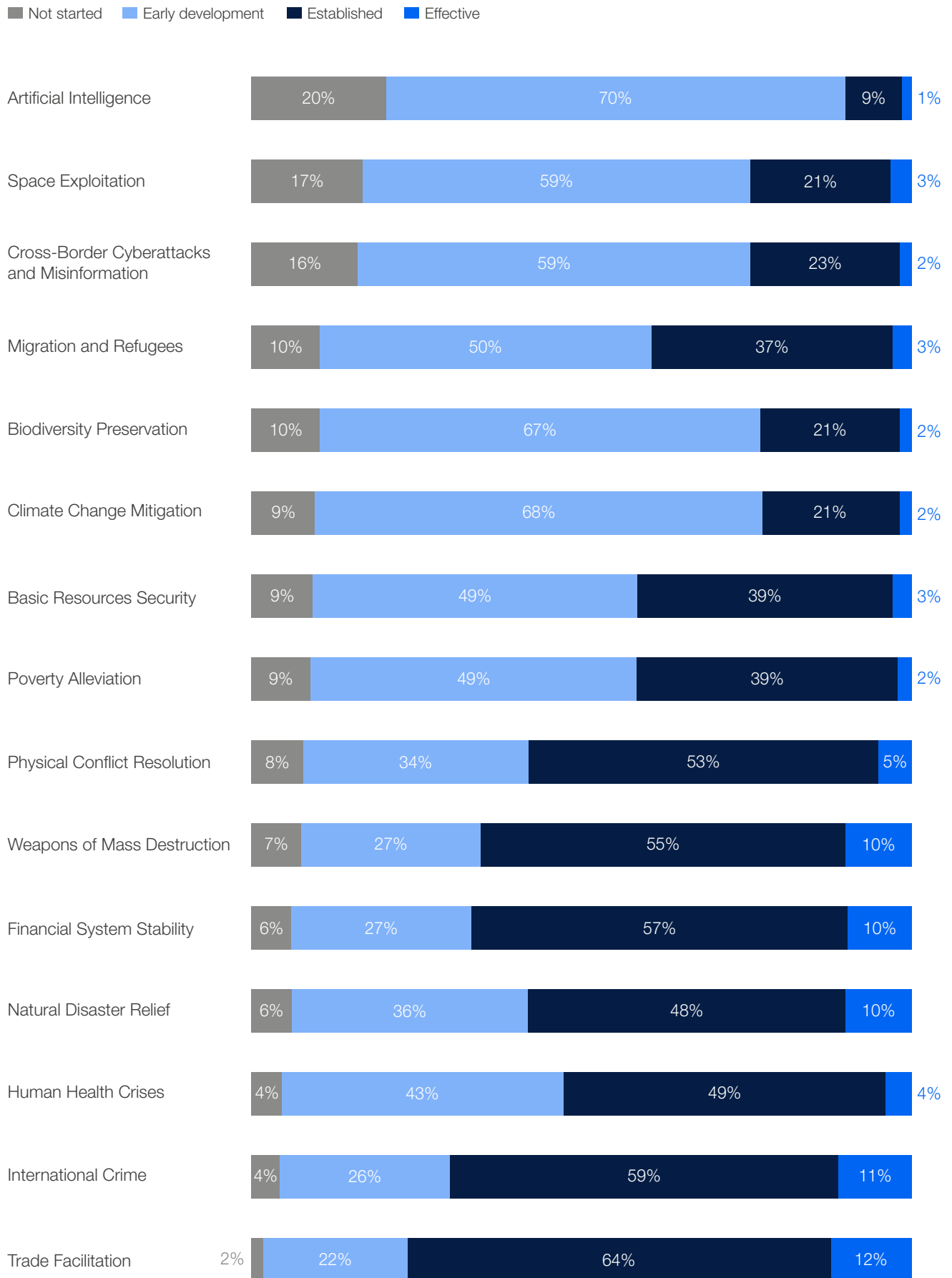


\*Line thickness scaled according to tally of links (see Appendix C: Technical Notes).

FIGURE IV

# International Risk Mitigation Efforts

Current state of international risk mitigation efforts in each area



# Endnotes

- 1 WHO (World Health Organization). "WHO Coronavirus (COVID-19) Dashboard – 'persons fully vaccinated'". <https://covid19.who.int/>, accessed 3 January 2022.
- 2 Kemp, S. 2021. "Digital 2021 April Global Statshot Report". Datareportal. 26 April 2021. <https://datareportal.com/reports/digital-2021-april-global-statshot>
- 3 UNESCO (United Nations Educational, Scientific and Cultural Organization). 2021. "UNESCO warns 117 million students around the world are still out of school" Press Release. UNESCO. 16 September 2021. <https://en.unesco.org/news/unesco-warns-117-million-students-around-world-are-still-out-school>
- 4 Sedik, T. S. and Xu, R. 2020. "A Vicious Cycle: How Pandemics Lead to Economic Despair and Social Unrest". IMF Working Papers. IMF. 16 October 2020. <https://www.imf.org/en/Publications/WP/Issues/2020/10/16/A-Vicious-Cycle-How-Pandemics-Lead-to-Economic-Despair-and-Social-Unrest-49806>
- 5 WHO. "WHO Coronavirus (COVID-19) Dashboard – 'confirmed cases' and 'deaths'". <https://covid19.who.int/>, accessed 3 January 2022.
- 6 WHO. 2021. "New policy brief calls on decision-makers to support patients as 1 in 10 report symptoms of "long COVID"". Policy Brief. WHO. 25 February 2021. <https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2021/2/new-policy-brief-calls-on-decision-makers-to-support-patients-as-1-in-10-report-symptoms-of-long-covid>
- 7 Our World in Data. "Coronavirus (COVID-19) Vaccinations – 'By country'". [https://ourworldindata.org/covid-vaccinations?country=OWID\\_WRL](https://ourworldindata.org/covid-vaccinations?country=OWID_WRL), accessed 3 January 2022.
- 8 Bloomberg. "More Than 8.23 Billion Shots Given: Covid-19 Tracker". <https://www.bloomberg.com/graphics/covid-vaccine-tracker-global-distribution/>, accessed 3 January 2022.
- 9 WHO. "WHO Coronavirus (COVID-19) Dashboard – 'confirmed cases'". <https://covid19.who.int/>, accessed 3 January 2022.
- 10 COVID-19 Mental Disorders Collaborators. 2021. "Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic". The Lancet. Volume 398, Issue 10312. 6 November 2021. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(21\)02143-7/fulltext#%20](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)02143-7/fulltext#%20)
- 11 WHO. 2021. "Noncommunicable diseases". Factsheet. WHO. 13 April 2021. <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>
- 12 Knight, G.M., Glover, R.E., McQuaid, C.F., Oлару, I.D., Gallandat, K., Leclerc, Q.J., Fuller, N.M., Willcocks, S.J., Hasan, R., van Kleef, E. and Chandler, C.I.R., 2021. "Antimicrobial resistance and COVID-19: Intersections and implications". *Epidemiology and Global Health*. eLife. 16 February 2021. <https://elifesciences.org/articles/64139>
- 13 IMF (International Monetary Fund). 2021. World Economic Outlook, October 2021: Recovery During a Pandemic Health Concerns, Supply Disruptions, and Price Pressures. October 2021. <https://www.imf.org/en/Publications/WEO/Issues/2021/10/12/world-economic-outlook-october-2021>
- 14 Ibid.
- 15 MarketWatch. "Bloomberg Commodity Index – YTD". <https://www.marketwatch.com/investing/index/bcom?countrycode=xx>, accessed 3 January 2022.
- 16 Cohen, A. 2021. "China's Energy Crisis Deepens with Potentially Fatal Consequences". Forbes. 19 October 2021. <https://www.forbes.com/sites/arielcohen/2021/10/19/chinas-energy-crisis-deepens-with-potentially-fatal-consequences/?sh=4af8e5531163>; Erlanger, S., Reed, S. and Troianovski, A. 2021. "As Europe faces a cold winter, Putin seizes on the leverage from Russia's gas output". New York Times. 7 October 2021. <https://www.nytimes.com/2021/10/07/world/europe/putin-russia-natural-gas-europe.html>;
- 17 World Economic Forum. 2021. "Chief Economists Outlook". WEF. November 2021. [https://www3.weforum.org/docs/WEF\\_Chief\\_Economists\\_Outlook\\_November\\_2021.pdf](https://www3.weforum.org/docs/WEF_Chief_Economists_Outlook_November_2021.pdf)
- 18 Kose, M. A., Ohnsorge, F. and Sugawara, N. 2021. "Navigating the debt legacy of the pandemic." Future Development. The Brookings Institution. 20 October 2021. <https://www.brookings.edu/blog/future-development/2021/10/20/navigating-the-debt-legacy-of-the-pandemic/>
- 19 Galouchko, K. 2021. "Fund managers sour on global growth expectations, BofA says". Bloomberg. 19 October 2021. <https://www.bloomberg.com/news/articles/2021-10-19/bofa-survey-shows-fund-managers-slashing-bonds-to-a-record-low>
- 20 MarketWatch. "U.S. Dollar Index (DXY) – YTD". <https://www.marketwatch.com/investing/index/dxy>, accessed 3 January 2022.
- 21 IMF. 2021. Op. cit.
- 22 International Labour Organization. 2021. "World Employment and Social Outlook. Trends 2021." ILO Flagship Report. ILO. 2021. [https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms\\_795453.pdf](https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_795453.pdf)
- 23 Deaton, A. 2021. "COVID-19 and Global Income Inequality". LSE Public Policy Review. London School of Economics Press. 3 May 2021. <https://ppr.lse.ac.uk/articles/10.31389/lseppr.26/>
- 24 Mahler, D. G., Lakner, C. and Yonzan, N. 2021. "Is COVID-19 increasing global inequality?". World Bank Blogs. World Bank. 7 October 2021. [https://blogs.worldbank.org/opendata/covid-19-increasing-global-inequality#\\_ftnref1](https://blogs.worldbank.org/opendata/covid-19-increasing-global-inequality#_ftnref1)
- 25 Dooley, M. and Kharas, 2021. H. "Long-run impacts of COVID-19 on extreme poverty". Future Development. The Brookings Institution. 2 June 2021. <https://www.brookings.edu/blog/future-development/2021/06/02/long-run-impacts-of-covid-19-on-extreme-poverty/>

- 26 Institute of Politics and Public Service. McCourt School of Public Policy. 2021. "New Poll: Voter Frustration Fuels Sharp Drop in Approval for Biden and both Parties in Congress". Press Releases and Announcements. Georgetown University. 28 October 2021. <https://politics.georgetown.edu/2021/10/28/new-poll-voter-frustration-fuels-sharp-drop-in-approval-for-biden-and-both-parties-in-congress/>
- 27 Krastev, I. and Leonard, M. 2021. "Europe's Invisible Divides: How Covid-19 is Polarising European Politics". Policy Brief. European Council on Foreign Relations. September 2021. <https://ecfr.eu/wp-content/uploads/Europes-invisible-divides-How-covid-19-is-polarising-European-politics.pdf>
- 28 Reality Check Team. 2021. "Foreign aid: Who will be hit by the UK government cuts?". BBC News. 8 November 2021. <https://www.bbc.com/news/57362816>
- 29 Cordesman, A. H. and Hwang, G. 2021. "Updated Report: Chinese Strategy and Military Forces in 2021". Report. Center for Strategic and International Studies. 3 August 2021. <https://www.csis.org/analysis/updated-report-chinese-strategy-and-military-forces-2021>
- 30 IMF. Op. cit.
- 31 Bridge Consulting (Beijing) Co., Ltd. "China COVID-19 Vaccine Tracker". <https://bridgebeijing.com/our-publications/our-publications-1/china-covid-19-vaccines-tracker/>, accessed 7 December 2021.
- 32 World Bank. 2021. "International Debt Statistics 2022". Report. World Bank. 11 October 2021. <https://www.worldbank.org/en/news/press-release/2021/10/11/low-income-country-debt-rises-to-record-860-billion-in-2020>
- 33 Denyer, S. 2020. "Japan helps 87 companies to break from China after pandemic exposed overreliance". The Washington Post. 21 July 2020. [https://www.washingtonpost.com/world/asia\\_pacific/japan-helps-87-companies-to-exit-china-after-pandemic-exposed-overreliance/2020/07/21/4889abd2-cb2f-11ea-99b0-8426e26d203b\\_story.html](https://www.washingtonpost.com/world/asia_pacific/japan-helps-87-companies-to-exit-china-after-pandemic-exposed-overreliance/2020/07/21/4889abd2-cb2f-11ea-99b0-8426e26d203b_story.html); Sikarwar, D. 2021. "India set to erect a Great Wall against Chinese companies". The Economic Times. 19 June 2021. <https://economictimes.indiatimes.com/news/economy/policy/india-set-to-erect-a-great-wall-against-chinese-companies/articleshow/76455684.cms?from=mdr>
- 34 Climate Action Tracker. 2021. "Glasgow's 2030 credibility gap: net zero's lip service to climate action". The Climate Action Tracker. 11 November 2021. <https://climateactiontracker.org/publications/glasgows-2030-credibility-gap-net-zeros-lip-service-to-climate-action/>
- 35 Irfan, U. 2021. "What the world did and didn't accomplish at COP26". Vox. 13 November 2021. <https://www.vox.com/22777957/cop26-un-climate-change-conference-glasgow-goals-paris>
- 36 Hodgson, C., Hook, L. and Pickard, J. 2021. "India and China weaken pledge to phase out coal as COP26 ends". Financial Times. 13 November 2021. <https://www.ft.com/content/471c7db9-925f-479e-ad57-09162310a21a>
- 37 UN Climate Change Conference UK 2021. 2021. "Glasgow Leaders' Declaration on Forests and Land Use". UNFCCC. 2 November 2021. <https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/>
- 38 Boadle, A. and Spring, J. 2021. "Brazil's Amazon deforestation surges to 15-year high, undercutting government pledge". Reuters. 19 November 2021. <https://www.reuters.com/world/americas/brazil-deforestation-data-shows-22-annual-jump-clearing-amazon-2021-11-18/>
- 39 Mountford, H., Waskow, D., Gonzalez, L., Gajjar, C., Cogswell, N., Holt, M., Fransen, T., Bergen, M. and Gerholdt, R. 2021. "COP26: Key outcomes from the UN Climate Talks in Glasgow". Reuters. 17 November 2021. <https://www.wri.org/insights/cop26-key-outcomes-un-climate-talks-glasgow>; Sengupta, S. 2021. "Calls for climate reparations reach boiling point in Glasgow talks". New York Times. 11 November 2021. <https://www.nytimes.com/2021/11/11/climate/climate-glasgow-cop26-loss-damage.html>
- 40 World Economic Forum, in partnership with Marsh & McLennan Companies, SK Group and Zurich Insurance Group. 2021. The Global Risks Report 2020. Insight Report. Chapter 2 Error 404: Barriers to Digital Inclusivity. Geneva: World Economic Forum. January 2021. <https://www.weforum.org/reports/the-global-risks-report-2021>
- 41 Balmforth, Tom. 2021. "'Razor-sharp precision': Russia hails anti-satellite weapons test". Reuters. 17 November 2021. <https://www.reuters.com/business/aerospace-defense/russia-dismisses-us-criticism-anti-satellite-weapons-test-2021-11-16/>; Stewart, P. 2021. "Top U.S. general confirms 'very concerning' Chinese hypersonic weapons test". 28 October 2021. <https://www.reuters.com/business/aerospace-defense/top-us-general-confirms-very-concerning-chinese-hypersonic-weapons-test-2021-10-27/>
- 42 UN DESA (United Nations, Department of Economic and Social Affairs). 2014. Global Governance and Global Rules for Development in the Post-2015 Era. Committee for Development Policy Policy Note. 16 June 2014. <https://www.un.org/development/desa/dpad/publication/cdp-policy-note-2014/>
- 43 Schwab, K. and Malleret, T, 2020, "COVID-19: The Great Reset", World Economic Forum. <https://www.weforum.org/agenda/2020/07/covid-19-the-great-reset/>

# Disorderly Climate Transition

1.8°C

most optimistic scenario of global warming  
after COP26

US\$

130 trillion

committed private capital to carbon neutrality

40 million

jobs created through re-skilling in renewables  
sector by 2050

Top 5

environmental risks lead the way in long-term  
concerns according to GRPS respondents

# Climate (in-)action

Accelerating and widespread climate change manifests itself in irreversible consequences.<sup>1</sup> The overwhelming weight of scientific analysis points to environmental adjustments and cataclysmic feedback loops that will push ecosystems beyond tipping points.<sup>2</sup> At that moment, decarbonization efforts would be rendered mute.

The latest nationally determined contributions (NDCs) to decarbonization made at the 2021 United Nations Climate Change Conference of the Parties (COP26) still fall short of the 1.5°C goal set out in the Paris Climate Agreement (for an extensive summary of COP26 outcomes, see Chapter 1, Box 1.1).<sup>3</sup> The current trajectory is expected to steer the world towards a 2.4°C warming,<sup>4</sup> with only the most optimistic of scenarios holding it to 1.8°C (see Figure 2.1).

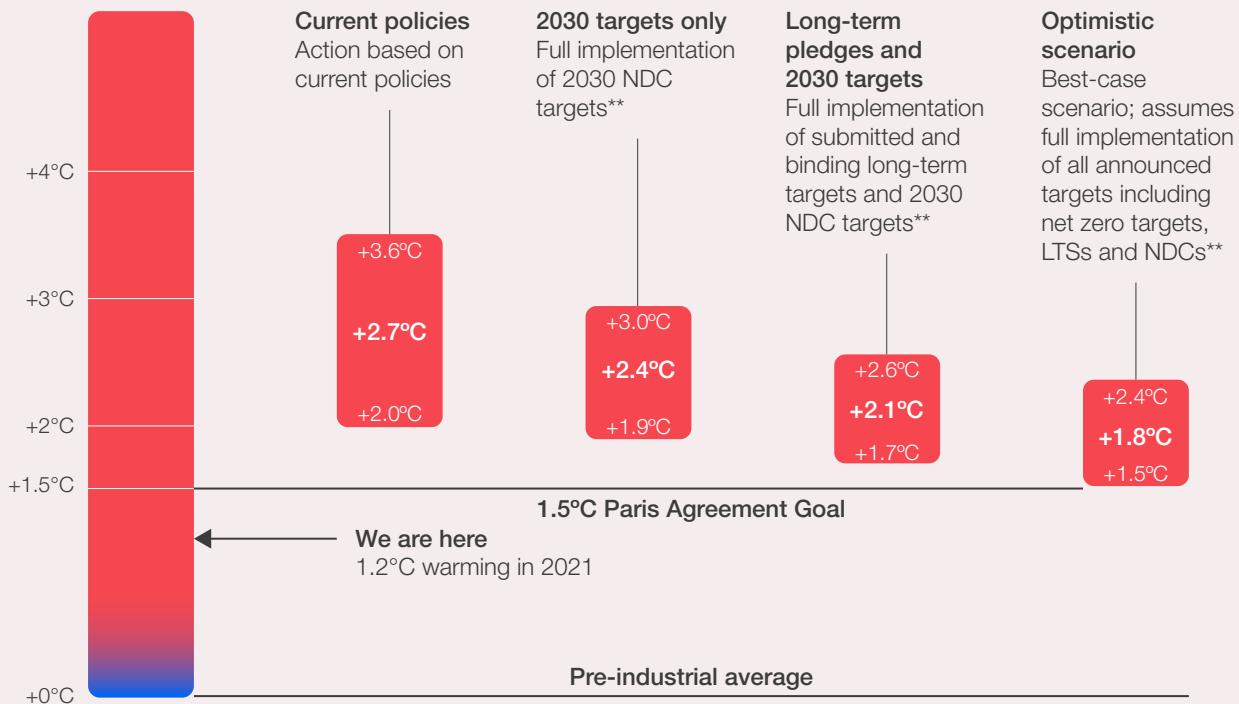
Without stronger action, global capacity to mitigate and adapt will be diminished, eventually leading to a “too little, too late” situation and ultimately a “hot house world scenario” with runaway climate change that makes the world all but uninhabitable.<sup>5</sup> The world will face high costs if we collectively fail to achieve the net zero goal by 2050.<sup>6</sup> Complete climate inaction will lead to losses projected to be between 4% and 18% of global GDP<sup>7</sup> with different impacts across regions.<sup>8</sup>

The transition to net zero—the state in which greenhouse gases (GHG) emitted into the atmosphere are balanced by their removal from the atmosphere\*—could be as transformative for economies and societies as past industrial revolutions. However, the complexities of the technological, economic and societal

\* Net zero carbon dioxide (CO<sub>2</sub>) emissions are achieved when anthropogenic CO<sub>2</sub> emissions are balanced globally by anthropogenic CO<sub>2</sub> removals over a specified period. Net zero CO<sub>2</sub> emissions are also referred to as “carbon neutrality.” This definition of “net zero” is from the IPCC (Intergovernmental Panel on Climate Change). 2018: Annex I Glossary. <https://www.ipcc.ch/sr15/chapter/glossary/>

FIGURE 2.1

## Global Temperature Scenarios by 2100



\*\* Nationally determined contributions (NDCs) are non-binding national plans for climate action, including targets for GHG emissions reductions. Long-term strategies (LTSs) are national mid-century development plans for confronting climate change. If 2030 NDC targets are weaker than projected emissions levels under current policies, then current policies are used here.

Source: Based on the Climate Action Tracker. <https://climateactiontracker.org/>

changes needed for decarbonization, coupled with the slow and insufficient nature of current commitments, will inevitably lead to varying degrees of disorderliness.

As climate change intensifies and some economies recover more quickly than others from COVID-19, a disorderly transition could bifurcate societies and drive countries further apart, and a too-slow transition will only beget damage and disruption across multiple dimensions over the longer term (see Box 2.1). Within countries, the disruptive potential of the transition could be amplified by disconnects between governments, businesses and households with respect to policy commitments, financial incentives, regulations and immediate needs. A sustained lack of coordination between countries would likely have profound geopolitical implications, with rising friction between strong decarbonization advocates and those who oppose quick strong action by using tactics such as stalling climate action or greenwashing— the practice of making people believe that a company or authority is more environmentally friendly than it actually is.

### **Tailwinds for a fast, but disorderly, transition**

Clear evidence of rising physical risks, such as melting land ice, rising sea levels and prolonged periods of extreme heat and cold,<sup>9</sup> as well as their associated consequences for human and economic

## **COVID-19 lockdowns saw a global dip in GHG emissions. However, upward trajectories soon resumed**

systems,<sup>10</sup> are intensifying momentum for the transition. And while COVID-19 lockdowns saw a global dip in GHG emissions, upward trajectories soon resumed:<sup>11</sup> GHG emissions rates rose faster in 2020 than their average over the last decade,<sup>12</sup> illustrating how the global economy is still heavily dependent on fossil fuels.

Governments, businesses, investors and communities are increasingly converging on the need for a quicker transition—each group setting higher expectations of the other. Green parties and green policies— such as a carbon border adjustment tax<sup>13</sup>— have gained traction in many countries, regions and industries, as have multilateral ideas like climate clubs.<sup>14</sup> A plethora of climate risk disclosure frameworks and measurement standards are now being combined within a new International Sustainability Standards Board (ISSB) by the International Financial Reporting Standards (IFRS). This will help clarify what needs to be done, and by whom, to highlight and prevent greenwashing and stalling on climate action.

The rise of stakeholder capitalism, shareholder activism and increased appetite from companies to use environmental,

#### BOX 2.1

### **Global Risks Perception Survey Ranks “Climate Action Failure” as Top Risk**

Respondents to the Global Risks Perception Survey (GRPS) 2021–2022 rank “climate action failure” as the most critical threat to the world in both the medium term (2–5 years) and long term (5–10 years), with the highest potential to severely damage societies, economies and the planet. Most also believe too little is being done: 77% said international efforts to mitigate climate change have “not started” or are in “early development”. (The survey was conducted before COP26. See Appendix C, Technical Notes).





REUTERS/PRAPAN CHANKAEW

social and governance (ESG) targets and metrics,<sup>15</sup> coupled with ESG-based investments, is re-shaping the financial and economic landscape,<sup>16</sup> and an increasing number of organizations are committing to decarbonize their operations. As banks, insurers and institutional investors are steering capital towards net zero, financial systems are rapidly emerging as critical enablers of the transition. A growing share of the US\$100 trillion bond market is mobilized for climate change solutions, and it is expected to reach the milestone of US\$1 trillion in annual issuances by 2022.<sup>17</sup> Moreover, during COP26, the Glasgow Financial Alliance for Net Zero (GFANZ) announced that over US\$130 trillion in private capital has been committed to carbon neutrality—enough to achieve net zero by 2050.<sup>18</sup> Similarly, parties at COP26 agreed on the framework for Article 6 of the Paris Agreement, enabling the immediate operationalizing of global carbon markets, ending uncertainty about the Clean Development Mechanism (CDM) and further establishing a new central UN supervisory body to trade carbon credits on specific projects.

These commitments by both businesses and governments are being closely monitored by civil society organizations and investors,<sup>19</sup> which fear untenable populist promises are being made for short-term political or financial gain.<sup>20</sup>

## Headwinds slowing the transition

The risk of a disorderly transition is aggravated by the interdependencies and distributed nature of economic and financial systems, the historic shielding of climate change externalities from citizens and businesses, decarbonization costs, and the many divergent interests at play that will complicate the transition. In the short term, these complexities are likely to prompt many actors to avoid or defer action.

Some national and business actors are still deliberately manoeuvring to stall or scale back the green transition. Governments need to balance the needs of populations dependent on carbon-intensive industries with international commitments. Yet some

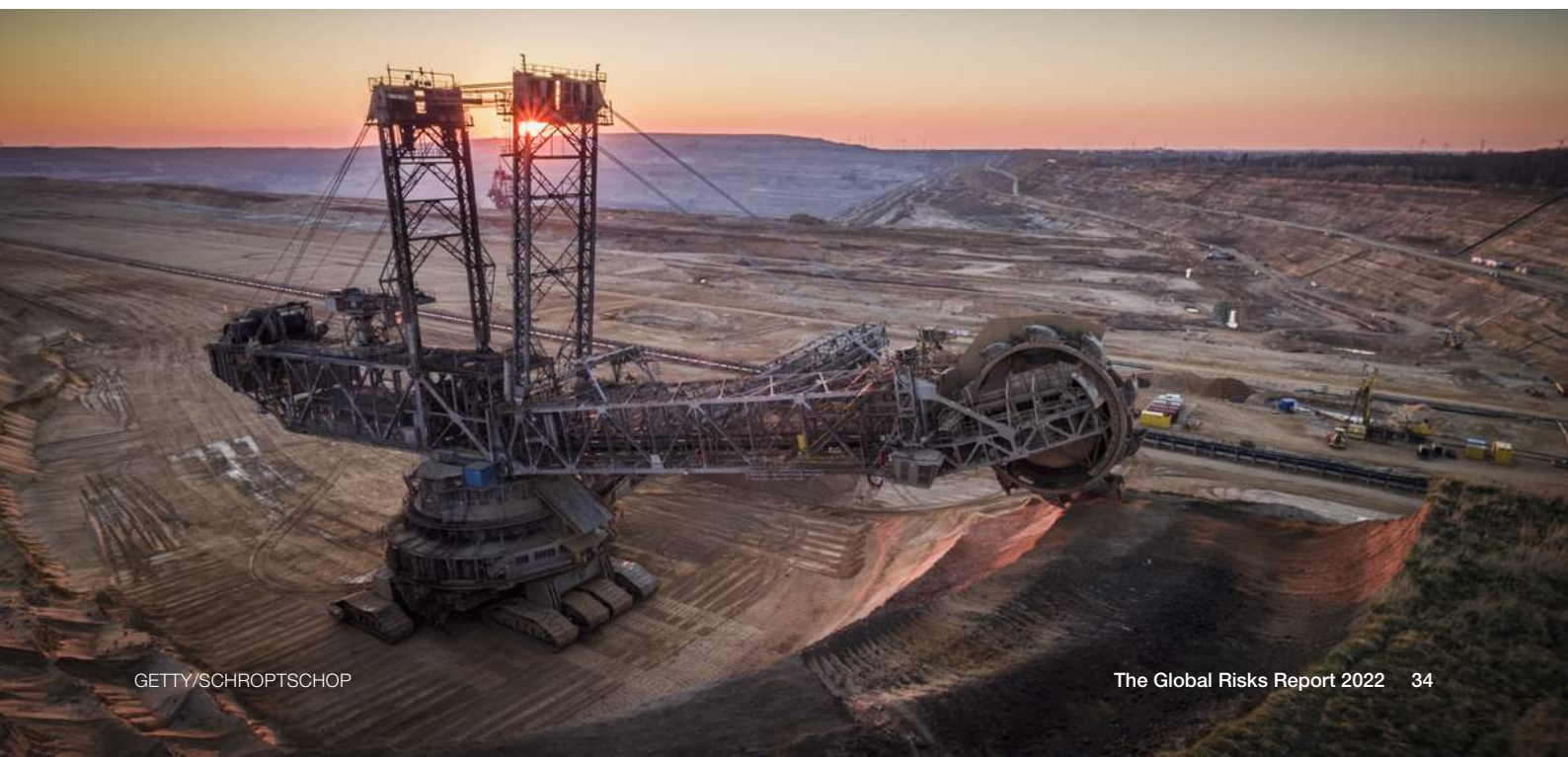
of these commitments are lofty and lacking scientific credibility,<sup>21</sup> legislatures are pre-emptively blocking new climate laws,<sup>22</sup> and regulations are being contested in courts by both proponents who push for more climate action and those who advocate for less.<sup>23</sup> Geopolitical tensions and rising competition over climate-friendly raw materials also further threaten to undermine international cooperation on green transition progress.<sup>24</sup> Some actors show little interest in the multilateral platforms on which climate action is taking place;<sup>25</sup> others continue to prioritize nationally important industries and could, in the wake of increased global tensions, shift to national security concerns over action on the transitions.

With government finances under pressure, regulatory obligations are not going far or fast enough, and there is an assumption that market forces will come to the rescue. In many countries there are insufficient incentives for households and businesses to invest in net zero technologies and few penalties for failing to do so. Slow uptake of new technologies such as low-carbon energy generation and carbon capture and storage, continued household overconsumption of carbon-intensive products and services,<sup>26</sup> and a failure to grasp the seriousness of climate threats all point to a slower transition that preserves “order” in the near term.<sup>27</sup> New innovations that require high amounts of energy during production and use, such as crypto-mining or crypto-trading,<sup>28</sup> often coming from fossil

## Post-COVID-19 recovery measures mostly neglect the green transition in favour of short-term stability

fuel energy sources, can also offset efforts to reduce ecological footprints.

Post-COVID-19 recovery measures mostly neglect the green transition in favour of short-term stability,<sup>29</sup> while loose monetary policies further distort green, market-based solutions or investments;<sup>30</sup> they also exacerbate the problem of zombie companies.<sup>31</sup> Carbon-intensive technologies continue to receive public subsidies,<sup>32</sup> with over 50 developed and emerging economies committing US\$345 billion to fossil fuels in 2020—a figure lower than in previous years largely because of depressed consumption and prices during the pandemic.<sup>33</sup> At the time of writing, the economic rebound following the impact of COVID-19 has seen (fossil) energy demand outstrip supply,<sup>34</sup> resulting in sharply increased energy prices, even as the world turns against fossil fuels.<sup>35</sup> Moreover, some business actors continue their efforts to slow the transition. Climate-sceptic lobbying,<sup>36</sup> greenwashing and sowing misinformation and distrust about climate science remain pervasive in many countries.<sup>37</sup>



Some economic incentives also complicate attempts to coordinate measures that could internalize costs in high-emission industries and countries, minimize market disruptions and more fairly redistribute burdens and rewards. Instead of fostering decarbonization, the lack of global emission prices and reporting requirements continues to shield consumers and producers from the cost of inaction.<sup>38</sup> This incentivizes countries and businesses not to curb emissions, but instead to game the system and avoid liability by offshoring carbon-intense activities or trading their emissions to countries with less stringent regulations.<sup>39</sup> Developing countries attracted to emissions in-shoring schemes by short-term financial gain

squander the opportunity to use carbon allowances for their own development and risk undermining their future access to trade flows and the finance needed for mitigation and adaptation.<sup>40</sup>

Businesses may be unprepared for transition risks such as rapid shifts in policies and regulations, the need to develop low-carbon technologies and changes in consumer behaviour and investor preferences.<sup>41</sup> These risks have the potential to destabilize the financial system,<sup>42</sup> as in aggregate they can increase default rates and asset volatility. They are further amplified in economies with low investment capability, high reliance on fossil fuels and less-inclusive political systems.<sup>43</sup>

## Consequences

The consequences and repercussions of the transition will necessarily reflect the speed at which it takes place; the efforts that go into it; and whether it is slow or aggressive, concerted or entrenched, and focused more on mitigation or adaptation. The goal of 1.5°C is so fundamental that societies need to be prepared to assume negative consequences of policies taken by governments today to avoid the worst consequences tomorrow. This includes job losses, increased costs and geopolitical insecurity associated with a disorderly transition. Only a socially just transition will make the consequences bearable for large parts of societies with governments needing to create policies and social-protection systems that help reduce the impacts for those affected. A rapid decarbonization would increase economic and societal disruption in the short term, while a slower pace with fewer short-term impacts would entail much larger costs and greater disorderliness in the long-term.

GRPS respondents drew attention to the societal consequences of environmental degradation at a global scale. They identify “climate action failure” and “extreme weather” as strong aggravators of “involuntary migration”, “livelihood crises”

and “social cohesion erosion”. In contrast, respondents to the Executive Opinion Survey (EOS) see the impacts from “climate action failure” as top risks in the short-term at a country level: “human environmental damage” and “extreme weather” are considered top-10 risks in 90 economies and 60 countries, respectively. All countries ranking these risks highly are particularly prone to wildfires, droughts, floods, deforestation and pollution.

### Varying speeds

#### A hasty pace

Concerted, aggressive action now will, because of the scale of the endeavour, bring discontinuities and thus disruptions, as efforts within and between industries, businesses and governments fail to align. It would alleviate long-term environmental consequences but could have severe short-term economic and societal impacts. Missteps will likely threaten national energy security, for example, and result in volatile energy prices. Over the longer term, countries will face questions regarding the viability of vehicle fuel and gas supply arrangements when much of the population has shifted away from combustion engines, gas boilers and heating.



GETTY/AERIAL PERSPECTIVE WORKS

As carbon-intensive industries employ millions of workers, their rapid termination could trigger economic volatility and increase societal and geopolitical tensions. Up to 8.5 million jobs in the energy sector (almost 30%) could be lost in fossil fuels and nuclear energy by 2050, although with re-skilling up to 40 million new jobs could be created, mostly in renewables.<sup>44</sup> Earlier or current investments in carbon-intensive technologies could result in stranded assets. These—even if they are the result of wilfully made investments in carbon-intensive technologies for short-term gain instead of long-term investments in clean technologies<sup>45</sup>—could impact the financial sector,<sup>46</sup> as well as the transition, when they are trapped in industries such as those that extract resources required for low-carbon technologies.<sup>47</sup> Despite these short-term disruptions, the social and economic consequences of unmitigated global warming and entire nations being flooded or disappearing would be even more cataclysmic: countries' complete economies and assets would be left stranded.

Non-holistic government approaches also pose risks. Adopting low-carbon and more sustainable technologies too hastily, in a way that neglects systemic interdependencies—such as transitioning one system before another linked or dependent one is ready—could lead to production shortages and disrupt secondary economic cycles if redundant systems are not in place to prevent energy supplies from collapsing. Poor regulation of new green markets could create

unwanted monopolies in geopolitically contested industries such as rare earth elements extraction.

Some approaches to the green transition reflect blind spots that risk damaging outcomes for workers and the environment.<sup>48</sup> These include focusing solely on carbon dioxide (CO<sub>2</sub>) emissions and ignoring methane,<sup>49</sup> or the increased use of resources for low-carbon technologies. They also risk setting regulatory requirements to phase out technologies before substitutes exist or, in other words, a focus on supply constraint of fossil fuels rather than an equal emphasis on demand-destruction in the most carbon-intensive industries.

### **Slow transition**

In contrast, a slower but more orderly transition might be more manageable in the short term but would result in the need for deeper and faster changes by 2050. This would lead to more pronounced long-term disorder, amplified at the same time by more damaging economic activity such as the closing off of opportunities, damaging impacts through environmental degradation impacting societal well-being and infrastructural fragilities.

The long-term financial impacts would disproportionately affect large and/or developing countries.<sup>50</sup> Some of these countries face political and financial barriers to swiftly reducing their reliance on fossil fuel energy production such as cutting coal use;<sup>51</sup> others rely on natural gas to

reach a higher level of industrialization before decarbonizing,<sup>52</sup> even though these policies further aggravate the destruction of ecosystems. Consequently, the loss of (arable) land would increase migration pressure and the number of climate refugees (see Chapter 4). This slow pathway may lead countries to prioritize adaptation over mitigation efforts. Yet, once carbon prices increase and demand destruction ends up making fossil energy investment a losing bet, leapfrogging to renewables sooner than later could prove to be a more effective long-term investment for such developing countries.

### Divergent paces

It is most likely that national transition programmes will move at different paces as a result of differences in political will (decarbonization ambitions and political interest), economic structure (service versus manufacturing) and capabilities (technological know-how and financial wherewithal). Countries that move faster will be able to consolidate their own national capabilities and clean tech industries; those that move more slowly will lack competitiveness in this area but be able to leverage the best that has been developed elsewhere. Initiatives that pay closer attention to scope 3\* emissions will shine a spotlight on global value chains and will increasingly disadvantage exports from laggard countries. Furthermore, the heterogeneity of climate action worldwide will be a risk for trade flows in the future, especially for the less-developed economies. By facing narrower access to trade finance, they risk exclusion from the opportunities for orderly climate mitigation and adaptation.<sup>53</sup>

Reputational damage and liability issues for governments and businesses seen as complicit in, if not responsible for, climate change could lead to breakdowns in trust between nations, higher global tensions and the possibility of sanctions being introduced against laggard nations, or fines/trade tariffs against relapsing businesses.

Transition policies risk losing public support if they neglect the impacts—on land use, resources, nature—of large-scale water and wind energy installations,<sup>54</sup> or emanate from failure to create just pricing schemes for communities willing to invest in green energy, such as a shift of fossil fuel to renewable energy subsidies or equal feed-in tariffs for individuals and large-scale providers.<sup>55</sup> Poor grid stability through the intermittency of renewable energy sources, shortages in storage capacity and the phasing out of existing baseload energy technologies that have a low carbon intensity yet are politically highly controversial, such as nuclear energy,<sup>56</sup> could also dwindle public support for cleaner energy sources.

## Especially at risk are unskilled workers unable to transition their skill sets

### Biotechnical and geoengineering solutions

While negative emission technologies are an essential component of all IPCC 1.5°C scenarios, geoengineering solutions could be silver-bullet solutions, but they may not adequately explore systemic interdependencies and implications.<sup>57</sup> Moreover, the deployment of such untested technologies carries unknown risks. Some geoengineering approaches—such as weather modification or solar radiation management (SRM)—could spiral out of control or create friction if they are used for geopolitical advantage in the absence of any governance framework,<sup>58</sup> as the effectiveness could vary regionally.<sup>59</sup> They could exacerbate geopolitical tensions between countries where the local climate is improving and those that are suffering from the unintended consequences.<sup>60</sup>

On the other side, biotechnical solutions such as carbon dioxide removal (CDR)

\* Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy. Scope 3 emissions are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions. This definition of “Scope 3 emissions” is from the Greenhouse Gas Protocol. 2021. [https://ghgprotocol.org/sites/default/files/standards\\_supporting/FAQ.pdf](https://ghgprotocol.org/sites/default/files/standards_supporting/FAQ.pdf)

from the atmosphere need to be scaled up to come close to keeping the 1.5°C scenario within reach under all IPCC scenarios.<sup>61</sup> The robustness of any net zero strategy that relies on CDR depends both on the effectiveness of the underlying projects that drive the CO<sub>2</sub> removal and, especially, on the permanence of the stored carbon.<sup>62</sup> Other solutions, such as carbon capture, utilization and storage (CCUS), are already heavily subsidized,<sup>63</sup> but they risk being used for greenwashing as carbon-heavy industries eventually fail to structural change their value chains to reduce their emissions.<sup>64</sup> Similarly, Bio-energy Carbon Capture and Storage (BECCS) solutions could create unintended geopolitical consequences or prove to be counterproductive.<sup>65</sup>

## Stakeholder consequences

### Loss of agency: Consequences for individuals

The type of transition will have far-reaching socio-economic implications for individuals. Where policies, incentives and innovations fail to stimulate effective market solutions, households will see increases in their cost of living due to rising decarbonization requirements for homes, rising fossil fuel

prices and physical climate impacts, among other issues. They may also face increased service disruption from utilities where system dependencies and discontinuities have not been adequately anticipated by participants. Especially at risk are unskilled workers, those unable to transition their skill sets and those currently employed in carbon-intensive industries that undergo radical transformation.<sup>66</sup> Many of these workers are already facing challenges related to automation and the hyper-globalization of the pre-COVID-19 era, when key heavy industries such as coal and steel were offshored to emerging markets.<sup>67</sup> Middle-class households could also be left behind if aggressive transition measures impact their finances and their purchasing power diminishes substantially.

Loss of income would inhibit people's access to new technologies and upward mobility, entrenching inequalities for generations. Unequal transition speeds could widen inequalities between economies and create pressure on workers to migrate to countries where their skills are still in demand (see Chapter 4). Failed or slow climate action could worsen gender inequalities as, in many low-income economies, women are responsible for gathering and producing





REUTERS/OCTAVIO JONES

food, securing water and collecting bioenergy sources such as firewood and crop waste. Together, these consequences could trigger disillusionment with climate action and lead to the radicalization of marginalized socio-economic groups across the political spectrum.

### **Loss of control: Consequences for governments**

Governments will face backlash whether climate action is slow or aggressive. Steeper transition costs such as high and quick increase in the price of carbon and fossil fuels could weaken public support for fast action; conversely, slow action could trigger further radicalization from those who feel authorities at all levels do not act fast enough, with a potential increase in inter-generational friction and more fiscal drain due to increased recovery funding. Investing in a net zero economy could create unsustainable levels of debt for economies lacking the means of such large-scale investment, or the loss of rent/tax revenue for economies heavily dependent on carbon intensive resource production, which would cripple public finances already vulnerable from the economic impacts of COVID-19 fallouts (see Chapter 1). Especially at risk are more climate-vulnerable countries; such green investment could be seen as a diversion from pandemic-related recovery programmes and the enhancement of core public infrastructure and services. Unequal access to low- or zero-carbon innovations could undermine support for governments in some countries.<sup>68</sup>

A socially unjust transition would exacerbate geopolitical and economic friction and inequalities between countries and regions. Laggard economies—especially those reliant on carbon-intensive sectors and that fail to keep up with technological innovation—risk losing competitive advantage and leverage in trade agreements, civil unrest, regime change and massive economic and societal disruption. Unequal access to materials and funding to enable the transition could increase tensions, as could unintended consequences—such as the destruction of ecosystems in developing countries to extract resources for next-level electrification of mobility in developed economies.<sup>69</sup>

Failed or delayed financial promises by advanced economies—such as a decline in promised foreign direct investment (FDI),<sup>70</sup> or shortcomings to the globally agreed annual \$100 billion for emerging and developing countries to finance their transition to lower emissions and adaptation measures to the physical consequences of climate change<sup>71</sup>—could leave developing countries stranded with costly, aggressive transition plans, unable to provide for vulnerable populations.

A zero-sum political game, with a first-come, first-served mentality, compounded by a lack of solidarity and combined with the absence of clear climate governance or enforceable accountability measures would increase tensions between economies transitioning quickly and those preferring or needing a slower transition.

### Loss of market share: Consequences for businesses

Policies triggering the premature termination of large-scale industries would disrupt markets, affect financing mechanisms and limit investment opportunities.<sup>72</sup>

Inconsistent policy signals, choices crippling competitiveness, and conflicting rhetoric, regulations and incentives would generate discontent among businesses. The transition could lead to stranded assets in carbon-intensive industries,<sup>73</sup> while devaluations could potentially affect the financial system,<sup>74</sup> leading to loss of liquidity and increasing liability, credit and market risks.<sup>75</sup> Businesses perceived as lagging, or as complicit in slowing down climate action,<sup>76</sup> could lose consumer and investor confidence and face additional state intervention and liability risk through judicial action.<sup>77</sup> Overall, businesses could also lose out on opportunities to invest in net zero technologies and the skilled professionals of the future,<sup>78</sup> impacting their long-term viability.

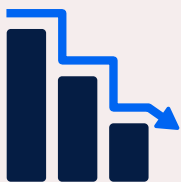
A disorderly transition could see more frequent and severe supply chain disruptions due to labour and product shortages, especially as sectors and companies switch operating models or simply go out of business. These disruptions present challenges to the

resilience of business models across all industries.

### Loss of nature

How the speed and degree of transition impacts natural ecosystems will, in turn, help or hinder its effectiveness. Some actions taken to mitigate climate change will incur costs for nature. In the rush to increase biomass use for BECCS, to use more agricultural land to create biofuels for industries such as aviation, and to extract minerals needed for the decarbonization of the world's economy,<sup>79</sup> additional negative impacts on ecosystems and indigenous societies in emerging economies are difficult to avoid. Solutions used for carbon offsetting, such as restoring or reforesting land—so-called offset forests—could be destroyed if that land is damaged by more severe weather such as wildfires or floods, eventually unleashing the stored carbon. Poorly sited windfarms or hydroelectric dams can affect ecosystems and wildlife at a large scale, and they also present societal risks (such as forced relocation of local residents) and political risks (such as by controlling downstream water-access to neighbouring countries). The continued degradation of nature will add to stress on local residents, public health, businesses and ultimately the stability of society, while regional population growth will further impact the use of land and resources such as water and food.

## Shocks to Reflect Upon



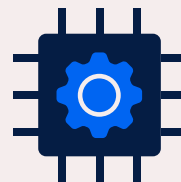
### Green Market Crash

What if the boom in sustainable investments becomes a bubble, followed by a crash that cripples innovation and progress?



### Fusion Power at Last

What if a new transformative technology emerges but cannot be mass-produced at low cost, disadvantaging developing economies and impacting climate action dynamics?



### Collateral Geo-Damage

What if unilateral implementation of large-scale geoengineering solutions creates unexpected knock-on effects that developing economies are ill-equipped to handle?



## Towards a more sequenced transition

Beyond the sheer scale, complexity and interdependency of the needed changes, the climate transition will be disorderly because decades of inaction and hesitant implementation of transition measures on local and global levels have steered the planet onto a path that will be difficult to change.

In a recovering yet diverging global economy, countries will need to transition at varying paces to prevent short-term disruptions from offsetting long-term gains, but the consequences of disparate transitions will be felt worldwide. The least disruptive climate transition measures will be those that holistically integrate the needs of individuals, societies, businesses and planet. Domestic and international

collaboration should focus on educating the public about the value and need of climate action, including a change in consumer behaviour and demand-destruction for carbon intensive goods. Businesses of all sizes need to be incentivised to proactively factor in transition risks and move to circular economy models, while governments should be encouraged to take bold and immediate steps towards implementing robust legal frameworks that ensure a just transition.

Any transition of this scale will be disruptive. All stakeholders need to focus on actions that will drive an innovative, determined and inclusive transition in order to minimize the impacts of disorder, facilitate adaptation and maximize opportunities.



# Endnotes

- 1 IPCC (Intergovernmental Panel on Climate Change). 2021. "Climate Change 2021: The Physical Science Basis". Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. In Press. <https://www.ipcc.ch/report/ar6/wg1/>
- 2 Elwin, P. and Baldock, Ch. 2021. "No rain on the plain: Deforestation threatens Brazil's agricultural exports". Planet Tracker. Briefing Paper, September 2021. [https://bunness.com/assets/pdf\\_files/no-rain-on-the-plain.pdf](https://bunness.com/assets/pdf_files/no-rain-on-the-plain.pdf); World Economic Forum, in partnership with Marsh & McLennan Companies and Zurich Insurance Group. 2020. The Global Risks Report 2020. Insight Report. Chapter 4 Save the Axolotl. Geneva: World Economic Forum. January 2020. <https://www.weforum.org/reports/the-global-risks-report-2020>
- 3 Climate Action Tracker. 2021. "Glasgow's 2030 credibility gap: net zero's lip service to climate action". The Climate Action Tracker. 11 November 2021. <https://climateactiontracker.org/publications/glasgows-2030-credibility-gap-net-zeros-lip-service-to-climate-action/>
- 4 Ibid.
- 5 NGFS (Network for Greening the Financial System). Climate Scenarios for Central Banks and Supervisors. June 2020. NGFS Publications. <https://www.ngfs.net/en/ngfs-climate-scenarios-central-banks-and-supervisors>
- 6 Ricke, K., Drouet, L., Caldeira, K. and Tavoni, M. 2018. "Country-level social cost of carbon." *Nature Climate Change*, 8, 895–900. <https://www.nature.com/articles/s41558-018-0282-y>
- 7 Swiss Re. 2021. "World economy set to lose up to 18% GDP from climate change if no action taken, reveals Swiss Re Institute's stress-test analysis". 22 April 2021. <https://www.swissre.com/media/news-releases/nr-20210422-economics-of-climate-change-risks.html>
- 8 Swiss Re. 2021. The Economics of Climate Change: No Action Not an Option. Swiss Re Institute. April 2021. [https://www.swissre.com/dam/jcr:5d558fa2-9c15-419d-8dce-73c080fca3ba/SRI\\_%20Expertise\\_Publication\\_EN\\_LITE\\_The%20economics\\_of\\_climate\\_change.pdf](https://www.swissre.com/dam/jcr:5d558fa2-9c15-419d-8dce-73c080fca3ba/SRI_%20Expertise_Publication_EN_LITE_The%20economics_of_climate_change.pdf)
- 9 IPCC. 2021. Op. Cit.
- 10 Bevere, L. and Weigel, A. 2021. "Sigma 1/2021 - Natural catastrophes in 2020". Swiss Re Institute. 30 March 2021. <https://www.swissre.com/institute/research/sigma-research/sigma-2021-01.html>
- 11 Carbon Monitor. 2021. <https://carbonmonitor.org/> accessed 10 December 2021.
- 12 WMO (World Meteorological Organization). 2021. Greenhouse Gas Bulletin: The State of Greenhouse Gases in the Atmosphere Based on Global Observation through 2020. No. 17, 25 October 2021. [https://library.wmo.int/doc\\_num.php?explnum\\_id=10904](https://library.wmo.int/doc_num.php?explnum_id=10904)
- 13 European Commission. 2021. "Carbon Border Adjustment Mechanism". European Commission, 14 July 2021. [https://ec.europa.eu/taxation\\_customs/green-taxation-0/carbon-border-adjustment-mechanism\\_de](https://ec.europa.eu/taxation_customs/green-taxation-0/carbon-border-adjustment-mechanism_de)
- 14 Nordhaus, W. 2015. "Climate Clubs: Overcoming Free-riding in International Climate Policy". *American Economic Review*, 2015, 105(4): 1339-1370. <https://www.aeaweb.org/articles?id=10.1257/aer.15000001>.
- 15 World Economic Forum. 2020. Measuring Stakeholder Capitalism: Towards Common Metrics and Consistent Reporting of Sustainable Value Creation. September 2020. <https://www.weforum.org/reports/measuring-stakeholder-capitalism-towards-common-metrics-and-consistent-reporting-of-sustainable-value-creation>
- 16 Bartalos, G. 2021. "Advisors are underestimating retail demand for ESG investments". RIA Intel. 12 April 2021. <https://www.riaintel.com/article/b1rcsns61vt8t/advisors-are-underestimating-retail-demand-for-esg-investments>; CFA Institute. 2020. "Future of sustainability in investment management: From ideas to reality". CFA Institute, Future of Finance. <https://www.cfainstitute.org/-/media/documents/survey/future-of-sustainability.ashx>; Reid, J. and Birgden, H. 2021. "Investing in a net-zero emissions transition". Marsh McLennan. <https://www.marshmclennan.com/insights/publications/2021/september/investing-in-a-net-zero-emissions-transition.html>
- 17 Fatin, L. 2021. "\$1 Trillion annual green bond milestone tipped for end 2022 in latest survey: Sean Kidney calls for \$5 Trillion per year by 2025". Climate Bonds Initiative. 28 October 2021. <https://www.climatebonds.net/2021/10/1trillion-annual-green-bond-milestone-tipped-end-2022-latest-survey-sean-kidney-calls>
- 18 GFANZ (Glasgow Financial Alliance for Net Zero). 2021. "Amount of finance committed to achieving 1.5°C now at scale needed to deliver the transition". 3 November 2021. <https://www.gfanzero.com/press/amount-of-finance-committed-to-achieving-1-5c-now-at-scale-needed-to-deliver-the-transition/>
- 19 Climate Action 100+. 2021. Net-Zero Company Benchmark. <https://www.climateaction100.org/progress/net-zero-company-benchmark/>; UN. 2021. "Nationally determined contributions under the Paris Agreement". UN Framework Convention on Climate Change, Synthesis report by the secretariat. 17 September 2021. [https://unfccc.int/sites/default/files/resource/cma2021\\_08\\_adv\\_1.pdf](https://unfccc.int/sites/default/files/resource/cma2021_08_adv_1.pdf)
- 20 Bündnis90/Die Grünen. 2021. Deutschland – Alles ist drin: Bundestagswahlprogramm 2021. [https://cms.gruene.de/uploads/documents/Wahlprogramm-DIE-GRUENEN-Bundestagswahl-2021\\_barrierefrei.pdf](https://cms.gruene.de/uploads/documents/Wahlprogramm-DIE-GRUENEN-Bundestagswahl-2021_barrierefrei.pdf); Edgecliffe-Johnson, A., and Mundy, S. 2021. "Big business and COP26: Are the 'net zero' plans credible?". *Financial Times*. 21 November 2021. <https://www.ft.com/content/d91b5934-de9e-4eef-a008-697bce53263f>
- 21 Angelo, M. 2020. "Brazil's updated climate plan seen lacking credibility as forests shrink". *Reuters*. 10 December 2020. <https://www.reuters.com/article/brazil-climate-change-idUSKBN28K1W6>; Harvey, F., Watts, J. and Ni, V. 2021. "China's new climate plan falls short of Cop26 global heating goal, experts say". *The Guardian*. 28 October 2021. <https://www.theguardian.com/environment/2021/oct/28/disappointing-but-not-unexpected-china-climate-goal-leaves-experts-unsatisfied>
- 22 Leber, R. 2021. "An 'attack on American cities' is freezing climate action in its tracks". *Vox*. 29 September 2021. <https://www.vox.com/22691755/gas-utilities-fight-electrification-preemption>
- 23 Court of The Hague. 2021. C/09/571932 / HA ZA 19-379. C/09/Shell. <https://uitspraken.rechtspraak.nl/inziendocument?id=ECLI:NL:RBDHA:2021:5339>; Taft, M. 2021. "The Supreme Court may fuck over the climate, too". *Gizmodo*. 29 October 2021. <https://gizmodo.com/the-supreme-court-may-fuck-over-the-climate-too-1847966561>
- 24 Megerian, C., and Su, A. 2021. "What U.S.-China tension means for fighting climate change". *Los Angeles Times*. 27 October 2021. <https://www.latimes.com/politics/story/2021-10-27/china-united-states-climate-cooperation>; White, E. 2021. "China says US tensions threaten fight against climate change". *Financial Times*. 2 September 2021. <https://www.ft.com/content/5e830153-1e1a-4dfb-b40a-8469384ab6d0>;

- 25 Colson, T. 2021. "Xi and Putin are snubbing the COP26 climate summit, even though China and Russia produce some 32% of global CO2 emissions". Business Insider. 25 October 2021. <https://www.businessinsider.com/china-xi-and-russia-putin-snubbing-cop26-2021-10?r=US&IR=T>
- 26 Deloitte. 2021. "How COVID-19 changes consumer behavior long-term". Monitor Deloitte. [https://www.deloitte-mail.de/custloads/141631293/md\\_1804032.pdf](https://www.deloitte-mail.de/custloads/141631293/md_1804032.pdf)
- 27 World Economic Forum, in Partnership with SAP and Qualtrics. 2021. The Climate Progress Survey: Business and Consumer Worries and Hopes. November 2021. [https://www3.weforum.org/docs/SAP\\_WEF\\_Sustainability\\_Report.pdf](https://www3.weforum.org/docs/SAP_WEF_Sustainability_Report.pdf)
- 28 Bogna, J. 2022. "What is the environmental impact of cryptocurrency?" PCmag. 8 January 2022. <https://uk.pcmag.com/old-cryptocurrency/138047/what-is-the-environmental-impact-of-cryptocurrency>; Digiconomist. 2022. Bitcoin Energy Consumption Index. <https://digiconomist.net/bitcoin-energy-consumption/>, accessed 8 January 2022.
- 29 O'Callaghan, B. J. and Murdock, E. 2021. "Are We Building Back Better? Evidence from 202 and Pathways to Inclusive Green Recovery Spending". United Nations Environment Programme. March 2021. <https://wedocs.unep.org/bitstream/handle/20.500.11822/35281/AWBBB.pdf>
- 30 Council on Foreign Relations. 2021. Global Monetary Policy Tracker. Greenberg Center for Geoeconomic Studies. <https://www.cfr.org/global/global-monetary-policy-tracker/p37726>
- 31 White, A. 2021. "'Zombie' firms kept alive by Covid-19 bailouts, EU official says". Bloomberg. 24 February 2021. <https://www.bloomberg.com/news/articles/2021-02-24/-zombie-firms-kept-alive-by-covid-19-bailouts-eu-official-says>
- 32 Parry, I., Black, S. and Vernon, N. 2021. "Still not getting energy prices right: A global and country update of fossil fuel subsidies". IMF Working Paper No. 2021/236. 24 September 2021. <https://www.imf.org/en/Publications/WP/Issues/2021/09/23/Still-Not-Getting-Energy-Prices-Right-A-Global-and-Country-Update-of-Fossil-Fuel-Subsidies-466004>
- 33 OECD and IEA. 2021. "Update on recent progress in reform of inefficient fossil-fuel subsidies that encourage wasteful consumption 2021". Contribution by the Organisation for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA) to G20 Environment, Climate and Energy Ministers, in consultation with the Organization of Petroleum Exporting Countries (OPEC). Climate and Energy Joint Ministerial Meeting. Naples. 23 July 2021. <https://www.oecd.org/g20/topics/climate-sustainability-and-energy/OECD-IEA-G20-Fossil-Fuel-Subsidies-Reform-Update-2021.pdf>
- 34 Clark, A. 2021. "Energy crisis sets stage for record global carbon emissions". Bloomberg. 8 October 2021. <https://www.bloomberg.com/news/articles/2021-10-08/energy-crisis-sets-stage-for-record-global-carbon-emissions>
- 35 Brower, D. 2021. "COP26: oil price soars even as the world turns against fossil fuels". Financial Times. 4 November 2021. <https://www.ft.com/content/37947e4a-71a1-4c0e-919b-1e3d55ee19ea>
- 36 Egan, M. and Nilsen, E. 2021. "House committee intends to subpoena fossil fuel companies for documents about climate disinformation". CNN. 29 October 2021. <https://edition.cnn.com/2021/10/28/politics/fossil-fuel-oversight-hearing-climate/index.html>
- 37 Egan, M. 2021. "Undercover Exxon video reveals an anti-climate campaign". CNN Business. 1 July 2021. <https://edition.cnn.com/2021/07/01/business/exxon-tape-video-keith-mccoy/index.html>
- 38 OECD . 2021. Carbon Pricing in Times of COVID-19: What Has Changed in G20 Economies? Paris: OECD. <https://www.oecd.org/tax/tax-policy/carbon-pricing-in-times-of-covid-19-what-has-changed-in-g20-economies.htm>; World Bank. 2021. Carbon Pricing Dashboard. <https://carbonpricingdashboard.worldbank.org/>, accessed on 12 December 2021.
- 39 Dai, R., Duan, R., Liang, H. and Ng, L. 2021. "Outsourcing climate change". European Corporate Governance Institute. Finance Working Paper Number 723/2021. [https://ecgi.global/sites/default/files/working\\_papers/documents/daidianliangngfinal.pdf](https://ecgi.global/sites/default/files/working_papers/documents/daidianliangngfinal.pdf)
- 40 Brenton, P. and Chemutai, V. 2021. "The Trade and Climate Change Nexus: The Urgency and Opportunities for Developing Countries". World Bank. <https://openknowledge.worldbank.org/handle/10986/36294>
- 41 Zurich Insurance. 2021. "Climate change's forgotten risks". 2 March 2021. <https://www.zurich.com/en/knowledge/topics/global-risks/climate-change-forgotten-risks>
- 42 Dunz, N., Naqvi, A. and Monasterolo, I. 2021. "Climate sentiments, transition risk, and financial stability in a stock-flow consistent model". Journal of Financial Stability, Vol. 54. June 2021. <https://www.sciencedirect.com/science/article/abs/pii/S1572308921000322?via%3Dihub>
- 43 Bolton, P. and Kacperczyk, M. 2021. "Global pricing of carbon-transition risk". National Bureau of Economic Research Working Paper 28510. February 2021. [https://www.nber.org/system/files/working\\_papers/w28510/w28510.pdf](https://www.nber.org/system/files/working_papers/w28510/w28510.pdf)
- 44 IRENA (International Renewable Energy Agency). 2020. Measuring the Socio-economics of Transition: Focus on Jobs. IRENA. Abu Dhabi. 2020. [https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Feb/IRENA\\_Transition\\_jobs\\_2020.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Feb/IRENA_Transition_jobs_2020.pdf)
- 45 Kramer, A.R. 2017. "The myth of 'Stranded Assets' in climate protection". Institute for Advanced Sustainability Studies blog post. Potsdam. 8 December 2017. [https://www.iass-potsdam.de/en/node/5572?utm\\_source=newsletter&utm\\_medium=email&utm\\_content=2019-09-08&utm\\_campaign=greenbuzz](https://www.iass-potsdam.de/en/node/5572?utm_source=newsletter&utm_medium=email&utm_content=2019-09-08&utm_campaign=greenbuzz)
- 46 Basel Committee on Banking Supervision. 2021. Climate-Related Risk Drivers and Their Transmission Channels. Bank for International Settlements. April 2021. <https://www.bis.org/bcbis/publ/d517.pdf>
- 47 Siyobi, B. 2021. "Stranded assets: The nexus between extractives, climate, & the circular economy within the African extractives sectors". South African Institute of International Affairs. June 2021. <https://media.africaportal.org/documents/Policy-Insights-112-siyobi.pdf>
- 48 European Agency for Safety and Health at Work. 2021. "Workers' safety and health in green jobs". <https://osha.europa.eu/en/emerging-risks/green-jobs>; O'Connor, S. 2021. "Not all green jobs are safe and clean". Financial Times. 26 October 2021. <https://www.ft.com/content/111f9600-f440-47fb-882f-4a5e3c96fae2>
- 49 The Economist. 2021. "Those who worry about CO2 should worry about methane, too". The Economist. 31 March 2021 Edition. <https://www.economist.com/science-and-technology/2021/04/03/those-who-worry-about-co2-should-worry-about-methane-too>
- 50 Swiss Re. 2021. The Economics of Climate Change. Op. cit.
- 51 Cursino, M. and Faulkner, D. 2021. "COP26: China and India must explain themselves, says Sharma". BBC. 14 November 2021. <https://www.bbc.com/news/uk-59280241>
- 52 Greenhalgh, K. 2021. "Nigerian government retains focus on gas-based transition". HIS Markit. 16 August 2021. <https://ihsmarkit.com/research-analysis/nigerian-government-retains-focus-on-gasbased-transition.html>

- 53 Brenton, P. and Chemutai, V. 2021. The Trade and Climate Change Nexus: The Urgency and Opportunities for Developing Countries. World Bank. <https://openknowledge.worldbank.org/handle/10986/36294>
- 54 Duwe, S. and Humbs, C. "Ausgebremst: Windkraft in der Krise". Kontraste, ARD (German Television). 15 July 2021. <https://www.rbb-online.de/kontraste/archiv/kontraste-vom-15-07-2021/ausgebremst-windkraft-in-der-krise.html>
- 55 SENE. 2021. "Einspeisevergütung für PV Anlagen – lohnt sich das noch?". SENE GmbH. Leipzig. <https://senec.com/de/photovoltaikanlage/einspeiseverguetung>
- 56 Deutsche Welle. 2021. "EU states split on classifying nuclear energy as 'green'". Deutsche Welle. 11 November 2021. <https://www.dw.com/en/eu-states-split-on-classifying-nuclear-energy-as-green/a-59792406>
- 57 Hellstern, T., Henderson, K., Kane, S. and Rogers, M. 2021. "Innovating to net zero: An executive's guide to climate technology". McKinsey. 28 October 2021. <https://www.mckinsey.com/business-functions/sustainability/our-insights/innovating-to-net-zero-an-executives-guide-to-climate-technology>
- 58 Reynolds, J.L. 2019. "Solar geoengineering to reduce climate change: a review of governance proposals". Proceedings of the Royal Society A. 475:20190255. <https://royalsocietypublishing.org/doi/10.1098/rspa.2019.0255>
- 59 Jones, A.C., Hawcroft, M.K., Haywood, J.M., Jones, A., Guo, X. and Moore, J.C. 2018. "Regional climate impacts of stabilizing global warming at 1.5 K using solar geoengineering". Earth's Future 6 (2): 230–251. <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017EF000720>
- 60 Trisos, Ch.H., Amatulli, G., Gurevitch, J., Robock, A., Xia, L. and Zambri, B. 2018. "Potentially dangerous consequences for biodiversity of solar geoengineering implementation and termination". Nature Ecology & Evolution. 2, 475–482. <https://www.nature.com/articles/s41559-017-0431-0>
- 61 Goswami, A. 2021. "Why geoengineering is still a dangerous, technoutopian dream". Downtoearth.org. 30 December 2021. <https://www.downtoearth.org.in/blog/climate-change/why-geoengineering-is-still-a-dangerous-techno-utopian-dream-74828>; UNEP (United Nations Environment Programme). 2021. Net-zero asset owner alliance back call to scale-up carbon removal from atmosphere. United Nations Environment Programme. 23 September 2021. <https://www.unepfi.org/news/industries/investment/net-zero-asset-owner-alliance-backs-call-to-scale-up-carbon-removal-from-atmosphere/>
- 62 UNEP (United Nations Environment Programme). 2021. The Net in Net Zero: The Role of Negative Emissions in Achieving Climate Alignment for Asset Owners. UNEP and PRI. September 2021. <https://www.unepfi.org/publications/the-role-of-negative-emissions-in-achieving-climate-alignment-for-asset-owners/>
- 63 Kusnetz, N. 2021. "Fossil fuel companies are quietly scoring big money for their preferred climate solution: Carbon capture and storage". Inside Climate News. 17 August 2021. <https://insideclimatenews.org/news/17082021/carbon-capture-storage-fossil-fuel-companies-climate/>
- 64 Fairs, M. 2021. "Carbon washing is the new greenwashing". Dezeen. 31 July 2021. <https://www.dezeen.com/2021/07/31/carbon-washing-greenwashing-opinion/>
- 65 Heck, V., Gerten, D., Lucht, W. and Popp, A. 2018. "Biomass-based negative emissions difficult to reconcile with planetary boundaries". Nature Climate Change. 8, 151–155. <https://www.nature.com/articles/s41558-017-0064-y>; O'Leary, S. and Hunkler, B. 2021. "Carbon capture, use, and sequestration (CCUS) would decarbonize the electric system . . . in the worst possible way". Ohio River Valley Institute. <https://ohiorivervalleyinstitute.org/wp-content/uploads/2021/10/CCUS-Report-FINAL-3.pdf>
- 66 IRENA. 2020. Op. cit.
- 67 Jones, C. 2020. "Was hyperglobalisation an anomaly?". Financial Times. 17 November 2020. <https://www.ft.com/content/a89f5911-5cba-4d62-8746-5213303a92ec>; OECD. 2021. "What happened to jobs at high risk of automation?" OECD. January 2021. <https://www.oecd.org/future-of-work/reports-and-data/what-happened-to-jobs-at-high-risk-of-automation-2021.pdf>; Rodrik, D. 2019. "Globalization's wrong turn: And how it hurt America". Foreign Affairs. July/August 2019. <https://www.foreignaffairs.com/articles/usa/2019-06-11/globalizations-wrong-turn>
- 68 UNCTAD (United Nations Conference on Trade and Development). 2021. Technology and Innovation Report 2021: Catching Technological Waves – Innovation with Equity. Geneva: UN. [https://unctad.org/system/files/official-document/tir2020\\_en.pdf](https://unctad.org/system/files/official-document/tir2020_en.pdf)
- 69 UNCTAD. 2020. "Developing countries pay environmental cost of electric car batteries". 22 July 2020. <https://unctad.org/news/developing-countries-pay-environmental-cost-electric-car-batteries>
- 70 OECD. 2021. FDI Flows. <https://data.oecd.org/fdi/fdi-flows.htm>, accessed 15 December 2021.
- 71 OECD. 2021. Climate Finance Provided and Mobilised by Developed Countries: Aggregate Trends Updated with 2019 Data. OECD. 17 September 2021. <https://www.oecd.org/env/climate-finance-provided-and-mobilised-by-developed-countries-aggregate-trends-updated-with-2019-data-03590fb7-en.htm>
- 72 Zurich Insurance. 2021. "Climate change's forgotten risks". 2 March 2021. <https://www.zurich.com/en/knowledge/topics/global-risks/climate-change-forgotten-risks>
- 73 Van der Ploeg, F. and Rezai, A. 2020. "Stranded assets in the transition to a carbon-free economy". Annual Review of Resource Economics 12: 281–298. <https://www.annualreviews.org/doi/10.1146/annurev-resource-110519-040938>
- 74 Basel Committee on Banking Supervision. 2021. Climate-Related Risk Drivers and Their transmission Channels. Bank for International Settlements. April 2021. <https://www.bis.org/bcbcs/publ/d517.pdf>
- 75 Dunz, N., Naqvi, A. and Monasterolo, I. 2021. "Climate sentiments, transition risk, and financial stability in a stock-flow consistent model". Journal of Financial Stability 54. June 2021. <https://www.sciencedirect.com/science/article/abs/pii/S1572308921000322?via%3Dihub>
- 76 Timperley, J. 2021. "The truth behind corporate climate pledges". The Guardian. 26 July 2021. <https://www.theguardian.com/environment/2021/jul/26/climate-crisis-green-light>
- 77 Court of The Hague. 2021. Op cit.
- 78 Bailey, R., Yeo, J., Jiang, L. and Ferguson, A. 2020. ESG as a Workforce Strategy: Engaging Today's Employees and Attracting Tomorrow's Talent. Marsh McLennan. <https://www.marshmclennan.com/insights/publications/2020/may/esg-as-a-workforce-strategy.html>
- 79 Dominish, E., Florin, N. and Teske, S. 2019. Responsible Minerals Sourcing for Renewable Energy. Report prepared for Earthworks by the Institute for Sustainable Futures, University of Technology Sydney. [https://earthworks.org/assets/uploads/2019/04/MCEC\\_UTS\\_Report\\_lowres-1.pdf](https://earthworks.org/assets/uploads/2019/04/MCEC_UTS_Report_lowres-1.pdf)

# Digital Dependencies and Cyber Vulnerabilities

435%

increase in ransomware in 2020

3 million

gap in cyber professionals needed worldwide

US\$

800 billion

estimated growth in value of digital commerce by 2024

95%

cybersecurity issues traced to human error

## Digital distress

Governments, societies and companies increasingly rely on technology to manage everything from public services to business processes, even routine grocery shopping.<sup>1</sup> Converging technological platforms, tools and interfaces connected via an internet that is rapidly shifting to a more decentralized version 3.0 are at once creating a more complex cyberthreat landscape and a growing number of critical failure points. As society continues to migrate into the digital world, the threat of cybercrime looms large, routinely costing organizations tens—even hundreds—of millions of dollars. The costs are not just financial: critical infrastructure, societal cohesion and mental well-being are also in jeopardy.

### Digital everything

Growing dependency on digital systems over the last 20 years has drastically shifted how many societies function.<sup>2</sup> The COVID-19-induced shift to remote work has accelerated the adoption of platforms and devices that allow sensitive data to be shared with third parties—cloud service providers, data aggregators, application programming interfaces (APIs) and other technology-related intermediaries.<sup>3</sup> These systems, while powerful tools for data and processing, attach an additional layer of dependency on service providers. Remote work has also moved digital exchanges from

office networks to residential ones, which have a greater variety of connected devices with less protection against cyber intrusion. In parallel, the appetite for capabilities predicated upon using multiple technologies working in concert—including artificial intelligence (AI), Internet of Things (IoT)/Internet of Robotic Things-enabled devices, edge computing, blockchain and 5G—is only growing.<sup>4</sup> While these capabilities afford tremendous opportunities for businesses and societies to use technology in ways that can dramatically improve efficiency, quality and productivity, these same capabilities also expose users to elevated and more pernicious forms of digital and cyber risk.

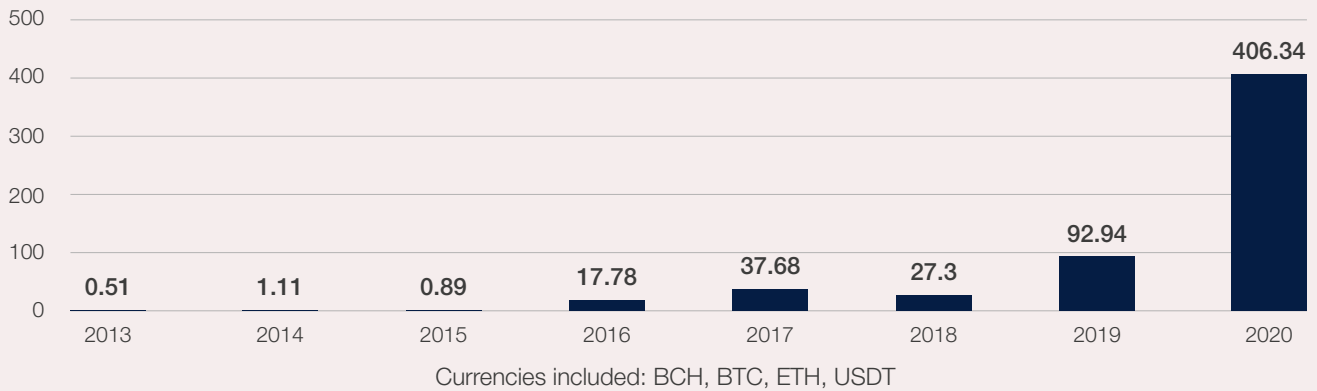
In the future, the interconnectedness and convergence of these digital tools will continue to increase as society embraces the next version of the internet built upon blockchain technology. One manifestation of this migration will be the metaverse: a network of 3D virtual spaces, enabled by cryptocurrencies and non-fungible tokens (NFTs) among other technologies, with unprecedented socio-economic interoperability and immersive virtual reality experiences.<sup>5</sup> Users will be required to navigate security vulnerabilities inherent in both increased dependency on and growing fragmentation in these types of complex technologies often characterized by decentralization and lack of structured guardrails or sophisticated onboarding infrastructure.



FIGURE 3.1

## Total Cryptocurrency Value Received by Ransomware Addresses, 2013-2020

Cryptocurrency value in millions of US\$



**Source:** Based on Chainalysis. Ransomware 2021: Critical Mid-Year Update. Insights blog. <https://blog.chainalysis.com/reports/ransomware-update-may-2021>

### Cyber vulnerabilities

In the context of widespread dependency on increasingly complex digital systems, growing cyberthreats are outpacing societies' ability to effectively prevent and manage them. For example, the digitalization of physical supply chains creates new vulnerabilities because those supply chains rely on technology providers and other third parties, which are also exposed to similar, potentially contagious, threats.<sup>6</sup> In December 2021, just one week after discovering a critical security flaw in a widely used software library (Log4j), more than 100 attempts at exploiting the vulnerability were detected every minute, illustrating how free access coding can spread vulnerabilities widely.<sup>7</sup> Information technology (IT) monitoring and management software also illustrate the potential for contagious exposure, which can break through the defences of critical cybersecurity supply chains, as shown by the Solar Winds Orion attack that occurred in late 2020.<sup>8</sup> While a state-based institution with highly sophisticated capabilities probably lodged this attack, other criminal organizations will certainly attempt to replicate this approach.<sup>9</sup> At the same time, older vulnerabilities persist with many organizations still relying on outdated systems or technologies.

Malicious activity is proliferating, in part because of the growing vulnerabilities—but also because there are few barriers to entry for participants in the ransomware industry and little risk of extradition, prosecution or sanction.<sup>10</sup> Malware increased by 358% in 2020, while ransomware increased by 435%,<sup>11</sup> with a four-fold rise in the total cryptocurrency value received by ransomware addresses (see Figure 3.1).<sup>12</sup> “Ransomware as a service” allows even non-technical criminals to execute attacks, a trend that might intensify with the advent of artificial intelligence (AI)-powered malware.<sup>13</sup> In fact, profit-seeking groups of cyber mercenaries stand ready to provide access to sophisticated cyber-intrusion tools to facilitate such attacks. Furthermore, cryptocurrencies have also allowed cybercriminals to collect payments with an only modest risk of detection or monetary clawback.<sup>14</sup>

Attacks themselves are also becoming more aggressive and widespread.<sup>15</sup> Cyberthreat actors using ransomware are leveraging tougher pressure tactics as well as going after more vulnerable targets, impacting public utilities, healthcare systems and data-rich companies.<sup>16</sup> For example, before it disbanded, DarkSide—the group accused of being responsible for the Colonial Pipeline attack—offered a suite of services (“triple” or “quadruple” extortion)



REUTERS/JIM YOUNG

to clients beyond simply encrypting files; these included data leaks and distributed denial-of-service (DDoS) attacks. Hacker groups will also contact victims' clients or partners to get them to urge the victims to pay ransoms. Among the services offered is the collection of top executive information for blackmail.<sup>17</sup>

Sophisticated cyber tools are also allowing cyberthreat actors to attack targets of choice more efficiently, rather than settling for targets of opportunity, highlighting the potential to carry out more goal-oriented attacks that could lead to even higher financial, societal and reputational damage in the future. Increasingly sophisticated use of spyware technologies, for example, has allowed for targeted attacks against journalists and civil rights activists across geographies—spurring a wave of political and industrial blowback in the form of government sanctions and lawsuits.<sup>18</sup> The ability to tailor attacks at will includes timing them for when cybersecurity teams and leadership could be distracted by other priorities, such as during peak COVID-19 outbreaks or a natural disaster. Cyberthreat actors are also accessing higher-quality and more sensitive information from victims. And deepfake technology is allowing cyberthreat actors to improve social engineering ploys, proliferate disinformation and wreak societal havoc, especially at times of high volatility.<sup>19</sup>

Global Risks Perception Survey (GRPS) respondents reflect these trends, ranking “cybersecurity failure” among the top-10 risks that have worsened most since the start of the COVID-19 crisis. Moreover, 85% of the Cybersecurity Leadership Community of the World Economic Forum have stressed that ransomware is becoming a dangerously growing threat and presents a major concern for public safety.<sup>20</sup> At a regional level, “cybersecurity failure” ranks as a top-five risk in East Asia and the Pacific as well as in Europe, while four countries—Australia, Great Britain, Ireland and New Zealand—ranked it as the number one risk. Many small, highly digitalized economies—such as Denmark, Israel, Japan, Taiwan (China), Singapore and the United Arab Emirates—also ranked the risk as a top-five concern.

Already-stretched IT and cybersecurity professionals are under an increasing burden, not only because of the expansion of remote work but also because of the growing complexity of regulations for data and privacy, even though such regulations are critical to ensuring public trust in digital systems.<sup>21</sup> There is an undersupply of

**“Cybersecurity failure” is one of the risks that worsened the most through COVID-19**



cyber professionals—a gap of more than 3 million worldwide<sup>22</sup>—who can provide cyber leadership, test and secure systems, and train people in digital hygiene.<sup>23</sup> As with other key commodities, a continued lack of cybersecurity professionals could ultimately hamper economic growth,<sup>24</sup> although new initiatives to “democratize” cybersecurity, for example, by providing free cybersecurity risk management tools, could help fill some of the gaps for small businesses or other institutions.<sup>25</sup>

There are concerns that quantum computing could be powerful enough to break encryption keys—which poses a significant security risk because of the sensitivity and criticality of the financial, personal and other data protected by these keys. The emergence of the metaverse could also expand the attack surface for malicious actors by creating more entry points for malware and data breaches.<sup>26</sup> As the value of digital commerce in the metaverse grows in scope and scale—by some estimates projected to be over US\$800 billion by 2024—these types of attacks will grow in frequency and aggression.<sup>27</sup> The myriad forms of digital property such as NFT art collections and

digital real estate could further entice criminal activity.

For governments attempting to prevent cybersecurity failures, patchwork enforcement mechanisms across jurisdictions continue to hamper efforts to control cybercrime.<sup>28</sup> Geopolitical rifts hinder potential cross-border collaboration, with some governments unwilling or unable to regulate cyber intrusions that originate inside and impact outside their borders. Unsurprisingly, given the geopolitical tensions around digital sovereignty, according to GRPS respondents, “cross-border cyberattacks and misinformation” and “artificial intelligence” were among the areas with the least “established” or “effective” international risk mitigation efforts.

Companies must also act ahead of new regulatory shifts, as the political undercurrents/geopolitical tensions between various countries might impact cross-border data flows. This might mean moving data processing to jurisdictions that might allow for better customer protection around data privacy issues.<sup>29</sup>

## Consequences

Often-repeated examples of past cyber intrusions are worth re-examination, as these cases demonstrate how damaging attacks on large and strategically significant systems—such as banking, hospital, Global Positioning System (GPS) or air traffic control systems—could be.<sup>30</sup> As resources are increasingly digitized, notable as well is the heightened risk of cyber espionage attacks that typically target intellectual property and result in high developmental and reputational costs to both private and public sector organizations.<sup>31</sup>

The interaction between digitalization and growing cyberthreats carries intangible consequences as well. The growth of deepfakes and “disinformation-for-hire” is likely to deepen mistrust between societies, business and government.<sup>32</sup> For example,

deepfakes could be used to sway elections or political outcomes.<sup>33</sup> More concretely, in one recent case, cybercriminals cloned the voice of a company director to authorize the transfer of US\$35 million to fraudulent accounts.<sup>34</sup> There is also a booming market for services designed to manipulate public opinion in favour of clients, public or private, or to damage rivals.<sup>35</sup> Fraud, too, will become easier and therefore more frequent with banking, health and civic processes going remote.

**Patchwork enforcement mechanisms continue to hamper efforts to control cybercrime**

In 2021, UK internet banking fraud rose by 117% in volume and 43% in value compared with 2020 levels, as people spent more time shopping online.<sup>36</sup> Digital safety overall—from health misinformation and extremism to child exploitation—faces new challenges with unexperienced and more vulnerable populations coming online.<sup>37</sup>

Even in the best-case scenario of aggressive digital threat defences, there will be significant increases in the cost of operations for all stakeholders. This could be particularly challenging for small- or medium-sized businesses that might spend 4% or more of their operational budget on security, compared to larger organizations that might spend closer to 1–2%.<sup>38</sup> Indeed, amid the rising frequency and severity of ransomware claims, cyber insurance pricing in the United States rose by 96% in the third quarter of 2021, marking the most significant increase since 2015 and a 204% year-over-year increase.<sup>39</sup> Respondents to the GRPS indicate a long-term concern with these developments, with “adverse tech advances” appearing as a top-10 risk over a 5-to-10-year horizon.

Cyberthreats also continue to drive states apart, with governments following increasingly unilateral paths to control

risks. As attacks become more severe and broadly impactful, already-sharp tensions between governments impacted by cybercrime and governments complicit in their commission will rise as cybersecurity becomes another wedge for divergence, rather than cooperation, among nation states.<sup>40</sup> Particularly in an era of rising tensions between superpowers, cyberattacks are another battlefield in which escalation is a key risk (see Chapter 1).<sup>41</sup> If cyberthreats continue without mitigation, governments will continue to retaliate against perpetrators (actual or perceived), leading to open cyberwarfare, further disruption for societies and loss of trust in governments’ ability to act as digital stewards.

### **Digital security divides: Consequences for people**

Among the most vulnerable are those who are only now coming online or will soon do so. Around 40% of the world’s population is not yet connected to the internet.<sup>42</sup> These individuals are already facing inequalities in digital security, which will only widen with the advent of internet 3.0 and the metaverse.<sup>43</sup> Within digitally advanced societies, vulnerable populations are also often more digitally at risk: for example, a recent study finds that low-income residents of San Francisco—

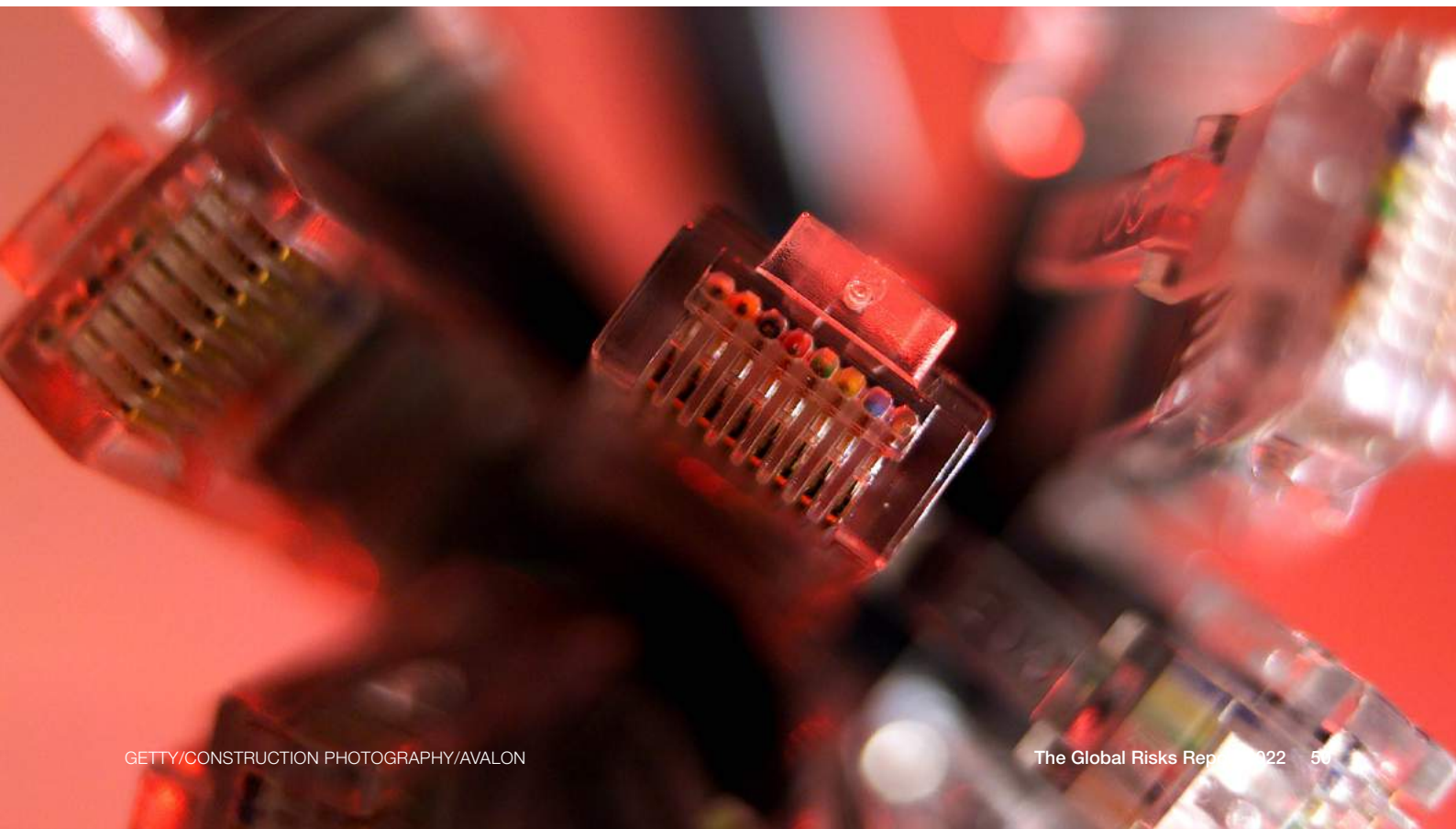
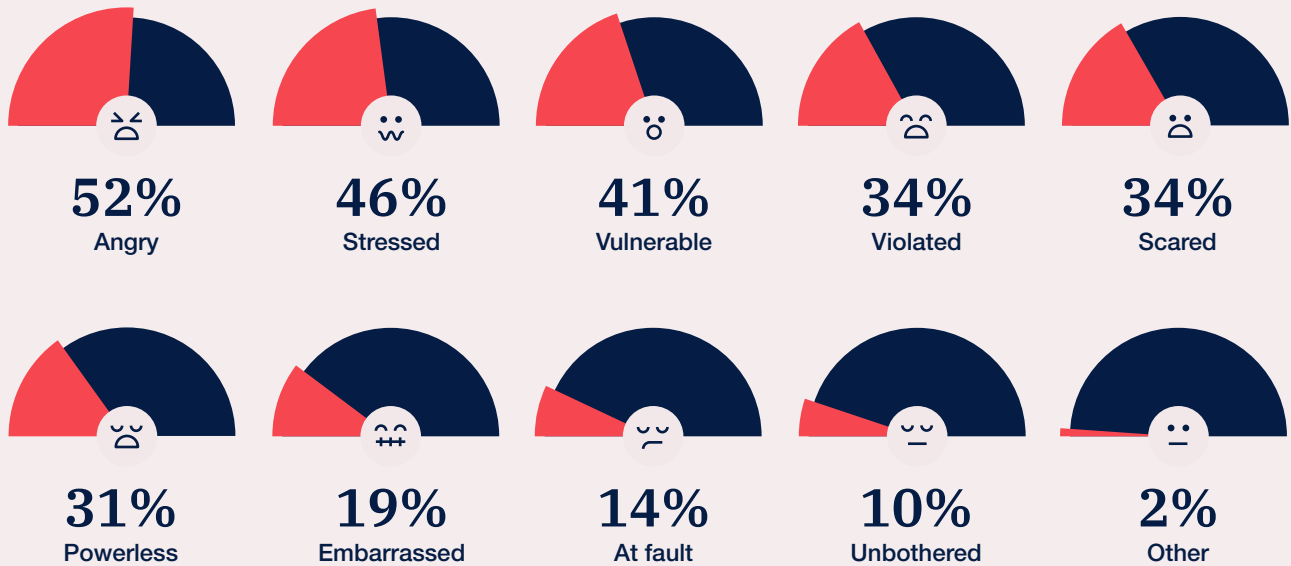


FIGURE 3.2

## Emotions Experienced after Detecting Unauthorized Access

Global total of those who detected unauthorized access in past 12 months



Source: NortonLifeLock Inc. 2021. "2021 Norton Cyber Safety Insights Report: Global Results". Norton and The Harris Poll. May 2021. [https://now.symasets.com/content/dam/norton/campaign/NortonReport/2021/2021\\_NortonLifeLock\\_Cyber\\_Safety\\_Insights\\_Report\\_Global\\_Results.pdf](https://now.symasets.com/content/dam/norton/campaign/NortonReport/2021/2021_NortonLifeLock_Cyber_Safety_Insights_Report_Global_Results.pdf)

the cultural heart of Silicon Valley—are more likely than wealthier residents to be cybercrime victims.<sup>44</sup> In other situations, obligatory digital identity markers could introduce new risks for citizens, particularly evident in the growing risk that deepfakes could compromise biometric authentication.<sup>45</sup>

Individuals will increasingly experience anxiety as control over their data becomes more precarious and they are subjected to personal attacks, fraud, cyberbullying and stalking (see Figure 3.2).<sup>46</sup> A perceived lack of agency could also lead to apathy in taking responsibility for securing one's own digital footprint, as evinced by the continued market dominance of instant messenger applications plagued by privacy controversies.<sup>47</sup> Even with more widespread "reject all" options on websites intended to simplify personal data privacy, there are drawbacks and caveats—such as limiting functionality and other options. Importantly, these features are just a tiny part of the larger privacy

equation. Websites are still littered with tracking pixels and third-party scripts that remain powerful ways to fingerprint online behaviours.<sup>48</sup>

### Overreaching or underdelivering: Consequences for governments

Government at all levels faces mounting responsibilities and many are struggling to uphold their end of the digital social contract: securing critical infrastructure; addressing threats to "epistemic security" from disinformation; protecting the integrity of civic processes and public services; legislating against cybercrime; training and educating populaces around cyber literacy; regulating digital service providers; and ensuring the availability of resources, such as rare-earth minerals, for the digital economy. The necessary oversight could lead to overreach as governments move to shut down systems, erect higher digital barriers or embark on digital colonization (by monopolizing digital systems) for geopolitical ends.<sup>49</sup> While such actions might carry the ostensible goal of reducing

attacks and disruption, these policies could quickly become a vehicle for oppression. Already suffering from a loss in public trust as a result of the COVID-19 crisis, governments may face further societal anger if they are unable to both keep up with the shifting threat landscape and responsibly manage these challenges.

**Pay, protect or perish: Consequences for businesses**

As cyberthreats continue to grow, insuring against such risks will become increasingly precarious, with insurers themselves facing retaliatory attacks for attempting to curb ransomware payments.<sup>50</sup> Thus, when an attack occurs, businesses will either be forced to pay increasingly high ransoms or suffer the reputational, financial, regulatory and legal consequences of cyberattacks. As previous incursions (like SolarWinds) have demonstrated, exposure to vendors and supply chain partners must also be assessed and managed. The impact of disruptive cyberattacks could be financially devastating for businesses that fail to invest in protections for their digital infrastructure, particularly in a scenario

in which governments begin prohibiting ransom payments or penalizing poor cybersecurity practices.<sup>51</sup> Furthermore, as environmental, social and governance (ESG) concerns come increasingly into focus (see Chapter 2), businesses that fail to demonstrate strong corporate governance around cybersecurity—such as by implementing robust systems and process oversight protocols, and by practicing accountability and transparency in the event of a breach—could suffer reputational harm in the eyes of ESG-focused investors.

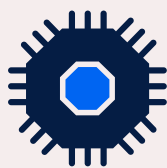
Businesses also operate in a world in which 95% of cybersecurity issues can be traced to human error,<sup>52</sup> and where insider threats (intentional or accidental) represent 43% of all breaches.<sup>53</sup> Some companies will inevitably move to greater segmentation of digital systems to better account for insider risk. Companies could begin or continue to lock up key data as a result of the cybersecurity issues. Workforce efficiency, too, could suffer if accessing data and information is less seamless.

**Shocks to reflect upon**



**NotPetya 2.0**

What if an attack that is even more wide-ranging and costly than NotPetya—with the ability to self-propagate and even mutate to avoid preventative controls—created cascading lockups of systemically important businesses, bankrupting organizations, disrupting services and unwinding the digital transformation efforts made over the past years?



**Sovereignty slips**

What if the shifts towards privately held IT infrastructure as well as cryptocurrency and decentralized finance undermine governments’ control over data, processes and financial systems?



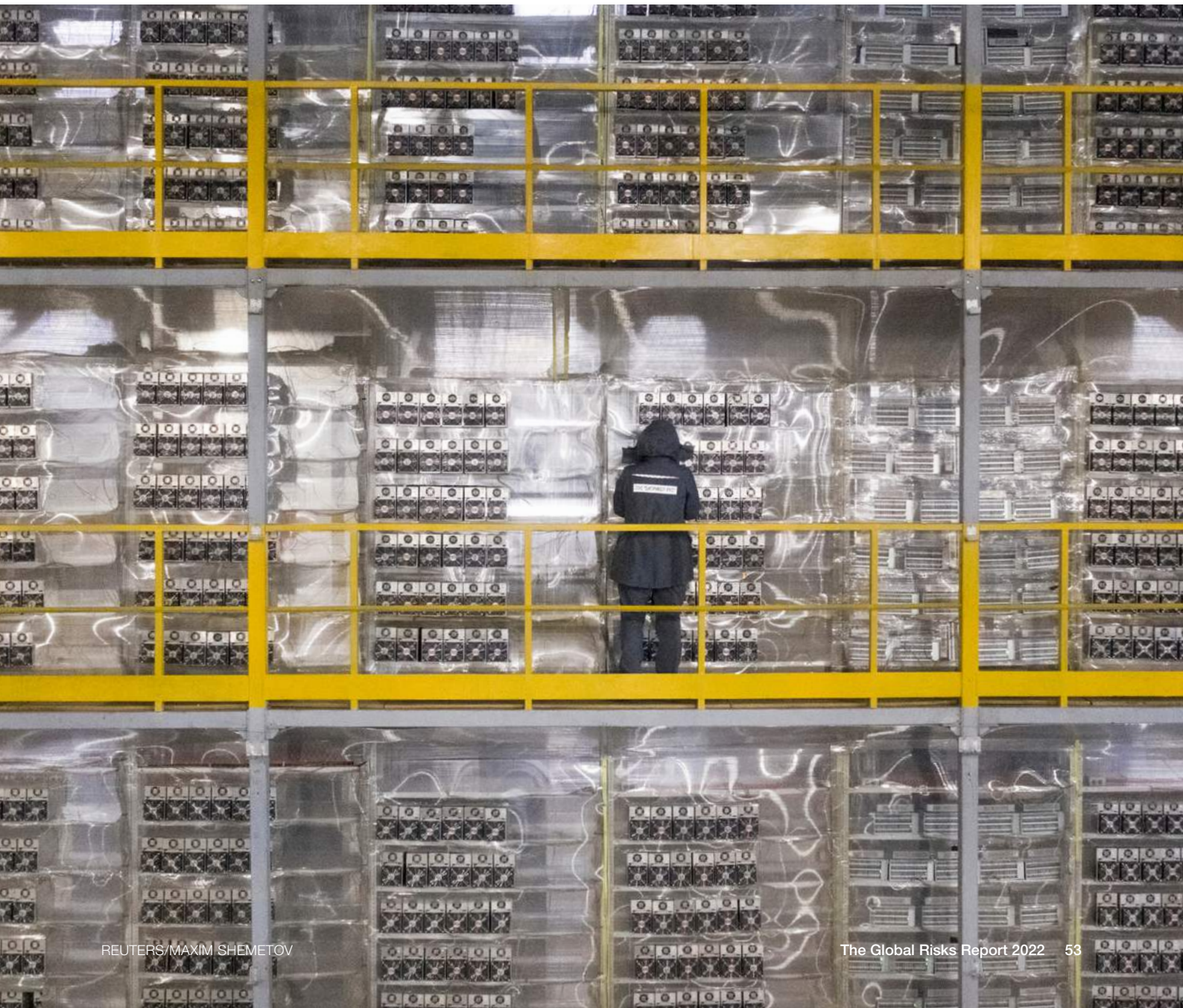
**Undetected disruption**

What if subtle changes in health, banking or other data go undetected for years, but carry significant consequences for premature death, loss of funds or other significant consequences over time? How can cyber espionage compromise return on R&D investment and competitiveness in the future?

## Towards greater cyber resilience

As our reliance on digital technologies grows and Internet 3.0 becomes reality, efforts aimed at building norms and defining rules of behaviour for all stakeholders in cyberspace are intensifying. While multistakeholder international dialogues can help strengthen links between actors operating in the digital security realm, cooperation between organizations could unlock best practices that can be replicated across industries and economies. Initiatives should focus on emerging technologies, such as blockchain, quantum and artificial intelligence, as well as the modes of digital exchange they facilitate, like the metaverse. Leaders must remain attentive to perennial concerns like cybercrime and ransomware

attacks as well. At the organizational level, upskilling leaders on cybersecurity issues and elevating emerging cyber risks to board-level conversations will strengthen cyber-resilience. In a deeply connected society, digital trust is the currency that facilitates future innovation and prosperity. Trustworthy technologies, in turn, represent the foundation on which the scaffolding of a fair and cohesive society is built. Unless we act to improve digital trust with intentional and persistent trust-building initiatives, the digital world will continue to drift towards fragmentation and the promise of one of the most dynamic eras of human progress may be lost.



# Endnotes

- 1 World Economic Forum, in partnership with Marsh & McLennan Companies, SK Group and Zurich Insurance Group. 2021. The Global Risks Report 2021. Insight Report. Chapter 2 Error 404. Geneva: World Economic Forum. January 2021. <https://www.weforum.org/reports/the-global-risks-report-2021>
- 2 World Economic Forum, in partnership with Marsh & McLennan Companies and Zurich Insurance Group. 2020. The Global Risks Report 2020. Insight Report. Chapter 5 Wild Wide Web. Geneva: World Economic Forum. January 2020. <https://www.weforum.org/reports/the-global-risks-report-2020>
- 3 Check Point Software Technologies Ltd. 2021. The Biggest Cloud Security Challenges of 2021. [https://pages.checkpoint.com/2020-cloud-security-report.html?utm\\_term=cyber-hub](https://pages.checkpoint.com/2020-cloud-security-report.html?utm_term=cyber-hub); Kent, J. 2020. "APIs are the next frontier in cybercrime". Security. 3 September 2020. <https://www.securitymagazine.com/articles/93239-apis-are-the-next-frontier-in-cybercrime>
- 4 Hoster, B. and Sequeira, T. 2021. Harnessing Technology Convergence: Lessons from Smart Manufacturers. Marsh McLennan. <https://www.marshmclennan.com/insights/publications/2021/may/harnessing-technology-convergence.html>
- 5 Allyn, B. 2021. "People are talking about Web3. Is it the Internet of the future or just a buzzword?" National Public Radio. 21 November 2021. <https://www.npr.org/2021/11/21/1056988346/web3-internet-jargon-or-future-vision>; Clark, P.A. 2021. "The metaverse has already arrived. Here's what that actually means". Time. 15 November 2021. <https://time.com/6116826/what-is-the-metaverse/>; Robertson, A. and Peters, J. 2021. "What is the metaverse, and do I have to care?" The Verge. 4 October 2021. <https://www.theverge.com/22701104/metaverse-explained-fortnite-roblox-facebook-horizon>
- 6 World Economic Forum, in partnership with Marsh & McLennan Companies, SK Group and Zurich Insurance Group. 2021. The Global Risks Report 2021. Insight Report. Chapter 5 Imperfect Markets. Geneva: World Economic Forum. January 2021. <https://www.weforum.org/reports/the-global-risks-report-2021>
- 7 Korn, J. 2021. "The Log4j security flaw could impact the entire internet. Here's what you should know". CNN. 15 December 2021. <https://edition.cnn.com/2021/12/15/tech/log4j-vulnerability/index.html>
- 8 Reuters Staff. 2021. "SolarWinds hack was 'largest and most sophisticated attack' ever: Microsoft president". Reuters. 15 February 2021. <https://www.reuters.com/article/us-cyber-solarwinds-microsoft-idUSKBN2AF03R>
- 9 Burke, S. 2021. "Cyber-crime learnings and predictions for 2021". Counter Terror Business. 15 January 2021. <https://counterterrorbusiness.com/features/cyber-crime-learnings-and-predictions-2021>
- 10 Coveware. 2021. "Ransomware attackers down shift to 'Mid-Game' hunting in Q3 2021". 21 October 2021. <https://www.coveware.com/blog/2021/10/20/ransomware-attacks-continue-as-pressure-mounts>
- 11 Help Net Security. 2021. "Malware increased by 358% in 2020". Help Net Security. 17 February 2021. <https://www.helpnetsecurity.com/2021/02/17/malware-2020/>
- 12 Chainalysis Team. 2021. "Ransomware 2021: Critical mid-year update". Insights. 14 May 2021. <https://blog.chainalysis.com/reports/ransomware-update-may-2021>
- 13 Sharton, B.R. 2021. "Ransomware attacks are spiking. Is your company prepared?" Harvard Business Review. 20 May 2021. <https://hbr.org/2021/05/ransomware-attacks-are-spiking-is-your-company-prepared>; Steib, M. 2021. "What's driving the surge in ransomware attacks?" New York Magazine Intelligencer. 7 September 2021. <https://nymag.com/intelligencer/article/ransomware-attacks-2021.html>; Pupillo, L. et al. 2021. "Artificial Intelligence and Cyber Security." CEPS Task Force. May 2021. <https://www.ceps.eu/wp-content/uploads/2021/05/CEPS-TFR-Artificial-Intelligence-and-Cybersecurity.pdf>
- 14 Rosenzweig, P. 2021. "There's a better way to stop ransomware attacks". New York Times (Guest Essay). 31 August 2021. <https://www.nytimes.com/2021/08/31/opinion/ransomware-bitcoin-cybersecurity.html>
- 15 Davis, E. and Mee, P. 2021. Growing Cyber Threat Demands a United Response. Marsh McLennan. <https://www.marshmclennan.com/insights/publications/2021/october/growing-cyber-threat-demands-a-united-response.html>
- 16 Accenture. 2021. Threats Unmasked: 2021 Cyber Threat Intelligence Report. 2021. [https://www.accenture.com/\\_acnmedia/PDF-158/Accenture-2021-Cyber-Threat-Intelligence-Report.pdf](https://www.accenture.com/_acnmedia/PDF-158/Accenture-2021-Cyber-Threat-Intelligence-Report.pdf); BBC. 2021. "Hacker tries to poison water supply of Florida city". BBC. 8 February 2021. <https://www.bbc.com/news/world-us-canada-55989843>; European Insurance and Occupational Pensions Authority. 2021. "Cyber risks: what is the impact on the insurance industry?" 15 October 2021. [https://www.eiopa.europa.eu/media/feature-article/cyber-risks-what-impact-insurance-industry\\_en](https://www.eiopa.europa.eu/media/feature-article/cyber-risks-what-impact-insurance-industry_en); Poulsen, K., McMillan, R. and Evans, M. 2021. "A hospital hit by hackers, a baby in distress: The case of the first alleged ransomware death". Wall Street Journal. 30 September 2021. <https://www.wsj.com/articles/ransomware-hackers-hospital-first-alleged-death-11633008116>; Sganga, N., Herridge, C. and Bidar, M. 2021. "Foreign hacking group targets hospitals, clinics with ransomware attacks, says new report". CBS News. 7 October 2021. <https://www.cbsnews.com/news/cyberattacks-ransomware-hacking-hospitals-target-foreign-groups/>
- 17 Accenture. 2021. Op. cit.
- 18 2021. "Apple sues Israeli firm NSO Group over spyware". Al Jazeera. 23 November 2021. <https://www.aljazeera.com/news/2021/11/23/apple-sues-israeli-firm-nso-group-over-spyware>
- 19 Collins, A. and Ebrahimi, T. 2021. "Risk governance and the rise of deepfakes". EPFL International Risk Governance Center. 12 May 2021. <https://www.epfl.ch/research/domains/irgc/spotlight-on-risk-series/risk-governance-and-the-rise-of-deepfakes/>
- 20 Cyber Outlook Series virtual workshop on survey results held on 31 March 2021 from Geneva by the Centre for Cybersecurity.
- 21 Herbert Smith Freehills. 2021. "China's new laws complicate data transfers". 24 August 2021. <https://hsfnotes.com/data/2021/08/24/chinas-new-laws-inhibit-data-transfers/>
- 22 Chandrasekhar, C. and Mee, P. 2021. "Why businesses and governments must fight cyber threats together". World Economic Forum Global Agenda. 3 May 2021. <https://www.weforum.org/agenda/2021/05/cybersecurity-governments-business/>
- 23 Insight. 2021. Cybersecurity at a Crossroads: The Insight 2021 Report. 4 March 2021. [https://www.insight.com/content/dam/insight-web/en\\_US/pdfs/insight/cybersecurity-at-a-crossroads/cybersecurity-at-a-crossroads--the-insight-2021-report.pdf](https://www.insight.com/content/dam/insight-web/en_US/pdfs/insight/cybersecurity-at-a-crossroads/cybersecurity-at-a-crossroads--the-insight-2021-report.pdf)

- 24 Cf. Tay, S. 2019. "A serious shortage of cybersecurity experts could cost companies hundreds of millions of dollars". CNBC. 5 March 2019. <https://www.cnbc.com/2019/03/06/cybersecurity-expert-shortage-may-cost-companies-hundreds-of-millions.html>
- 25 Bloomberg. 2019. "Coalition Secures \$40M in Funding to Democratize Access to Cybersecurity". Press Release. 9 May 2019. <https://www.bloomberg.com/press-releases/2019-05-09/coalition-secures-40m-in-funding-to-democratize-access-to-cybersecurity>
- 26 Boyd, C. 2021. "Zuckerberg's Metaverse, and the possible privacy and security concerns". Malwarebytes Labs. 2 November 2021. <https://blog.malwarebytes.com/privacy-2/2021/11/zuckerbergs-metaverse-and-the-possible-privacy-and-security-concerns/>; Department of Homeland Security. 2021. Post-Quantum Cryptography. <https://www.dhs.gov/quantum>; Kalmann, A. 2018. "Blog: Cyber Security & the Metaverse". IBC365. 22 June 2018. <https://www.ibt.org/blog-cyber-security-and-the-metaverse/2904.article>
- 27 Kanterman M. and Naidu N. 2021 "Metaverse may be \$800 billion market, next tech platform". Bloomberg Intelligence. 1 December 2021. <https://www.bloomberg.com/professional/blog/metaverse-may-be-800-billion-market-next-tech-platform/>
- 28 Steib. 2021. Op. cit.
- 29 Murgia M. 2021. "Palantir to reshore all UK data processing from US before regulatory 'tsunami' hits". 17 December 2021. <https://www.ft.com/content/76fa6a3f-a818-4e88-be14-b578ae378d7c>
- 30 Pocock, J. and O'Brien, S. 2021. Cyber Risk: The Emerging Cyber Threat to Industrial Control Systems. Lloyd's, CyberCube, and Guy Carpenter. 2021. [https://www.marshmcclennan.com/content/dam/mmc-web/insights/publications/2021/august/The%20Emerging%20Cyber%20Threat%20to%20Industrial%20Control%20Systems\\_Final%2016.02.2021.pdf](https://www.marshmcclennan.com/content/dam/mmc-web/insights/publications/2021/august/The%20Emerging%20Cyber%20Threat%20to%20Industrial%20Control%20Systems_Final%2016.02.2021.pdf)
- 31 Verizon. 2020. 2020-2021. Cyber-Espionage Report. <https://www.verizon.com/business/resources/reports/2020-2021-cyber-espionage-report.pdf>
- 32 Buckley, J. and Conner, S. 2021. "Cyber Threats: Living with Disruption". Control Risks and AirMic. 12 October 2021. <https://www.controlrisks.com/our-thinking/insights/reports/cyber-threats-living-with-disruption>
- 33 See, e.g., CBS News. 2019. "Doctored Nancy Pelosi video highlights threat of 'deepfake' tech". 26 May 2019. <https://www.cbsnews.com/news/doctored-nancy-pelosi-video-highlights-threat-of-deepfake-tech-2019-05-25/>
- 34 Brewster, T. 2021. "Fraudsters cloned company director's voice in \$35 million bank heist, police find". Forbes. 14 October 2021. <https://www.forbes.com/sites/thomasbrewster/2021/10/14/huge-bank-fraud-uses-deep-fake-voice-tech-to-steal-millions/?sh=af66cf275591>
- 35 Fisher, M. 2021. "Disinformation for hire, a shadow industry, is quietly booming". The New York Times. 25 July 2021. <https://www.nytimes.com/2021/07/25/world/europe/disinformation-social-media.html>; Joyce, S., Kashifuddin, M., Nocera, J. and Upton, P. 2021. "The disinformation age has arrived. Are you ready?" PwC. 9 February 2021. <https://www.pwc.com/us/en/tech-effect/cybersecurity/corporate-sector-disinformation.html>
- 36 UK Finance. 2021. Fraud — The Facts 2021. <https://www.ukfinance.org.uk/system/files/Fraud%20The%20Facts%202021-%20FINAL.pdf>
- 37 Moon Sehat, C. 2021. "Advancing digital safety: A framework to align global action". World Economic Forum. June 2021. [https://www3.weforum.org/docs/WEF\\_Advancing\\_Digital\\_Safety\\_A\\_Framework\\_to\\_Align\\_Global\\_Action\\_2021.pdf](https://www3.weforum.org/docs/WEF_Advancing_Digital_Safety_A_Framework_to_Align_Global_Action_2021.pdf); Lalani, F. 2021. "Risks to kids online are growing. Here's what we can do". World Economic Forum. 13 October 2021. <https://www.weforum.org/agenda/2021/10/overcoming-the-growing-risks-to-kids-online/>
- 38 Braue, D. 2021. "Global cybersecurity spending to exceed \$1.75 trillion from 2021-2025". Cybercrime Magazine. 10 September 2021. <https://cybersecurityventures.com/cybersecurity-spending-2021-2025/>; Meeuwisse, R. 2019. "Is effective cybersecurity expensive?" Infosecurity Magazine. 10 April 2019. <https://www.infosecurity-magazine.com/blogs/effective-cybersecurity-expensive>
- 39 Marsh. 2021. Global Insurance Market Index Q3 2021. October 2021. [https://www.marsh.com/fr/en/services/insurance-market-and-placement/insights/global\\_insurance\\_market\\_index.html](https://www.marsh.com/fr/en/services/insurance-market-and-placement/insights/global_insurance_market_index.html)
- 40 Sabbagh, D. 2021. "Experts say China's low-level cyberwar is becoming severe threat". The Guardian. 23 September 2021. <https://www.theguardian.com/world/2021/sep/23/experts-china-low-level-cyber-war-severe-threat>
- 41 BBC. 2021. "Aukus: UK, US and Australia launch pact to counter China". BBC. 16 September 2021. <https://www.bbc.com/news/world-58564837>; Kanno-Youngs, Z. and Sanger, D.E. 2021 "U.S. accuses China of hacking Microsoft". The New York Times. 26 August 2021. <https://www.nytimes.com/2021/07/19/us/politics/microsoft-hacking-china-biden.html?>; McWhorter, D. 2021. "Exposing one of China's cyber espionage units". Mandiant. <https://www.mandiant.com/resources/apt1-exposing-one-of-chinas-cyber-espionage-units>
- 42 Kemp, S. 2021. "Digital 2021 April Global Statshot Report". Datareportal. 26 April 2021. <https://datareportal.com/reports/digital-2021-april-global-statshot>
- 43 Rodriguez, K. and Opsahl, K. 2020. "Augmented reality must have augmented privacy". Electronic Frontier Foundation. 16 October 2020. <https://www.eff.org/deeplinks/2020/10/augmented-reality-must-have-augmented-privacy>
- 44 Sultan, A. 2021. "Improving Cybersecurity Awareness in Underserved Populations". UC Berkeley Center for Long-Term Cybersecurity White Paper Series. 2021. [https://cltc.berkeley.edu/underserved\\_populations/](https://cltc.berkeley.edu/underserved_populations/)
- 45 Kite-Powell, J. 2021. "The rise of voice cloning and deepfakes in the disinformation wars". Forbes. 21 September 2021. <https://www.forbes.com/sites/jenniferhicks/2021/09/21/the-rise-of-voice-cloning-and-deep-fakes-in-the-disinformation-wars/?sh=405859e138e1>; Nicolls, D. 2019. "Will deepfake technology defeat biometric authentication?" Jumio.com. 10 October 2019. <https://www.jumio.com/deepfake-technology-biometric-authentication/>; Pipikaite, A. 2021. "How to improve security of biometric data". World Economic Forum Global Agenda. 2 September 2021. <https://www.weforum.org/agenda/2021/09/untangling-the-benefits-and-risks-of-biometrics/>
- 46 ISACA. 2021. "State of Cybersecurity 2021: Threat Landscape, Security Operations and Cybersecurity Maturity (Part 2)". ISACA. 2021. <https://www.isaca.org/go/state-of-cybersecurity-2021>; Kite-Powell, J. 2020. "Here's how 2020 created a tipping point in trust and digital privacy". Forbes. 27 October 2020. <https://www.forbes.com/sites/jenniferhicks/2020/10/27/heres-how-2020-created-a-tipping-point-in-trust-and-digital-privacy/?sh=7fe5bc4a4fc5>; Lucas, O. 2021. "Corporate data responsibility: Bridging the consumer trust gap". PwC. August 2021. [https://advisory.kpmg.us/articles/2021/bridging-the-trust-chasm.html?utm\\_source=vanity&utm\\_medium=referral&mid=m-00005652&utm\\_campaign=c-00107353&cid=c-00107353](https://advisory.kpmg.us/articles/2021/bridging-the-trust-chasm.html?utm_source=vanity&utm_medium=referral&mid=m-00005652&utm_campaign=c-00107353&cid=c-00107353); Muggah, R. 2021. "Digital privacy comes at a price. Here's how to protect it". World Economic Forum Global Agenda. 8 September 2021. <https://www.weforum.org/agenda/2021/09/how-to-protect>

- [digital-privacy/](#); NortonLifeLock, Inc. 2021. "Norton Cyber Safety Insights Report: Global Results". Norton and The Harris Poll. May 2021. [https://now.symassets.com/content/dam/norton/campaign/NortonReport/2021/2021\\_NortonLifeLock\\_Cyber\\_Safety\\_Insights\\_Report\\_Global\\_Results.pdf](https://now.symassets.com/content/dam/norton/campaign/NortonReport/2021/2021_NortonLifeLock_Cyber_Safety_Insights_Report_Global_Results.pdf)
- 47 Statista. Most popular global mobile messenger apps as of October 2021, based on number of monthly active users, accessed 14 December 2021. <https://www.statista.com/statistics/258749/most-popular-global-mobile-messenger-apps/>
- 48 Privacy International. 2019. "Most cookie banners are deceptive and annoying. This is not privacy". Privacy International. 21 May 2019. <https://privacyinternational.org/explainer/2975/most-cookie-banners-are-annoying-and-deceptive-not-consent>
- 49 Kwet, M. 2021. "Digital colonialism: The evolution of US empire". TNI's Future Lab series on Technology, Power and Emancipation organized in collaboration with ROAR magazine. 4 March 2021. <https://longreads.tni.org/digital-colonialism-the-evolution-of-us-empire/>; Ryan-Mosley, T. 2021. "Why you should be more concerned about Internet shutdowns". MIT Technology Review. 9 September 2021. <https://www.technologyreview.com/2021/09/09/1035237/internet-shutdowns-censorship-exponential-jigsaw-google/>
- 50 Buckley, J. and Conner, S. 2021. "Cyber threats: Living with disruption". Control Risks and AirMic. 12 October 2021. <https://www.controlrisks.com/our-thinking/insights/reports/cyber-threats-living-with-disruption/>; 2021. "Insurance giant AXA victim of ransomware attack". Security. 19 May 2021. <https://www.securitymagazine.com/articles/95245-insurance-giant-axa-victim-of-ransomware-attack>
- 51 Rappeport, A., Kramer, A.E. and Sanger, D.E. 2021. "The Biden administration is combating ransomware with a crackdown on cryptocurrency payments". The New York Times. 21 September 2021. <https://www.nytimes.com/2021/09/21/us/politics/treasury-department-combating-ransomware-cryptocurrency.html>; U.S. Securities and Exchange Commission. 2021. "SEC Announces Three Actions Charging Deficient Cybersecurity Procedures". Press Release. 30 August 2021. <https://www.sec.gov/news/press-release/2021-169>
- 52 Mee, P. and Brandenburg, R. 2020. "After reading, writing and arithmetic, the 4th 'r' of literacy is cyber-risk". World Economic Forum Global Agenda. 17 December 2020. <https://www.weforum.org/agenda/2020/12/cyber-risk-cyber-security-education>
- 53 Check Point Software Technologies Ltd. 2021. The Biggest Cloud Security Challenges of 2021. <https://www.checkpoint.com/cyber-hub/cloud-security/what-is-cloud-native-security/the-biggest-cloud-security-challenges-in-2021/>



# Barriers to Migration

200 million

projected climate refugees by 2050

~25%

remittances-to-GDP in El Salvador and Honduras

9%

decline in FDI to low-income countries in 2021

4,800

estimated migrants perished or missing in 2021

## Nowhere to go

Large parts of the global population face an increasingly insecure outlook (see Chapter 1). Global Risks Perception Survey (GRPS) respondents perceive “livelihood crises” as one of the most potentially severe risks over the next decade. Millions of people are already seeking to cross borders in search of better economic opportunities.

Over the last decade, the number of international migrants has grown consistently, from 221 million people in 2010 to 281 million in 2020.<sup>1</sup> Economic hardship, climate change, conflict and political instability are forcing millions more people to leave their homes. These trends are reflected in the GRPS, where “involuntary migration” is ranked as a top long-term concern.

Better international collaboration is required to manage these flows to ensure that economic migrants are not exposed to exploitation and that involuntary migrants—refugees—crossing into other countries receive the assistance and shelter that they need. The scale of the challenge has put significant pressure on existing frameworks for migration and refugee protection, such as the 1951 Refugee Convention and 1967

Protocol;<sup>2</sup> this pressure is compounded by fractures within the international community and national interest postures that risk limiting global capacity to address this challenge. Some 60% of GRPS respondents believe “migration and refugees” is an area where international mitigation efforts are falling short (that is, they have either “not started” or are in “early development”).

Economic migration often has considerable benefits for both origin and destination countries. It is “the most effective way to reduce poverty and share prosperity”, according to a World Bank report,<sup>3</sup> and can support economic growth by helping address labour shortages in destination countries. While most cross-border migration takes place between low- and middle-income countries, 83% of non-migrant residents in the 22 richest Organisation for Economic Co-operation and Development (OECD) countries have experienced net economic gains from the influx of migrants.<sup>4</sup> On the other hand, some project-based migration undertakings to enhance cross-border infrastructure have had negative impacts in destination countries, where the



tendency to employ workers from origin countries has reduced opportunities for income and skills transfer for native, destination-country workers.<sup>5</sup>

Refugees can also ultimately make a positive contribution to the economies of destination countries, depending partly on a balanced intake across countries that have the capacity to take them in. Their ability to contribute often depends on whether they receive support to deal with the aftereffects of forced displacement—for example, counselling for post-traumatic stress, which is not normally afforded to economic migrants. Instead, millions of refugees remain crowded in camps on the fringes of society—often in countries in the Global South that do not have the economic capacity to absorb them.

However, national-level barriers to the movement of people are increasing. Disillusionment with globalization has fuelled nativist discourses and national interest policies in many destination countries in recent years, and COVID-19 has accelerated this trend. An IPSOS–World Economic Forum Survey from April 2021 found that positive views towards globalization fell during the pandemic by an average of 10 percentage points across

25 countries.<sup>6</sup> Many governments, reflecting popular attitudes, have expressed concern about pressures on education and healthcare services, housing capacity and local employment; for others, integration concerns have been a priority.

Higher barriers to both orderly and disorderly migration elevate the risk of forgoing potential pathways to restoring livelihoods, closing income and labour gaps and maintaining political stability. Instead, the clash between heightened insecurity in origin countries and migration barriers in destination countries will exacerbate global divergence (see Chapter 1), aggravating tensions within and between countries that could complicate an equitable recovery and lead to ever more desperate measures by those who feel compelled to move.

## Growing insecurity in origin countries

Movement restrictions related to COVID-19 interrupted some migration flows;<sup>7</sup> as these restrictions are lifted, divergent economic recoveries will likely amplify pressures to migrate that have been restrained through the pandemic.<sup>8</sup> Many origin countries—mostly less advanced and less vaccinated



ones (see Chapter 1)—face highly insecure economic outlooks as growth stagnates, public finances continue to be stretched and pandemic-related stimuli—on which vulnerable groups have depended—are scaled back.<sup>9</sup> Employment in these countries may also decline if the pandemic persists, exacerbated by a worldwide trend for workplace automation, re-shoring business operations and shortening supply chains that may affect foreign direct investment (FDI) inflows, exports and growth.<sup>10</sup> In many lower-income countries, where informal work is prevalent, informal migrant workers are particularly exposed to the pandemic's economic fallout because of their low income and lack of access to state support.<sup>11</sup>

Climate change is a key driver of migration. It displaces people directly because of natural disasters and it can displace them indirectly by encouraging economic migration from weakening economies vulnerable to the adverse impacts of climate change. The inability to adapt to

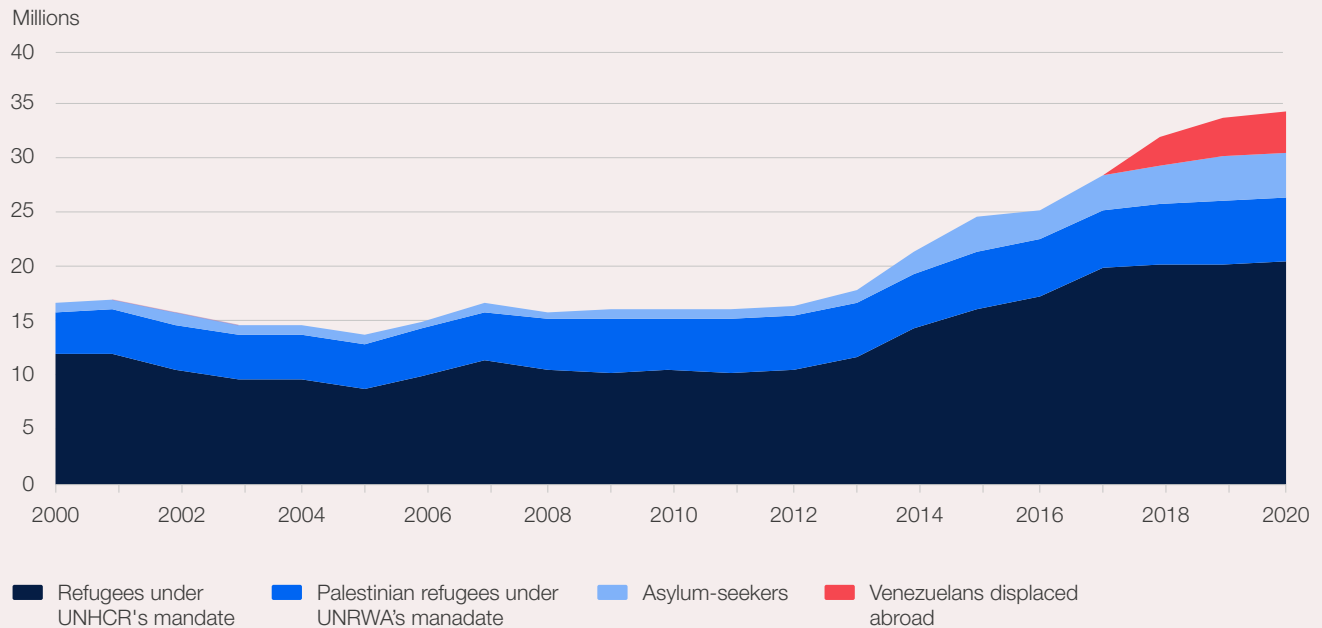
## Climate change, conflict and political instability will force millions to leave their homes

or mitigate the impacts of climate change threaten to make certain densely populated parts of the world uninhabitable.<sup>12</sup> More frequent and extreme weather events—including fires, floods and droughts—could displace more than 200 million people by 2050.<sup>13</sup> Water scarcity is a key driver of migration because of its impact on health and livelihoods as well as the conflicts it risks triggering.<sup>14</sup> GRPS respondents rated “extreme weather” and “climate action failure” as strong aggravators of “involuntary migration”. Densely populated countries that are highly dependent on agriculture—such as India, Nigeria, Pakistan and the Philippines<sup>15</sup>—are especially vulnerable to climate insecurity. Worsening extreme weather will trigger large-scale migration and displacement, but the



FIGURE 4.1

## Refugees, Asylum-Seekers and Venezuelans Displaced Abroad, 2000–2020 (Millions)



**Source:** Data from UNHCR, “Refugee Data Finder”. <https://www.unhcr.org/refugee-statistics/download/?url=rVpdj6>, accessed 1 December 2021.

**Note:** UNHCR = United Nations High Commissioner for Refugees; UNRWA = United Nations Relief and Works Agency.

international community’s reluctance to recognize “climate refugees” and “environmental migrants” is widening their legal protection gap.<sup>16</sup> Legislative and governance frameworks remain ill-equipped to protect millions at risk of displacement who do not qualify as traditional refugees.<sup>17</sup> These governance voids could leave governments blindsided in the event of a sudden, high-impact environmental shock. Moreover, the failure to achieve inclusive transitions to net zero economies (see Chapter 2) could worsen economic insecurity for businesses and households in those origin countries left behind.

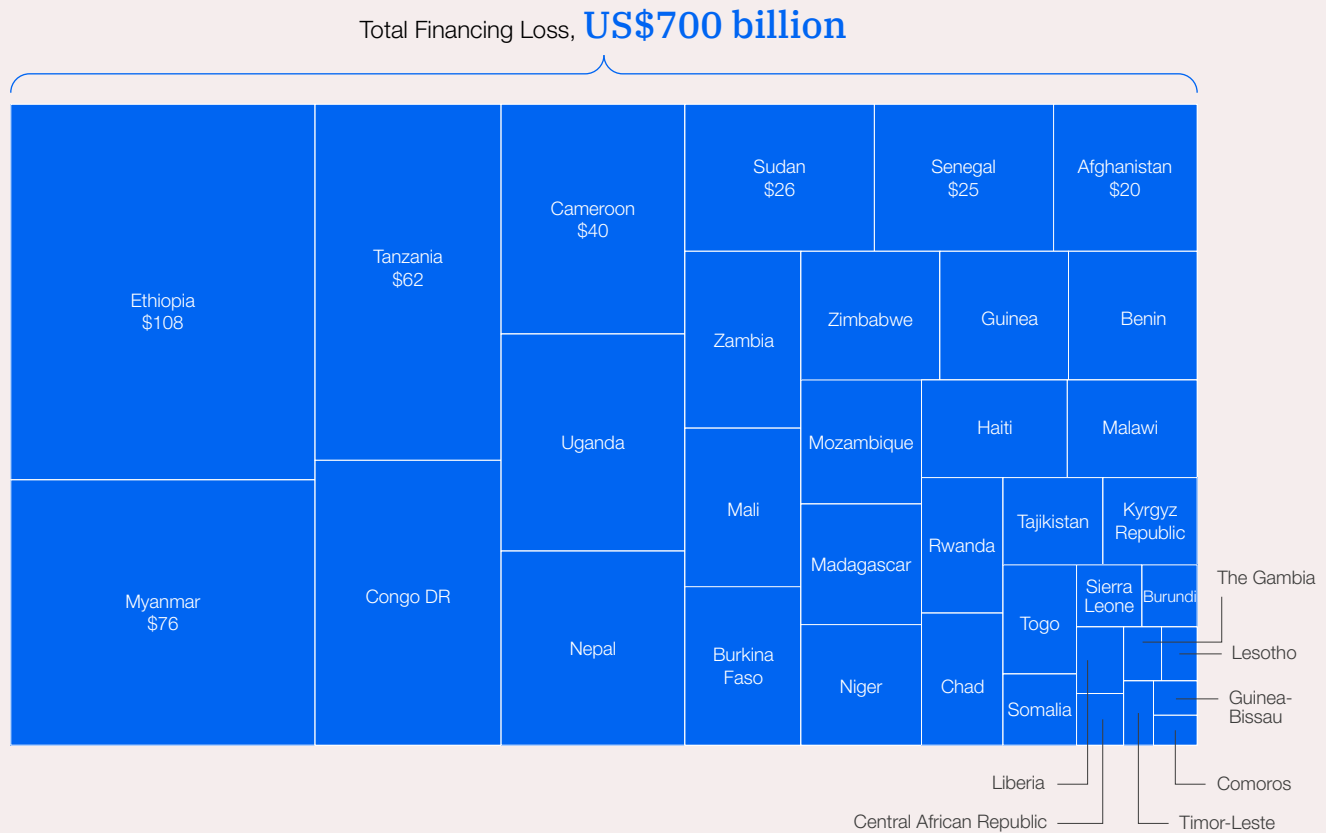
Conflict and political insecurity are also major drivers of involuntary migration. In 2020, there were over 34 million people displaced abroad globally from conflict alone—a historical high (see Figure 4.1)—mostly due to long-standing conflicts and political turmoil in Afghanistan, Myanmar, South Sudan, Syria and Venezuela,<sup>18</sup> and

to expanding conflicts within and beyond the borders of Ethiopia.<sup>19</sup> According to the Executive Opinion Survey (EOS), “involuntary migration” is a top short-term threat in Armenia, Ukraine and Venezuela, which have experienced conflict and political instability.<sup>20</sup> Political turmoil may well worsen in the aftermath of the COVID-19 pandemic, compounded by the reduction of international security forces from conflict zones such as Afghanistan and the Sahel region of Africa. Moreover, some political leaders have reacted to economic crises and social unrest with authoritarianism, discriminatory policies, or extremist discourses that put ethnic or religious minorities at risk of marginalization or violence.

**National-level barriers to the movement of people are increasing**

FIGURE 4.2

## Developing Countries' Financing Loss versus GDP, 2020 (US\$ billions)



**Source:** Data from OECD. Global Outlook on Financing for Sustainable Development 2021. <https://www.oecd.org/development/global-outlook-on-financing-for-sustainable-development-2021-e3c30a9a-en.htm>; World Bank Open Data, “GDP (current US\$)” and “GDP per capita (current US\$)”. <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>, accessed 1 December 2021.

Global cooperation to resolve or mitigate ongoing humanitarian crises is being challenged by financial pressures in advanced economies, greater focus on domestic priorities and a more tense geopolitical context (see Chapter 1). Already, the pandemic has diminished external financing to developing countries by US\$700 billion—equivalent to the combined GDPs of 36 of the world’s poorest economies (see Figure 4.2).<sup>21</sup>

### Mobility barriers in destination countries

There are three potential barriers to cross-border migration: post-pandemic effects on international mobility, future employment trends and increased national interest postures of many countries.

The COVID-19 pandemic and its economic ramifications have emboldened some groups and political leaders to adopt more hostile postures against migration, foreigners or communities with foreign roots. Restrictions on international movement as a result of the pandemic remained in place in 32 countries at the time of writing.<sup>22</sup> These include critical destination and corridor countries such as China, India, Russia, the United Arab Emirates and the United States. Future easing of restrictions will depend on the progress of vaccination and the evolution of COVID-19, but persistent vaccination gaps globally, and particularly within origin countries, means international mobility will continue to be restricted for many.

The pandemic may also narrow future employment opportunities for migrant workers in destination countries, both

because of the economic disruption it created and because of the accelerating automation and digitalization of tasks and services. The World Economic Forum's *Future of Jobs Report* found that 50% of employers globally planned to automate tasks in response to COVID-19, often in sectors that have relied on migrant workers.<sup>23</sup> The report also estimates that 85 million jobs will be destroyed by automation by 2025, and although 97 million new jobs will emerge, these jobs may not necessarily match the skillsets of many migrants.<sup>24</sup> The short-term economic rebound from the pandemic has resulted in a surge in hiring in some key sectors for migrants such as hospitality and healthcare, but in the long-term, new consumption patterns in destination countries—such as more e-commerce and less business travel—are expected to shrink demand for jobs in migrant-

intensive industries such as agriculture, food services and warehousing.<sup>25</sup>

National interest postures have also become more entrenched across both developing and advanced economies. For example, Chile and Peru have reframed their migration governance mechanisms, which complicates access for migrant and refugee populations to essential financial and healthcare services.<sup>26</sup> Meanwhile, restrictive policies originally grounded in public health concerns have not been rolled back, as indicated by sustained declines in issued visas for the United Kingdom and the perpetuation of Title 42 expulsions at the US border.<sup>27</sup> Other destination countries have sought to harden borders to prevent the arrival of involuntary migrants, as evidenced in fresh ambitions to build walls in Europe and Turkey.<sup>28</sup>

## Consequences

Barriers to orderly migration could have negative global consequences, such as widening labour gaps and income disparity, triggering or worsening humanitarian crises and increasing societal polarization.

**Economic consequences.** The economic rebound from COVID-19 has created labour shortages in specific industries—albeit some may be temporary—by disrupting market dynamics and supply chains and prompting workers to re-evaluate their personal and career choices. At the time of writing, the United States faced over 11 million unfilled jobs in general and the European Union had a deficit of 400,000 drivers just in the trucking industry.<sup>29</sup> The hospitality sector, one of the most severely affected by the pandemic, is especially vulnerable to long-term labour shortages that migration could close. In the United States, a survey found that over 50% of former hospitality employees would not return to their previous jobs, and 60% of workers seeking employment would not consider the hospitality sector.<sup>30</sup>

A decrease in migrant employment could weaken the global flow of remittances such that growth in income fails to keep pace with inflation, thereby limiting social mobility in origin countries. Remittances also support private consumption, savings and investment in origin countries and can equate to a significant proportion of GDP (from nearly one-fourth of GDP in El Salvador and Honduras to over one-third in Somalia).<sup>31</sup> They proved to be resilient through the pandemic, falling by 2% annually in low- and middle-income countries in 2020<sup>32</sup>—far less than the 30% drop in FDI<sup>33</sup>—and quickly recovering to rise by 7.3% in 2021.<sup>34</sup> Combined with stagnant tourism and pressures on exports,<sup>35</sup> a fall in remittances would weaken another important source of financing for many developing countries.

**Businesses risk worker deficits and demand shocks from constrained migration**



GETTY/PAUL RATJE

### Humanitarian consequences.

Humanitarian crises could worsen where barriers to exit prevent vulnerable groups from escaping persecution or violence. In some fragile states, governments could block their citizens' departure to halt depopulation as well as capital flight. In Afghanistan and Myanmar, governments have reportedly impeded citizens from leaving the country.<sup>36</sup> Blocking emigration prevents people from seeking more secure livelihoods and diasporas from reuniting with families. It can exacerbate societal fractures by closing a mechanism to reduce poverty and narrow inequality, fuelling citizens' animosity towards government and potentially empowering criminal or even terrorist groups that offer hope to disaffected individuals.

More limited international mobility opportunities will push migrants to embark on more perilous journeys and risk worsening or triggering humanitarian crises in neighbouring and corridor countries. One such case is the Syrian crisis, which by 2021 had already displaced nearly 6 million Syrians abroad—mostly to Turkey, Lebanon and Jordan—but could further deteriorate.<sup>37</sup> An estimated 700,000 Central American migrants transited through

Mexico in 2021—a rapid return to pre-pandemic levels<sup>38</sup>—and those unable to enter the United States are unlikely to return to their origin countries.<sup>39</sup> At one point, 15,000 Central American refugees were stranded for days in precarious conditions under a bridge on the Mexico-US border.<sup>40</sup> According to the EOS, “involuntary migration” is a top short-term threat in El Salvador, Guatemala, Honduras and Nicaragua.

These perilous journeys can also lead to tragic loss of life, such as when people become lost at sea or face harsh weather while stuck in borderlands.<sup>41</sup> At the time of writing, nearly 4,800 migrants were estimated to have perished or gone missing in 2021, most of them trying to reach Europe from Africa.<sup>42</sup> Although there is worldwide consensus on the urgent need to combat human trafficking, the International Organization for Migration estimates that organized human-trafficking groups operate in every country.<sup>43</sup>

**Geopolitical consequences.** Migration pressures could exacerbate geopolitical tensions and even fuel cross-border conflicts. For example, in the Middle East, half a million Afghans are expected



to take increasingly drastic measures to circumvent migration restrictions and flee to neighbouring countries<sup>44</sup>—including Iran, which has enlarged its military presence along the border to deter a potential Taliban incursion.<sup>45</sup> Management of migration flows has become a tense issue between Turkey, which hosts some 3.6 million Syrian refugees,<sup>46</sup> and the European Union.

Geopolitical rifts could also worsen—and new ones emerge—if origin country migration is increasingly used as a geopolitical instrument. The crossing of migrants from Morocco into the Spanish enclave of Ceuta aggravated tensions that originated in the European Union’s lack of support for Morocco’s claims over the Western Sahara.<sup>47</sup> Political tensions between Belarus and the European Union escalated considerably as Belarus encouraged travel from the Middle East, moved migrants to camps along its border with Poland and pushed them to cross over, prompting Poland to deploy troops in response.<sup>48</sup> In such cases, destination-country governments seeking to comply with international laws on the treatment of refugees—thereby preserving their

## Geopolitical rifts could worsen if migration is used as a geopolitical instrument

reputation among the global community in the spheres of global development and human rights—will have to carefully manage diplomatic relationships with neighbours to arrive at a way forward while responding to immigrant scepticism among a significant proportion of their populations.

### Consequences for stakeholders

People, governments and businesses in origin and destination countries face distinct challenges from divergent perspectives on migration. But stakeholders in both geographies also face common challenges: social unrest if migration is used to discriminate against and marginalize certain groups; hardening political contexts if governments exploit migration challenges to justify more control over citizens and markets; and some negative economic



consequences if legitimate diaspora networks in destination countries created by migration are undermined.

### Left alone: Consequences for people

By 2020, there were more than 4 million stateless persons in the world, the highest number in a decade;<sup>49</sup> but this number risks increasing due to heightened social polarization and strained government capacity. Limited options for migrants to gain admittance to destination countries upon entry—even temporarily—could be compounded by corridor countries refusing to allow them to remain within their borders. People in this situation—who are unwilling or unable to return home and whose governments do not take responsibility for their welfare—are at risk of being stranded in irregular settlements or facilities with minimal access to basic goods and services, financial support or diplomatic assistance. Others unable to escape insecurity are at risk of violence or falling prey to extremist ideologies and organizations. Refugees would face poor conditions and even violence in transit and in camps if international cooperation to manage involuntary migration is lacking. Even more economic migrants could resort to desperate measures and become

vulnerable to exploitation by human-smuggling cartels.

In destination countries, growing extremism could create greater challenges for migrants trying to assimilate.<sup>50</sup> Citizens could also see their civil liberties violated by governments using migration management to justify widespread population surveillance and intrusions on personal information.

### Last resort: Consequences for governments

Remittances improve living standards in origin countries and provide an important source of financing.<sup>51</sup> Without them, governments in origin countries whose economic stability hinges on remittances may face severe complications in their ability to govern—some could be at risk of degenerating into failed states. Destination-country governments also face risks domestically from failing to address citizens' concerns with migration. Adopting stricter migration measures could encounter some popular backlash as pro-migration advocates make their voices heard on the streets and online, while failing to effectively manage inflows risks stoking the growth of populism.

## Shocks to Reflect Upon



### Not in My Country

What if xenophobic political parties in federal democracies start winning more elections and securing leadership positions in destination-country border or sanctuary towns? What if they ignore federal law and start taking border protection or mobility policies into their own hands, facilitating vigilante behaviour?



### Show Me the Money

What if stricter migration policies lead to more burdensome regulation, reduced competition and higher fees in remittance services? What if traditional remittance channels are choked off and cryptocurrencies become the prevalent method for sending remittances, exposing digitally insecure migrants to cybertheft?



### Too Little, Too Late

What if stalled or delayed climate action means that ecosystems reach their tipping points suddenly and unexpectedly, accelerating climate migration into neighbouring countries as droughts, floods and resource scarcity worsen?



GETTY/JIM WATSON

### Little room: Consequences for businesses

Businesses in destination countries are at risk from a global worker deficit and demand-side shocks that could result from constrained migration. Migrant workers comprise an attractive consumer group that can contribute to developing domestic markets and support international expansion by boosting brand awareness

in their home countries. But businesses perceived to favour stricter foreign labour requirements, or that are seen as not making enough effort to support their migrant staff, could face a public backlash from migrant communities and their supporters. On the other hand, businesses that welcome migrant workers with a view to low-cost labour may expose themselves to union pushback.

## Towards two-way bridges

At a time of global divergence, migration could foster economic integration. International mobility could narrow inequality within and between countries by matching job seekers in origin countries with unfulfilled vacancies abroad in growth industries—such as healthcare, renewable energy and transportation.<sup>52</sup>

More efficient and orderly channels for migration—including coherent legal and policy frameworks, cross-border cooperation and alignment and better enforcement against smuggling operations—could

prompt closer political ties between countries and encourage collaboration on issues of mutual concern such as shared infrastructure for cross-border financial flows. The global community could also build goodwill across geopolitical divisions by strengthening collaboration mechanisms for refugee intake.

Migration offers opportunities but also entails challenges for origin, corridor and destination countries. Leaders have the chance to jointly identify where new bridges can be built for mutual benefit.

# Endnotes

- 1 United Nations Population Division, "International Migrant Stock". <https://www.un.org/development/desa/pd/content/international-migrant-stock>, accessed 17 December 2021
- 2 UNHCR (United Nations High Commissioner for Refugees). 1951. "The 1951 Convention Relating to the Status of Refugees and its 1967 Protocol". UNHCR. 25 July 1951. <https://www.unhcr.org/about-us/background/4ec262df9/1951-convention-relating-status-refugees-its-1967-protocol.html>
- 3 World Bank. 2018. Moving for Prosperity: Global Migration and Labor Markets. Policy Research Report. World Bank Group. 15 June 2018. <https://www.worldbank.org/en/research/publication/moving-for-prosperity>
- 4 Aubry, A., Burzyński, M. and Docquier, F. 2016. "The welfare impact of global migration in OECD countries". Journal of International Economics, Volume 101. July 2016. <https://www.sciencedirect.com/science/article/abs/pii/S002219961630040X>
- 5 Hillman, J. and Tippett, A. 2021. "Who built that? Labor and the Belt and Road Initiative". Council on Foreign Relations. 6 July 2021. <https://www.cfr.org/blog/who-built-labor-and-belt-and-road-initiative>
- 6 IPSOS. 2021. "World Opinion on Globalization and International Trade in 2021". Ipsos Global Advisor 25-Country Survey for the World Economic Forum. IPSOS. August 2021. <https://www.ipsos.com/en/sentiment-about-globalization-cooler-pandemic-across-world>
- 7 International Organization for Migration. 2021. Global Mobility Restriction Overview. Weekly Update. IOM. 4 October 2021. <https://migration.iom.int/reports/covid-19-travel-restrictions-output-%E2%80%944-october-2021?close=true>
- 8 International Centre for Migration Policy Development. 2021. "ICMPD migration outlook 2021. Seven things to look out for in 2021". ICMPD. 26 January 2021. [https://www.icmpd.org/file/download/50542/file/ICMPD\\_Migration\\_Outlook\\_2021\\_final.pdf](https://www.icmpd.org/file/download/50542/file/ICMPD_Migration_Outlook_2021_final.pdf)
- 9 IMF (International Monetary Fund). "Policy Responses to COVID-19". Policy Tracker. <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#B>, accessed 3 December 2021.
- 10 Mercer. 2021. "Win with empathy. Global Talent Trends 2020-2021". 8 February 2021. <https://www.mercer.com/our-thinking/career/global-talent-hr-trends.html>; Milne, R. and Dempsey, H. 2021. "Suez blockage will accelerate global supply chain shift, says Maersk chief". Financial Times. 29 March 2021. <https://www.ft.com/content/e9452046-e88e-459a-9c54-341c85f3cb0d>; Reinsch, W.A., Benson, E., Lim, J., Hokayem, A. and Mortensen, S. 2021. The Manufacturer's Dilemma: Reshoring and Resiliency in a Pandemic World. Center for Strategic and International Studies. <https://www.csis.org/analysis/manufacturers-dilemma-reshoring-and-resiliency-pandemic-world>; World Economic Forum. 2020. The Future of Jobs Report 2020. October 2020. [https://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2020.pdf](https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf)
- 11 Fleming, S. 2020. "This is how COVID-19 is affecting informal workers". World Economic Forum. 29 July 2020. <https://www.weforum.org/agenda/2020/07/coronavirus-impact-informal-workers-world-bank/>
- 12 World Economic Forum, in partnership with Marsh & McLennan Companies and Zurich Insurance Group. 2020. The Global Risks Report 2020. Insight Report. Chapter 3 A Decade Left. Geneva: World Economic Forum. January 2020. <https://www.weforum.org/reports/the-global-risks-report-2020>
- 13 World Bank. 2021. Groundswell Part 2: Acting on Internal Climate Migration. Report. Open Knowledge Repository. World Bank Group. September 2021. <https://openknowledge.worldbank.org/handle/10986/36248>
- 14 UNHCR. 2021. Global Report 2020. UNHCR. 2020. <https://www.unhcr.org/flagship-reports/globalreport/>; Rachman, G. 2021. "The threat of conflict over water is growing". Financial Times. 1 November 2021. <https://www.ft.com/content/b29578f1-c05f-4374-bbb4-68485ef6dbf7>
- 15 World Bank Open Data. "Agriculture, forestry, and fishing, value added (% of GDP)". <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS>, accessed 2 December 2021.
- 16 Rameez Raza, M. and Shekhar, R. 2020. "Climate Crisis, Migration and Refugees: Bridging the Legal Protection Gap for a Sustainable Future". RLI Blog on Refugee Law and Forced Migration. School of Advanced Study, University of London. 29 July 2020. <https://rli.blogs.sas.ac.uk/2020/07/29/climate-crisis-migration-and-refugees-bridging-the-legal-protection-gap-for-a-sustainable-future/>
- 17 Apap, J. and Perron de Revel, C. 2021. "The concept of 'climate refugee'. Towards a possible definition." Briefing. European Parliamentary Research Service. October 2021. [https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698753/EPRS\\_BRI\(2021\)698753\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698753/EPRS_BRI(2021)698753_EN.pdf)
- 18 UNHCR. 2021. Global Trends in Forced Displacement – 2020. UNHCR. 18 June 2021. <https://www.unhcr.org/60b638e37/unhcr-global-trends-2020>
- 19 UNHCR. 2021. "Eritrean refugees in Tigray caught up in conflict". Press Briefing. 27 July 2021. <https://www.unhcr.org/news/briefing/2021/7/60ffc4d44/eritrean-refugees-tigray-caught-conflict.html>
- 20 Council on Foreign Relations. 2021. "Nagorno-Karabakh Conflict" and "Conflict in Ukraine". Global Conflict Tracker. <https://www.cfr.org/global-conflict-tracker/?category=us>, accessed 3 December 2021.
- 21 OECD (Organisation for Economic Cooperation and Development). 2021. Global Outlook on Financing for Sustainable Development 2021: A New Way to Invest for People and Planet. OECD. [https://www.oecd-ilibrary.org/sites/e3c30a9a-en/1/3/1/index.html?itemId=/content/publication/e3c30a9a-en&csp\\_=8cdd8991f371dde0be547aab4112527a&itemIGO=oeecd&itemContentType=book](https://www.oecd-ilibrary.org/sites/e3c30a9a-en/1/3/1/index.html?itemId=/content/publication/e3c30a9a-en&csp_=8cdd8991f371dde0be547aab4112527a&itemIGO=oeecd&itemContentType=book); World Bank Open Data. "GDP (current US\$)" and "GDP per capita (current US\$)". <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD> and [https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?most\\_recent\\_value\\_desc=false](https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?most_recent_value_desc=false), accessed 1 December 2021.
- 22 Blavatnik School of Government. "Covid-19 Government Response Tracker". University of Oxford. <https://www.bsg.ox.ac.uk/research/research-projects/covid-19-government-response-tracker>, accessed 7 December 2021.
- 23 World Economic Forum. 2020. The Future of Jobs Report 2020. October 2020. [https://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2020.pdf](https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf)
- 24 Ibid.
- 25 McKinsey Global Institute. 2021. The Future of Work after COVID-19. Report. McKinsey & Company. 18 February 2021. <https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-after-covid-19>

- 26 Freier, L.F. and Vera Espinoza, M., 2021. "COVID-19 and immigrants' increased exclusion: The politics of immigrant integration in Chile and Peru". *Frontiers in Human Dynamics* 3: 6. <https://www.frontiersin.org/articles/10.3389/fhumd.2021.606871/full>
- 27 Constantino, A. K. 2021. "U.S. defends expulsion of undocumented migrants under health policy, even as it eases border restrictions for travelers with visas". CNBC. 13 October 2021. <https://www.cnn.com/2021/10/13/us-defends-expelling-migrants-as-canada-mexico-border-restrictions-ease.html>; GOV.UK. "Summary of latest statistics. Immigration statistics, year ending June 2021". Cabinet Office Government Digital Service. <https://www.gov.uk/government/statistics/immigration-statistics-year-ending-june-2021/summary-of-latest-statistics>, accessed 21 December 2021; Somerville, W. and Walsh, P.W. 2021. "United Kingdom's decades-long immigration shift interrupted by Brexit and the pandemic". Migration Policy Institute. 19 August 2021. <https://www.migrationpolicy.org/article/united-kingdom-shift-immigration-interrupted-brexit-pandemic>; US Customs and Border Protection. "Nationwide Enforcement Encounters: Title 8 Enforcement Actions and Title 42 Expulsions 2022". CBP Enforcement Statistics. <https://www.cbp.gov/newsroom/stats/cbp-enforcement-statistics/title-8-and-title-42-statistics>, accessed 21 December 2021.
- 28 Follain, J. 2021. "EU should pay for walls against migrants, 12 nations tell bloc". Bloomberg. 8 October 2021. <https://www.bloomberg.com/news/articles/2021-10-08/eu-should-pay-for-walls-against-migrants-12-nations-tell-bloc>; Yackley, A. J. 2021. "The Turkish wall built to keep out refugees from Afghanistan". *Financial Times*. 15 September 2021. <https://www.ft.com/content/49d85b11-4bbe-4518-b6d8-d532e30c373c>
- 29 Arnold, M. and Vladkov, A. 2021. "Europe's trucker shortage becoming 'extremely dangerous'". *Financial Times*. 13 October 2021. <https://www.ft.com/content/e8ca2a08-308c-4324-8ed2-d788b074aa6c>; US Bureau of Labor Statistics. 2021. "Job Openings and Labor Turnover Summary". Economic News Release. USBLS. 8 December 2021. <https://www.bls.gov/news.release/jolts.nr0.htm>
- 30 Joblist. 2021. "Q2 2021 United States job market report". Job Market Reports. Joblist. 8 July 2021. <https://www.joblist.com/jobs-reports/q2-2021-united-states-job-market-report>
- 31 World Bank Open Data. "Personal remittances, received (% of GDP)". [https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS?most\\_recent\\_value\\_desc=true](https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS?most_recent_value_desc=true), accessed 14 December 2021
- 32 World Bank. 2021. "Defying Predictions, Remittance Flows Remain Strong During COVID-19 Crisis". Press Release. World Bank Group. 12 May 2021. <https://www.worldbank.org/en/news/press-release/2021/05/12/defying-predictions-remittance-flows-remain-strong-during-covid-19-crisis>
- 33 Ibid.
- 34 Dillip, R. 2021. "Global Remittance Flows in 2021: A Year of Recovery and Surprises". World Bank Blogs. World Bank Group. 17 November 2021. <https://blogs.worldbank.org/peoplemove/global-remittance-flows-2021-year-recovery-and-surprises>
- 35 United Nations World Tourism Organization. 2021. "Global tourism sees upturn in Q3 but recovery remains fragile". UNWTO. 28 November 2021. <https://www.unwto.org/taxonomy/term/347>; World Bank Open Data. "Exports of goods and services (% of GDP) - Low & middle income". <https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?locations=XO>, accessed 2 December 2021.
- 36 Gannon, K. 2021. "Taliban stop planes of evacuees from leaving but unclear why". AP News. 5 September 2021. <https://apnews.com/article/middle-east-religion-taliban-dbe38a9a3c0b33f3532aac5ff1b50078>; Myanmar Now. "Workers trying to leave Myanmar turned away at airports after junta tightens rules". Myanmar Now. 21 October 2021. <https://www.myanmar-now.org/en/news/workers-trying-to-leave-myanmar-turned-away-at-airports-after-junta-tightens-rules>
- 37 UNHCR. 2021. Operational Data Portal. Refugee Situations. "Syria Refugee Regional Response". <https://data2.unhcr.org/en/situations/syria>, accessed 6 January 2022.
- 38 Congressional Research Service. 2021. "Central American migration: Root causes and U.S. policy". In Focus. 27 October 2021. <https://sgp.fas.org/crs/row/IF11151.pdf>
- 39 NPR (National Public Radio). 2021. "How the southern U.S. border has become a nearly constant humanitarian crisis". Interview with Alicia Schmidt Camacho in "All Things Considered". NPR. 24 September 2021. <https://www.npr.org/2021/09/24/1040550699/how-the-southern-u-s-border-has-become-a-nearly-constant-humanitarian-crisis>
- 40 Gonzalez, V. and Spagat, E. 2021. "Inside Biden's border plans: How optimism turned to chaos". AP News. 3 November 2021. <https://apnews.com/article/immigration-coronavirus-pandemic-donald-trump-joe-biden-health-af698c3434cc31dfbce43a66bf43b49>
- 41 ECRE (European Council on Refugees and Exiles). 2020. "Bosnia and Herzegovina: Snowfall increases hardships of people stuck in Europe's borderlands". Ecre News. 11 December 2020. <https://ecre.org/bosnia-and-herzegovina-snowfall-increases-hardships-of-people-stuck-in-europes-borderlands/>; UN News. 2021. "Drowning of 27 migrants in English Channel is worst disaster on record: IOM". United Nations. 25 November 2021. <https://news.un.org/en/story/2021/11/1106562>
- 42 Missing Migrants Project. "Dead and Missing by Year". IOM. <https://missingmigrants.iom.int/data>, accessed 23 December 2021.
- 43 International Organization for Migration. 2021. World Migration Report 2022. IOM. <https://worldmigrationreport.iom.int/wmr-2022-interactive/>
- 44 UNHCR. 2021. "Afghanistan Situation Regional Refugee Preparedness and Response Plan". Operational Data Portal. UNHCR. 27 August 2021. <https://data2.unhcr.org/en/documents/details/88385>
- 45 Nadimi, F. 2021. "Iran sets its eyes on Afghanistan". Policy Analysis. The Washington Institute for Near East Policy. 19 July 2021. <https://www.washingtoninstitute.org/policy-analysis/iran-sets-its-eyes-afghanistan>
- 46 UNHCR. 2021. "Refugees and Asylum Seekers in Turkey". UNHCR. <https://www.unhcr.org/tr/en/refugees-and-asylum-seekers-in-turkey>
- 47 Casey, N. and Bautista, J. 2021. "'Come on in, boys': A wave of the hand sets off Spain-Morocco migrant fight". *New York Times*. 2 June 2021. <https://www.nytimes.com/2021/06/02/world/europe/spain-ceuta-migrants-morocco.html>; Torreblanca, J. I. 2021. "This time is different: Spain, Morocco, and weaponised migration". Commentary. European Council on Foreign Relations. 26 May 2021. <https://ecfr.eu/article/this-time-is-different-spain-morocco-and-weaponised-migration/>
- 48 Emmott, R. 2020. "EU says Lukashenko is not legitimate Belarus president". Reuters. 24 September 2020. <https://www.reuters.com/article/us-belarus-election-eu-idUSKCN26FOZE>; Pempel, K. and Kiselyova, M. 2021. "'Go through. Go,' Lukashenko tells migrants at Polish border". Reuters. 26 November 2021. <https://www.reuters.com/world/europe/lukashenko-tells-migrants-belarus-poland-border-he-wont-make-them-go-home-2021-11-26/>
- 49 UNHCR. 2021. "Global Trends in Forced Displacement – 2020". Op. cit.
- 50 International Organization for Migration. 2019. World Migration Report 2020. IOM. 2019. [https://publications.iom.int/system/files/pdf/wmr\\_2020.pdf](https://publications.iom.int/system/files/pdf/wmr_2020.pdf)
- 51 World Bank. 2018. Op. cit.
- 52 McKinsey Global Institute. 2021. Op. cit.

# Crowding and Competition in Space

5

number of new government-developed space stations by 2030

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70,000

estimated number of satellites to launch in coming decades

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28

nations with domestic space regulation

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1 million

estimated number of debris pieces 1 centimetre and larger

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# Space is getting busier

Humans have been inspired by space exploration for decades but growing commercial and geopolitical interests are increasingly influencing this frontier. While early space activity was conducted or funded by the public sector, the last decade has seen growing private investment. New commercial entrants are disrupting traditional incumbents' control in delivering satellite services, especially in internet-related communications or launch services. Some governments are encouraging private space activity to further national "territorial" claims or to foster the development of high-value jobs, especially in the zone of Low Earth Orbit (LEO) or Medium Earth Orbit (MEO), as well as enhancing their military or defence-oriented presence.\* Increased exploitation of these orbits carries the risk of congestion, an increase in debris and the possibility of collisions in a realm with few governance structures to mitigate new threats.

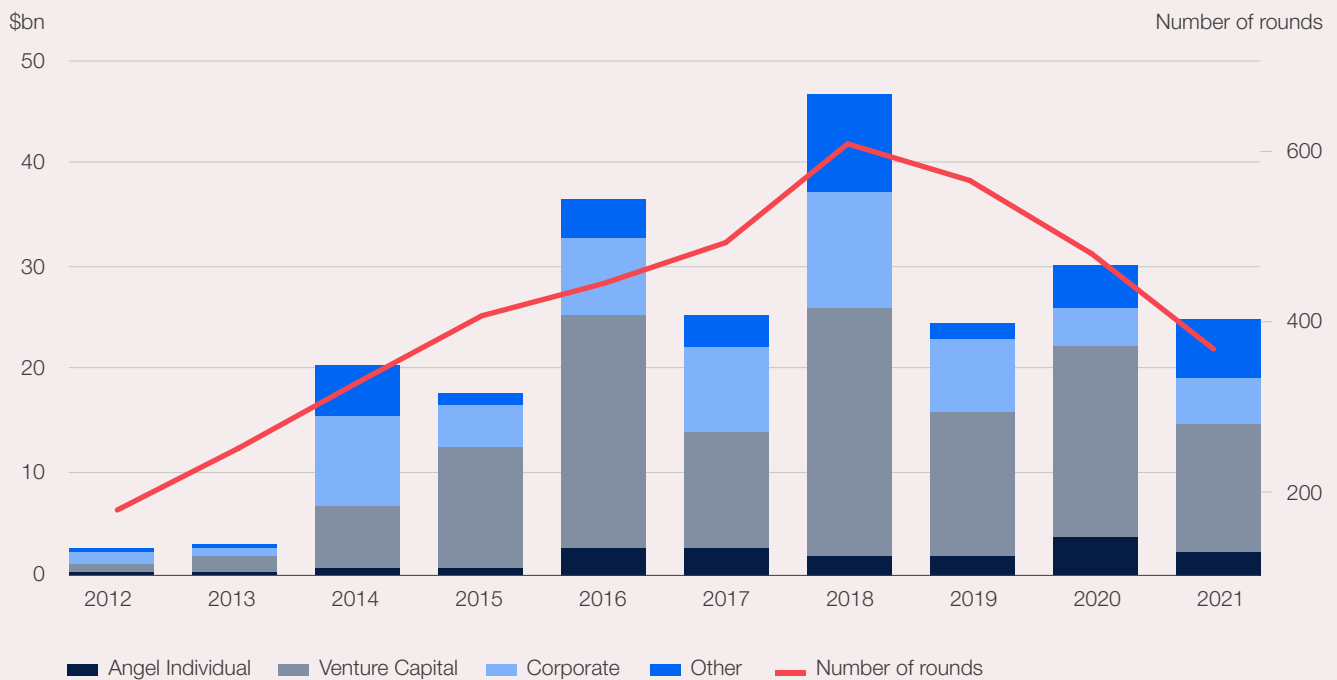
## A LEO/MEO space race

The traditional Geostationary Orbit (GEO) commercial satellite market, which has dominated the communications sector for decades, is now losing commercial value because of competition from new players seeking to provide services from LEO or MEO. More recently, in the last decade, the financing of new applications for space-based initiatives has grown fast: businesses, start-ups and research entities are proliferating, raising money in the billions, and thereby driving down the cost of launch systems, particularly in LEO (see Figure 5.1).<sup>1</sup> Lower costs bring more opportunity for a greater diversity of actors to launch constellations of smaller satellites. With this more cost-effective access to space, attention is increasingly shifting to new opportunities in areas such as hyperspectral remote sensing, energy

\* Low Earth Orbit (LEO) is generally considered to encompass Earth-centred orbits with an altitude of 2,000 kilometres (1,200 miles) or less. The Geostationary Orbit (GEO) encompasses a higher-altitude orbit, typically at an altitude of 35,000 kilometres above the Earth's equator while Medium Earth Orbit (MEO) comprises a range of orbits between LEO and GEO.

FIGURE 5.1

## Space Investment: Equity Capital by Investor Type (US\$ Billions)



Source: Space Capital. Q3 2021. <https://app.powerbi.com/view?r=eyJrjoiNGY4MWI4OWEiMjNmZS00OTM3LWE5M2QyYXZlZDk3YTllwicl6jYzMDZkMTJlTEwODMNGNhOS04Yjk2LTdjYzYzMDcwMwIzMiIsImMiOjN9>

generation, manufacturing, mining and tourism.<sup>2</sup> However, the largest growth is still expected to come from industries that are already expanding digital connectivity on Earth, such as direct-to-consumer broadband access.<sup>3</sup>

## National ambitions

Space programmes are still widely seen as a sign of national prestige, as they project geopolitical and military power as well as have scientific and commercial significance. Powers such as China, Europe (EU and ESA), France, Germany, India, Japan, NATO, Russia, the United Kingdom and the United States have publicly announced space forces and continue to build space infrastructure, with plans for at least five new space stations by 2030 in the works.<sup>4</sup> The first commercial space station is also slated for completion in the next decade.<sup>5</sup> Next-step deep space exploration projects are under development, such as the United States-led Artemis programme—which aims to reopen exploration of the Moon and eventually develop outposts on Mars and

## Businesses, start-ups and research entities are proliferating

asteroids.<sup>6</sup> In addition, new space-faring powers will emerge as more economies begin to see opportunities to expand both geopolitical and commercial influence in this arena. Among countries that have expressed interest are Argentina, Brazil, and Mexico in Latin America; Egypt, Iran, Turkey, Saudi Arabia, South Africa and the United Arab Emirates in Africa and the Middle East; and Australia, Indonesia, Malaysia, New Zealand, South Korea and Vietnam in the Asia-Pacific region.<sup>7</sup>

Alongside new programme development, the critical infrastructure on which many civil and commercial entities rely must be maintained and secured.<sup>8</sup> Satellites in LEO as well as in MEO and GEO are used for multiple purposes that include climate and natural resource monitoring, broadband internet, and radio and television broadcasting, as well as position,





navigation and timing services.<sup>9</sup> While this infrastructure will continue to remain vital for governments, businesses and societies, it is also creating opportunities for nations with an advanced space industry, supported by national-level regulation, to stake claims to specific orbital sectors by virtue of first-mover advantage.<sup>10</sup> Finally, space will continue to be of critical military

importance: armed forces have long relied on space-based or space-supported technologies—including Global Positioning System (GPS) for navigation, dedicated military satellite-based communications for secure digital connectivity and spy satellites for intelligence—making such systems tempting military targets and spurring the need for enhanced defensive measures.<sup>11</sup>

## Consequences

A greater number and diversity of actors operating in space could generate new or exacerbate old frictions if not responsibly managed. The trend in commercial, civil and military sectors is to replace traditionally large and expensive single geostationary satellite systems with a more distributed system of multiple smaller satellites in LEO. Approximately 11,000 satellites have been launched since Sputnik 1 in 1957, but 70,000 more could enter orbit in the coming decades if proposed plans play out.<sup>12</sup> The vast majority of these new planned and approved satellites will be launched by a handful of operators that will have increasing influence over the regulatory landscape.

Once in orbit, and unless actively decommissioned, many of these satellites could remain in space for hundreds of years.<sup>13</sup> Smaller, low-cost satellites are also proliferating because of lower costs and fewer barriers to entry.<sup>14</sup> While the risk is still relatively low, an increase in the number of satellites also increases the opportunity for collisions, or, at the least, a need to engage in emergency manoeuvres to avoid contact.

Collisions could hinder future space development or aggravate international tensions. This is because when objects in space collide, they may break up and produce debris that—even at sizes of 1 to 5 centimetres in diameter—could cause severe damage.<sup>15</sup> For example, the International Space Station (ISS) was damaged in May 2021 when a piece of debris penetrated its robotic arm.<sup>16</sup> Such strikes have been documented for decades, but they may become more

frequent. One theory, known as the "Kessler Effect" (see Box 5.1), posits the potential consequences of a cascading effect.<sup>17</sup> Estimates put the current number of smaller pieces of debris (larger than 1 centimetre in size) at nearly a million,<sup>18</sup> while larger objects over 10 centimetres number in the thousands (see Figure 5.2). Providing orbital servicing and debris removal could, however, help alleviate some of the worst consequences.<sup>19</sup> Tracking debris is a critical tool in preventing collision or damage, but it will need to become increasingly sophisticated to maintain reliability in a more congested realm.

With such possibilities becoming likelier in a congested space, the lack of updated international rules around space activity increases the risk of potential clashes. The most relevant of space agreements, the Outer Space Treaty, was concluded in 1967 and still, through the UN Office for

### BOX 5.1

## The Kessler Effect

First identified by NASA scientist Donald Kessler in 1978, this describes a scenario where the density of objects (satellites and debris) in LEO is high enough that collisions between objects could cause a cascade in which each collision generates space debris that increases the likelihood of further collisions and an exponential growth of debris. One implication is that the distribution of debris in orbit could render space activities and the use of satellites in specific orbital ranges difficult for many generations.



REUTERS/JOE SKIPPER

Outer Space Affairs (UNOOSA), governs much of the activity taking place in space. However, few effective governance tools have emerged in recent years to reflect new realities, such as the pressing need for an authority to govern satellite launches and servicing, space traffic control and common enforcement principles.<sup>20</sup>

As an exemplar challenge, the 1972 Space Liability Convention—which governs international responsibility for space objects launched from Earth—lacks precision around hybrid aircraft and rocket transport systems. For example, different legal authorities may govern depending on whether a vehicle is deemed to have launched when an aircraft takes off with a rocket attached or when the rocket detaches from the aircraft—and whether the hybrid vehicle is an aircraft or spacecraft while both pieces are attached. New addenda may be needed to clarify when space law should supersede aviation law.<sup>21</sup> Even the most robust governance realm, electromagnetic spectrum management, which is governed by the International Telecommunication Union (ITU), faces serious crowding pressures with new satellite systems and increased competition in the terrestrial spectrum usage of emerging 5G technologies.<sup>22</sup>

Respondents to the Global Risks Perception Survey (GRPS) reflect these

gaps: 76% of respondents characterized the current state of international risk mitigation efforts in space as either “not started” or in “early development”.

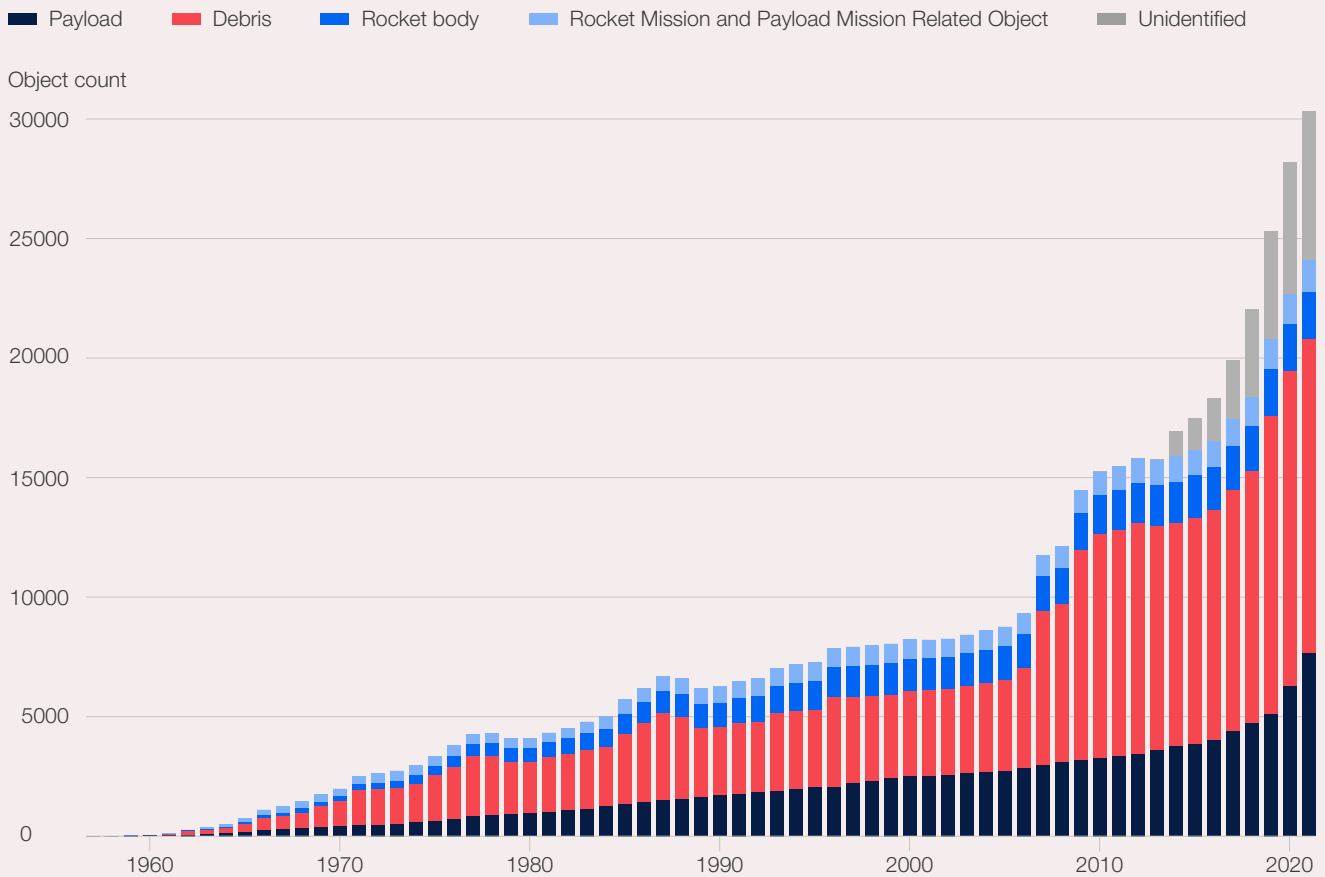
Governments, too, have developed their own national space policies,<sup>23</sup> with commercial interests as a key pillar of their national strategies, alongside national security and civil space policy. Although many governments have cooperated behind the scenes historically and still do today,<sup>24</sup> there is significant policy divergence among the 28 nations with space regulation,<sup>25</sup> and countries now operate at different scales and with different levels of ambition.<sup>26</sup> Such fragmentation compromises the further development of beneficial commercial space activities, which require shared norms across states to be able to function.<sup>27</sup>

National space ambitions also bring a growing risk of the militarization of space. The US military created a Space Force as a separate branch of its armed services in 2019, while Japan’s Space Operations Squadron and the United Kingdom’s

## National space ambitions bring a growing risk of militarization of space

FIGURE 5.2

## Evolution of the Number of Objects in All Orbits, 1960–2020



Source: European Space Agency. 2021. ESA's Annual Space Environment Report. 27 May 2021. [https://www.sdo.esoc.esa.int/environment\\_report/Space\\_Environment\\_Report\\_latest.pdf](https://www.sdo.esoc.esa.int/environment_report/Space_Environment_Report_latest.pdf)

Space Command were both created in the last two years. Other leading armed forces also now typically include a space component—for instance, in 2021, the French Air Force became the Air and Space Force (Armée de l’Air & de l’Espace). In November of 2021, an anti-satellite weapons test conducted by Russia created significant debris and threatened astronauts on the ISS.<sup>28</sup> Other countries have conducted similar testing, raising the spectre of repeat occurrences from other nations, which would add considerably to the problem of space debris (see Figure 5.2).<sup>29</sup> A hypersonic weapons arms race also risks contributing to the militarization of space—China, Russia and the United States are all developing such weapons and each tested them in the second half of 2021.<sup>30</sup> And with expanding geospatial

intelligence, all of Earth is observable by satellites, which could spur some nations to blind, jam or otherwise interfere with satellite Earth observation.<sup>31</sup> As technology advances, space mineral exploitation—already heralded as part of some deep-space exploration programmes—could also be viewed as another competitive wedge over a more distant horizon.<sup>32</sup>

Gaps in space governance render arms races even more likely. For example, the Outer Space Treaty prohibits nuclear weapons in space but does not address conventional weapons, which is particularly worrisome in today’s context of conventional weapons development and testing in space. New rules are unlikely in the near future, as there is little agreement over key issues such as

boundaries, control over space objects, or dual-use systems.<sup>33</sup> Any further decline in cooperation on space governance will only exacerbate risks.<sup>34</sup>

### **Service disruption and environmental unknowns: Consequences for people**

Societies are dependent on space infrastructure in myriad everyday ways. GPS satellites not only allow for safe navigation in the air, land and sea, but they also underpin financial transactions, data transmissions and energy control systems. Threats—such as a massive solar storm or jamming or spoofing of GPS satellites—could cause the internet to slow, navigation systems to fail, and controls for energy grids, water or transportation to crash. Ripple effects across societies could be extensive, even for a few seconds of disruption.<sup>35</sup>

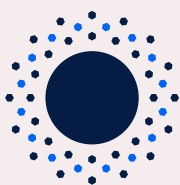
There are also significant unknowns about the impacts of rapid space development on Earth's environment—including damage to the ozone layer, butterfly effects from black carbon (soot) emissions, and possible alterations of the polar jet stream.<sup>36</sup> Of course, technological advances, such as developments in space-based solar power, could offset many of the potential negative environmental impacts of growing space exploration and exploitation.<sup>37</sup>

### **Gravitational push and pull: Consequences for governments**

Notwithstanding high levels of private sector investment, increased commercialization and growing geopolitical competition will demand higher government spending on space programmes and defence at a time when public finances are under greater pressure due to the economic overhang of COVID-19 (see Chapter 1). For example, governments will increasingly need to compete for talent, with private sector entities offering more lucrative employment packages. Defence agencies will need to continue to expend resources to defend against more-sophisticated space-based weaponry and increasingly effective space-based tools of statecraft, such as enhanced surveillance or espionage.

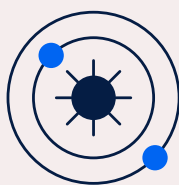
Yet, for a large majority of governments, space technology and access will remain out of reach altogether at a time when reliance on space technologies is growing for all. Forty-one nations have registered space agencies with UNOOSA,<sup>38</sup> yet the many governments not represented will continue to struggle to develop their capacities or earn a seat at the table in key decision-making processes. Without concerted effort to facilitate inclusive growth in the space realm, inequalities in the commercial and geopolitical benefits accruing from space development will only grow.

## **Shocks to Reflect Upon**



### **Kessler Collapse**

What if a cascading chain of collisions between near-Earth objects and space debris result in a saturated Low Earth Orbit that renders space practically unusable for further commercial development?



### **Solar Disruption**

What if a massive solar event or geomagnetic storm disrupts satellite-based services and functions, causing massive, cascading economic and societal consequences on Earth?<sup>39</sup>



### **Property in Space**

What if violations of the Outer Space Treaty—such as mineral resources being claimed in a Moon "gold rush"—are carried out without meaningful consequences?

### **Opportunity blocks: Consequences for businesses**

Venture financing flooded into the space industry following the successful launches of commercial space flights. As commercial activity in space grows, more companies could crop up seeking entry while investor interest is high. However, if manufacturing,

tourism or other space ventures fail to take flight, speculators and space industry companies could see their bubble burst. Similarly, grassroots campaigns to ban space pollution and prevent privatization of important science data could give investors pause, stifling the unmitigated venture financing in the field.<sup>40</sup>

## **Towards cooperation in space**

Although space represents yet another realm in which geopolitical and commercial tensions will play out, important traditions of cooperation in this arena should not be forgotten. Norms of behaviour established through voluntary measures that are not legally binding with the goal of building trust and establishing mutual understanding have helped mitigate escalating tensions in the past. While this trend could continue, more robust formal governance will be required in a more crowded and competitive space. Specific and functional bilateral or multilateral agreements between major space powers could help create norms and influence broader global behaviours.

Space situational awareness, space traffic management and debris mitigation are areas in which norms-based and eventually formal international agreements would benefit all actors. Critically, and like other realms where technology is developing at a faster pace than its regulation, bringing private sector actors into the agreement processes will help ensure that such pacts reflect both commercial and technical realities. Taking advantage of these opportunities to achieve widely accepted norms could then help facilitate discussions around more challenging issues in space, such as limits on weaponization, ownership and appropriate venues from which to govern the realm.



# Endnotes

- 1 Fildes, N. 2021. "Satellite groups face race to scale up or become space junk: Billionaire enthusiasts and new technology have brought valuations down to earth in a fragmented market". Financial Times. 14 November 2021. <https://www.ft.com/content/138b3f58-cdad-484f-b180-ce0b96bb7028>
- 2 Morgan Stanley. 2020 "Space: Investing in the Final Frontier". 24 July 2020. <https://www.morganstanley.com/ideas/investing-in-space>; Stutt, A. 2020. "The global race to mine outer space". Mining.com. 22 May 2020. <https://www.mining.com/the-global-race-to-mine-outer-space/>; Woo, E. 2021. "Start-ups aim beyond Earth". The New York Times. 7 July 2021. <https://www.nytimes.com/2021/07/07/technology/space-start-ups.html>
- 3 Morgan Stanley. 2020. Op. cit.
- 4 Gabbat, A. 2021. "US accuses Russia of 'dangerous' behavior after anti-satellite weapons test". The Guardian. 15 November 2021. <https://www.theguardian.com/science/2021/nov/15/us-investigating-debris-event-space-reports-russia-anti-satellite-weapon-test>; Jones, A. 2021. "China's Tiangong space station". Space. 24 August 2021. <https://www.space.com/tiangong-space-station>; Rome, N. 2021. "Growth of space and lunar stations: Promise amidst geopolitical risk". Georgetown Security Studies Review. 14 July 2021. <https://georgetownsecuritystudiesreview.org/2021/07/14/growth-of-space-and-lunar-stations-promise-amidst-geopolitical-risk/>
- 5 Rome. 2021. Op. cit.
- 6 NASA. 2021. Artemis Mission. <https://www.nasa.gov/specials/artemis/>
- 7 European Space Policy Institute. 2021. Emerging Spacefaring Nations. June 2021. <https://espi.or.at/publications/espi-public-reports/category/2-public-espi-reports>; Goswami, N. 2021. "Status of existing and emerging Asia-Pacific space powers capabilities". Nautilus Institute. 20 August 2021. <https://nautilus.org/napsnet/napsnet-special-reports/status-of-existing-and-emerging-asia-pacific-space-powers-capabilities/>
- 8 Buchs, R. 2021. "Intensifying space activity calls for increased scrutiny of risks". EPFL. 14 April 2021. <https://www.epfl.ch/research/domains/ircg/spotlight-on-risk-series/intensifying-space-activity-calls-for-increased-scrutiny-of-risks/>
- 9 Ibid.
- 10 Davis, G. 2021. "SpaceX's competitors claim Elon Musk could monopolize space". Tech Times. 29 May 2021. <https://www.techtimes.com/articles/260823/20210529/spacexs-competitors-claims-elon-musk-monopolize-space-starlink-constellation-unsustainable.htm>
- 11 Broad, W.J. 2021. "How space became the next 'great power' contest between the U.S. and China". The New York Times. 6 May 2021. <https://www.nytimes.com/2021/01/24/us/politics/trump-biden-pentagon-space-missiles-satellite.html>
- 12 Daehnick, C. and Harrington, J. 2021. "Look out below: What will happen to the space debris in orbit?" McKinsey & Company. 1 October 2021. <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/look-out-below-what-will-happen-to-the-space-debris-in-orbit>; Jones, A. 2021. "China is developing plans for a 13,000-satellite megaconstellation". SpaceNews. 21 April 2021. <https://spacenews.com/china-is-developing-plans-for-a-13000-satellite-communications-megaconstellation/>; Spiegel Business. 2021. "Bezos' space company is planning a private space station – slightly smaller than the ISS". Spiegel Business. 25 October 2021. <https://www.spiegel.de/wirtschaft/unternehmen/jeff-bezos-plant-private-raumstation-orbital-reef-etwas-kleiner-als-die-iss-a-1779efd7-6ee6-4c92-9986-7fc996951e8f>
- 13 Daehnick, C. and Harrington, J. 2021. "Look out below: What will happen to the space debris in orbit?" McKinsey & Company. 1 October 2021. <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/look-out-below-what-will-happen-to-the-space-debris-in-orbit>
- 14 NASA. 2021. State-of-the-Art Small Spacecraft Technology. October 2021. [https://www.nasa.gov/sites/default/files/atoms/files/soa\\_2021.pdf](https://www.nasa.gov/sites/default/files/atoms/files/soa_2021.pdf)
- 15 Nature. 2021. "The world must cooperate to avoid a catastrophic space collision". Nature. 11 August 2021. <https://www.nature.com/articles/d41586-021-02167-5>
- 16 Strickland, A. 2021. "Space junk hit the International Space Station, damaging a robotic arm". CNN. 1 June 2021. <https://edition.cnn.com/2021/06/01/world/iss-orbital-debris-robotic-arm-scn/index.html>
- 17 Hyde, J. L., Christiansen, E.L. and Lear, D.M. 2019. "Observations of MMOD Impact Damages to the ISS". NASA. 9 December 2019. <https://ntrs.nasa.gov/citations/20190033989>; Kessler, DJ. and Cour-Palais, B.G. 1978. "Collision frequency of artificial satellites: The creation of a debris belt". Journal of Geophysical Research. Volume 83, Issue A6. 1 June 1978.
- 18 The European Space Agency. 2021. "Space debris by the numbers". 22 December 2021. [https://www.esa.int/Safety\\_Security/Space\\_Debris/Space\\_debris\\_by\\_the\\_numbers](https://www.esa.int/Safety_Security/Space_Debris/Space_debris_by_the_numbers)
- 19 Rooney, K. 2021. "The big space clean-up – and why it matters". World Economic Forum Global Agenda. 20 May 2021. <https://www.weforum.org/agenda/2021/05/space-junk-clean-satellite/>
- 20 Stuart, J. 2017. "The Outer Space Treaty has been remarkably successful – but is it fit for the modern age?". The Conversation. 27 January 2017. <https://theconversation.com/the-outer-space-treaty-has-been-remarkably-successful-but-is-it-fit-for-the-modern-age-71381>; Kwan, R. and Henley, J. 2021. "China berates US after 'close encounters' with Elon Musk satellites". The Guardian. 28 December 2021. <https://www.theguardian.com/science/2021/dec/28/china-complains-to-un-after-space-station-is-forced-to-move-to-avoid-starlink-satellites>
- 21 Li, C. and Wang, G. 2021. "Applicability of the Liability Convention for Private Spaceflight". Space: Science & Technology. 4 May 2021. <https://doi.org/10.34133/2021/9860584>
- 22 Panhans, D., Schicht, R., Hamady, F. and Werlé, T. 2020. "The Coming Battle for Spectrum". 11 February 2020. <https://www.bcg.com/en-us/publications/2020/coming-battle-for-spectrum>
- 23 See, e.g., U.S. Office of the Vice-President. 2021. "United States Space Priorities Framework." 1 December 2021. <https://www.whitehouse.gov/wp-content/uploads/2021/12/United-States-Space-Priorities-Framework--December-1-2021.pdf>
- 24 Marshall W. and Hadfield, C. 2021. "Why the U.S. and China should collaborate in space". Time. 15 April 2021. <https://time.com/5954941/u-s-china-should-collaborate-in-space/>; Shackelford, S. 2019. "Renewed space rivalry between nations

- ignores a tradition of cooperation". The Conversation. 10 January 2019. <https://theconversation.com/renewed-space-rivalry-between-nations-ignores-a-tradition-of-cooperation-108810>
- 25 Goguichvili, S., Linenberger, A. and Gillette, A. 2021. "The Global Legal Landscape of Space: Who Writes the Rules on the Final Frontier?" 1 October 2021. <https://www.wilsoncenter.org/article/global-legal-landscape-space-who-writes-rules-final-frontier>
- 26 European Space Policy Institute. 2021. "Emerging Spacefaring Nations". June 2021. <https://espi.or.at/publications/espi-public-reports/category/2-public-espi-reports>
- 27 Goguichvili, Linenberger and Gillette. 2021. Op. cit.
- 28 Gabbat, A. 2021. "US accuses Russia of 'dangerous' behavior after anti-satellite weapons test". The Guardian. 15 November 2021. <https://www.theguardian.com/science/2021/nov/15/us-investigating-debris-event-space-reports-russia-anti-satellite-weapon-test>; Rincon, P. and Amos, J. 2021. "Russian anti-satellite test adds to worsening problem of space debris". BBC. 16 November 2021. <https://www.bbc.com/news/science-environment-59307862>
- 29 Historically, collisions and anti-satellite weapons testing have created significant increases in the number of orbiting space objects and debris, e.g., in 2009, when an active commercial communications satellite collided with a derelict military satellite, or in 2007, from an anti-satellite test.
- 30 Sevastopulo, D. and Hille, K. 2021. "China tests new space capability with hypersonic missile". Financial Times. 16 October 2021. <https://www.ft.com/content/ba0a3cde-719b-4040-93cb-a486e1f843fb>; Stone, M. 2021. "U.S. in hypersonic weapon 'arms race' with China -Air Force secretary". Reuters. 1 December 2021. <https://www.reuters.com/business/aerospace-defense/us-hypersonic-weapon-arms-race-with-china-air-force-secretary-2021-11-30/>; Reuters. 2021. "Russia conducts test launch of hypersonic missile -Interfax". 24 December 2021. <https://www.reuters.com/world/europe/russia-conducts-test-launch-hypersonic-missile-interfax-2021-12-24/>
- 31 Vinci, A. 2020. "The coming revolution in intelligence affairs". Foreign Affairs. 31 August 2020. <https://www.foreignaffairs.com/articles/north-america/2020-08-31/coming-revolution-intelligence-affairs>
- 32 Stutt, A. 2020. "The global race to mine outer space". Mining.com. 22 May 2020. <https://www.mining.com/the-global-race-to-mine-outer-space/>
- 33 Pozdnyakova, G. 2021. "Top-10 themes for 2022: Space: a worrying geopolitical frontier". Deutsch Bank. 8 December 2021. [https://www.dbresearch.com/servlet/reweb2.ReWEB?rwsite=RPS\\_EN-PROD&rwobj=ReDisplay.Start.class&document=PROD0000000000521006](https://www.dbresearch.com/servlet/reweb2.ReWEB?rwsite=RPS_EN-PROD&rwobj=ReDisplay.Start.class&document=PROD0000000000521006)
- 34 Panda, A. 2021. "Military Competition, New Technologies, and Space". An Asian Space Odyssey. March 2021. Diplomat Risk Intelligence. <https://dri.thedi diplomat.com/report/2021-03/>
- 35 Scott, C. 2018. "The violent solar storms that threaten Earth". BBC. 22 November 2018. <https://www.bbc.com/news/science-environment-46260959>; Tullis, P. 2019. "GPS is easy to hack, and the U.S. has no back-up". Scientific American. 1 December 2019. <https://www.scientificamerican.com/article/gps-is-easy-to-hack-and-the-u-s-has-no-backup/>
- 36 Ross, M. and Vedda, J.A. 2018. "The Policy and Science of Rocket Emissions". Center for Space Policy and Strategy. 31 March 2018. [https://aerospace.org/sites/default/files/2018-05/RocketEmissions\\_0.pdf](https://aerospace.org/sites/default/files/2018-05/RocketEmissions_0.pdf)
- 37 David, L. 2021. "Space solar power's time may finally be coming". Space.com. 3 November 2021. <https://www.space.com/space-solar-power-research-advances>
- 38 UNOOSA (United Nations Office for Outer Space Affairs). <https://www.unoosa.org/oosa/en/ourwork/space-agencies.html>, accessed 15 December 2021
- 39 Khodairy, S., Sharaf, M., Awad, M., Hamed, R.A. and Hussein, M. 2020. "Impact of solar activity on Low Earth Orbiting satellites". Journal of Physics: Conference Series 1523 (1): 012010. IOP Publishing. <https://iopscience.iop.org/article/10.1088/1742-6596/1523/1/012010/pdf>
- 40 Szkutak, R. 2021. "The billionaire space race launches a new venture capital solar system". Forbes. 16 September 2021. <https://www.forbes.com/sites/rebeccaszkutak/2021/09/16/the-billionaire-space-race-launches-a-new-venture-capital-solar-system/?sh=74f837e7482e>

# Refreshing Resilience

COVID-19 Lessons for a Whole-of-Society Response

67.2%

COVID-19-vaccinated population in high-income countries

20-40×

increase in number of daily COVID-19 cases between peak and trough

2.1 million

maximum estimated excess deaths in Africa by 2021



## Adaptive resilience to the pandemic at the national level

The 2021 *Global Risks Report* closed with a reflection on the extent to which shortcomings in the pandemic response could be attributed to long-standing complacencies, the novel and specific complexities of COVID-19, the volatile and divisive (geo)political environment or simple mismanagement. This chapter takes stock of national response strategies implemented in the second year of the pandemic, and then reflects on collaborative opportunities within countries to improve preparedness for future crises and organizational resilience.

During 2020, national governments sought to protect lives and livelihoods against a novel virus that was resulting in a significant mortality rate—with the backdrop of significant shortcomings in

national and global preparedness. In 2021, as the virus evolved more contagious variants, governments sought to deploy new responses, in alignment with measures developed the previous year, to return to societal and economic normalcy. Most countries experienced several surges during the year, with the number of daily cases characterized by exponential growth and a 20- to 40-fold increase between peak and trough (see Figure 6.1). By this measure, most countries presented both success stories and cautionary tales at different times.

**Most countries saw both success stories and cautionary tales at different times**

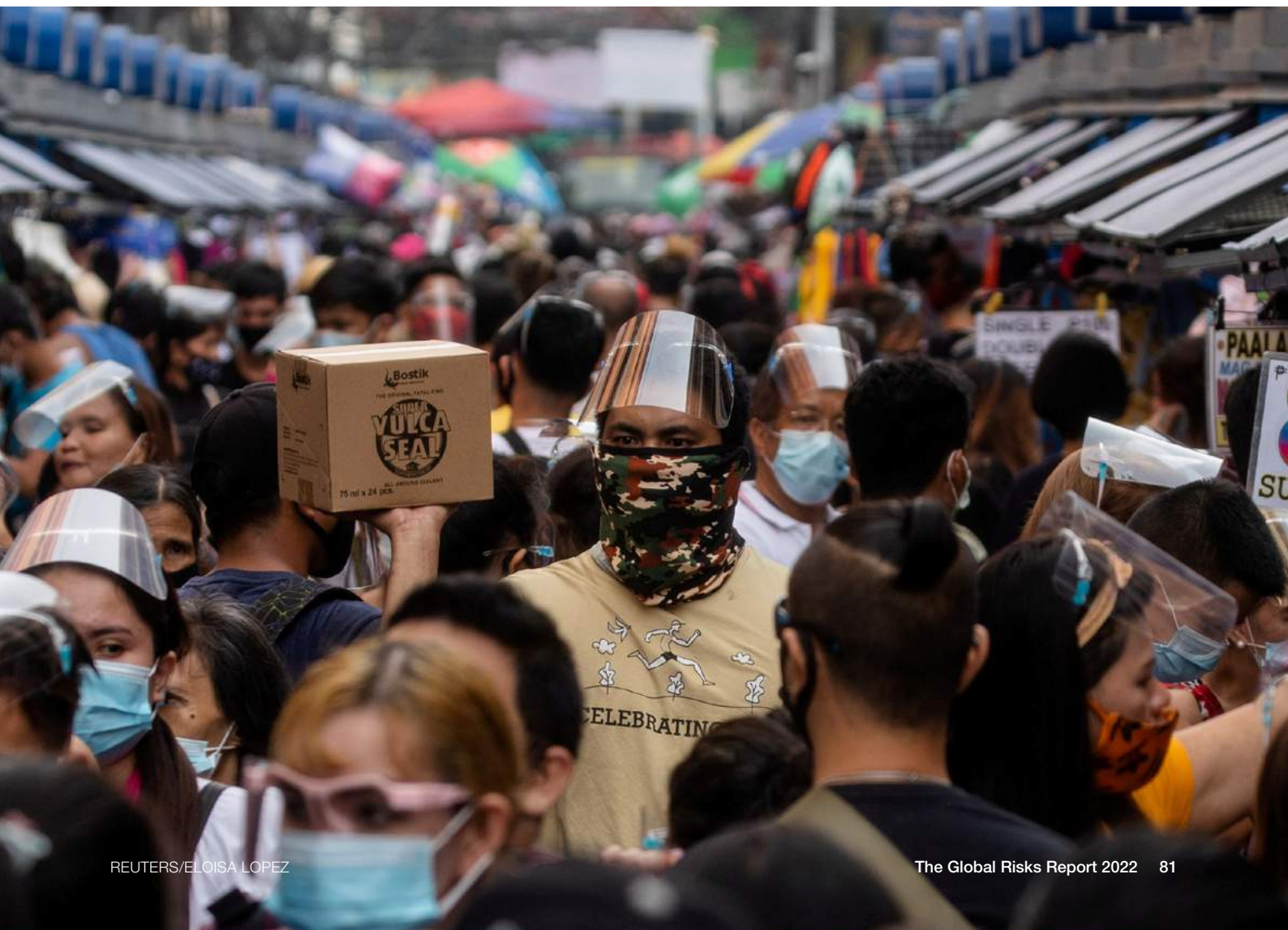
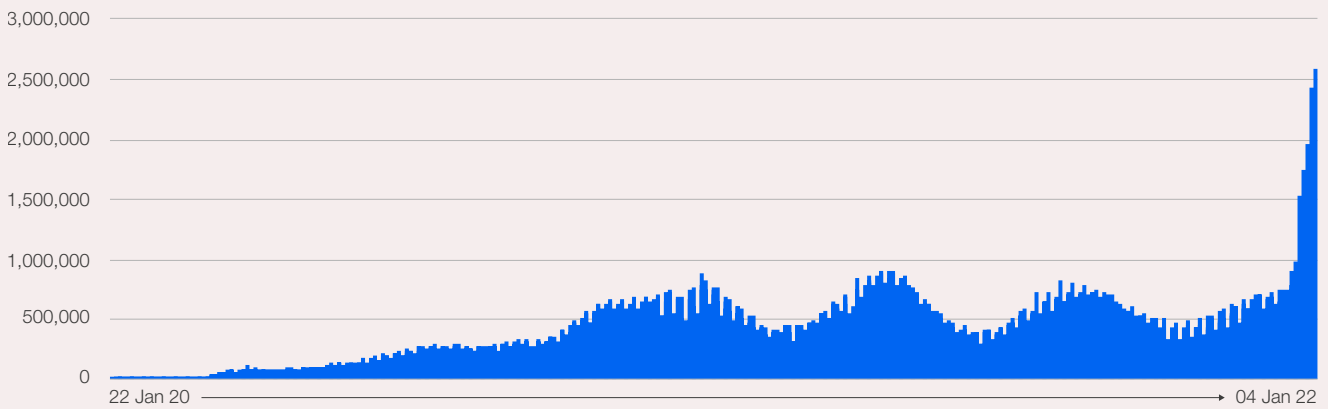


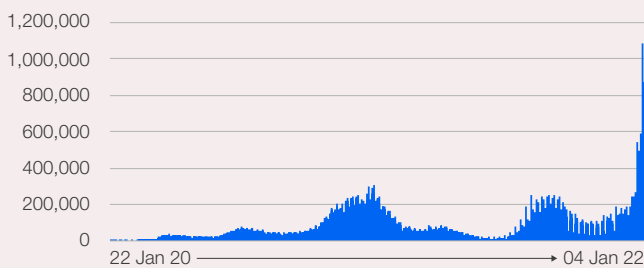
FIGURE 6.1

## COVID-19 Daily New Cases: Global and Top Six Countries by Infections

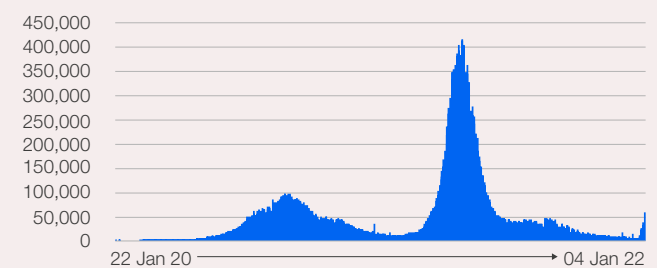
### Global



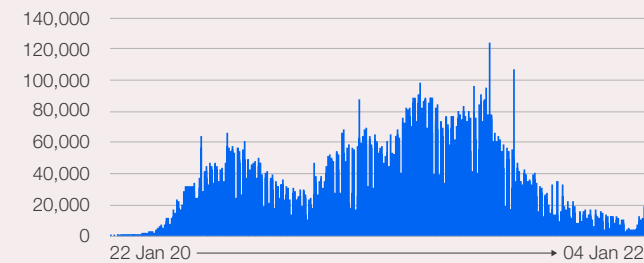
### United States



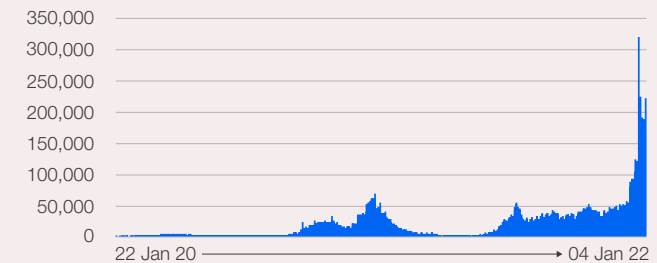
### India



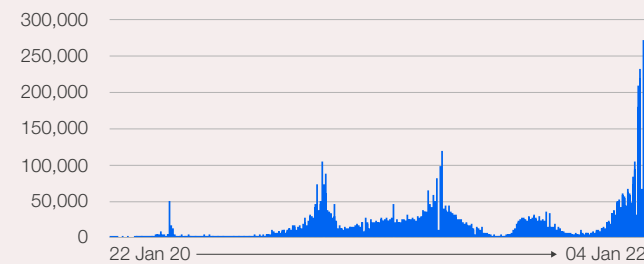
### Brazil



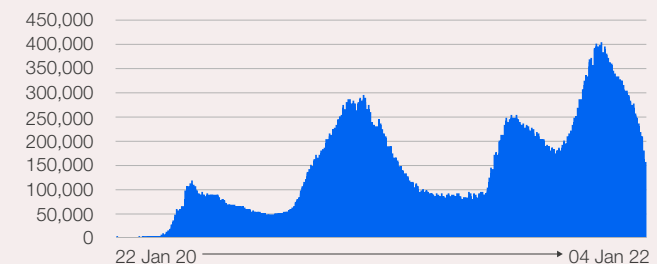
### United Kingdom



### France



### Russia



Source: Worldometer. Covid-19 Coronavirus Pandemic – “Daily new cases”. <https://www.worldometers.info/coronavirus/>, accessed 5 January 2022.

Two interlinked factors have proved critical for the effective national management of the pandemic: first, governments’ readiness to adjust response strategies according

to changing circumstances; and second, their ability to maintain societal trust and compliance through principles-based decisions and effective communications.

## Flexible response strategies

In general, effective national responses were characterized by a holistic view of societal well-being, multi-pronged approaches to transmission control and health system protection, robust coordination of policy and process, reliable logistics and the deployment of new interventions and increasingly granular and real-time data where available. Countries such as Chile and Finland were better able to manage peak periods than those with less well-rounded approaches.<sup>1</sup> They achieved this via cross-departmental policy agendas; expanded networks of community health workers; key health worker protections; a range of individually imperfect but collectively effective transmission control measures such as testing, tracing, and isolating; digital healthcare technologies; and early investment in anticipation of future needs.

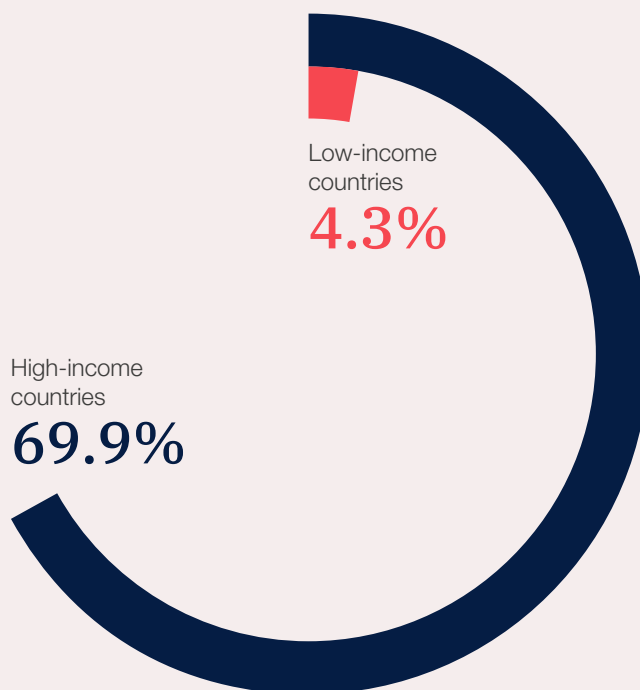
Critical for many countries was the establishment of well-judged policy transitions between enabling social interaction and economic activity when possible and returning, when needed, to the kind of mobility constraints that were default strategies in the early stages of the crisis. Rapid and wholesale easing of constraints on social and economic activity often resulted in a steep rise in case numbers, although the impact on health systems and mortality was often mitigated by high vaccination rates. Some countries that had prided themselves on very low case numbers for a long time found it hard to acknowledge or pivot when that was no longer the best indicator to measure the state of the pandemic.<sup>2</sup> The Omicron variant, with its higher infectiousness, will moreover force governments to revisit the balance between sustaining economic activity and limiting spread. Some are choosing to minimize disruptions in light of the virus' evidently milder threat, although they must be prepared to reinstate restrictions as necessary given that healthcare systems remain at risk of collapse.<sup>3</sup>

The arrival of effective vaccines and antiviral treatments changed the game in terms of managing the impact of the virus

on citizens' health and national health systems, enabling greater latitude in other policies.<sup>4</sup> Mass deployment of affordable rapid tests also helped people move and mingle again while mitigating transmission risk. However, although a range of vaccines was technically available from early in the year, differing negotiating powers, contracting approaches and approval regimes had a strong impact on programme rollout timetables. Many high-income countries had privileged access to vaccines: by early December 2021, all but three Organisation for Economic Co-operation and Development (OECD) countries had double-vaccinated at least 50% of their populations.<sup>5</sup> Some middle-income countries had also achieved high levels of vaccination: for example, the 79% vaccination rate in Malaysia was largely due to effective distribution,<sup>6</sup> while Brazil's 65% was attributed to strong vaccine enthusiasm.<sup>7</sup>

FIGURE 6.2

### Percentage of the Population Who Are Fully Vaccinated



Source: ONE. 2021. "Data dive: The astoundingly unequal vaccine rollout". January 2022.



REUTERS/ELOISA LOPEZ

The lowest vaccination rates were mostly found in low-income countries (see Figure 6.2), especially in Africa, that had to rely on “vaccine diplomacy” initiatives from individual countries and multilateral agreements such as the Covid-19 Vaccines Global Access (COVAX) programme. The latter suffered from low contributions from high-income countries, high levels of bureaucracy, unpredictable supplies, and storage and distribution challenges.<sup>8</sup> Relatively younger populations and “a favorable climate may have blunted the mortality of the virus in these countries, though excess deaths were estimated at between 0–2.1 million in Africa by May 2021,<sup>9</sup> and long Covid may emerge as a longer-term challenge given the large number of non-fatal cases.

In general, successful vaccine rollout programmes struck a balance between speed and robustness, recognizing that perfect was sometimes the enemy of good. Vaccine effectiveness was found to improve following a second dose but waned over time, leading advanced economies to introduce booster jab programmes in which take-up and speed were key priorities.<sup>10</sup> By the latter part of the year, analysis showed that fully vaccinated individuals were less likely to transmit the virus, experience severe or long-haul symptoms, occupy hospital beds or die.<sup>11</sup>

Although global eradication of COVID-19 is no longer a viable option, persistent transmission of SARS-Cov-2 allows the emergence of new variants that are more contagious and may be more virulent and escape immunity conferred by infection or existing vaccines. Hence, the relatively slower vaccine rollouts in middle- and low-income countries, as well as vaccine hesitancy wherever present, remain a continued pandemic risk for all countries and require anticipation of further policy transitions. As and when new variants arise, governments will need to reimpose an appropriate set of control measures.

### Maintaining societal trust

Maintaining societal trust involved galvanizing compliance and cooperation across citizens and the business community through frequent changes of government policy over an extended period. This often proved

**Mass and affordable testing helped people move and mingle while mitigating transmission**

challenging as, during 2021, many citizens became even more weary of lockdowns and obligations such as mask-wearing. In late November, several European countries and Australia experienced riots when governments tightened regimes in the face of ballooning case numbers.<sup>12</sup>

Moreover, in advanced economies with widespread access to vaccines, significant percentages of the adult population remained unvaccinated at the end of 2021 due to misplaced concerns about the risk of the vaccines relative to that of catching the virus, over-confidence in their own natural immunity and adherence to a range of theories that lack scientific basis.<sup>13</sup> In other countries, general distrust of the government has resulted in widespread vaccine hesitancy, with alternative sources of authority, including local opinion and religious leaders, not sufficiently able to help allay fears.<sup>14</sup>

The trust component of managing this crisis has often depended on a balance between imposing constraints or coercions based on science and policies that encourage good behaviour. Communication has needed to steer a narrow course between individual freedoms and collective resilience; indeed, nearly 50% of the World Economic Forum

global risk experts identified this tension as one of the most critical for societies to manage.<sup>15</sup> The challenge will only intensify as the pandemic extends into its third year and the public grows increasingly weary, especially during festive seasons as expectations for unfettered social activity increase.

The faster distribution of testing kits, along with easier self-administration and greater reliability of results, were helpful for enabling social interactions and international mobility. Widespread availability of affordable testing will be crucial as restrictions are increasingly lifted and greater social activity causes demand to outstrip supply, as has already been seen in some countries. However, regarding vaccines, some governments have become concerned that voluntary measures have reached their limits, especially with the arrival of the Omicron variant.<sup>16</sup> Plans for vaccination requirements, with sanctions on employment or mobility for those who continue to resist, will test societal goodwill and compliance as well as government determination in light of divisive politics.<sup>17</sup> Additionally, national resilience strategies for future pandemics may require anticipation of some level of distrust and defiance of restrictions and interventions aimed at protecting vulnerable population segments.



# Preparing national resilience ecosystems for future crises

The COVID-19 crisis repeatedly surprised those charged with anticipating its trajectory and will likely leave further complex problems in its wake. Nor is the pandemic and its response the only challenge that governments, societies and businesses are facing. As the *Global Risks Report* sets out, new crises may lie just over the horizon.

Many critical risks demand a whole-of-society response. This involves not only the engagement of different sectors leading to multiple individual actions, but also more effective interaction between different sectors in ways that are accretive to well-being and prosperity.<sup>18</sup>

Countries must distinguish between different resilience goals to harness their collective capabilities more effectively and navigate the many inevitable trade-offs, as failure to appreciate where agendas are misaligned will limit the traction any solutions can gain. One such goal might be community resilience to potential disasters; another might be reliable critical economic and societal infrastructure; a third might be long-term strategic imperatives such as industrial transformation.<sup>19</sup> Each of these goals requires different strategies, providing a frame for different cross-sectoral interactions.

## Government lens

National risk assessments and resilience strategy reviews should be used to reveal where momentum is insufficient and greater government intervention is needed. It is not desirable or feasible for governments to seek to fill all gaps themselves; instead, they should look to harness the capabilities and energies of other sectors to complement enhanced competencies that ought to lie in the public realm.<sup>20</sup> Strategies should set out what is needed and examine all available levers with fresh eyes. They should identify where governments may need to compel action by others, and where they can exercise power as a

client, stimulate new initiatives, facilitate collaboration or simply act as cheerleader for good practices.

In their interactions with the private sector, governments that are more dirigiste might want to adjust their approaches to models for stockpiling critical goods, requisitioning and procurement in a crisis.<sup>21</sup> All might also seek tougher cybersecurity mandates and set out stronger expectations of stress testing for critical infrastructure.<sup>22</sup> They might seek to bring about a research and development ecosystem for resilience, coordinate crisis management exercises involving public and private sectors and provide a level of backstop for pooled insurance schemes targeted at catastrophic risks.<sup>23</sup>

On three issues, finding a balanced path is critical. First, it is essential to allocate risk in a way that means the taxpayer does not ultimately pay up in every crisis nor do governments sweep risks off the public balance sheet onto the private sector. More transparent, analysis-led discussions about risks and tolerances should spur more equitable, creative solutions about the cost and pricing of risk as well as fiscal and market buffers that might mitigate fallout in the event of crisis.

Second, regulating for resilience must factor in rapid changes in assets, industries and systems; conflicting priorities in regulatory mandates; and enforcement challenges. Arguably, systemically important assets, firms and sub-sectors ought to experience greater oversight to prevent “hidden” assets in digital ecosystems, dominant firms in niche but critical industries and growing segments of certain sectors

**Government should harness capabilities in other sectors to enhance public competencies**

where the plausible near-simultaneous failure of several providers could have negative far-reaching consequences.<sup>24</sup> For regulatory regimes that primarily look out for present-day consumers, long-term resilience should be a central tenet and capability underpinning the development and implementation of major critical infrastructure capital investment plans.<sup>25</sup> Stronger cross-sector regulatory hubs could sharpen debate and help reconcile differing agendas of bodies with separate statutory powers.<sup>26</sup>

Third, data-sharing arrangements must be adjusted in a way that enables both pre-emptive resilience building and sharper crisis management. There are good reasons for constraining some flows of data and intelligence, including national security, commercial confidentiality, antitrust constraints and personal privacy. Acknowledging this, governments may seek to identify crisis circumstances—such as a cybersecurity lapse—in which they should compel critical infrastructure operators to provide data to government bodies. In other situations, such as an earthquake, they might permit, or even encourage, competing firms to share data with each other to ensure strategic supplies for the nation. Prior to crises, governments should consider how to develop more collaborative approaches to scenario and impact analyses, build semi-accessible and proprietary data into resilience analytics and crisis decision-making, and better facilitate

pre-competitive data sharing by companies for innovations that will benefit both participants and the national good.<sup>27</sup>

## Business lens

Many companies have sought to understand how they can contribute to the resilience of the countries in which they operate. They recognize that better national-level preparedness leads to shock events having smaller impacts on the economy and stability of government policy, creating a better environment in which to plan, invest and execute.

Opportunities fall into four groups. First, large firms already look intensively at business interruption risks across supply chains, managed service providers, utilities and customers with a view to softening the impact of bottlenecks and outages; smaller firms could do the same with a lighter touch.<sup>28</sup> Second, nationally important companies worked with each other where permitted during the pandemic; more broadly scoped codes of conduct could set out best-practice behaviours per industry for future crises.<sup>29</sup> Third, the pandemic spurred companies to look harder at the resilience of their workforces and the communities in which they are located; large employers could build a resilience dimension into health and benefits offerings.<sup>30</sup> Fourth, some firms have been seeking to take a more





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active role in addressing large-scale public policy challenges that affect their business but cannot be resolved by government alone; more of that effort could be directly positioned in support of public goods.<sup>31</sup>

While public funds have traditionally directed resilience efforts, there is a growing imperative for businesses to take up the mantle of driving innovation in order to reduce blind spots and counter stovepiping tendencies within government. Greater private sector participation in strategic forums can allow experts and practitioners to contribute to and challenge government agendas. Dynamic cross-sectoral interactions around priorities, policies and operating practices can also help uncover efficient and efficacious solutions as well as generate broader traction for fresh initiatives.<sup>32</sup>

## Community lens

Both the pandemic and extreme weather events have highlighted areas where central governments and local bodies can combine more effectively. Failure to join up policy agendas across national government departments can have devastating impacts at the local level, where crises play out and disconnects are exposed. Similarly, “air gaps” between central and local governments—often due to struggles for authority or weaknesses in liaison networks—have compromised data flows, the effectiveness of initiatives and local trust.<sup>33</sup> Improved communication processes, better devolution of decision-

## Better national preparedness creates a better environment to invest

making authorities, stronger coordination of on-the-ground efforts between central government specialist agencies and local administrations and better capacity-building at local and national levels would go a long way in supporting resilience.

There is scope for central and local governments to do more to support resilience efforts at the community level, often in partnership with non-governmental organizations and businesses. Local resilience forums can galvanize communities to provide detailed intelligence on situational vulnerabilities and likely impacts of key risks, helping to prioritize resilience measures. Enhancing awareness and participation, empowering local actors and building capabilities are vital for the cultural shift that is essential for sustaining resilience programmes over the long term.

There are multiple opportunities to enrich interfaces between academic communities and government agendas at local, national and international levels, especially for the provision of expertise and evidence on matters of science and technology.<sup>34</sup> Collaborative exploration of risk and resilience issues—before, during and after a crisis—would benefit from stronger, more flexible communication channels and higher levels of trust (see Box 6.1).



## From Insights to Practice

Based on the challenges of the past year, the World Economic Forum has worked with two of its principal risk communities, the Chief Risk Officers Community and the Global Future Council on Frontier Risks, to identify five practical lessons to improve organizational practice for resilience:

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### 1. Ground analyses in delivery requirements.

It is often useful to start not with specific risks but with the types of failure, damage and attrition that could compromise core business goals. Working back from these undesirable outcomes makes for a more open assessment of current practices and a better appreciation of the capabilities, levers, tools and processes that might need to be introduced, deployed, redesigned or enhanced.

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### 2. Appreciate vulnerabilities within the broader ecosystem.

As well as examining the critical assets and operations they control, organizations should look at the broader ecosystem in which they operate. They should examine their resilience to shortfalls, outages and delays of the third-party assets and services on which they depend, and the tolerances of those who depend on them.

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### 3. Embrace a diversity of resilience strategies.

Some possible crises can be mitigated by placing more emphasis on just-in-case reliability than on just-in-time efficiency. Others may be best served by implementing back-ups and redundancies, adjusting operational processes, or ensuring that the organization can move quickly and adapt in order to maintain business continuity. Supportive employee behaviours are as vital as structural measures, especially when empowered by good leadership and effective communication.

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### 4. Connect resilience efforts with other goals.

Many organizational environmental, social and governance (ESG) goals are shared with a broad-based resilience platform and would benefit from improved alignment. For example, shortening supply chains can advance net zero strategies as well as reduce exposure to adverse geoeconomic developments, while strong community relations may help recovery initiatives in the event of a disaster.

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### 5. Consider resilience to be a journey not a destination.

Organizations with leading resilience programmes learn from stress-testing exercises and actual crises to emerge stronger, more supple and better prepared. They are alert to changing circumstances that may demonstrate elevated risks, vigilant in challenging themselves about blind spots and shortcomings that require additional action and eager to adapt response strategies to better achieve critical goals.

# Endnotes

- 1 Bloomberg. 2021. "The Best and Worst Places to Be as Winter Meets Omicron". 30 November 2021. <https://www.bloomberg.com/graphics/covid-resilience-ranking/>
- 2 Tan, Y. 2021. "What went wrong in Singapore and Taiwan?" BBC News. 20 May 2021. <https://www.bbc.com/news/world-asia-57153195>
- 3 The Guardian. 2021. "WHO warns Omicron could overwhelm health systems as cases rise to record highs in Europe". 29 December 2021. <https://www.theguardian.com/world/2021/dec/29/who-warns-omicron-could-overwhelm-health-systems-as-cases-rise-to-record-highs-in-europe>
- 4 Crow, D. 2021. "How mRNA became a vaccine game-changer". Financial Times. 13 May 2021. <https://www.ft.com/content/b2978026-4bc2-439c-a561-a1972eeba940>
- 5 Our World in Data. Share of the population fully vaccinated against COVID-19. <https://github.com/owid/covid-19-data/tree/master/public/data>, accessed 15 December 2021.
- 6 Kurlantzick, J. 2021. "Lessons ASEAN could learn from Malaysia's pandemic success". The Japan Times. 5 November 2021. <https://www.japantimes.co.jp/opinion/2021/11/05/commentary/world-commentary/malaysias-pandemic-success/>
- 7 Freelon, K. 2021. "In Brazil's successful vaccine campaign, a lesson for the U.S." Undark Magazine. 14 October 2021. <https://undark.org/2021/10/14/in-brazil-successful-vaccine-campaign-lesson-for-us/>
- 8 Fleming, S., Mancini, P.D. and Pilling, D. 2021. "'Erratic' European Covid vaccine donations hamper African jabs rollout". Financial Times. 9 December 2021. <https://www.ft.com/content/d0b53ea4-5eef-4bc7-814c-a69b0dfa1c06>
- 9 The Economist. 2021. "There have been 7m-13m excess deaths worldwide during the pandemic". The Economist. 15 May 2021. <https://www.economist.com/briefing/2021/05/15/there-have-been-7m-13m-excess-deaths-worldwide-during-the-pandemic>
- 10 Stieg, C. 2021. "New data says you should get a Covid vaccine booster shot as soon as you're eligible — here's why". CNBC. 10 November 2021. <https://www.cnbc.com/2021/11/10/why-young-healthy-people-should-get-covid-vaccine-booster-shots.html>
- 11 Aravindan, A and Lin, C. 2021. "Vaccinated people make up 75% of recent COVID-19 cases in Singapore, but few fall ill". Reuters. 23 July 2021. <https://www.reuters.com/world/asia-pacific/vaccinated-people-singapore-make-up-three-quarters-recent-covid-19-cases-2021-07-23/>; Mathieu, E. and Roser, M. 2021. "How do death rates from COVID-19 differ between people who are vaccinated and those who are not?" Our World in Data. 23 November 2021; updated 10 December 2021. <https://ourworldindata.org/covid-deaths-by-vaccination>
- 12 DW. 2021. "COVID curbs spark protests worldwide". Deutsche Welle. 21 November 2021. <https://www.dw.com/en/covid-curbs-spark-protests-worldwide/a-59892484>
- 13 See, e.g., Thompson, D. 2021. "Millions are saying no to the vaccines. What are they thinking?" The Atlantic. 4 May 2021. <https://www.theatlantic.com/ideas/archive/2021/05/the-people-who-wont-get-the-vaccine/618765/>; Calonzo, A. and Tan, K. 2021. "Anti-Vaxxer Propaganda Spreads in Asia, Endangering Millions". Bloomberg. 1 July 2021. <https://www.bloomberg.com/news/articles/2021-06-30/anti-vaxxer-disinformation-spreads-in-asia-endangering-millions>
- 14 Hartwig, R. and Hoffmann, L. 2021. Challenging Trust in Government: COVID in Sub-Saharan Africa. GIGA Focus Afrika. <https://www.giga-hamburg.de/en/publications/25196662-challenging-trust-government-covid-saharan-afrika/>
- 15 The World Economic Forum Chief Risk Officers Community and Global Future Council on Frontier Risks were asked which tension was most critical in achieving strong resilience in societies. In addition to "individual rights v. collective resilience", other selected tensions included "cost optimization v. risk exposure" (22%), "government overreach v. expectation management" (11%), "public v. private protocols in a crisis" (11%), and "use of emergency powers v. market evolution" (4%).
- 16 Onishi, N. and Casey, N. 2021. "Crack Down Hard, or Wait and See? Europe Splits on Omicron Response". The New York Times. 20 December 2021. <https://www.nytimes.com/2021/12/20/world/europe/europe-divided-omicron-response.html>
- 17 Fleming, S. and Chazan, G. 2021. "Von der Leyen calls for EU 'discussion' on mandatory vaccination". Financial Times. 1 December 2021. <https://www.ft.com/content/3e96d309-0283-4a33-9fc0-2bc5de22cb5f>; Henley, J. 2021. "Germany: Mandatory Covid jabs a step closer as unvaccinated face lockdown". The Guardian. 2 December 2021. <https://www.theguardian.com/world/2021/dec/02/germany-could-make-covid-vaccination-mandatory-says-merkel>; Shear, M. D. and Scheiber, N. 2021. "Biden tests limits of presidential power in pushing vaccinations". New York Times. 4 November 2021. <https://www.nytimes.com/2021/09/10/us/politics/biden-vaccines.html>
- 18 OECD (Organisation for Economic Co-operation and Development). 2014. Recommendation of the Council on the Governance of Critical Risks. <https://www.oecd.org/gov/risk/recommendation-on-governance-of-critical-risks.htm>
- 19 Smith-Bingham, R. 2021. Partnering with purpose: Strengthening national-level resilience in the UK through more dynamic public-private interactions. National Preparedness Commission & Marsh McLennan. [https://www.marshmclennan.com/content/dam/mmc-web/insights/publications/2021/november/Marsh\\_McLennan-National\\_Preparedness\\_Commission\\_Partnership-with-Purpose\\_vF.pdf](https://www.marshmclennan.com/content/dam/mmc-web/insights/publications/2021/november/Marsh_McLennan-National_Preparedness_Commission_Partnership-with-Purpose_vF.pdf)
- 20 OECD. 2018. Assessing Global Progress in the Governance of Critical Risks. OECD Reviews of Risk Management Policies. <https://doi.org/10.1787/9789264309272-en>
- 21 OECD. 2020. Stocktaking report on immediate public procurement and infrastructure responses to COVID-19. Updated 24 June. <https://www.oecd.org/coronavirus/policy-responses/stocktaking-report-on-immediate-public-procurement-and-infrastructure-responses-to-covid-19-248d0646/#section-d1e2236>
- 22 Caminiti, S. 2021. "What cybersecurity leaders say they need from the federal government". CNBC. 25 August 2021. <https://www.cnbc.com/2021/08/25/what-cybersecurity-leaders-say-they-need-from-the-federal-government.html>
- 23 EIOPA (European Insurance and Occupational Pensions Authority). 2021. "EIOPA staff paper on measures to improve the insurability of business interruption risk in light of pandemics". Luxembourg: Publications Office of the European Union. <https://www.eiopa.europa.eu/sites/default/files/publications/eiopa-staff-paper-on-measures-to-improve-insurability.pdf>

- 24 Smith-Bingham, R. 2021. Op. Cit
- 25 OECD. 2021. Building Resilience: New Strategies for Strengthening Infrastructure Resilience and Maintenance. <https://www.oecd.org/g20/topics/infrastructure/Building-Infrastructure-Resilience-OECD-Report.pdf>
- 26 Financial Services Regulatory Initiatives Forum. 2021. Regulatory Initiatives Grid. November 2021. <https://www.fca.org.uk/publication/corporate/regulatory-intitiatives-grid-november-2021.pdf>
- 27 World Economic Forum. 2021. "Data-Driven Economies: Foundations for Our Common Future". White Paper. April 2021. [https://www3.weforum.org/docs/WEF\\_WP\\_DCPI\\_2021.pdf](https://www3.weforum.org/docs/WEF_WP_DCPI_2021.pdf)
- 28 Asseri, A. H., Abilkasimov, M., Frio, D. and Beato, F. 2021. "Managing third-party risks? Here's how a holistic approach can help". World Economic Forum Agenda. 30 September 2021. <https://www.weforum.org/agenda/2021/09/managing-third-party-risks-heres-how-a-holistic-approach-can-help/>
- 29 MedTech Europe. 2020. "MedTech Europe Code Guidance on COVID-19 Emergency Support". 27 March 2020. [https://www.medtecheurope.org/wp-content/uploads/2020/03/MTE\\_code\\_guidance\\_compliance\\_covid19.pdf](https://www.medtecheurope.org/wp-content/uploads/2020/03/MTE_code_guidance_compliance_covid19.pdf)
- 30 Hariharan, K., Rudoy, J. and Friedman, L. 2021. "How businesses can improve the health of societies". BRINK. 13 July 2021. <https://www.brinknews.com/how-businesses-can-improve-the-health-of-societies/>
- 31 Rosenberg, S. and Fried, I. 2021. "The government-industry cyberdefense dance". Axios. 26 August 2021. <https://www.axios.com/cybersecurity-summit-biden-government-industry-e8185e32-0346-40e5-af4f-6cd79f93cbb9.html>
- 32 See, e.g., Zurich Insurance Group. 2021. "The Zurich Flood Resilience Alliance". <https://floodresilience.net/zurich-flood-resilience-alliance/>
- 33 Dilanian, K. and De Luce, D. 2020. "Trump administration's lack of a unified coronavirus strategy will cost lives, say a dozen experts". NBC News. 3 April 2020. <https://www.nbcnews.com/politics/donald-trump/trump-administration-s-lack-unified-coronavirus-strategy-will-cost-lives-n1175126>
- 34 Rojas, C.R., Richards, C. and Rhodes, C. 2021. Pathways to Linking Science and Policy in the Field of Global Risk. Centre for the Study of Existential Risk. University of Cambridge. 23 April 2021. <https://www.cser.ac.uk/news/new-report-pathways-linking-science-and-policy-fie/>



# Appendices

# Descriptions of Global Risks 2022

## Global Risks

A “global risk” is the possibility of the occurrence of an event or condition that, if it occurs, could cause significant negative impact for several countries or industries. For the purposes of this report, the scope is over the next 10 years.

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

	Global Risk	Description
Economic	<b>Asset bubble bursts</b> in large economies	Prices for housing, investment funds, shares and other assets in a large economy increasingly disconnect from the real economy
	<b>Collapse</b> of a systemically important <b>industry</b>	Collapse of a systemically important global industry or firm with an impact on the global economy, financial markets and/or society
	<b>Debt crises</b> in large economies	Corporate and/or public finances overwhelmed by debt accumulation and/or debt servicing in large economies, resulting in mass bankruptcies, defaults, insolvency, liquidity crises or sovereign debt crises
	Failure to <b>stabilize price</b> trajectories	Inability to control an unmanageable increase (inflation) or decrease (deflation) in the general price level of goods and services
	Proliferation of <b>illicit economic activity</b>	Global proliferation of informal and/or illegal activities that undermine economic advancement and growth: counterfeiting, illicit financial flows, illicit trade, tax evasion, human trafficking, organized crime etc.
	<b>Prolonged economic stagnation</b>	Near-zero or slow global growth lasting for many years
	Severe <b>commodity shocks</b>	Abrupt shocks to the supply and demand of systemically important commodities at a global scale that strain corporate, public and/or household budgets: chemicals, emissions, energy, foods, metals, minerals etc.
Environmental	<b>Biodiversity loss</b> and ecosystem collapse	Irreversible consequences for the environment, humankind, and economic activity, and a permanent destruction of natural capital, as a result of species extinction and/or reduction
	<b>Climate action failure</b>	Failure of governments and businesses to enforce, enact or invest in effective climate-change adaptation and mitigation measures, preserve ecosystems, protect populations and transition to a carbon-neutral economy
	<b>Extreme weather events</b>	Loss of human life, damage to ecosystems, destruction of property and/or financial loss at a global scale as a result of extreme weather events: cold fronts, fires, floods, heat waves, windstorms etc.
	<b>Human-made environmental damage</b>	Loss of human life, financial loss and/or damage to ecosystems as a result of human activity and/or failure to co-exist with animal ecosystems: deregulation of protected areas, industrial accidents, oil spills, radioactive contamination, wildlife trade etc.
	Major <b>geophysical disasters</b>	Loss of human life, financial loss and/or damage to ecosystems as a result of geophysical disasters: earthquakes, landslides, geomagnetic storms, tsunamis, volcanic activity etc.
	<b>Natural resource crises</b>	Chemical, food, mineral, water or other natural resource crises at a global scale as a result of human overexploitation and/or mismanagement of critical natural resources

Geopolitical	<b>Collapse of a multilateral institution</b>	Dissolution of a global multilateral institution established to resolve economic, environmental, geopolitical and/or humanitarian crises with regional or global implications: border disputes, environmental commitments, migration crises, health emergencies, trade disputes etc.
	<b>Fracture of interstate relations</b>	Economic, political and/or technological rivalries between geopolitical powers resulting in a fracture of bilateral relations and/or growing tensions
	<b>Geoeconomic confrontations</b>	Deployment of economic levers, including investment controls, trade controls, non-tariff barriers and/or currency measures, by global or regional powers to decouple economic interactions between nations and consolidate spheres of influence
	<b>Geopolitical contestation of strategic resources</b>	Concentration, exploitation and/or mobility restriction by a state of goods, knowledge, services or technology critical to human development with the intent of gaining geopolitical advantage
	<b>Interstate conflict</b>	Belligerent bilateral or multilateral conflict between states with global consequences: biological, chemical, cyber and/or physical attacks, military interventions, proxy wars etc.
	<b>State collapse</b>	Collapse of a state with global geopolitical importance as a result of internal conflict, breakdown of rule of law, erosion of institutions, military coup, regional or global instability
	<b>Terrorist attacks</b>	Large-scale, scattered or isolated terrorist attacks carried out by individuals or non-state groups with ideological, political or religious goals, resulting in loss of life, severe injury and/or material damage
	<b>Weapons of mass destruction</b>	Deployment of biological, chemical, cyber, nuclear or radiological weapons, resulting in loss of life, destruction and/or international crises
Societal	<b>Collapse or lack of social security systems</b>	Non-existence or widespread bankruptcy of social security systems and/or erosion of social security benefits: disability, elderly, family, injury, maternity, medical care, sickness, survivor, unemployment etc.
	<b>Employment and livelihood crises</b>	Structural deterioration of work prospects and/or standards for the working-age population: unemployment, underemployment, lower wages, fragile contracts, erosion of worker rights etc.
	<b>Erosion of social cohesion</b>	Loss of social capital and a fracture of social networks negatively impacting social stability, individual well-being and economic productivity as a result of persistent public anger, distrust, divisiveness, lack of empathy, marginalization of minorities, political polarization etc.
	<b>Failure of public infrastructure</b>	Unequitable and/or insufficient public infrastructure and services as a result of mismanaged urban sprawl, poor planning and/or under-investment, negatively impacting economic advancement, education, housing, public health, social inclusion and the environment
	<b>Infectious diseases</b>	Massive and rapid spread of viruses, parasites, fungi or bacteria that cause an uncontrolled contagion of infectious diseases, resulting in an epidemic or pandemic with loss of life and economic disruption
	<b>Large-scale involuntary migration</b>	Large-scale involuntary migration induced by climate change, discrimination, lack of economic advancement opportunities, persecution, natural or human-made disasters, violent conflict etc.
	<b>Pervasive backlash against science</b>	Censure, denial and/or scepticism towards scientific evidence and the scientific community at a global scale, resulting in a regression or stalling of progress on climate action, human health and/or technological innovation
	<b>Pollution-driven harms to human health</b>	Physical and mental health impacts from harmful chemical or other particulates in the air, water or food, which may stem from energy generation, industrial and agricultural practices, waste management failures, natural disasters, human behaviour and other sources
	<b>Severe mental health deterioration</b>	Pervasiveness of mental health ailments and/or disorders globally and across multiple demographics, negatively impacting well-being, social cohesion and productivity: anxiety, dementia, depression, loneliness, stress etc.
	<b>Widespread youth disillusionment</b>	Youth disengagement, lack of confidence and/or loss of trust of existing economic, political and social structures at a global scale, negatively impacting social stability, individual well-being and economic productivity

Technological	<b>Adverse outcomes of technological advances</b>	Intended or unintended negative consequences of technological advances on individuals, businesses, ecosystems and/or economies: AI, brain-computer interfaces, biotechnology, geo-engineering, quantum computing etc.
	<b>Breakdown of critical information infrastructure</b>	Deterioration, saturation or shutdown of critical physical and digital infrastructure or services as a result of a systemic dependency on cyber networks and/or technology: AI-intensive systems, internet, hand-held devices, public utilities, satellites etc.
	<b>Digital inequality</b>	Fractured and/or unequal access to critical digital networks and technology, between and within countries, as a result of unequal investment capabilities, lack of necessary skills in the workforce, insufficient purchase power, government restrictions and/or cultural differences
	<b>Digital power concentration</b>	Concentration of critical digital assets, capabilities and/or knowledge by a reduced number of individuals, businesses or states, resulting in discretionary pricing mechanisms, lack of impartial oversight, unequal private and/or public access etc.
	<b>Failure of cybersecurity measures</b>	Business, government and household cybersecurity infrastructure and/or measures are outstripped or rendered obsolete by increasingly sophisticated and frequent cybercrimes, resulting in economic disruption, financial loss, geopolitical tensions and/or social instability
	<b>Failure of technology governance</b>	Lack of globally accepted frameworks, institutions or regulations for the use of critical digital networks and technology, as a result of different states or groups of states adopting incompatible digital infrastructure, protocols and/or standards

## APPENDIX B

# Executive Opinion Survey: National Risk Perceptions

Table B.1 presents the top five risks for each of the 124 economies surveyed by the World Economic Forum’s Executive Opinion Survey (EOS) between May and September 2021. Over 12,000 leaders answered the following question: “What five risks will pose a critical threat to your country in the next two years?” and were asked to select these from a list of 35 risks, with no particular order. “Risk 1” indicates the most frequently selected risk in each economy. Where there is a tie, the tied risks are presented alphabetically in the same cell, separated by a dotted line (“---”) and the next cell in the row contains an ellipsis (“...”). For example, in Armenia, two risks (“human-made environmental damage” and “large-scale involuntary migration”) are tied for third place and there is therefore no risk in fourth place.

The question posed to EOS respondents is comparable to the following question asked to GRPS respondents: “Please identify your top five global risks of concern [that will become a critical threat to the world] over the next 0–2 years”. The list of 35 risks to select from in the EOS is also comparable to the list of risks in the Global Risks Perception Survey (GRPS), except for two new risks that were added to the GRPS after the EOS was conducted—“geoeconomic confrontations” and “pollution-driven harms to human health”—and one risk that changed name from “geopolitization of strategic resources” in the EOS to “geopolitical contestation of strategic resources” in the GRPS (see Appendix C, Global Risks Perception Survey Technical Notes).

TABLE B.1

## Top Five Risks Identified by the Executive Opinion Survey

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>Albania</b>	Fracture of interstate relations	Human-made environmental damage	Failure of cybersecurity measures	Debt crises in large economies	Infectious diseases
<b>Angola</b>	Employment and livelihood crises	Prolonged economic stagnation	Human-made environmental damage	State collapse	Widespread youth disillusionment
<b>Argentina</b>	Prolonged economic stagnation	Employment and livelihood crises	State collapse	Failure to stabilize price trajectories	Digital inequality
<b>Armenia</b>	Interstate conflict	Prolonged economic stagnation	Human-made environmental damage --- Large-scale involuntary migration	...	Failure of cybersecurity measures --- Fracture of interstate relations
<b>Australia</b>	Failure of cybersecurity measures	Extreme weather events	Climate action failure	Infectious diseases	Debt crises in large economies



Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>Austria</b>	Climate action failure	Erosion of social cohesion	Debt crises in large economies	Digital power concentration	Prolonged economic stagnation Extreme weather events
<b>Azerbaijan</b>	Natural resource crises	Asset bubble bursts in large economies	Debt crises in large economies	Climate action failure Collapse of a multilateral institution Human-made environmental damage Infectious diseases	...
<b>Bahrain</b>	Prolonged economic stagnation	Debt crises in large economies Failure of cybersecurity measures	...	Infectious diseases	Employment and livelihood crises
<b>Bangladesh</b>	Employment and livelihood crises	Digital inequality Geopolitization of strategic resources	...	Human-made environmental damage	Climate action failure Failure of cybersecurity measures
<b>Barbados</b>	Extreme weather events	Prolonged economic stagnation	Employment and livelihood crises	Collapse of a systemically important industry	Climate action failure Infectious diseases
<b>Belgium</b>	Climate action failure	Debt crises in large economies	Extreme weather events	Asset bubble bursts in large economies Fracture of interstate relations	...
<b>Benin</b>	Proliferation of illicit economic activity	Failure to stabilize price trajectories	Severe commodity shocks	Pervasive backlash against science	Erosion of social cohesion
<b>Bolivia</b>	Employment and livelihood crises	Proliferation of illicit economic activity	Digital inequality Human-made environmental damage	...	State collapse

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>Bosnia and Herzegovina</b>	Human-made environmental damage	...	Employment and livelihood crises	Digital inequality	...
	Prolonged economic stagnation			Widespread youth disillusionment	
<b>Botswana</b>	Employment and livelihood crises	Collapse or lack of social security systems	Prolonged economic stagnation	Widespread youth disillusionment	Debt crises in large economies
<b>Brazil</b>	Prolonged economic stagnation	Employment and livelihood crises	Digital inequality	Human-made environmental damage	Geopolitization of strategic resources
<b>Brunei Darussalam</b>	Employment and livelihood crises	Prolonged economic stagnation	Failure of technology governance	Human-made environmental damage	Failure of cybersecurity measures
<b>Bulgaria</b>	Human-made environmental damage	Infectious diseases	Interstate conflict	Debt crises in large economies	...
				Employment and livelihood crises	
<b>Cambodia</b>	Human-made environmental damage	Prolonged economic stagnation	Adverse outcomes of technological advances	...	Biodiversity loss and ecosystem collapse
			Infectious diseases		Debt crises in large economies
<b>Cameroon</b>	Employment and livelihood crises	Terrorist attacks	Debt crises in large economies	Human-made environmental damage	Natural resource crises
<b>Canada</b>	Debt crises in large economies	Climate action failure	Extreme weather events	Employment and livelihood crises	Infectious diseases
<b>Cape Verde</b>	Employment and livelihood crises	Prolonged economic stagnation	Human-made environmental damage	Debt crises in large economies	Biodiversity loss and ecosystem collapse
					Failure of cybersecurity measures
<b>Chad</b>	Debt crises in large economies	Employment and livelihood crises	Breakdown of critical information infrastructure	Terrorist attacks	Human-made environmental damage
<b>Chile</b>	Prolonged economic stagnation	Erosion of social cohesion	Collapse or lack of social security systems	State collapse	Extreme weather events

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>China</b>	Extreme weather events	Asset bubble bursts in large economies	Infectious diseases	Collapse or lack of social security systems	Geopolitization of strategic resources
<b>Colombia</b>	Employment and livelihood crises	Human-made environmental damage	Prolonged economic stagnation	State collapse	Proliferation of illicit economic activity
<b>Congo</b>	Employment and livelihood crises	...	Biodiversity loss and ecosystem collapse	...	Interstate conflict
	Human-made environmental damage		Digital inequality		State collapse
<b>Costa Rica</b>	Prolonged economic stagnation	Employment and livelihood crises	Digital inequality	State collapse	Debt crises in large economies Extreme weather events
<b>Côte d'Ivoire</b>	Terrorist attacks	Debt crises in large economies	Failure to stabilize price trajectories	Employment and livelihood crises	Human-made environmental damage
<b>Croatia</b>	Prolonged economic stagnation	Geopolitization of strategic resources	Digital inequality	Human-made environmental damage	Widespread youth disillusionment
<b>Cyprus</b>	Climate action failure	Debt crises in large economies	Geopolitization of strategic resources	Asset bubble bursts in large economies	...
				Infectious diseases	
				Prolonged economic stagnation	
<b>Czech Republic</b>	Debt crises in large economies	Collapse of a systemically important industry	Asset bubble bursts in large economies	Infectious diseases	Failure to stabilize price trajectories
<b>Denmark</b>	Climate action failure	Asset bubble bursts in large economies	...	Failure of cybersecurity measures	Debt crises in large economies
		Infectious diseases			
<b>Dominican Republic</b>	Extreme weather events	Employment and livelihood crises	Debt crises in large economies	Digital inequality Failure of cybersecurity measures	...

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>Ecuador</b>	Collapse or lack of social security systems	Prolonged economic stagnation	Employment and livelihood crises	Proliferation of illicit economic activity	Digital inequality
<b>Egypt</b>	Natural resource crises	Infectious diseases	Debt crises in large economies	Failure to stabilize price trajectories	Employment and livelihood crises
<b>El Salvador</b>	Prolonged economic stagnation	State collapse	Extreme weather events	Employment and livelihood crises	Collapse or lack of social security systems Digital inequality
<b>Estonia</b>	Interstate conflict	Debt crises in large economies	Asset bubble bursts in large economies Fracture of interstate relations	...	Human-made environmental damage
<b>Finland</b>	Prolonged economic stagnation	Debt crises in large economies	Climate action failure	Asset bubble bursts in large economies	Infectious diseases
<b>France</b>	Erosion of social cohesion	Debt crises in large economies Geopolitization of strategic resources	...	Climate action failure	Failure of cybersecurity measures
<b>Georgia</b>	Interstate conflict	Digital inequality	Failure to stabilize price trajectories	Debt crises in large economies	Employment and livelihood crises
<b>Germany</b>	Climate action failure	Erosion of social cohesion	Digital power concentration	Debt crises in large economies	Fracture of interstate relations Geopolitization of strategic resources
<b>Ghana</b>	Employment and livelihood crises Human-made environmental damage	...	Geopolitization of strategic resources	Failure of cybersecurity measures	Collapse of a systemically important industry
<b>Greece</b>	Prolonged economic stagnation	Extreme weather events	Debt crises in large economies	Interstate conflict	Digital inequality

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>Guatemala</b>	Proliferation of illicit economic activity	State collapse	Extreme weather events	Failure of public infrastructure	Erosion of social cohesion Human-made environmental damage
<b>Honduras</b>	State collapse	Employment and livelihood crises	Extreme weather events	Proliferation of illicit economic activity	Prolonged economic stagnation
<b>Hong Kong SAR, China</b>	Asset bubble bursts in large economies	Prolonged economic stagnation	Infectious diseases	Interstate conflict	Erosion of social cohesion
<b>Hungary</b>	Failure to stabilize price trajectories	Extreme weather events	Climate action failure	Infectious diseases	Fracture of interstate relations
<b>Iceland</b>	Asset bubble bursts in large economies	...	Collapse of a systemically important industry	Failure of cybersecurity measures	...
	Climate action failure	...		Infectious diseases	
<b>India</b>	Fracture of interstate relations	Debt crises in large economies	Widespread youth disillusionment	Failure of technology governance	Digital inequality
<b>Indonesia</b>	Debt crises in large economies	...	Employment and livelihood crises	Geopolitization of strategic resources	Failure of cybersecurity measures
	Human-made environmental damage				
<b>Iran</b>	Employment and livelihood crises	Widespread youth disillusionment	Prolonged economic stagnation	Natural resource crises	Biodiversity loss and ecosystem collapse
<b>Ireland</b>	Climate action failure	...	Fracture of interstate relations	Debt crises in large economies	...
	Failure of cybersecurity measures			Prolonged economic stagnation	
<b>Israel</b>	Terrorist attacks	Asset bubble bursts in large economies	...	Failure of cybersecurity measures	Weapons of mass destruction
		Interstate conflict			
<b>Italy</b>	Climate action failure	...	Extreme weather events	Geopolitization of strategic resources	Digital inequality
	Debt crises in large economies				

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
Japan	Prolonged economic stagnation	Extreme weather events	Interstate conflict	Failure of cybersecurity measures	Asset bubble bursts in large economies
					Infectious diseases
Jordan	Debt crises in large economies	Employment and livelihood crises	Natural resource crises	Prolonged economic stagnation	Failure to stabilize price trajectories
Kazakhstan	Employment and livelihood crises	...	Severe commodity shocks	Interstate conflict	Geopolitization of strategic resources
	Failure to stabilize price trajectories				
Kenya	Employment and livelihood crises	Debt crises in large economies	Human-made environmental damage	Prolonged economic stagnation	...
				Terrorist attacks	
Republic of Korea	Asset bubble bursts in large economies	Employment and livelihood crises Infectious diseases	...	Debt crises in large economies	Human-made environmental damage
Kuwait	Asset bubble bursts in large economies	...	Failure of technology governance Geopolitization of strategic resources	...	Human-made environmental damage
	Collapse or lack of social security systems				Infectious diseases
Kyrgyzstan	Employment and livelihood crises	Interstate conflict	Failure of technology governance	Climate action failure	Failure to stabilize price trajectories
Lao PDR	Failure to stabilize price trajectories	Employment and livelihood crises	Human-made environmental damage	Biodiversity loss and ecosystem collapse	Breakdown of critical information infrastructure
					Infectious diseases
Latvia	Interstate conflict	Asset bubble bursts in large economies	Digital inequality	Debt crises in large economies	...
				Prolonged economic stagnation	

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>Lebanon</b>	State collapse	Human-made environmental damage	Collapse or lack of social security systems	Debt crises in large economies Prolonged economic stagnation	...
<b>Lesotho</b>	Digital inequality	Infectious diseases	Climate action failure	Extreme weather events	Debt crises in large economies
<b>Lithuania</b>	Interstate conflict	Severe commodity shocks	Asset bubble bursts in large economies Failure of cybersecurity measures	...	Human-made environmental damage
<b>Luxembourg</b>	Asset bubble bursts in large economies	Climate action failure Debt crises in large economies	...	Digital inequality Fracture of interstate relations	...
<b>Malawi</b>	Failure to stabilize price trajectories	Human-made environmental damage Prolonged economic stagnation	...	Proliferation of illicit economic activity	Debt crises in large economies Employment and livelihood crises
<b>Malaysia</b>	Human-made environmental damage	Employment and livelihood crises	Prolonged economic stagnation	Geopolitization of strategic resources	Debt crises in large economies
<b>Mali</b>	Employment and livelihood crises Terrorist attacks	...	Debt crises in large economies	Collapse or lack of social security systems	Failure of technology governance
<b>Malta</b>	Human-made environmental damage	Collapse of a systemically important industry	Proliferation of illicit economic activity	Failure of cybersecurity measures	Asset bubble bursts in large economies
<b>Mauritius</b>	Prolonged economic stagnation	Collapse of a systemically important industry	Employment and livelihood crises	Extreme weather events	Erosion of social cohesion
<b>Mexico</b>	Proliferation of illicit economic activity	Prolonged economic stagnation	State collapse	Employment and livelihood crises	Digital inequality
<b>Moldova</b>	Prolonged economic stagnation	Large-scale involuntary migration	Interstate conflict	Extreme weather events	Proliferation of illicit economic activity

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>Mongolia</b>	Human-made environmental damage	Employment and livelihood crises	Prolonged economic stagnation State collapse	...	Geopolitization of strategic resources
<b>Montenegro</b>	Employment and livelihood crises	Fracture of interstate relations	Prolonged economic stagnation	Digital inequality	Human-made environmental damage
<b>Morocco</b>	Natural resource crises	Employment and livelihood crises	Prolonged economic stagnation	Digital inequality	Extreme weather events Interstate conflict
<b>Namibia</b>	Employment and livelihood crises	Digital inequality	Prolonged economic stagnation	Extreme weather events	Debt crises in large economies
<b>Nepal</b>	Employment and livelihood crises	Human-made environmental damage	Geopolitization of strategic resources	Infectious diseases	Digital inequality Prolonged economic stagnation
<b>Netherlands</b>	Climate action failure	Erosion of social cohesion	Failure of cybersecurity measures	Asset bubble bursts in large economies	Debt crises in large economies
<b>New Zealand</b>	Failure of cybersecurity measures	Asset bubble bursts in large economies Infectious diseases Prolonged economic stagnation	...	...	Climate action failure Extreme weather events
<b>Nicaragua</b>	State collapse	Prolonged economic stagnation	Employment and livelihood crises Extreme weather events	...	Collapse or lack of social security systems
<b>Nigeria</b>	Terrorist attacks	Prolonged economic stagnation	Widespread youth disillusionment	Employment and livelihood crises	Human-made environmental damage
<b>North Macedonia</b>	Human-made environmental damage	Failure of public infrastructure	Debt crises in large economies	Prolonged economic stagnation	Digital inequality
<b>Pakistan</b>	Debt crises in large economies	Extreme weather events	Failure to stabilize price trajectories	Failure of cybersecurity measures	Human-made environmental damage



Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>Panama</b>	Collapse or lack of social security systems	Prolonged economic stagnation	Employment and livelihood crises	Digital inequality	Human-made environmental damage
<b>Paraguay</b>	Proliferation of illicit economic activity	Collapse or lack of social security systems	Digital inequality	Human-made environmental damage	Employment and livelihood crises State collapse
<b>Peru</b>	State collapse	Prolonged economic stagnation	Employment and livelihood crises	Digital inequality	Human-made environmental damage Proliferation of illicit economic activity
<b>Philippines</b>	Prolonged economic stagnation	Digital inequality	Extreme weather events	Employment and livelihood crises	Failure of public infrastructure
<b>Poland</b>	Human-made environmental damage	Infectious diseases	Interstate conflict	Fracture of interstate relations Prolonged economic stagnation	...
<b>Portugal</b>	Prolonged economic stagnation	Debt crises in large economies	Employment and livelihood crises	Digital inequality	Collapse or lack of social security systems
<b>Qatar</b>	Climate action failure	Digital inequality	Collapse of a systemically important industry Fracture of interstate relations Infectious diseases Natural resource crises	...	...
<b>Romania</b>	Human-made environmental damage	Employment and livelihood crises	Debt crises in large economies Geopolitization of strategic resources	...	Large-scale involuntary migration
<b>Russian Federation</b>	Interstate conflict	Failure to stabilize price trajectories	Infectious diseases	Employment and livelihood crises	Severe commodity shocks

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
Rwanda	Employment and livelihood crises	Prolonged economic stagnation	Extreme weather events	Digital inequality	Failure of cybersecurity measures
Saudi Arabia	Failure to stabilize price trajectories	Human-made environmental damage Infectious diseases	...	Interstate conflict	Fracture of interstate relations Prolonged economic stagnation
Senegal	Employment and livelihood crises	Debt crises in large economies	Terrorist attacks	Human-made environmental damage	Digital inequality Natural resource crises
Serbia	Human-made environmental damage	Debt crises in large economies	Employment and livelihood crises	Digital inequality	Geopolitization of strategic resources
Sierra Leone	Employment and livelihood crises	Human-made environmental damage	Prolonged economic stagnation	Failure to stabilize price trajectories	Widespread youth disillusionment
Singapore	Prolonged economic stagnation	Infectious diseases	Asset bubble bursts in large economies	Failure of cybersecurity measures	Climate action failure
Slovakia	Collapse of a systemically important industry	Collapse or lack of social security systems	Debt crises in large economies Human-made environmental damage	...	Digital inequality
Slovenia	Severe commodity shocks	Geopolitization of strategic resources	Asset bubble bursts in large economies	Extreme weather events Human-made environmental damage	...
South Africa	Prolonged economic stagnation	Employment and livelihood crises	State collapse	Failure of public infrastructure	Proliferation of illicit economic activity
Spain	Employment and livelihood crises	Prolonged economic stagnation	Debt crises in large economies	Climate action failure Fracture of interstate relations	...

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
<b>Sri Lanka</b>	Human-made environmental damage	Debt crises in large economies	Employment and livelihood crises — — — Infectious diseases	...	Digital inequality
<b>Sweden</b>	Asset bubble bursts in large economies	Terrorist attacks	Climate action failure	Debt crises in large economies	Human-made environmental damage
<b>Switzerland</b>	Asset bubble bursts in large economies	Prolonged economic stagnation	Debt crises in large economies — — — Fracture of interstate relations — — — Geopolitization of strategic resources — — — Interstate conflict	...	...
<b>Taiwan, China</b>	Infectious diseases	Extreme weather events	Geopolitization of strategic resources	Failure of cybersecurity measures	Asset bubble bursts in large economies
<b>Tajikistan</b>	Interstate conflict	Failure to stabilize price trajectories	Extreme weather events	Employment and livelihood crises — — — Infectious diseases	...
<b>Tanzania</b>	Debt crises in large economies	Employment and livelihood crises	Human-made environmental damage	Climate action failure — — — Infectious diseases	...
<b>Thailand</b>	Debt crises in large economies	Human-made environmental damage	Prolonged economic stagnation	Digital inequality	Employment and livelihood crises
<b>Trinidad and Tobago</b>	Prolonged economic stagnation	Employment and livelihood crises	Digital inequality	Collapse of a systemically important industry	Extreme weather events
<b>Tunisia</b>	State collapse	Debt crises in large economies	Employment and livelihood crises	Prolonged economic stagnation	Proliferation of illicit economic activity
<b>Turkey</b>	Employment and livelihood crises	Prolonged economic stagnation	Fracture of interstate relations	Human-made environmental damage	Failure of technology governance

Economy	Risk 1	Risk 2	Risk 3	Risk 4	Risk 5
Ukraine	Prolonged economic stagnation	State collapse	Climate action failure	...	...
			Failure to stabilize price trajectories		
			Interstate conflict		
United Arab Emirates	Infectious diseases	Asset bubble bursts in large economies	Debt crises in large economies	...	Climate action failure
			Failure of cybersecurity measures		Employment and livelihood crises
United Kingdom	Failure of cybersecurity measures	Debt crises in large economies	Prolonged economic stagnation	Infectious diseases	Extreme weather events
United States	Asset bubble bursts in large economies	Climate action failure	Extreme weather events	Debt crises in large economies	Employment and livelihood crises
Uruguay	Severe commodity shocks	Prolonged economic stagnation	Employment and livelihood crises	Extreme weather events	Collapse or lack of social security systems
Venezuela	State collapse	Prolonged economic stagnation	Human-made environmental damage	Large-scale involuntary migration	Proliferation of illicit economic activity
Viet Nam	Biodiversity loss and ecosystem collapse	Asset bubble bursts in large economies	Infectious diseases	Extreme weather events	...
				Geopolitization of strategic resources	
Yemen	Failure to stabilize price trajectories	State collapse	Failure of public infrastructure	Employment and livelihood crises	...
				Interstate conflict	
				Natural resource crises	
Zambia	Employment and livelihood crises	Debt crises in large economies	Failure to stabilize price trajectories	Human-made environmental damage	Prolonged economic stagnation

# Technical Notes: Global Risks Perception Survey 2021–2022

The Global Risks Perception Survey (GRPS) is the World Economic Forum’s source of original risks data, harnessing the expertise of the Forum’s extensive network of academic, business, government, civil society and thought leaders. Survey responses were collected from 8 September to 12 October 2021 from the World Economic Forum’s multistakeholder communities (including the Global Shapers Community), the professional networks of its Advisory Board, and members of the Institute of Risk Management. The results of the GRPS are used to create the graphics depicting the Global

Risks COVID-19 Hindsight, Future Outlook, the Global Risks Horizon, Global Risks Severity, Global Risks Effects and International Risk Mitigation Efforts presented at the beginning of the report and to offer insights used throughout.

Both the GRPS and the *Global Risks Report* adopt the following definition: *a global risk is the possibility of the occurrence of an event or condition which, if it occurs, could cause significant negative impact for several countries or industries. For the purposes of this report, the scope is over the next 10 years.*

## Updates in the GRPS 2021–2022

### New list of risks

The list of 37 global risks included in the survey was updated in 2021.

Two new risks were added in response to observed economic, geopolitical and environmental trends. These new risks are: (1) “Goeconomic confrontations” and (2) “Pollution harms to human health”.

The names and definitions of the remaining 35 risks have been revised and, where applicable, have been modified and/or expanded to reflect new ways in which the risks may materialize and the potential adverse outcomes they may cause. However, to ensure comparability over time, although names and definitions were modified, the fundamental concept of the risk remained consistent with that in previous versions of the survey.

### New sections

The GRPS 2021–2022 was extensively reformed this year to gather fresher, broader and more informed risk perceptions and to incorporate new approaches to risk management and analysis. The GRPS 2021–2022 is comprised of six sections:

- 1. COVID-19 Hindsight and Future Outlook (new):** asks respondents to form an opinion about how the COVID-19 pandemic aggravated risks, permitting some comparability with GRPS results from previous years. This opinion then facilitates the projection of their views forward beyond the pandemic. This section also captures respondent sentiment on the outlook for the world to inform an analysis of how individual contexts may influence global risk perceptions and the perceived status of mitigation efforts.
- 2. Global Risks Horizon:** recognizes that respondents may have varying perceptions on the evolution of global risks within a 10-year horizon. This section asks respondents to take a view on risks in the short term (0–2 years), medium term (2–5 years) and long term (5–10 years), also capturing respondents’ sense of urgency about global risks and informing an analysis of choices and trade-offs that may face decision-makers.
- 3. Global Risks Severity (new):** asks respondents to rank the potential damage of a global risk over the next 10 years and reminds respondents to consider multiple criteria—including human suffering, societal disruption, economic shock, environmental degradation and political instability. This section

uses ranking rather than a 1–5 rating scale to allow respondents to answer the question with more confidence.

4. **Global Risks Effects (new):** recognizing that risks are not isolated but affect and amplify each other through negative feedback loops, this section incentivizes a holistic view of global risks by asking respondents to consider cascading impacts in conjunction with the severity of the risk itself.
5. **Global Governance – International Risk Mitigation Efforts (new):** recognizing that risk

mitigation needs to be a part of the global agenda, this section asks respondents to assess the current state of international mitigation efforts in 15 global governance areas. It identifies achievements and areas of opportunity for global action and cooperation and informs an analysis of how the various stages of effectiveness may influence future preparedness.

6. **Open Questions (new):** complements risk identification with a series of questions to detect blind spots, trends and shocks. This section ensures that the GRPS is a flexible and engaging mechanism to source expert knowledge.

## Methodology

### COVID-19 Hindsight & Future Outlook

#### COVID-19 Hindsight:

For each of the 37 global risks listed in Appendix A, respondents were asked to identify three global risks that they believe had worsened since the start of the COVID-19 crisis. A simple tally for each of the 37 global risks was calculated on this basis. The results are illustrated in Figure I.

#### Future Outlook:

Respondents were asked to express their feeling about the outlook for the world in four sentiments: worried, concerned, positive, optimistic. A simple tally for each of the four sentiments was calculated on this basis. The results are illustrated in Figure 1.2.

Respondents were then asked to characterize their outlook for the world over the next 3 years with the following four answer options: accelerating global recovery; fractured trajectories, separating winners and losers; consistently volatile with multiple surprises; progressive tipping points with increasing catastrophic outcomes. A simple tally for each of the four sentiments was calculated on this basis. The results are illustrated in Figure 1.1.

### Global Risks Horizon

For each of the 37 global risks listed in Appendix A, respondents were asked to identify when they believe a risk will become a critical threat to the world, within the following timeframes:

- Short-term threats: 0–2 years

- Medium-term threats: 2–5 years
- Long-term threats: 5–10 years

A simple tally for each of the 37 global risks was calculated on this basis. The results are illustrated in Figure II.

### Global Risks Severity

For each of the 37 global risks listed in Appendix A, respondents were asked to choose nine risks and rank order them from 1 to 9 according to their perceived severity of impact—“most severe” was defined as having the potential to yield the most damage on a global scale within the next 10 years. Respondents were asked to value the impact of risks considering multiple criteria, including human suffering, societal disruption, economic shock, environmental degradation and political instability.

The results were aggregated according to the following scoring schedule:

- 9 points each time a risk was selected as the most severe risk
- 8 points each time a risk was selected as the second-most severe risk
- 7 points each time a risk was selected as the third-most severe risk
- 6 points each time a risk was selected as the fourth-most severe risk

- 5 points each time a risk was selected as the fifth-most severe risk
- 4 points each time a risk was selected as the sixth-most severe risk
- 3 points each time a risk was selected as seventh-most severe risk
- 2 points each time a risk was selected as the eighth-most severe risk
- 1 point each time a risk was selected as the ninth-most severe risk

A simple sum of the scores for each of the risks according to the above scoring schedule was calculated on this basis. The results are illustrated in Figure 1.3.

## Global Risks Effects

In the Global Risks Severity component, for each of the risks ranked most severe, second-most severe and third-most severe, respondents were then asked to select two risks that will be aggravated by those top severe risks.

A simple tally of the number of times a risk was identified as being aggravated by another for each of the most, second-, third-, fourth- and fifth-most severe risks was calculated on this basis. The results are illustrated in the Global Risks Effects (Figure III).

In the Global Risks Effects graph, the size of each of the most concerning risk nodes is scaled according to the above scoring schedule. The thickness of each of the links between a risk and the risks being aggravated is scaled according to the above tally.

## Global Governance – International Risk Mitigation Efforts

From 15 international risk areas listed below, respondents were asked to rate the state each area was with regard to international risk mitigation efforts: “not started”, “early development”, “established”, or “effective”.

A simple tally for each of the four possible states was calculated on this basis. The results are illustrated in Figure IV.

The 15 international areas were: Artificial Intelligence (e.g., autonomous weapons, bias); Basic resource security (food and water); Biodiversity preservation; Climate change mitigation; Cross-border cyberattacks and misinformation; Financial system stability; Human health crises; International crime; Migration and refugees; Natural disaster relief; Physical conflict resolution; Poverty alleviation; Space exploitation; Trade facilitation; Weapons of mass destruction.

## Completion thresholds

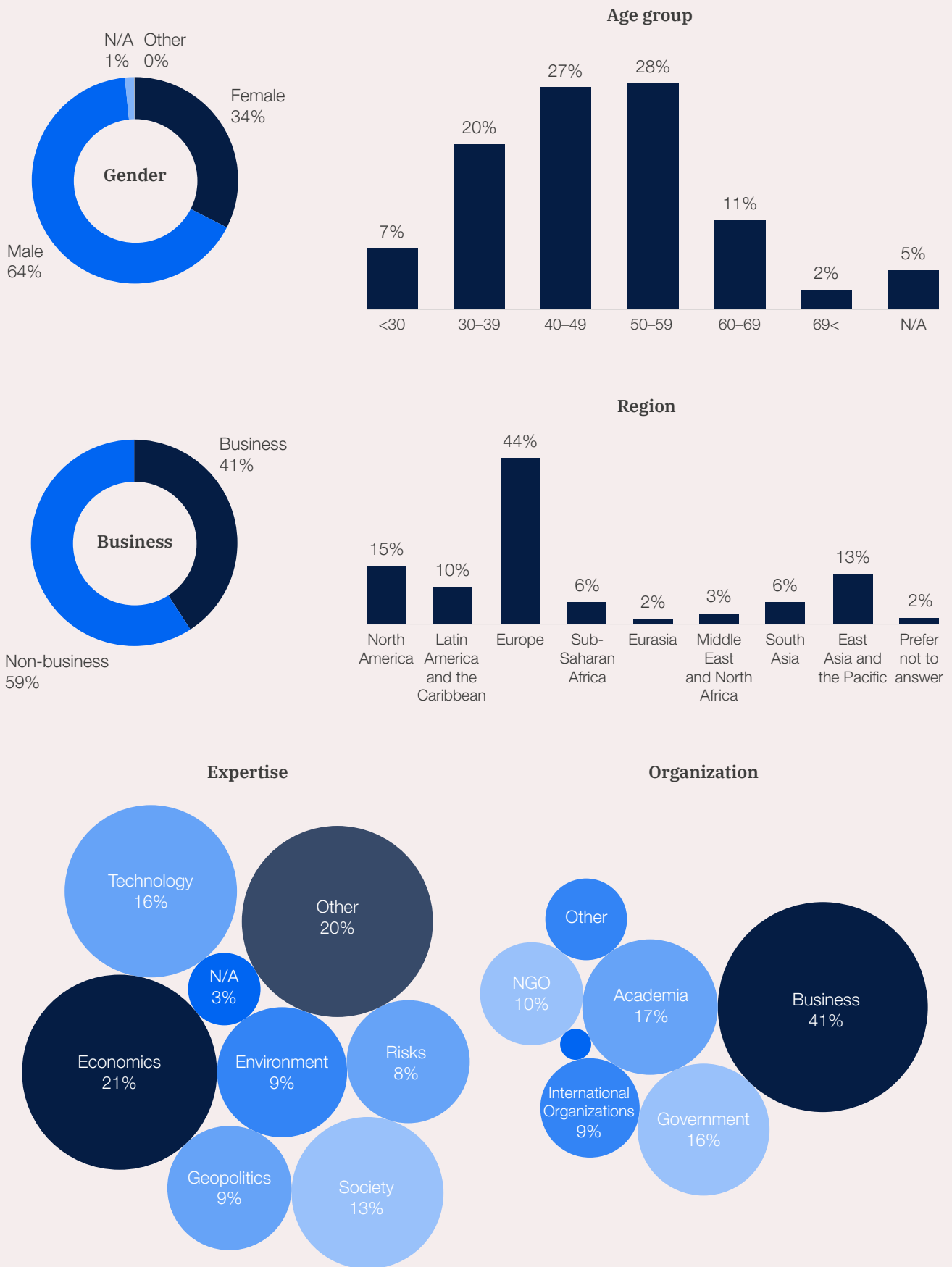
A total of 1,183 responses to the GRPS were received. From these, 959 were kept, using as a threshold at least one non-demographic answer.

- **Section 1 - COVID-19 Hindsight & Future Outlook:** 959 respondents selected the three global risks.
  - **Future Sentiment:** 957
  - **Future Outlook:** 957
- **Section 2 - Global Risks Horizon:** 926 (0–2 years); 912 (2–5 years); 904 (5–10 years) respondents placed at least one risk within a possible timeframe. The results were computed among all respondents of the survey.
- **Section 3 - Global Risks Severity:** 893 respondents; 888 ranked at least one severe risk and assigned at least one driver.
- **Section 4 - Global Risks Effects:** 837 respondents identified at least one risk aggravating another.
- **Section 5 – Global Governance – International Risk Mitigation Efforts:** 829 (climate change) respondents scored at least one level of response, either global or regional. The results were computed among all respondents of each risk area within the section.
- **Sample distribution:** the 959 respondents from Section 1 were used to calculate the sample distribution by place of residence (region), gender, age, area of expertise and institution.

Figure C.1 presents some key descriptive statistics and information about the profiles of the respondents.

TABLE C.1

# Survey Sample Composition



Source: World Economic Forum Global Risks Perception Survey 2021–2022





# Acknowledgements

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